TITLE 13. CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC HEARING TO CONSIDER ADOPTION OF THE 2012 AMENDMENTS TO THE CALIFORNIA ZERO EMISSION VEHICLE REGULATION

The Air Resources Board (ARB or Board) will conduct a public hearing at the time and place noted below to consider adoption of the 2012 amendments to the California Zero Emission Vehicle (ZEV) regulation.

DATE:	January 26, 2012
TIME:	9:00 a.m.
PLACE:	Metropolitan Water District Headquarters 700 North Alameda Street Los Angeles, California 90012-2944

This item will be considered at a two-day meeting of the Board, which will commence at 9:00 a.m., January 26, 2012, and will continue at 8:30 a.m., on January 27, 2012. This item may not be considered until January 27, 2012. Please consult the agenda for the hearing, which will be available at least 10 days before January 26, 2012, to determine the day on which this item will be considered.

INFORMATIVE DIGEST OF PROPOSED ACTION AND POLICY STATEMENT OVERVIEW

Sections Affected: Proposed amendments to California Code of Regulations, title 13, sections 1962.1 and 1962.2 (re-numbered to 1962.3), which incorporate by reference "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", as adopted December 17, 2008, and last amended December 2, 2009, and proposed adoption of California Code of Regulations, title 13, section 1962.2, which incorporate by reference "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 adopted December 17, 2008, and last amended December 2, 2009.

Background

In 1990, the California Air Resources Board (ARB or the Board) adopted an ambitious program to dramatically reduce the environmental impact of light-duty vehicles (LDV) through the gradual introduction of zero emission vehicles (ZEV) into the California fleet. The ZEV program, which affects passenger cars and light-duty trucks (LDT1 and LDT2), has been adjusted five times since its inception: in 1996, 1998, 2001, 2003, and 2008; to reflect the development of new technologies such as hybrid electric vehicles, natural gas vehicles, longer range battery electric vehicles, and fuel cell vehicles. Through these adjustments the fundamental goal of the program has not changed: the commercialization of ZEV technologies.

At the March 2008 hearing, the Board directed staff to redesign the 2015 and beyond requirements for the ZEV program by strengthening its requirements and focusing primarily on the zero emission drive. Battery electric vehicle (BEV), fuel cell vehicle (FCV), and plug-in hybrid electric vehicle (PHEV) technologies, are included. California would continue to be the central location for advanced, low greenhouse gas (GHG) technology vehicles as they move from the demonstration phase to commercialization.

In 2009, staff undertook an assessment of pathways to meet California's long term 2050 GHG reduction goals in the LDV subsector. It included a review of ZEV technology and a review of current and possible future complementary policies that would be needed to aid in infrastructure development, and a review of market pull policies for ZEVs. Based on the United States Department of Energy vision model, staff developed a California-specific model for the LDV subsector, and concluded that nearly all new vehicle sales by the 2040 model year need to be ZEVs and PHEVs in order to achieve the needed long term emission reductions. The Board directed staff in Resolution 09-66 to prepare amendments to the regulations considering the following:

- Shift focus from only criteria pollutant emission reductions to both GHG and criteria pollutant emission reductions;

- Focus on commercializing low-carbon emitting technologies, such as ZEVs and PHEVs, in a timeframe sufficient to meet the 2050 target of an 80-percent reduction in GHG emissions compared to 1990 levels;

- Take into consideration new low emission vehicle (LEV) III GHG fleet standards and revise the ZEV regulatory structure, credit values, and stringency of the current requirements accordingly.

Description of Proposed Regulatory Action

The ZEV regulation is the most technology-forcing piece of the Advanced Clean Car package. Proposed amendments to the ZEV regulation focus on advanced technologies, simplifying the program where needed, and increasing stringency for 2018 model year and beyond to help meet long term goals.

Amendments Affecting 2009 through 2017 Model Years

Staff is proposing minor mid-course corrections and clarifications to the current regulation (through the 2017 model year) that will help ensure successful compliance with more stringent 2018 and subsequent model year requirements. The amendments include:

A. *Provide Compliance Flexibility:* Remove carry forward credit limitations for ZEVs, allowing manufacturers to bank ZEV credits indefinitely for use in later years. Slightly reduce the 2015 through 2017 credit requirement for intermediate volume manufacturers (IVM, less than 60,000 vehicles produced each year), to allow them to prepare for requirements in 2018. Extend the provision that allows ZEVs placed in any state that has adopted the California ZEV regulation to count towards the ZEV requirement through 2017 (i.e. extending the "travel provision" for BEVs through 2017).

B. *Adjust Credits and Allowances:* Increase credits for a Type V (300 mile FCV) ZEV to appropriately incentivize this emerging technology.

C. *Add New Vehicle Category:* Add Type I.5x and Type IIx vehicles as a compliance option for manufacturers to meet up to half of their minimum ZEV requirement. These vehicles are closer to a BEV than to a PHEV because they are designed with primarily zero-emission operation. Their small non-ZEV fuel auxiliary power unit (APU)is specified with limited performance and fuel capacity for limited range extension.

<u>*Amendments Affecting 2018 and Subsequent Model Years*</u>

Staff is proposing amendments for 2018 and subsequent model years to help achieve early commercialization of ZEVs and transitional zero emission vehicles (TZEV, typically a plug in hybrid electric vehicle) through simplifying the regulation and pushing technology to a higher volume production in order to achieve cost reductions. The amendments include:

A. *Increase Volume Requirement for 2018 and Subsequent Model Years:* Increase requirements that push ZEVs and TZEVs to nearly 15 percent of new sales by 2025. This will help ensure production volumes are at a level sufficient to bring battery and fuel cell technology down the cost curve and reduce ZEV incremental prices, and provide a greater choice of vehicle types for potential purchasers.

B. *Focus Regulation on ZEVs and TZEV:* Move the partial zero emission vehicle (PZEV, a near-zero emitting conventional technology) and advanced technology PZEV(AT-PZEV, typically a non-plug-in hybrid electric vehicle) technology categories from the ZEV regulation to the LEV regulation because they have reached commercial volumes and their relevance to further reducing criteria and GHG emissions can be better governed by the emission performance standards

C. in the LEV III regulation. Allow manufacturers to use banked PZEV and AT-PZEV credits earned in 2017 and previous model years in the ZEV program, but discount the credits, and place a cap on usage in 2018 and subsequent model years. Focus the 2018 and subsequent model year requirements on ZEVs and TZEVs.

D. *Amend Manufacturer Size Definitions, Ownership Requirements, and Transitions*: Amend IVM and large volume manufacturer (LVM) size definitions to bring all but the smallest manufacturers under the full ZEV requirements by model year 2018. Align LEV III and ZEV ownership requirements, so that manufacturers who own more than 33.4 percent of each are considered as the same manufacturer for determination of size. Modify transition periods for manufacturers switching size categories. These changes result in applying the ZEV regulation to manufacturers that represent 97 percent of the LDV market.

E. *Modify Credit System:* Base credits for ZEVs on range, with 50 mile BEVs earning 1 credit each and 350 mile FCVs earning 4 credits each. Allow longer range BEVs (BEVx) which have a limited combustion engine range extender to meet up to half of a manufacturer's minimum ZEV requirement. The range of credits reflect the utility of the vehicle (i.e. the zero emitting miles it may travel) and its expected timing for commercialization. Simplify and streamline TZEV credits based on the vehicle's zero-emission range capability and ability to drive electrically for 10 miles on the more aggressive US 06 drive schedule. In addition to simplifying the program, reduce the spread of credits so that technologies are more evenly treated with less variation in compliance outcomes (numbers of vehicles produced to meet the regulation requirements).

F. *Modify Travel Provision:* End the Travel Provision for BEVs after model year 2017, so that states that have adopted CA's ZEV program are more likely to receive a proportionate share of ZEVs. Extend the Travel Provision for FCVs until sufficient complementary polices are in place in states having adopted the California ZEV regulation. This will allow FCV technology to continue to mature, and provide time for Section 177 states to build infrastructure.

G. *Add GHG-ZEV Over-Compliance Credits:* Allow manufacturers who systematically over comply with the proposed LEV III GHG fleet standard to offset a portion of their ZEV requirement in 2018 through 2021 model years only.

These amendments, part of the Advanced Clean Cars regulatory proposals to be heard as a package on the same day, thus address multiple pollutant types in the context of California's passenger motor vehicle program as a whole.

COMPARABLE FEDERAL REGULATIONS

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

AVAILABILITY OF DOCUMENTS AND AGENCY CONTACT PERSONS

ARB staff has prepared an Initial Statement of Reasons (ISOR) for the proposed regulatory action, which includes a summary of the economic and environmental impacts of the proposal. The ISOR is entitled: 2012 Proposed Amendments to the California Zero Emission Vehicle Program Regulations.

Copies of the ISOR and the full text of the proposed regulatory language, in underline and strikeout format to allow for comparison with the existing regulations, may be accessed on ARB's website listed below, or may be obtained from the Public Information Office, Air Resources Board, 1001 I Street, Visitors and Environmental Services Center, First Floor, Sacramento, California, 95814, (916) 322-2990, on **December 7, 2011.**

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

Inquiries concerning the substance of the proposed regulation may be directed to the designated agency contact persons, Ms. Anna Wong, Air Pollution Specialist, Sustainable Transportation Technology Branch, (916) 323-2410, or Ms. Elise Keddie, Manager, ZEV Implementation Section, (916) 323-8974.

Further, the agency representative and designated back-up contact persons, to whom non-substantive inquiries concerning the proposed administrative action may be directed are Ms. Lori Andreoni, Manager, Board Administration and Regulatory Coordination Unit, (916) 322-4011, or Ms. Amy Whiting, Regulations Coordinator, (916) 322-6533. The Board staff has compiled a record for this rulemaking action, which includes all the information upon which the proposal is based. This material is available for inspection upon request to the contact persons.

This notice, the ISOR and all subsequent regulatory documents, including the FSOR, when completed, are available on ARB's website for this rulemaking at http://www.arb.ca.gov/regact/2012/zev2012/zev2012.htm

COSTS TO PUBLIC AGENCIES AND TO BUSINESSES AND PERSONS AFFECTED

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

Pursuant to Government Code sections 11346.5(a)(5) and 11346.5(a)(6), the Executive Officer has determined that the proposed regulatory action would not create costs or savings to any State agency or in federal funding to the State, costs or mandate to any local agency or school district, whether or not reimbursable by the State pursuant to Government Code, title 2, division 4, part 7 (commencing with section 17500), or other nondiscretionary cost or savings to State or local agencies.
In developing this regulatory proposal, ARB staff evaluated the potential economic impacts on representative private persons or businesses. The ARB estimates the total impact of the ZEV regulation to regulated manufacturers, apart from all other regulations, to be $10.2 billion, from model year 2018 through 2025 compliance.

The Executive Officer has made an initial determination that the proposed regulatory action would not have a significant statewide adverse economic impact directly affecting businesses, including the ability of California businesses to compete with businesses in other states, or on representative private persons.

In accordance with Government Code section 11346.3, the Executive Officer has determined that the proposed regulatory action would affect the creation or elimination of jobs within the State of California, or the expansion of businesses currently doing business within the State of California. A detailed assessment of the economic impacts of the proposed regulatory action can be found in the ISOR.

The Executive Officer has also determined, pursuant to California Code of Regulations, title 1, section 4, that the proposed regulatory action would affect small businesses.
In accordance with Government Code sections 11346.3(c) and 11346.5(a)(11), the Executive Officer has found that the reporting requirements of the regulation which apply to businesses are necessary for the health, safety, and welfare of the people of the State of California. Staff's proposed regulations do not impose any new reporting requirements on manufacturers.

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

ENVIRONMENTAL ANALYSIS

In accordance with ARB's certified regulatory program, California Code of Regulations, title 17, sections 60006 through 60007, and the California Environmental Quality Act, Public Resources Code section 21080.5, ARB has conducted an analysis of the potential for significant adverse and beneficial environmental impacts associated with the proposed regulatory action. The environmental analysis of the proposed regulatory action can be found in Appendix B of the ISOR.

SUBMITTAL OF COMMENTS

Interested members of the public may also present comments orally or in writing at the meeting, and comments may be submitted by postal mail or by electronic submittal before the meeting. The public comment period for this regulatory action will begin on **December 12, 2011.** To be considered by the Board, written comments, not physically submitted at the meeting, must be submitted on or after **December 12, 2011** and received **no later than 12:00 noon on January 25, 2012**, and must be addressed to the following:

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

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

You can sign up online in advance to speak at the Board meeting when you submit an electronic board item comment. For more information go to: http://www.arb.ca.gov/board/online-signup.htm.

Please note that under the California Public Records Act (Gov. Code, § 6250 et seq.), your written and oral comments, attachments, and associated contact information (e.g., your address, phone, email, etc.) become part of the public record and can be released to the public upon request.

ARB requests that written and email statements on this item be filed at least 10 days prior to the hearing so that ARB staff and Board members have additional time to consider each comment. The Board encourages members of the public to bring to the attention of staff in advance of the hearing any suggestions for modification of the proposed regulatory action.

Additionally, the Board requests but does not require that persons who submit written comments to the Board reference the title of the proposal in their comments to facilitate review.

STATUTORY AUTHORITY AND REFERENCES

This regulatory action is proposed under the authority granted in Health and Safety Code, sections 39600, 39601, 43013, 43018, 43101, 43104 and 43105, Health and Safety Code. This action is proposed to implement, interpret, and make specific 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.

HEARING PROCEDURES

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

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

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

SPECIAL ACCOMMODATION REQUEST

Special accommodation or language needs can be provided for any of the following:

- An interpreter to be available at the hearing;
- Documents made available in an alternate format or another language; or
- A disability-related reasonable accommodation.

To request these special accommodations or language needs, please contact the Clerk of the Board at (916) 322-5594 or by facsimile at (916) 322-3928 as soon as possible, but no later than 10 business days before the scheduled Board hearing. TTY/TDD/Speech to Speech users may dial 711 for the California Relay Service.

Comodidad especial o necesidad de otro idioma puede ser proveído para alguna de las siguientes:

- Un intérprete que esté disponible en la audiencia.
- Documentos disponibles en un formato alterno (por decir, sistema Braille, o en impresión grande) u otro idioma.
- Una acomodación razonable relacionados con una incapacidad.

Para solicitar estas comodidades especiales o necesidades de otro idioma, por favor llame a la oficina del Consejo al (916) 322-5594 o envíe un fax a (916) 322-3928 lo más pronto posible, pero no menos de 10 días de trabajo antes del día programado para la audiencia del Consejo. TTY/TDD/Personas que necesiten este servicio pueden marcar el 711 para el Servicio de Retransmisión de Mensajes de California.

CALIFORNIA AIR RESOURCES BOARD

James N. Goldstene
Executive Officer

Date: November 29, 2011

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

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
AIR RESOURCES BOARD

STAFF REPORT: INITIAL STATEMENT OF REASONS

ADVANCED CLEAN CARS

2012 PROPOSED AMENDMENTS TO THE CALIFORNIA ZERO EMISSION VEHICLE PROGRAM REGULATIONS

Date of Release: December 7, 2011
Scheduled for Consideration: January 26-27, 2012

EXECUTIVE SUMMARY

In 1990, the California Air Resources Board (ARB or the Board) adopted an ambitious program to significantly reduce the environmental impact of light-duty vehicles through the commercial introduction of zero emission vehicles (ZEV) into the California fleet. Since then the requirements of the ZEV program have resulted in several important milestones being achieved. Many gasoline engines now emit at near zero emission levels of smog-forming emissions. Non-plug-in hybrid electric vehicles (HEV) have been commercialized, and the number of models offered for sale is quickly expanding. Recently, battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV) have been introduced for sale, and fuel cell electric vehicles (FCV) are expected to be sold beginning in 2015. This movement to commercialize advanced clean cars has occurred in large part because of the ZEV regulation.

The ZEV regulation, which affects passenger cars and light-duty trucks, remains critically important to California's efforts to meet health based air quality goals. More recently, the program's goals have evolved to also include paving the way for achieving California's long term climate change emission reduction goals. For these reasons, California remains committed to the commercialization of ZEV technologies.

At its March 2008 hearing, the Board directed staff to redesign the 2015 and subsequent model year requirements for the ZEV regulation. It directed staff to strengthen the regulation above what is currently required and focus primarily on the zero emission drive, that is BEV, hydrogen FCV, and PHEV technologies. The goal of the Board direction was to ensure California as the central location for moving advanced, low greenhouse gas (GHG) technology vehicles from the demonstration phase to commercialization.

In 2009, staff undertook an analysis of pathways to meeting California's long term 2050 GHG reduction goals in the light duty vehicle subsector.[1] The analysis showed ZEVs will need to reach nearly 100 percent of new vehicle sales between 2040 and 2050, with commercial markets for ZEVs launching in the 2015 to 2020 timeframe. The analysis concluded that even widespread adoption of advanced conventional technologies, like non-plug-in HEVs, will not be enough to meet the 2050 targets. Staff presented its findings at the December 2009 Board hearing.

At the December hearing, the Board adopted Resolution 09-66, reaffirming its commitment to meeting California's long term air quality and climate change reduction goals through commercialization of ZEV technologies. The Board further directed staff to consider shifting the focus of the ZEV regulation to both GHG and criteria pollutant emission reductions, commercializing ZEVs and PHEVs in order to meet the 2050 goals, and to take into consideration the new Low Emission Vehicle (LEV III) fleet standards and propose revisions to the ZEV regulation accordingly.

[1] California Governor Arnold Schwarzenegger enacted Executive Order S-03-05, requiring a reduction in state-wide GHG emissions to 80-percent below 1990 levels by 2050

This rulemaking is an opportunity for the Board to commit to the transformation of California's light-duty vehicle fleet. As the technology-forcing piece of the Advanced Clean Car package, the ZEV regulation along with new LEV III criteria pollutant and GHG standards can be the catalyst to that transformative process. Proposed amendments to the regulation focus on technologies that help meet long term emission reduction goals, simplify the program where needed, and increase requirements for 2018 and subsequent model years.

Proposed Amendments to the Regulations

2009 through 2017 Model Year Amendments

Staff's goal for amendments affecting the current ZEV regulation through 2017 model year is to make minor mid-course corrections and clarifications, and enable manufacturers to successfully meet 2018 and subsequent model year requirements. The amendments include:

A. *Provide Compliance Flexibility:* Remove carry forward credit limitations for ZEVs, allowing manufacturers to bank ZEV credits indefinitely for use in later years. Slightly reduce the 2015 through 2017 credit requirement for intermediate volume manufacturers (IVM, less than 60,000 vehicles produced each year), to allow them to prepare for requirements in 2018. Extend the provision that allows ZEVs placed in any state that has adopted the California ZEV regulation to count towards the ZEV requirement through 2017 (i.e. extending the "travel provision" for BEVs through 2017).

B. *Adjust Credits and Allowances:* Increase credits for Type V (300 mile FCV) ZEVs to appropriately incentivize this longer term technology.

C. *Add New Vehicle Category:* Add Type I.5x and Type IIx vehicles as a compliance option for manufacturers to meet up to half of their minimum ZEV requirement. The proposed vehicle is closer to a BEV than to a PHEV: a vehicle with primarily zero-emission operation equipped with a small non-ZEV fuel auxiliary power unit (APU) for limited range extension.

2018 and Subsequent Model Year Amendments

Staff's goal for the proposed amendments for 2018 and subsequent model years is to achieve ZEV and transitional zero emission vehicle (TZEV; most commonly a PHEV) commercialization through simplifying the regulation and pushing technology to higher volume production in order to achieve cost reductions. The amendments include:

A. *Increase Requirement for 2018 and Subsequent Model Years.* Increase requirements which push ZEVs and TZEVs to over 15 percent of new sales by 2025. This will ensure production volumes are at a level sufficient to bring battery and fuel cell technology down the cost curve and reduce incremental ZEV prices.

B. *Focus Regulation on ZEVs and Transitional Zero Emission Vehicles (TZEV):* Remove partial zero emission allowance vehicle (PZEV, near-zero emitting conventional technologies) and advanced technology partial zero emission allowance vehicle (AT PZEV, typically non-plug-in HEVs) credits as compliance options for manufacturers because these technologies are now commercialized and their emissions are better reflected in the LEV III program. Allow manufacturers to use banked PZEV and AT PZEV credits earned in 2017 and previous model years, but discount the credits, and place a cap on usage in 2018 and subsequent model years. Focus the 2018 and subsequent model year requirements on ZEVs and TZEVs

C. *Amend Manufacturer Size Definitions, Ownership Requirements, and Transitions.* Amend IVM and large volume manufacturer (LVM) size definitions to bring all but the smallest manufacturers under the full ZEV requirements by model year 2018. Align LEV III and ZEV ownership requirements, so that manufacturers who own more than 33.4 percent of each other are considered as the same manufacturer for determination of size. Modify transition periods for manufacturers switching size categories. These changes result in applying the ZEV regulation to manufacturers that represent 97 percent of the light duty vehicle market.

D. *Modify Credit System.* Base credits for ZEVs on range, with 50 mile BEVs earning 1 credit each and 350 mile FCVs earning 4 credits each. Allow extended range BEVs (BEVx) which have a limited combustion engine range extender to meet up to half of a manufacturer's minimum ZEV requirement. The range of credits reflects the utility of the vehicle (i.e. the zero emitting miles it may travel) and its expected timing for commercialization. Simplify and streamline TZEV credit based on the vehicle's zero-emission range capability, and ability to perform 10 miles on the more aggressive US06 drive schedule. In addition to simplifying the program, reducing the spread of credits makes the technologies more evenly treated and reduces the variation in compliance outcomes (numbers of vehicles produced to meet the regulation requirements).

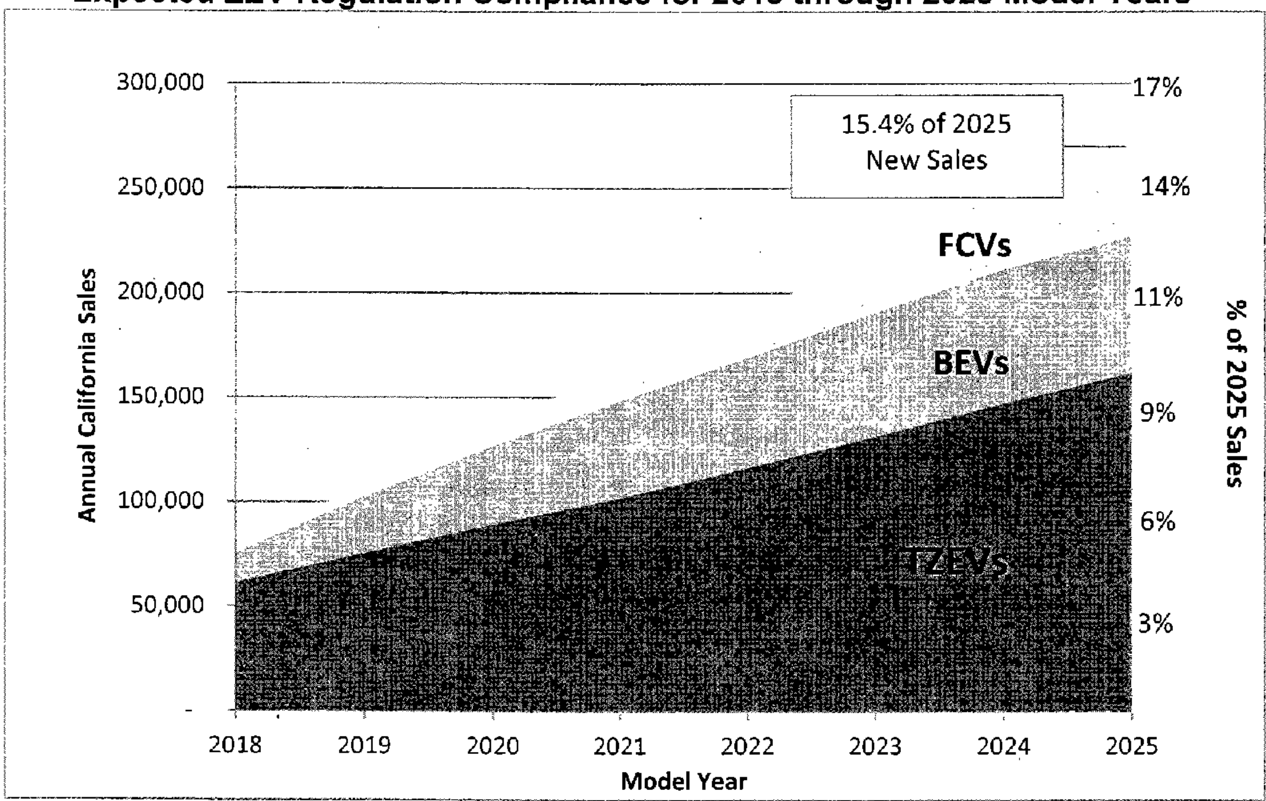
E. *Modify Travel Provision:* End the Travel Provision for BEVs after model year 2017. Extend the Travel Provision for FCVs until sufficient complementary polices are in place in states that have adopted the California ZEV regulation. This will allow FCV technology to continue to mature, and provide time for

Section 177 States to build infrastructure and put in place incentives to foster FCVs.

F. *Add GHG-ZEV Over-Compliance Credits:* Allow manufacturers who systematically over comply with the proposed LEV III GHG fleet standard to offset a portion of their ZEV requirement in 2018 through 2021 model years only.

Effect of Proposed Amendments
As a result of staff's proposal, over 1.4 million ZEVs and TZEVs are expected to be produced cumulatively in California by 2025, with 500,000 of those vehicles being pure ZEVs (BEVs and FCVs).

Expected ZEV Regulation Compliance for 2018 through 2025 Model Years



During this time frame, the incremental price of a ZEV or TZEV is expected to rapidly decline, but remain higher than a conventional vehicle, by approximately $10,000 (high-end estimate).

The proposed amendments will also result in an emissions benefit as compared to the current regulations, and will likely provide benefits beyond that achieved by complying with the LEV III criteria pollutant standard with conventional vehicles only. This is due to increased electricity and hydrogen use, and subsequently decreased gasoline production and refinery emissions.

Advanced Clean Cars
Continuing its leadership role in the development of innovative and ground breaking emission control programs and to achieve California's goals of meeting ambient air quality standards and reducing climate changing GHG emissions, ARB has developed the Advanced Clean Cars (ACC) program. The ACC program combines the control of smog-causing pollutants and GHG emissions into a single coordinated package of requirements for model years 2015 through 2025 and assures the development of environmentally superior cars that will continue to deliver the performance, utility and safety car owners have come to expect. The ZEV regulation (with amendments proposed herein) will act as the technology forcing piece of the ACC program, pushing manufacturers to produce ZEVs and PHEVs in the 2018 through 2025 model years. In addition, the ACC program also includes amendments to the Clean Fuels Outlet (CFO) requirements that will assure that ultra-clean fuels such as hydrogen are available to meet vehicle demands brought on by amendments to the ZEV regulation.

Beyond 2025, the driving force for lower emissions will be climate change. In order to meet our 2050 GHG goal, the new vehicle feet will need to be primarily composed of advanced technology vehicles such as electric and FCVs by 2035 in order to address fleet turnover. Accordingly, the ACC program coordinates the goals of the LEV, ZEV, and CFO programs in order to lay the foundation for commercialization and support of ultra-clean vehicles.

A more complete description of the impacts and benefits of the ACC can be found in the LEV staff report, including in its Executive Summary.

Staff Recommendation
Staff recommends that the Board adopt the amendments as proposed in this Initial Statement of Reasons (ISOR). The proposed amendments will help support future commercialization of ZEVs and TZEVs through simplification of the regulation and increasing requirements in 2018 and subsequent model years.

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Appendix A-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

Appendix A-3. §1962.2 Zero Emission Vehicle Standards for 2018 and subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles

Appendix A-4. 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

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APPENDIX B: ENVIRONMENTAL ANALYSIS FOR ADVANCE CLEAN CARS REGULATION PACKAGE

APPENDIX C: ECONOMIC ANALYSIS INPUTS

Table of Acronyms

AB .... Assembly Bill
ACC .... Advanced Clean Car
APU .... Auxiliary Power Unit
ARB .... California Air Resources Board
AT PZEV ..... Advanced Technology Partial Zero Emission Allowance Vehicle, typically a non-plug in hybrid such as the Prius
BEV............. Battery Electric Vehicle
BEVx........... Range Extended Battery Electric Vehicle
CAFE .... Corporate Average Fuel Economy
CEC .... California Energy Commission
CEQA.......... California Environmental Quality Act
CO_2 .... Carbon Dioxide
CPUC.......... California Public Utilities Commission
DC............... Direct Current
E-DRAM....... Economic Dynamic Revenue Assessment Model
EA .... Joint Environmental Assessment for Advanced Clean Car Rulemaking
EAER .... Equivalent All Electric Range
EMFAC .... ARB's mobile emissions inventory modeling program
Enhanced AT PZEV... Enhanced Advanced Technology Partial Zero Emission Allowance Vehicle, now called a Transitional Zero Emission Vehicle or TZEV
EPL .... Environmental Performance Label
EPRI .... Electric Power Research Institute
EU .... European Union
EVSE .... Electric Vehicle Supply Equipment
FCV............. Fuel Cell Electric Vehicle
FSOR.......... Final Statement of Reasons
g/mi .... grams per mile
gCO_2/mi .... grams carbon dioxide per mile
GHG............ Greenhouse Gas
HEV .... Hybrid electric vehicle (non plug-in)
HICE .... Hydrogen Internal Combustion Engine
ICM .... Indirect Cost Multiplier
ILVM .... Independent Low Volume Manufacturer
ISOR .... Initial Statement of Reasons
IVM .... Intermediate Vehicle Manufacturer
kW............... Kilowatt
LCFS........... Low Carbon Fuel Standard
LDT............. Light- Duty Truck with loaded vehicle weight up to 8500 pounds
LEV I .... First generation Low Emission Vehicle program, adopted in a 1990-1991 rulemaking, and generally applicable in the 1994-2003 model years
LEV II .... Second generation Low Emission Vehicle program, adopted in a 1998 -1999 rulemaking, and generally applicable in the 2004 and subsequent model years

LEV III..........Third generation Low Emission Vehicle program (criteria pollutant and greenhouse gas emission fleet standards), proposed as part of the Advanced Clean Cars rulemaking package in 2012, and generally applicable to 2015 and subsequent model years for Criteria Pollutants, and applicable to 2017 and subsequent model years for Greenhouse Gases.
MDV.............Medium Duty Vehicle
MMT.............Million Metric Tonnes
MOA ....Memorandum of Agreement
NAS ....National Academy of Sciences
NEV ....Neighborhood Electric Vehicle
NHTSA.........National Highway Traffic Safety Administration
NMOG ....Non-Methane Organic Gas
NOx ....Oxides of Nitrogen
NMOG+ NOx...Non-Methane Organic Gas plus Oxides of Nitrogen
PC................Passenger Car
PHEV ....Plug-in Hybrid-Electric Vehicle
PM ....Particulate Matter
ppb...............parts per billion
PZEV ....Partial Zero Emission Allowance Vehicle, typically, a conventional gasoline, diesel, or natural gas vehicle that meets the most stringent standards for smog-forming emissions
R_{cda} ....Charge Depleting Range Actual
RD&D...........Research, Development, and Demonstration
ROG ....Reactive Organic Gases
RPS ....Renewable Portfolio Standard
SIP...............State Implementation Plan
SULEV.........Super Ultra Low Emission Vehicle
SVM.............Small Volume Manufacturer
TAR..............Joint Agency Technical Assessment Report Release September 2010
TTW.............Tank-To-Wheel (emissions)
Type 0 ....Utility EV, less than 50 mile range
Type I ....City EV, range of 50 to less than 100 miles
Type II ....Full Function EV, range of 100 or more miles
Type III ....ZEV, range of 100 or more miles plus fast refueling, or 200 miles
Type IV ....ZEV, range of 200 or more miles plus fast refueling
Type V ....ZEV, range of 300 or more miles plus fast refueling
TZEV............Transitional Zero Emission Vehicle, typically a plug-in hybrid electric vehicle
UAW ....United Auto-Workers (union)
UDDS ....Urban Dynamometer Driving Schedule
US06............US06 drive schedule
U.S. DOE.....United States Department of Energy
U.S. DOT .....United States Department of Transportation
U.S. EPA......United States Environmental Protection Agency
VAC ....Volts Alternative Current

VMT ....Vehicle Miles Traveled
WTW............Well-To-Wheel (emissions)
ZEV ....Zero Emission Vehicle

1 INTRODUCTION

In 1990, the California Air Resources Board (ARB or the Board) adopted an ambitious program to dramatically reduce the environmental impact of light-duty vehicles (LDV) through the gradual introduction of zero emission vehicles (ZEV) into the California fleet as part of the original Low Emission Vehicle (LEV I) program. The ZEV program, which affects passenger cars (PC) and light-duty trucks (LDT), has been adjusted five times since its inception - in 1996, 1998, 2001, 2003, and 2008, to reflect the pace of ZEV development and the emergence of new ZEV and ZEV-like technologies. Through these adjustments the fundamental goal of the program has not changed: California remains committed to the commercialization of ZEV technologies.

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

Faced with ever more stringent regulations, vehicle manufacturers have made remarkable progress in advancing vehicle technology. Conventional vehicles meeting ARB's most stringent emission certification standards achieve emission levels that seemed impossible when the ZEV program was adopted in 1990. The relative contribution of PCs and LDTs is expected to decline over time as new standards phase in, but in 2020 such vehicles will still be responsible for approximately 10 percent of total emissions. State and federal law requires implementation of control strategies to attain ambient air quality standards as quickly as practicable.

Due to California's long history in leading the charge for ZEVs and ZEV enabling technologies and the state's need for criteria pollutant and greenhouse gas (GHG) emission reductions, it is essential that California continues to lead in launching the ZEV commercialization effort. California consumers have a history of adopting new and "green" technologies. Manufacturers have targeted California for many of their demonstration programs, research efforts, and early deployment due to California's mild climate and "green" consumer base. For The EV Project, a project run by ECOtality through a grant from the United States Department of Energy (U.S. DOE), nearly half of the Nissan Leafs and Chevrolet Volts for the project were placed in California.[2] It is important that California continue as the proving grounds and launching point for emerging ZEV technologies.

This rulemaking is an opportunity for the Board to further the transformation of California's light duty vehicle (LDV) fleet to zero emission and low carbon. As the

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[2] ECOtality, 2011. ECOtality. "Quarterly Report: Second Quarter 2011" http://www.theevproject.com/downloads/documents/Q2%20EVP%20INL%20Report.pdf.

technology-forcing piece of the Advanced Clean Car (ACC) package, the ZEV regulation along with staff proposed amendments to the Low Emission Vehicle (LEV III) Criteria Pollutant and LEV III GHG standards can be the catalyst for that transformative process.

Public Process for ZEV Regulation Development

To support development of the ACC package, beginning in May 2010, ARB staff held two public workshops to engage stakeholders and obtain input on the proposed regulations. These stakeholders primarily included representatives from regulated and non-regulated manufacturers, vehicle component suppliers, and environmental advocates.

These workshops were held at ARB offices in Sacramento and El Monte. The announcements and materials for these workshops were posted on ARB's website and distributed through a list serve that included over 14500 recipients. Each workshop attracted over 30 attendees in person. Both meetings were either telecast, webcast or available by teleconference. The dates and materials presented at the workshops are available on ARB's ZEV program website at http://www.arb.ca.gov/msprog/zevprog/zevprog.htm.

1.1 ZEV Program Objectives (Overall Summary)

Since its adoption, the ZEV program has pushed the boundaries of ZEV development and emission reduction from cars and trucks, while taking into account the cost, performance, suitability for volume production, and long-term prospects of various technologies. The following are the main objectives of staff's proposed changes:

- Maintain requirements that facilitate and accelerate ZEV technologies needed to meet California's long term GHG and criteria pollutant targets,
- Push technology to higher volume production in order to achieve cost reductions,
- Minor mid-course corrections and clarifications for model years 2012 through 2017,
- Maintain compliance flexibility in meeting the ZEV requirements, and
- Simplify the structure of the ZEV program.

In the wake of the commercial release of General Motor's Volt PHEV and Nissan's battery electric Leaf, it appears ZEVs have successfully entered the market. However, amending and strengthening ZEV regulatory requirements at this time will ensure continued technology development by multiple manufacturers. Two or three manufacturers succeeding in a particular vehicle technology does not guarantee achieving our air quality or 2050 GHG goals. The key is moving beyond the early adopters and providing viable choices for the everyday consumer.

The most significant amendment in staff's proposal is the increased ZEV volume requirement for 2018 and subsequent model years. Staff's 2009 analysis showed that almost every LDV sold by model year 2040 would need to be a ZEV in order to meet California's long term GHG goals. More recent analyses by various organizations continue to confirm this trend: the need for large-scale electrification of the LDV fleet.[3,4,5] Staff's proposal helps to get California's fleet on an appropriate trajectory toward meeting this long term GHG goal, while offering compliance flexibility and not placing unnecessary and burdensome requirements on those manufacturers clearly on their way to commercializing ZEV technology.

Staff's proposed amendments also help simplify the regulation in model years 2018 and beyond. ZEV credits are now linear, based only on the vehicle's range. Also, the PHEV[6] credit calculation has been simplified, allowing manufacturers to do one calculation, as opposed to the old method of adding up various allowances. Another change affecting many manufacturers in both the LEV III proposal and the ZEV regulation proposal is a new manufacturer size definition. This change will bring nearly all manufacturers under the full ZEV requirements by model year 2018. This amendment is important for commercialization of 2050 vehicle technologies, ensuring a portfolio of vehicle models and technologies become available.

1.2 Air Quality and Climate Change in California

There are currently roughly 25 million cars operating in California, and by 2035, will grow to more than 30 million cars. Prior to the establishment of ARB in 1968, photochemical smog pollution was a major health concern that caused acute health impacts to Californians. Much of this smog was formed by automobile emissions. Over the next 40 years, ARB adopted the most stringent automobile emissions standards in the world, requiring use of the catalytic converter that revolutionized emissions control and dramatically reduced emissions from automobiles. Those regulations, in conjunction with regional programs to reduce emissions from refineries, power-plants, and other stationary sources, led to a major improvement in air quality. In 1980, the South Coast Air Basin experienced widespread ozone levels which exceeded air quality standard for 179 days per year[7]. In 2010, that number was reduced to 63 days per year, and those violations occurred in a much smaller portion of the Air Basin. During this same period, peak ozone concentrations in Southern California dropped more than 60 percent - from 273

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[3] CCST, 2011. California Council on Science and Technology, May 2011. "California's Energy Future: The View to 2050."
[4] NREL, 2011a. National Renewable Energy Laboratory. February 15, 2011 "Role of Fuel Carbon Intensity in Achieving 2050 GHG Reduction Goals within the LDV Sector."
[5] IEA, 2011. International Energy Agency. June 2011. "Technology Roadmap: Electric and Plug-in Hybrid Electric Vehicles."
[6] Plug-in hybrid electric vehicles (PHEV) are also referred to as Transitional Zero Emission Vehicles, or TZEVs. Staff is proposing new terminology to be straighter forward and simple.
[7] 1997 federal 8-hour ozone standard of 0.08 ppm.

parts per billion (ppb) to 112 ppb. Similar air quality improvements were seen in many other regions of California.

Despite these major improvements, air quality in both the greater Los Angeles region and the San Joaquin Valley are classified by the United States Environmental Protection Agency (U.S. EPA) as "extreme" ozone non-attainment areas. This is the most severe federal non-attainment classification, and these two areas of California are the only two areas in the nation granted this designation. Bringing these regions into attainment requires more significant emission controls than anywhere else in the United States.

In 2007, California adopted State Implementation Plans (SIP) to chart the course to attainment of the 1997 federal 8-hour ozone standard. To achieve the 1997 ozone standard by the attainment date in 2023, oxides of nitrogen (NOx) emissions in the greater Los Angeles region must be reduced by two thirds, even after considering all of the regulations in place today, with the most significant share of needed emission reductions coming from long-term advanced clean air technologies. In the San Joaquin Valley, the SIP identified the need to reduce NOx emissions by 80 tons/day in 2023 through the use of long-term and advanced technology strategies. To put this in context, this is equivalent to eliminating the NOx emissions from all on-road vehicles operating in these regions.

Despite the dramatic emission reductions and air quality improvements achieved to date, most urban areas of California, including Southern California, and the Central Valley continue to exceed the federal ozone standard[8]. ARB, the South Coast Air Quality Management District, and the San Joaquin Valley Air Pollution Control District are beginning to evaluate the emission reductions needed to attain the more health-protective ozone standard U.S. EPA established in 2008. In order to meet these challenges, air quality and land-use agencies in the South Coast and San Joaquin Valley are actively pursuing a coordinated strategy that would result in the widespread use of zero-emission technologies on transportation networks designed to reduce smog-forming emissions from single-occupant vehicle use.

Climate change poses a serious threat to the economic well-being, public health, natural resources, and environment of California. Global warming is projected to have detrimental effects on some of California's largest industries (including agriculture and tourism), increase the strain on electricity supplies, and contribute to unhealthy air.[9,10,11]

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[8] 2008 federal 8-hour ozone standard of 0.075 ppm. Designations, classifications, attainment date and planning requirements for the 2008 federal ozone standard have not yet been established by the U.S. Environmental Protection Agency. ARB anticipates that SIPs will be due to U.S. EPA by 2015 with attainment required in the 2031/32 timeframe.

[9] CNRA, 2009. California Natural Resources Agency. 2009. "*2009 California Climate Adaptation Strategy*" http://www.energy.ca.gov/2011publications/CEC-600-2011-007/CEC-600-2011-007-SD.pdf

[10] UC Berkeley, 2008. University of California, Berkeley. November 2008. "*California Climate Risk and Response*"

[11] ARB 2009a. California Air Resources Board. May 11, 2009 Update. "Climate Change Scoping Plan" http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf

A number of state policies directly address climate change emissions. Assembly Bill (AB) 32 (2006) requires that statewide climate change emissions be reduced to 1990 levels by 2020. AB 1007 (2005) indicates a need for electric drive trains as well as other significant actions to meet California's goals. Fleet performance standards outlined by AB 1493 (2002) and the LEV III program provide a foundation for these emission reductions, however, performance standards alone cannot provide reasonable assurance that ZEVs will be produced in necessary volumes to provide a sufficient launch of the technology in the marketplace. The ZEV regulation is the necessary tool to ensure a portfolio of advanced technologies are available to consumers.

In recognizing the potential for large, damaging impacts from climate change, former California Governor Arnold Schwarzenegger enacted Executive Order S-03-05, requiring a reduction in state-wide GHG emissions to 80-percent below 1990 levels by 2050. Staff's 2009 analysis[12] showed widespread adoption of conventional technologies, even conventional mild hybrid electric vehicles (HEV), will not be enough to meet these stringent targets. ZEVs will need to reach nearly 100 percent of new vehicle sales between 2040 and 2050, with commercial markets for ZEVs launching in the 2015 to 2020 timeframe. All ZEV technologies – fuel cell electric vehicle (FCV), battery electric vehicle (BEV), and plug-in hybrid electric vehicle (PHEV) – need to be encouraged and promoted through regulatory and non-regulatory methods.

1.3 ZEV Program History

Manufacturers originally pursued the development of BEVs to meet the ZEV requirements. In 1996, ARB eliminated the requirements for the 1998 through 2002 model years due to cost and performance issues, to allow additional time for battery research and development. ARB entered into memorandums of agreement (MOA) with vehicle manufacturers to place, in California, roughly 1,800 advanced-BEVs between 1998 and 2000. The agreements were designed to provide battery developers with the necessary initial production volumes to meet the cost and performance goals needed for begin early commercial production.

Contrary to expectations, advanced battery costs remained too high for commercial viability. Notwithstanding these costs, several manufacturers continued to place a modest number of BEVs beyond the MOA volumes. These vehicles earned ZEV credits that have been used for compliance with the regulation.

Manufacturers began to look seriously at hydrogen FCVs in the late 1990's as an alternative to BEVs. This interest led to cooperative efforts among ARB, industry and other governmental agencies to create the California Fuel Cell Partnership in 1999.

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[12] ARB, 2009b. California Air Resources Board. November 25, 2009. "White Paper: Summary of Staff's Preliminary Assessment of the Need for Revisions to the Zero Emission Vehicle Regulation - Attachment B: 2050 Greenhouse Gas Analysis" http://www.arb.ca.gov/msprog/zevprog/2009zevreview/attachment_b_2050ghg.pdf

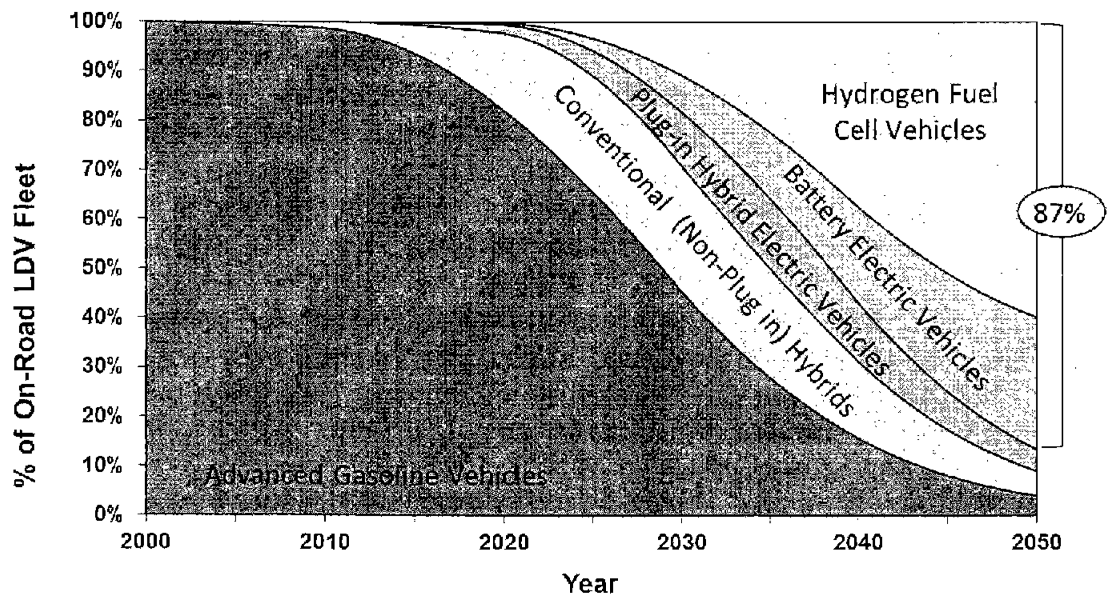
The Partnership demonstrates vehicle technology while exploring the paths to commercialization, including the development of public hydrogen fueling infrastructure. Changes to the ZEV regulation in 2003 provided new incentives for FCVs, resolved legal challenges, and addressed the state of technology at that time.

1.4 2008 Amendments and 2009 Technology Review

The Board adopted Resolution 08-24 at the March 2008 hearing, directing staff to redesign the 2015 and beyond requirements for the ZEV program, strengthen the requirement more than the current program, focus primarily on the zero emission drive, that is BEV, FCV, and PHEV technologies, and ensure California as the central location for advanced, low GHG technology vehicles from the demonstration phase to commercialization.

In 2009, staff undertook an assessment of ZEV technologies, an analysis of pathways to meeting California's long term 2050 GHG reduction goals in the LDV subsector[13] and a review of current and possible future complementary policies that would be needed to aid in infrastructure development and market pull policies for ZEVs. Based on the U.S. DOE Vision model[14], staff developed a California-specific model for the LDV subsector, relying heavily on model inputs and assumptions from peer-reviewed studies. Figure 1 shows what the cumulative on-road PCs would need to be to reach the 2050 goal.

Figure 1: On Road Passenger Car Scenario to Reach 2050 Goal



[13] This analysis assumed a 2050 target of 80% below the passenger vehicle portion of 1990's GHG inventory, or 20% of 108.5 MMT of CO_2 equivalent emissions.
[14] DOE, 2008. United States Department of Energy. Vision Model, 2008. http://www.transportation.anl.gov/modeling_simulation/VISION/

This graph shows the cumulative on-road PC mix for the scenario developed by staff that reaches the Governor's GHG emission reduction goal. The most important trend to highlight is that ZEVs grow to become approximately 87 percent of on-road PCs after ZEV sales reached nearly 100 percent in 2040.

Through modeling various scenarios, including the scenario shown in Figure 1, staff concluded:

- ZEVs are essential to meeting California's long term GHG emission reduction goals.
- A high-volume (100,000s) ZEV market needs to exist by 2020 in order for ZEV sales and fleet turn-over rates to result in enough ZEVs to achieve deep reductions in GHG emissions.
- Any amendments to the ZEV regulation should help keep the LDV subsector on track to reach an 80 percent reduction in GHG emissions by 2050.
- FCVs, BEVs, and PHEVs with low carbon biofuels are the three most viable candidates for near-zero carbon transportation. All three vehicle technologies will be necessary in order to achieve the GHG goal, and to lessen the risk of market failures.

Staff presented its findings at the December 2009 Board Hearing. At the December hearing, the Board adopted Resolution 09-66[15], reaffirming its direction to meet California's long term air quality and climate change reduction goals through commercialization of low-carbon emitting vehicle technologies. The Board directed staff to consider the following in preparing amendments to the ZEV regulation:

- Shift focus from only criteria pollutant emission regulations to GHG emission reductions and criteria pollutants;
- Focus on transforming California's light-duty fleet and commercializing low-carbon emitting technologies, such as ZEVs and PHEV in a timeframe sufficient to meet the 2050 target of 80 percent reduction in GHG emissions compared to 1990 levels;
- Take into consideration new LEV III GHG fleet standards and revise the ZEV regulatory structure, credit values, and stringency of the current requirements accordingly.

In 2010, President Barack Obama directed the U.S. EPA and National Highway Traffic Safety Administration (NHTSA) to work with California to develop GHG fleet standards

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[15] ARB 2009c. California Air Resources Board. Resolution 09-66. December 9, 2009. http://www.arb.ca.gov/msprog/zevprog/2009zevreview/res09_66.pdf

for model year 2017 through 2025 LDVs. The Joint Technical Assessment Report (TAR) was released in September 2010. The report concluded "electric drive vehicles including hybrid(s)...battery electric vehicles...plug-in hybrid(s)...and hydrogen fuel cell vehicles...can dramatically reduce petroleum consumption and GHG emissions compared to conventional technologies...The future rate of penetration of these technologies into the vehicle fleet is not only related to future GHG and CAFE standards, but also to future reductions in HEV/PHEV/EV [electric vehicle] battery costs, the overall performance and consumer demand for the advanced technologies..."[16] Manufacturers confirmed in meetings leading up to the release of the TAR, their commitment to develop ZEV technologies. "...[A] number of the firms suggested that in the 2020 timeframe their U.S. sales of HEVs, PHEVs, and EVs [electric vehicle] combined could be on the order of 15-20% of their production."(EPA, 2010, pp.2-5)

1.5 The Current Program

Table 1.1 below specifies large volume manufacturer credit obligations for 2012 through 2014 and 2015 through 2017model years.

[16] EPA, 2010. United States Environmental Protection Agency, National Highway Safety and Traffic Administration and California Air Resources Board. September 2010. "Interim Joint Technical Assessment Report: Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards for Model Years 2017-2025" (p. vii)

Table 1.1: Summary of 2012 Through 2017 Model Year Requirements For Large Volume Manufacturers*

Vehicle Category	Vehicle Technology Descriptions	2012-2014 Annual Credit Requirement	2012-2014 Annual % of Fleet	2015-2017 Annual Credit Requirement	2015-2017 % of Fleet
ZEV	Zero tailpipe emissions: battery electric vehicles, and hydrogen fuel cells.	0.79%	0.2%	3%	0.7%
TZEV	Transitional Zero Emission Vehicles; Vehicles certified to PZEV standards that utilize a ZEV fuel: e.g. plug-in hybrid electric vehicles or hydrogen internal combustion engine vehicles. Proposed terminology replacing "Enhanced AT PZEV"	2.21%	1.5%	3%	2%
AT PZEV	Vehicles certified to PZEV standards and employing ZEV-enabling technologies: e.g. hybrids or compressed natural gas vehicles.	3%	7%	2%	6%
PZEV	Conventional vehicles certified to the most stringent tailpipe emission standards, zero evaporative emissions, and extended warranty.	6%	30%	6%	30%

*The ZEV regulation establishes a credit requirement, shown in shaded columns , for manufacturers each year. Manufacturers earn credits through production of vehicles from different categories. The "Annual % of Fleet" represents the percentage of new vehicle sales expected from each vehicle category due to compliance with the regulations.

The four categories of vehicles used to meet the ZEV regulation are ZEVs, TZEVs (formerly "Enhanced advanced technology partial zero emission allowance vehicles" or "Enhanced AT PZEV"), advanced technology partial zero emission allowance vehicles (AT PZEV), and partial zero emission allowance vehicles (PZEV). To date all manufacturers are fully in compliance, with nearly 5,600 ZEVs demonstrated, and over 1,700,000 PZEVs and 350,000 AT PZEVs commercially introduced, resulting in significant emissions reductions. Examples of PZEVs are the Honda Civic and Mazda 6 while an example of an AT PZEV is the Ford Fusion Hybrid. Table 1.2, below, shows the cumulative number of vehicles placed in compliance with the ZEV regulation.

Table 1.2: Cumulative Vehicle Placement

ZEV Credit Category	Technology Type	Quantity of Vehicles
ZEV	Fuel Cell	350
	Battery Electric	5,200
	Neighborhood Electric	28,800
AT PZEV	Hybrid or Compressed Natural Gas	380,000
PZEV	Conventional Gas	1,750,000

*On-road number is less for FCVs and NEVs.

Manufacturer Compliance Status and Near Term Production Plans

All manufacturers have complied with ZEV regulation requirements. For the 2012 model year, six large volume manufacturers (LVM) are required to comply with the entire regulation, meaning these manufacturers must produce pure ZEVs: Chrysler, Ford Motor Company, General Motors, Honda, Nissan, and Toyota. Ten intermediate volume manufacturers (IVM) have the option to meet their entire requirement with credits from PZEV. These ten manufacturers include: BMW, Hyundai, Jaguar-Land Rover, Kia, Mazda, Mercedes Benz, Subaru, Volkswagen and Volvo. Several other non-regulated manufacturers are actively producing ZEVs and neighborhood electric vehicles (NEV), and earning ZEV credits.

The 2008 amendments provided greater flexibility in the regulation for model years 2012 and beyond, offering more equal treatment of ZEV technologies. Manufacturers have complied by producing the maximum number of PZEVs and AT PZEVs. Half of the LVMs have heavily pursued FCV technology, while the other half have focused predominately on BEV technology.

Fuel Cell Vehicle Technology, Deployment, and Infrastructure Status

Manufacturers have continued to pursue FCV technology, publically committing to early-commercialization in the 2015 to 2020 timeframe. In a joint letter issued in September 2009, manufacturers (Daimler, Ford, General Motors, Honda, Hyundai, Kia, Toyota, alliance Renault SA, and Nissan) strongly supported fuel cell technology, anticipating that from 2015 onwards, FCVs could reach commercialization. Recently, Mercedes Benz announced a three year lease program for its 2011 B-Class F-Cell vehicle.[17]

In January 2011, thirteen Japanese companies jointly announced significant cost reductions in manufacturing FCVs, commitment to 100 hydrogen stations in Japan by 2015, and joint support for spreading FCV technology throughout Japan.[18] Such

[17] Autobloggreen, 2010. AutoBlogGreen.com. Eric Loveday. "Mercedes-Benz prices B-Class F-Cell lease at $849 a month" http://www.green.autoblog.com/2010/11/22/mercedes-benz-prices-b-class-f-cell-lease-at-849-a-month/

[18] Toyota, 2011. Toyota Motor Company. January 13, 2011 "Japanese Companies Eye Smooth Domestic Launch of FCVs" http://www2.toyota.co.jp/en/news/11/01/0113.html

worldwide developments help to bring vehicle costs down, advancing FCVs closer towards commercialization.

Hydrogen infrastructure technology is advancing and station performance is improving. As a result, customer experience is progressing toward being comparable to today's gasoline fueling experience. Through ARB and California Energy Commission (CEC) funding, five new stations are currently under construction or will have opened by the end of the year. Also, an existing station has been updated and put back into service with improvements in accessibility. Additionally, eight new hydrogen stations will be opening in the next two years, with three more stations planned to be upgraded with increased capacity and accessibility. In total, over 2000 additional kilograms per day of hydrogen will have been made available to FCVs located in the California's Bay Area and South Coast air quality management districts. The increased capacity will support up to 2500 FCVs total. Confidential submittals auto manufacturers reveal that over 50,000 FCVs are planned to be in operation in California by 2017.

Recently, a number of manufacturers have announced aggressive production plans for PHEVs and BEVs for the next three model years. These announcements reflect technological advancement in lithium ion battery technology and a general shift in customer demand and corporate environmental stewardship. The following table provides a summary of manufacturers' current program commitments, by technology category, as publicly stated.

Table 1.3: Manufacturer ZEV and TZEV Announcements

Manufacturer	Model	Type	Timeframe	Reference
BMW	ActiveE	BEV	2011	BMW, 2011a
	i3	BEV	2013	BMW, 2011b
	i3 Rex	PHEV		BMW, 2011c
	i8	PHEV	2014	BMW, 2011b
BYD	e6	BEV	2012	BYD, 2010
CODA	*(unknown)*	BEV	2011	PopularMechanics, 2011
Chrysler	Fiat 500 EV	BEV	2012	Chrysler, 2010
Fisker	Karma	PHEV	2011	Fisker, 2011
Ford	C-MAX Energi	PHEV	2012	Ford, 2011a
	Focus Electric	BEV	2011	Ford, 2011b
	Transit Connect Electric	BEV	in production	n/a
GM	Cadillac ELR	PHEV	*(unknown)*	GM, 2011a
	Spark	BEV	2012	GM, 2011b
	Volt	PHEV	in production	n/a
	(unknown)	FCV	2015	USA TODAY, 2010
Honda	Fit EV	BEV	2012	Honda, 2011
	(unknown)	PHEV	2012	
	Clarity FCX	FCV	in production	n/a
Hyundai	Tucson IX	FCV	2015	Bloomberg, 2010
Mercedes Benz	*(unknown)*	BEV	2012	Mercedes, 2011
	F-Cell	FCV	in production	Autobloggreen, 2010
Mitsubishi	i	BEV	in production	n/a
	Outlander	PHEV	2013	Motor Trend, 2011
Nissan	LEAF	BEV	in production	n/a
Smart	fortwo ED	BEV	in production	n/a
Tesla	Model S	BEV	2012	Tesla, 2011
Think	City	BEV	in production	n/a
Toyota	Prius Plug-In	PHEV	2012	Toyota, 2011b
	RAV-4 EV	BEV	2012	Toyota, 2011c
	Scion iQ-EV	BEV	2012	
	(unknown)	FCV	2015	Toyota, 2011d
Volkswagen	e-up!	BEV	2013	Volkswagen, 2011
Wheego	Whip LiFe	BEV	in production	n/a

The table reveals that nearly every manufacturer will be introducing production BEV and PHEV products within the next one to three years, and five manufacturers will commercially introduce FCVs by 2015.

2 SUMMARY OF PROPOSED AMENDMENTS

In response to the Board's direction in 2008 and in 2009, and in consideration of the issues related to technology commercialization and new proposed GHG and criteria pollutant standards, staff proposes amendments to the program that strengthen and simplify the regulation. The amendments are spilt into two parts: Model year 2012 through 2017 (Part I), and model years 2018 and beyond (Part II). The amendments identified in this section represent the most significant changes being proposed in each "Part." Additional minor proposed amendments and concurrent rationale can be found below in Section 9.

The following sections more fully describe each of the major proposed amendments and the rationale for the proposed change.

2.1 Part I: Model Year 2012 through 2017 Amendments

2.1.1 Type I.5x and Type IIx: Range Extended Battery Electric Vehicles

Some manufacturers have proposed a new class of advanced vehicles for separate treatment as part of the ZEV program: range extended battery electric vehicle (referred to as a "Type I.5x and Type IIx vehicles" or "BEVx" in this proposal). The proposed vehicle is closer to a BEV than to a PHEV: a vehicle with primarily zero-emission operation equipped with a small non-ZEV fuel auxiliary power unit (APU) for limited range extension. Manufacturers proposing this type of vehicle describe it as having reduced performance while operating in APU mode that allows drivers to find a charging location, and discouraging non-zero emission driving. Most of these vehicles are expected to have a zero-emission range of 80 miles or greater. This vehicle has substantially more range than currently announced PHEVs, with electric range comparable to full function BEVs and will probably require ground-up BEV design. Manufacturers believe that the APU will be a relatively high-cost option on top of an existing, full function (100+ mile), BEV.

BEVs are expected to play an important role in ARB's long-term emissions reduction strategy, but the market for current technology BEVs might be limited. The proposed vehicle has the potential to expand the BEV market beyond current market estimates by giving interested BEV customers an extra measure of confidence about range, and if successful, would add substantial zero-emission vehicle miles traveled (VMT) to the overall California fleet. While the APU within the vehicle may evolve during this transition, from gasoline to advanced biofuels to hydrogen, it is reasonable to believe that this proposed vehicle may help meet ARB's long-term GHG and criteria pollutant emissions reduction goals.

Staff expects BEVxs to play a longer-term role than TZEVs because of their improved zero emission mileage potential. These vehicles would be particularly well suited to use of low upstream GHG fuels that might be more expensive, since the predominant operating cost would be offset by relatively low-cost electricity. In addition to potential for emerging alternative fuel use, there is an opportunity to explore engine technologies that are advantageous but otherwise unsuitable for application in conventional vehicles. Engine technology applied to existing PHEVs is derived from small conventional production gasoline engines, but highly specialized APUs for BEVxs may eventually spin off and evolve in completely different directions. Future BEVxs with highly specialized engine and fuel technologies could be optimized to drive cost, weight, size, and emissions down and make these specialized BEVx APUs suitable for more affordable and therefore more widespread application. Lotus Engineering and other automotive design firms have been developing hybrid-specific APUs and have several unique concepts under development already.[19]

There are several reasons to consider equivalent regulatory treatment for BEVxs relative to BEVs with the same range capability. Most BEV drivers must plan their vehicle use with some degree of "reserve" range left in the battery, while BEVx drivers will have the confidence plan trips that consume all, or nearly all, of the energy storage capability of their battery systems. In this way, the BEVx market may appeal to drivers who would not otherwise consider a BEV with the same range. Also, since staff considers these vehicles full function BEVs with short range APUs, it is important that the minimum range for eligibility be equivalent to full function BEVs in the marketplace.

Staff proposes the following criteria to these proposed vehicles:

(1) the APU range is equal to or less than the all-electric range,

(2) engine operation cannot occur until the battery charge has been depleted to the charge-sustaining lower limit,

(3) have a minimum 80 miles electric range, and

(4) super ultra low emission vehicle (SULEV) and zero evaporative emissions compliant and TZEV warranty requirements on the battery system.

Though not required, manufacturers are expected to incorporate further performance limits on charge sustaining APU mode operation, including speed restrictions. The intent of the backup APU is not to charge the battery, but rather, to enable the vehicle to drive to a charging station. BEVxs will fit the needs of drivers who are looking for an improved regional driving capability, but not for use in long-distance driving.

Because of the potential for strong zero emissions mileage performance potential, staff proposes to treat this emerging class of BEVxs similar to BEVs, similar to current treatment of NEVs. For the 2012 through 2017 model years, BEVxs will be referred to as Type I.5x and Type IIx vehicles, to fit in with the pre-2018 nomenclature for ZEVs. Staff proposes Type I.5x and Type IIx vehicles will receive the same credits as Type I.5 and Type II ZEVs: 2.5 and 3 credits, respectively. Staff proposes that a manufacturer may meet up to 50 percent of the portion of their requirement that must be met with pure ZEVs with these Type I.5x and Type IIx vehicles. Additionally, staff proposes that these vehicles will qualify under the Travel Provision, through 2017, like their ZEV counterparts. Lastly, Type I.5x and Type IIx vehicles will be eligible for

[19] Lotus, 2010. Lotus Engineering. Turner, James, et al,. "The Lotus Range Extender Engine." SAE Int J Engines 3:318-351.

advanced demonstration credit through 2017 model year. See Section 2.2.6, below, for 2018 and subsequent model year treatment.

It is staff's intent to provide equivalent incentives for BEVxs, and to encourage outside stakeholders distributing or controlling incentives normally allocated to ZEVs to also allocate equivalent benefits to vehicles meeting the new BEVx requirements.

2.1.2 Extend Compliance Flexibility Provisions Through Model Year 2017

Advanced Demonstrations
Currently, up to 25[20] ZEVs or TZEVs[21] that are placed in a California advanced technology demonstration program may earn ZEV credits even if they are not "delivered for sale." Instead of being sold or leased, these demonstration vehicles are typically operated by the manufacturer to gain needed experience and information about the technology. In addition, vehicles in these programs are required to be in California for at least one year of a two year placement. The current regulation sunsets advanced demonstration credits after model year 2014.

Even though some manufacturers have seemingly commercialized ZEVs, many manufacturers are still in the research and development phase for zero emission technologies. Staff is proposing to extend advanced demonstrations for ZEVs, but not TZEVs, through model year 2017, allowing advanced demonstrations credits for TZEVs to sunset after model year 2014 as currently written. With staff's proposal to amend the definition for LVMs which causes additional manufacturers to come under the full ZEV requirements in model year 2018, extension of this provision will allow prospective 2018 LVMs to demonstrate technologies needed to meet future requirements, while lessening the burden of placing the vehicles in service.

Travel Provision
Section 177 of the federal Clean Air Act[22] allows other states to adopt California motor vehicle emission standards including the ZEV regulation. Currently, there are 11 states which have adopted the California ZEV regulation: Arizona, Connecticut, Maine, Maryland, Massachusetts, New Jersey, New Mexico, New York, Oregon, Rhode Island, and Vermont (hereafter, referred to as section 177 ZEV states). The current ZEV regulation allows all ZEV "types", except TZEVs, placed in service in Section 177 ZEV states to be counted towards compliance with the California percentage ZEV requirements as if they are placed in service in California. Similarly, a vehicle placed in California counts towards compliance in a Section 177 ZEV state. The effect of travel is the number of ZEVs required to be produced by vehicle manufacturers, regardless of how many states adopt the ZEV program, will not exceed those required by ARB's regulation alone. Typically the number of vehicles that have to be produced for the

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[20] California Code of Regulation (CCR), title 13, section 1962.1(g)(4) language states 25 vehicles per model, per ZEV state, per year.
[21] CCR, title 13, section 1962.1(g)(4) language currently states Enhanced AT PZEVs are eligible. Staff is proposing to replace Enhanced AT PZEVs with Transitional Zero Emission Vehicles or TZEVs.
[22] United States Code, title 42, section 7507

Section 177 ZEV states is 1.5 to 2 times the number that has to be produced for California (two times is used in this document for simplicity).

There is currently no travel provision for TZEVs, and staff is not proposing to change this provision. This means that manufacturers that choose to comply in California using TZEVs may not use those credits for compliance in the Section 177 ZEV states.

Currently the Travel Provision sunsets after model year 2014 for Type I, Type I.5, and Type II ZEVs, which are typically BEVs. Staff proposes to extend this provision through model year 2017 for these three ZEV types. California markets have matured and are well prepared for increased sales requirements. However, markets in Section 177 ZEV states need additional time to prepare for ZEVs, and some vehicle manufacturers need time to expand their BEV offerings to other states and to different climates.

Staff is also proposing clarifying language within this provision to ensure only manufacturers with a requirement are allowed to use this provision. This is the current intent of the language in this provision, and the proposed language is only for clarification.

2.1.3 Increase Incentives for Fuel Cell Vehicles: Model Years 2015 – 2017

Under the current regulation, travel for BEVs expires after 2014 model year, but FCVs travel through model year 2017. Thus the production of a BEV to meet California's regulation means an additional obligation to produce approximately two more BEVs to comply with the combined requirement of the section 177 ZEV states. If a FCV is produced for compliance in California, there is no further production obligation in the Section 177 ZEV states because the travel provision applies to FCVs.

Due to staff's proposed extension of the travel provision for BEVs for model years 2015 through 2017 described above, production of a BEV satisfies the obligation of both Section 177 ZEV states and California, whereas the current regulation would result in a requirement to produce three BEVs, compared to one FCV. As a result there will be a substantially reduced incentive to produce FCVs in this timeframe.

California is investing heavily to create a publically accessible hydrogen fueling infrastructure which is a necessary prerequisite to manufacturers introducing to the market FCVs. Staff's 2009 fleet-wide GHG analysis showed FCV technology would be the predominate on-road ZEV technology in model year 2050. In development of the 2009 analysis, as well as this rulemaking, many manufacturers stated BEV technology would only be able to fulfill 20 to 30 percent of future fleet sales.[23] Thus decreasing the relative credit derived from producing a FCV, compared to a BEV,

[23] ARB, 2009d. California Air Resources Board. "White Paper: Summary of Staff's Preliminary Assessment of the Need for Revisions to the Zero Emission Vehicle Regulation," http://www.arb.ca.gov/msprog/zevprog/2009zevreview/

sends the wrong signal to those five manufacturers planning the introduction of FCVs prior to 2017.

Staff proposes to address this issue by increasing the amount of credit earned by Type V ZEVs, or 300 mile range fast-refueling capable FCVs. Currently, Type V ZEVs earn seven credits each. Staff proposes to increase the credit value to nine credits. This would be three times the amount a Type II ZEV (a 100 mile BEV) would earn in this time frame. Proponents of this change have requested significantly greater credit. However, staff believes the proposed credit level appropriately recognizes and provides an incentive for the technology without greatly reducing the number of vehicles produced in this timeframe for compliance. It also better reflects the current higher cost of producing a FCV, compared to a BEV, at the current state of FCV development and lower production quantities.

2.1.4 Decrease Overall Requirement for IVMs for Model Years 2015 – 2017

IVMs currently are allowed to comply fully with credits from PZEVs to meet their ZEV obligation. Table 2.1 below shows an IVM's credit requirement, and what this means in terms of a percentage of its annual vehicle sales being PZEVs.

Table 2.1: Current IVM Requirement 2012 through 2017

Model Years	Current Credit Percentage Requirement	Percentage of IVM Fleet
2012 through 2014	12%	~60%
2015 through 2017	14%	~80%

Due to staff proposed amendments to manufacturer size definitions, many current IVMs will become LVMs by model year 2018. Staff is not proposing any additional lead time for these manufacturers, and considers the next six model years (up to model year 2018) adequate for ZEV development, considering many of the manufacturers have development programs underway.

For these reasons, staff proposes to reduce the credit percentage for IVMs for model years 2015 through 2017, from 14 percent to 12 percent. This still guarantees 60 percent of each IVM's fleet will be PZEVs, a substantially higher percentage of the manufacturers' fleets than LVM fleets. The change will allow IVMs, especially those becoming LVMs in 2018, to focus on development of ZEV technologies necessary for meeting more stringent ZEV requirements in 2018.

2.1.5 Remove Carry Forward Provisions

Historically, the ZEV regulation allowed the banking and trading of credits earned from early introduction or over-compliance with the regulation. In 2008, staff modified the way banked ZEV credits could be used to meet future requirements. ZEV credits could be used to meet ZEV obligations for the model year in which they were earned and two additional model years. For example, if a manufacturer earns three ZEV credits from placing a Type II ZEV[24] in model year 2010, the manufacturer may bank and use those credits to meet the portion of the regulation that must be met with ZEVs for model years 2011 and 2012 compliance. In 2013, the credits may only satisfy the portion of the requirement that may be met with TZEVs.

Staff proposes to remove this provision, and allow ZEV credits to be banked and used to meet the full requirement in all future model years. The decision to remove this provision is justified based on the substantial increase in ZEV volume proposed for model years 2018 and beyond, and the incentive it provides to produce ZEVs prior to 2018. Currently requirements plateau for three years at a time but hold steady indefinitely at a relatively low level for 2018 through 2025 model years. Because staff is proposing to increase volumetric requirements each year for model years 2018 through 2025, it is unlikely that manufacturers will be able to bank large volumes of credits for later use. Also, some manufacturers will likely need banked credits to assist with compliance in later years. Lastly, this proposed amendment simplifies the regulation in 2018 and subsequent model years.

2.1.6 Minor Amendments

Amend PZEV Calculations
Staff is proposing several minor amendments to the PZEV calculations. First, ARB received several comments regarding the zero-emission VMT PZEV allowance, many of which were received during 2009 rulemaking for PHEV test procedure amendments and aftermarket parts certification requirements.[25] The issues concerned the equation for greater than 40 mile PHEVs, in section 1962.1(c)(3)(A), and potential future PHEVs with blended operation. Staff is proposing to correct inconsistencies in the zero-emission VMT allowance equation as indicated in Table 2.2 below.

[24] An example of a Type II ZEV is a 100 mile BEV.
[25] Rulemaking documents and public comments received during the 45-day and subsequent comment periods for the PHEV test procedure rulemaking can be accessed at the following link: http://www.arb.ca.gov/regact/2008/phev09/phev09.htm

Table 2.2: Proposed Regulatory Language – Zero Emission VMT Allowance

2.1.6.1 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

*EAER means equivalent all electric range.
*R_{cda} means charge depleting range actual.

Second, staff is providing clarifying language as to the utility factors (UF) to be used in determining a manufacturer's zero emission VMT allowance. Within the update Society of Automotive Engineers J2841 (March 2009), there are multiple UFs. Staff proposes to specify the UF determined to be according to Section 4.5.2 Equation 5 and the "Fleet UF" Utility Factor Equation Coefficients in Section 4.5.2, Table 3, in J2841 (March 2009).

Third, staff is proposing to delete the alternative test procedures for determining a manufacturer's zero emission VMT allowance. The alternative test procedures allowed manufacturers to receive zero emission VMT allowance for vehicles using fuels that produce near-zero, but not zero criteria pollutants. Staff is proposing this amendment because no automakers have included vehicles requiring or requesting such exemptions in any vehicle planned through 2017. This change would most likely impact a manufacturer planning to certify and sell hydrogen internal combustion engine (HICE) vehicles in the near-term, but staff believes that HICE vehicles are not under consideration for sales until the 2020 and beyond timeframe when hydrogen fueling infrastructure may be more commonly available in California.

Also, staff is proposing to eliminate the Type C advanced componentry allowance. In past years, manufacturers produced conventional hybrids with lower system voltages, and there was still some degree of motor system technology transferrable to ZEVs. Since that time, ZEV technology has advanced and staff now believes that the minimum qualifying system should be increased to the higher voltage Type D because (1) AT PZEVs need to make use of systems that more closely represent those that are needed for ZEVs, and (2) no manufacturers have certified, or have disclosed plans to certify, a Type C AT PZEV.

Decrease Value of Transportation System Credits

Transportation system credits were included in the ZEV regulation in 2001 to evaluate the benefits and issues related to the shared use of ZEVs, and the application of new technologies (at that time) such as reservation management, card systems, depot management, etc. Manufacturers earn transportation system credits by placing vehicles (currently PZEVs, AT PZEVs, TZEVs, and ZEVs) in car-sharing programs with automated reservation system technologies, and receive additional credits for linking these car-sharing programs to transit. Car sharing programs may be run by a manufacturer, or by a third party (e.g., Zipcar).

Transportation system credits have been a lucrative compliance strategy for manufacturers. When originally conceived, transportation system credits were thought to give manufacturers a different venue for placing new technologies in multiple consumer hands without requiring vehicle purchase or lease.

In Resolution 09-66, the Board found that the ZEV regulation will help assure the successful launch of commercial ZEVs and TZEVs (enhanced AT PZEV, as stated in Resolution 09-66) in the next decade. Staff believes limiting the number of credits offered for reasons other than vehicle placement is key to ensuring ZEV and TZEV commercial success. For this reason, and in an effort to simplify the regulation, staff proposes to decrease the amount of extra credits for TZEVs and ZEVs placed in transportation systems. The following table 2.3 enumerates the adjusted credit volumes for model year 2012 through 2017.

Table 2.3: Proposed Transportation System Amendments 2012-2017

Type of Vehicle	*Current Credit for Shared Use, Intelligence*	<u>Proposed</u> <u>Credit</u> for Shared Use, Intelligence	*Current Credit for Linkage to Transit*	<u>Proposed</u> <u>Credit</u> for Linkage to Transit
TZEV	1.0	0.5	1.0	0.5
ZEV	2.0	1.0	1.0	0.5

End Transportation System Credit Provision after Model Year 2017

Car sharing programs are important for air quality and GHG emission reductions, and have potential to play an important role in land use policies such as SB 375[26]. However, the proposed amendments for 2018 and subsequent model years are meant to simplify the program and require manufacturers to place large numbers of ZEVs in the hands of customers.

Staff proposes to end the transportation system credit provision after model year 2017. Staff met with interested stakeholders regarding expiration of this provision and learned that monetary incentives for vehicle purchase might have the same effect as

[26] SB 375, 2008. Steinberg. September 30, 2008. http://www.leginfo.ca.gov/pub/07-08/bill/sen/sb_0351-0400/sb_375_bill_20080930_chaptered.pdf Accessed September 7, 2011.

earning ZEV credits. Currently, most parties earning transportation system credits are not regulated, and sell those credits to regulated manufacturers. Staff believes ensuring monetary incentives are available for car-sharing programs to purchase advanced technology vehicles, like ZEVs and TZEVs, will work similarly to car sharing programs earning ZEV credits. This policy shift is reflected in the recently approved spending plan for the AB 118 Clean Vehicle Rebate Program which sets aside specific amounts of rebate funds for share car programs.

ZEV Bank Account Conversion
Staff proposes to no longer use non-methane organic gas (NMOG) fleet values when calculating manufacturers' ZEV credit account balances starting for 2015 model year compliance. NMOG values are used in ZEV banking to offer an incentive for early vehicle placement, because grams per mile (g/mi) NMOG fleet requirements decrease each year in LEV II. In the LEV III rulemaking for criteria pollutant emission standards for cars and trucks (see rulemaking documents related to LEV III), staff is proposing to change from an NMOG fleet standard to an NMOG plus NOx (NMOG + NOx) fleet standard. A combined NMOG + NOx value would be higher than the lowest NMOG standard in the LEV II regulation, and would not serve as an early compliance incentive in the ZEV regulation.

Staff proposes to divide each ZEV account holder's bank balances after model year 2014 compliance by the lowest NMOG value, 0.035, to convert the credits from g/mi NMOG to straight ZEV credits. This will enable all banking in 2015 and subsequent model years to be in ZEV credits, simplifying the regulation. Due to this change, staff proposes clarifying language throughout section 1962.1, title 13, CCR to make clear the change over from g/mi NMOG ZEV credit to straight ZEV credits.

PZEV Qualification
Staff is proposing to begin LEV III criteria pollutant fleet standards in model year 2015. These will include new tailpipe NMOG + NOx standards as well as evaporative emission standards. Staff will also be proposing new emission certification categories that go beyond SULEV standards. Due to these change in LEV III, staff proposes that in order to earn PZEV credit within the ZEV regulation in 2015 and subsequent model years, the vehicle must be certified to the more stringent SULEV 30 or SULEV 20 standards, and meet LEV III zero-evaporative standards. See the LEV III ISOR for more information on these certification categories.

Charging Requirement Specifications
ARB requires a minimum degree of charging connection compatibility amongst all grid-charged electric vehicles. This requirement ensures the use of standard chargers to facilitate ZEV and TZEV commercialization. The requirement for minimal charging commonality does not preclude the installation of additional vehicle charging capabilities such as direct current (DC) fast charge.

Several unanticipated changes in BEV and PHEV designs have occurred since the Board adopted infrastructure requirements in 2001. Low-range BEVs and PHEVs with both 220 and 120 volt charging capability and battery packs small enough to achieve reasonable charge times with chargers of less than the 3.3 kilowatt (kW) minimum capability were not anticipated when the requirements were adopted. Additionally, charging connection capability was never explicitly required of NEVs.

Staff believes the capability of low-range BEVs to charge on both 220 and 120 volts alternating current (VAC) should be encouraged; it enhances the overall compatibility of low-range BEVs that make use of shared charging stations. ARB has provided an exemption from the current requirements for the 2012 Toyota Plug-in Prius because it is both 220 and 120 VAC compatible, but still capable of fully charging its battery in less than 2 hours even though it is equipped with a relatively low-power on-board charger. Staff proposes to delete the exception for BEVs that only charge at 120 VAC and instead allow for lower power on-board chargers on these low-range BEVs, as long as an optional minimum charge time requirement of 4 hours is met.

Since the original charging requirement went into effect, no manufacturer has certified a vehicle with the 120 VAC only exemption, and none have indicated an interest in future vehicles with 120 VAC only charging. Instead, several manufacturers have agreed that an alternative minimum charge time would be a better way to provide an exemption to the 3.3 kW minimum power requirement for small vehicles because a 120 VAC only vehicle would be (1) less attractive to customers, and (2) incompatible with the objectives of this charging requirement because these vehicles would be incompatible with most planned public infrastructure or even stations installed under future building code requirements.

Staff proposes to require NEVs to meet this same charging connection requirement, beginning in model year 2014 to align with charging requirements for other grid-charged electric vehicles.

Modifications for NEVs

NEVs are simple, low cost, speed limited (25 miles per hour) BEV whose profile is often similar to a golf cart. Currently, ZEV credits for producing a NEV are only allowed to be used to meet up to certain amounts of a manufacturer's ZEV requirement. Pre-2006 model year NEV credits are more stringently capped than 2006 and beyond NEV credits. Staff proposes to extend caps for 2012 through 2014, to 2015 through 2017 model years. Table 2.4, below, lists staff proposed caps for pre 2006 NEV credits for 2015 through 2017 model years.

Table 2.4: Proposed Pre-2006 NEV Credit Limits

Model Years	Portion of the Obligation that:	Percentage of the Obligation that may be met with NEV credits
2012 – 2017	Must be met with ZEVs	0%
	May be met with TZEVs, AT PZEVs, or PZEVs	50%

Table 2.5, below, lists staff proposed caps for post-2006 NEV credits for 2015 through 2017 model years.

Table 2.5: Proposed Post-2006 NEV Credit Limits

Model Years	Portion of the Obligation that:	Percentage of the Obligation that may be met with NEV credits
2012 – 2017	Must be met with ZEVs	0%
	May be met with TZEVs, AT PZEVs, or PZEVs	No Limit

Additionally, staff is proposing to add NEV acceleration, top speed, and constant speed range testing requirements to the "Test Procedures for 2009 through 2017 Model Zero-Emission Vehicle and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck And Medium-Duty Vehicle Classes" to specify testing methods for NEV certification.

Clarifications in Penalty Equation

California Health and Safety Code section 43211 applies a penalty to manufacturers of $5,000 per vehicle not produced in compliance with ARB's standards. In looking at the penalty equation currently in the ZEV regulation, it is not clear how the penalty is to be applied to manufacturers out of compliance. In the ZEV regulation, manufacturers have a wide array of compliance options, with vehicles earning various amounts of credits. However, a manufacturer's ZEV requirement is ZEV credit production; all other vehicle credit types are compliance options, not requirements. Therefore, staff interprets the overall penalty for ZEV non-compliance to be $5,000 per whole credit not produced. Staff proposes to clarify the regulatory language in section 1962.1, title 13, CCR to reflect this intent, and proposes the following equations in Table 2.6 to determine the penalty to be applied to manufacturers not in compliance with the ZEV regulation:

Table 2.6: Proposed ZEV Regulation Penalty Equations

Applicable Model Years	Equation
2009 through 2014	(No. of credits required to be generated for the model year) – (Amount of credits submitted for compliance for the model year) / (the fleet average requirement for PCs and LDT1s for the model year)
2015 and Subsequent	(No. of credits required to be generated for the model year) – (Amount of credits submitted for compliance for the model year)

Lead Time Provisions
Currently, manufacturers are given five years of lead time when transitioning into a larger size definition. For example, if a manufacturer were to increase in sales, such that their 2011 through 2013 sales average exceeded the current LVM threshold of 60,000 sales, the manufacturer would be subject to the full ZEV requirements in model year 2019. However, due to staff proposed modifications for definition and lead time, to be discussed in subsection 2.2.1 below, staff proposes that manufacturers starting their transition before 2018 will be subject to full ZEV requirements starting in 2018 model year. This means, for example, if a manufacturer's 2013 through 2015 sales average (for the first time) is 61,000 vehicles, then instead of being subject to LVM requirements in 2021, the manufacturer will be subject to LVM requirements in 2018.

There is a group of current IVMs that will become subject to LVM requirements in 2018, due to staff's proposed amendments to the definition thresholds, as discussed below in subsection 2.2.1. Some of these current IVMs are closer to becoming an LVM under the current definition of 60,000 vehicles sold, and others will only become an LVM due to staff proposed definition changes. The purpose of staff's proposed amendments is to bring a larger percentage of manufacturers under the full ZEV requirements. This proposed amendment to the lead time provision ensures a level playing field, making manufacturers close to the current definition thresholds (60,000 vehicles per year), subject to LVM requirements at the same time as manufacturers effected by staff's proposed definition change.

Change of Ownership Provisions
Currently, section 1962.1, title 13, CCR, specifies how to calculate a manufacturer's sales when a change of ownership occurs. Staff proposes to include additional clarifying language to this provision to specify 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. This amendment ensures additional lead time is not earned in this type of situation.

Vehicle Credit Eligibility
Currently, ZEVs earn one-credit for the ZEV to be "delivered for sale" and the additional credits for the ZEV to be "placed in service". Staff proposes two change regarding vehicle credit eligibility. First, staff proposes that a vehicle must be both delivered for sale and placed in service in California in order to receive the total credit amount. This change is due to some manufacturers having internet based sales, and questions surrounding the location of a vehicle's delivery and placement in service. Staff's proposed change clarifies the original intent of the provision. The vehicle may still receive partial credit if the vehicle is just delivered for sale. Second, staff proposes to place a five year limit on 2012 and prior model year ZEVs to collect "placed in service" credit. Staff is proposing this five year limit to ensure that the ZEVs offered to consumers are moderately current advanced technology and advanced technology components have not deteriorated.

Rounding Convention
Staff proposes ZEV credit and debits to be rounded to the nearest thousandth of a credit or debit only on the final credit and debit total for a compliance year using the conventional rounding method, for 2009 through 2014 model year. For example all numbers including the vehicle production numbers, the debit requirement, and the credits earned will not be rounded. Only the final total for each compliance year will be rounded to the nearest thousandth. This amendment is meant to provide clarification and to avoid differences in calculating ZEV credits and debits. Staff proposes ZEV credits and debits to be rounded to the nearest thousandth on the final credit and debit total for a compliance year using the conventional rounding method for 2015 and subsequent model years.

2.2 Part II: 2018 and Subsequent Model Year Amendments

2.2.1 Amend Manufacturer Size Definitions
A manufacturer's California sales volume plays an important role in determining a manufacturer's treatment under various LDV regulations. Size is based on a manufacturer's average PC, LDT, and medium duty vehicle (MDV) sales in California. Table 2.7 lists the current manufacturer size definitions, and the regulations that apply to each manufacturer size definition.

Table 2.7: Current Size Definition Categories and Applicable California Regulations

Current Size Category	Current Definition (PC, LDT, MDV Avg Sales)	Applicable Regulations
Small Volume (SVM)	Between 1 and 4,500	Limited LEV II, Limited Pavley
Independent Low Volume (ILVM)	Less than 10,000 (must apply to Executive Officer)	Limited LEV II, Limited Pavley
Intermediate Volume (IVM)	Between 4,501 and 60,000	Full LEV II, Full Pavley Compliance by 2016, Limited ZEV (PZEV Only)
Large Volume (LVM)	60,001 and greater	Manufacturers subject to full regulations

Currently, IVMs (those having more than 4,500 PC, LDT, and MDV, on average, in California) and LVMs (those having more than 60,000 PC, LDT, and MDV sales, on average, in California) are the two groups of manufacturers mandated by the ZEV regulation. LVMs are required to comply with a minimum amount of ZEVs, while IVMs may meet their entire requirement through PZEV production. Small volume manufacturers (SVM) and independent low volume manufacturers (ILVM) are not required to comply with the ZEV regulation, but may generate, trade, and sell ZEV credits. Table 2.8 below lists current LVMs and IVMs, along with an average of each company's 2008 through 2010 vehicle sales.

Table 2.8: Current Manufacturer Size Status (2008 – 2010 MY Sales Averages, Rounded)

Large Volume Manufacturers (<60,000 PCs, LDTS, MDVs)		Intermediate Volume Manufacturers (<4,500 PCs, LDTs, MDVS)	
Chrysler	89,000	BMW	53,000
Ford	130,000	Daimler	52,000
GM	167,000	Hyundai	34,000
Honda	175,000	Jaguar Land Rover	9,000
Nissan	112,000	Kia	21,000
Toyota	315,000	Mazda	30,000
		Mitsubishi	8,400
		Subaru	14,000
		Volkswagen	52,000
		Volvo	8,000

At the 2008 March hearing, the Board did not adopt staff's proposal to extend the transition time for an IVM becoming an LVM from six years to twelve years. Board members questioned the differing treatment of the two sizes of manufacturers, concluding both sizes should be treated similarly.[27] Though sales in California differ between each manufacturer, many current IVMs have similar sales figures as LVMs on a worldwide basis.

Inconsistencies exist between the LEV and ZEV regulations regarding LVM and IVM definitions and ownership. Under the light-duty GHG regulations, two manufacturers are to aggregate their sales when one manufacturer owns more than 10 percent of another manufacturer. Under the ZEV regulation, two manufacturers are to aggregate their sales for size determination when one manufacturer owns greater than 50 percent of another manufacturer. Another discrepancy between the two regulations is lead time for manufacturers changing sizes. A manufacturer who has moved from IVM status to LVM status under the light-duty GHG regulations has 3 years lead time, while under ZEV the manufacturer has 5 years lead time, before having to comply with the full requirements.

As staff began to examine differential treatment of companies under the three regulations, the need to align ownership thresholds, re-examine the cut points for IVM and LVM size definitions, and align lead time provisions became apparent to reduce confusion. Staff proposes to decrease the IVM – LVM threshold from 60,000 PCs, LDTs, and MDVs on average in California to 20,000 on average. Manufacturers will be redefined and will determine their requirement based on their 2015 through 2017 sales average.

Additionally, to align ownership thresholds between the light-duty GHG fleet regulations with the ZEV regulations, staff proposes that two manufacturers' sales will

[27]ARB, 2008. California Air Resources Board. March 27, 2008 Board Hearing Transcript. http://www.arb.ca.gov/board/mt/2008/mt032708.txt

be aggregated for determination of size if one manufacturer owns greater than 33.4 percent of another manufacturer.

Lastly, staff proposes new lead time provisions under the ZEV regulation, as well as provisions for manufacturers decreasing sizes, from LVM to IVM, or IVM to SMV status. A manufacturer with three consecutive averages over a size threshold will be subject to the stepped-up requirement the first model year following the last year of the third consecutive threshold. Below is an example of how this would work:

Manufacturer A Sales Averages

2017-2019	2018-2020	2019-2021	2020-2022
19,000	**21,000**	**25,000**	**28,000**

Manufacturer A, formerly an IVM would be subject to LVM requirements in model year 2023. Similarly, staff proposes manufacturers decreasing in size, and moving from one size category to another would only do so after three consecutive averages below a size threshold. Below is an example for a manufacturer moving from a larger size category to a small size category:

Manufacturer B Sales Averages

2017-2019	2018-2020	2019-2021	2020-2022
6,000	**4,200**	**3,900**	**4,000**

Manufacturer B, formerly an IVM, would be treated as an SVM starting in model year 2023, and no longer subject to the ZEV regulation. Also, staff proposes that manufacturers will no longer be able to qualify as an ILVM for purposes of the ZEV regulation after model year 2017.

The effect of these changes is all the IVMs listed in Table 2.8, except Volvo, Subaru, Jaguar/Land Rover and Mitsubishi, would be expected to become LVMs in 2018, and meet the full ZEV requirements starting that year. This proposed change is needed to assure that major manufacturers compete on a level playing field, and to assure a variety of ZEVs are available to the consumer. Other changes are discussed in Section 2.2.4.

2.2.2 Remove PZEV and AT PZEV Compliance Options

PZEVs and AT PZEVs have been compliance options for manufacturers since 1996. Credit multipliers along with high credit amounts were used to encourage manufacturers to develop ZEV-enabling technologies, and offset manufacturers' overall ZEV requirements. Most manufacturers are currently selling or have near term plans to sell PZEVs and AT PZEVs (namely conventional HEVs like the Toyota Prius). To date, over 1.7 million PZEVs and 350,000 AT PZEVs have been delivered for sale in California as a result of the ZEV regulation. This leads staff to conclude that PZEV and AT PZEVs have reached commercialization and are no longer appropriate as a compliance option in the ZEV regulation. Additionally, at the 2009 December Board

Hearing, the Board adopted Resolution 09-66, which resolves that PZEVs and AT PZEVs, currently a part of the ZEV regulation, are commercial and can be removed from the ZEV regulation as a compliance option.

Therefore, staff proposes to remove new production of PZEVs and AT PZEVs as compliance options under the ZEV regulation for 2018 and subsequent model years. Capitalizing on the successful commercialization of these technologies, it is appropriate that the LEV III Criteria Pollutant and GHG fleet regulations will rely upon these vehicles to aide in compliance with the standards being proposed. The LEV III rulemaking for criteria pollutant standards is proposing to require the PC and truck fleet to meet the SULEV tailpipe NMOG + NOx fleet standard by 2025. Vehicles will also be required to have virtually zero-evaporative emissions. Additionally, the LEV III rulemaking for GHG standards could result in over 40 percent of hybridization of the PC and truck fleet by 2025, dependent on each manufacturer's compliance method. These regulations will continue to ensure the expansion of volumes of PZEV and AT PZEV-like vehicles, allowing the ZEV regulation to focus on commercialization of zero and near-zero emitting vehicle technologies.

2.2.3 Increase ZEV Requirement for 2018 and Subsequent Model Years

Currently, manufacturers' 2018 and subsequent model year ZEV requirements are held at the same percentage each year, as shown in Table 2.9 below.

Table 2.9: Current 2018 and Subsequent ZEV Credit Requirement

Credit Category	Credit Requirement
Minimum ZEV	5.0%
Maximum TZEV*	3.0%
Maximum AT PZEV*	2.0%
Maximum PZEV	6.0%
Total ZEV Requirement	16.0%

*The regulation does not specify the split between TZEVs and AT PZEVs. For this analysis, staff assumed AT PZEV TZEV credit requirement would remain the same from the 2015 through 2017 requirements . If the PZEV and AT PZEVs (highlighted in grey) are moved to the LEV III program as proposed, the remaining ZEV requirement under the current regulation would be 8%.

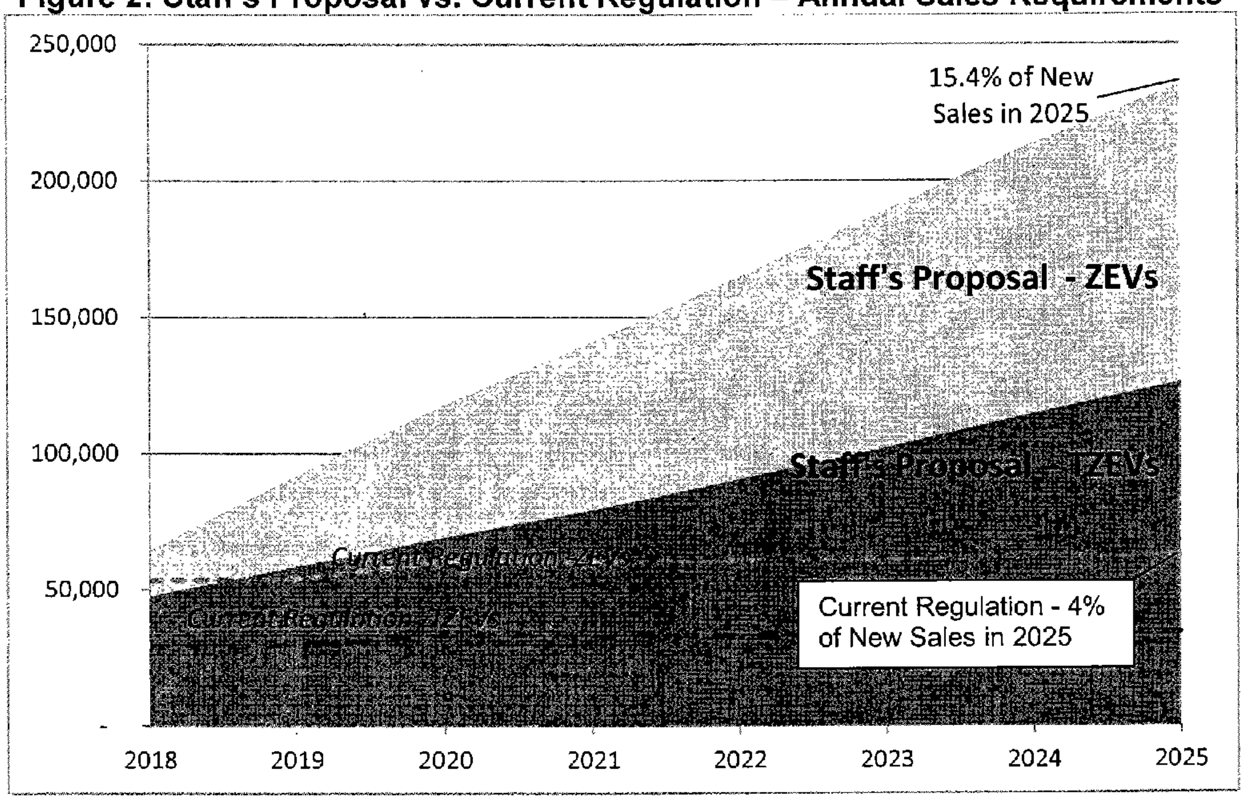
To address one of the program's primary objectives (ZEV technology commercialization and long-term GHG and criteria emission goals), staff proposes to increase each manufacturer's compliance requirements for 2018 and subsequent model years, ultimately reaching credit requirements of 6 percent for TZEVs and 16 percent for pure ZEVs in 2025. This increase is outlined in Table 2.10 below.

Table 2.10: Proposed ZEV Credit Requirement for 2018 and Subsequent

Model Year	2018	2019	2020	2021	2022	2023	2024	2025 and Subsequent
Overall ZEV Requirement	4.5%	7.0%	9.5%	12.0%	14.5%	17.0%	19.5%	22.0%
Min. ZEV	2.0%	4.0%	6.0%	8.0%	10.0%	12.0%	14.0%	16.0%
Max. TZEV	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%

As shown in Table 2.10 above, the proposed overall ZEV credit requirement, between model year 2018 and model year 2022, is less than the current program. Because staff is proposing to revise the number of credits earned per vehicle (typically by one half), and PZEVs and AT PZEVs no longer would count towards meeting a manufacturer's ZEV obligation, it is more illustrative to compare the actual number of ZEVs required to be produced given the current and proposed crediting structure. This is shown below in Figure 2.

Figure 2: Staff's Proposal vs. Current Regulation – Annual Sales Requirements



In establishing the proposed requirements above, staff reviewed a range of compliance alternatives to ensure program objectives were met, including work done in 2009 to examine the LDV sector meeting long term GHG emission reduction goals. (ARB, 2009a) Starting from staff's 2050 analysis, staff considered the appropriate level of ZEVs and TZEVs that should be required in the 2018 through 2025 model year timeframe based on a number of factors: ZEV platforms, technology cost curves, and the future GHG fleet standards.

Staff's 2050 analysis suggests over 35 percent of LVMs' 2025 LDV sales would need to be ZEVs and TZEVs to keep California on a trajectory to meet the 2050 GHG reduction goal. In terms of PC sales that would need to be ZEVs or TZEVs would likely be higher because staff expects that manufacturers will preferentially produce ZEV as PCs rather than LDTs, in order to reduce costs, especially for BEVs. While these sorts of production numbers would likely help the LDV sector reach its long term GHG emission reduction goals, the effect on the PC market in such a short timeframe suggests staff consider less stringent requirements. Staff chose requirements which push ZEVs and TZEVs to 15 percent of new LDV sales by 2025.

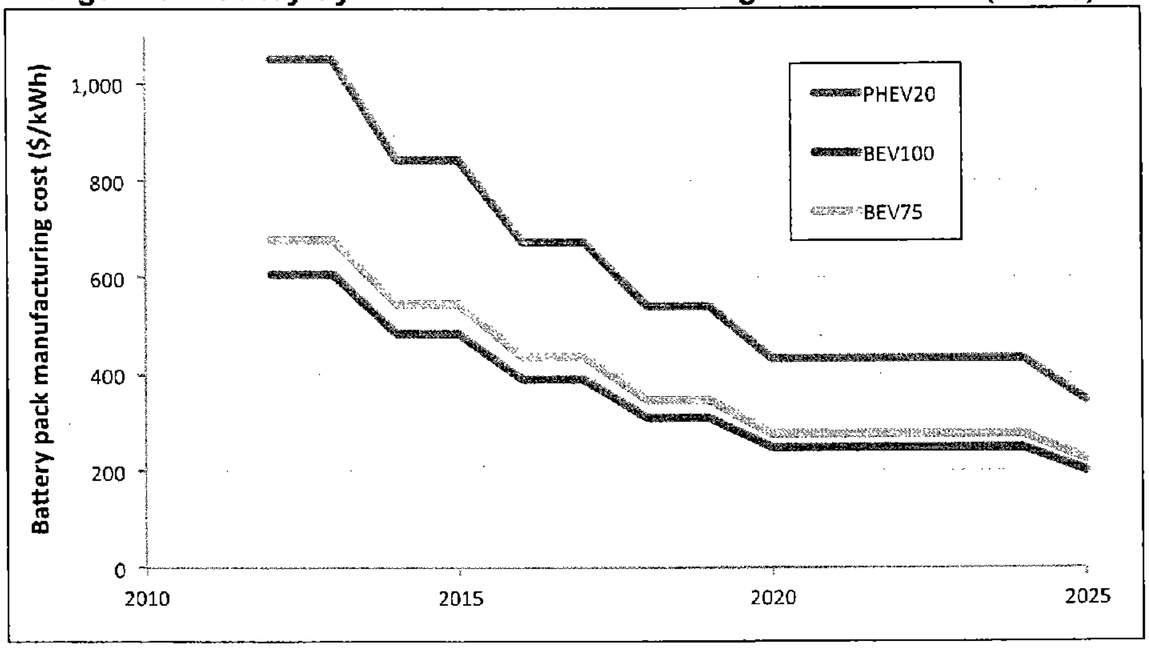
Another important factor staff considered in choosing future requirements was cost. In order to highlight the scale of cost reductions anticipated as a result of high volume production, the following four Figures (3, 4, 5, and 6) show declining production costs, over the period of the regulation, for the advanced batteries and fuel cell systems considered in the analysis. To highlight the most relevant and expensive components of the advanced vehicle platforms, the values shown here assume direct manufacturing.[28]

Generally, battery and fuel cell costs decline over time due to several factors. As production volumes increase, costs decline due to economies of scale. Additionally, as manufacturers operate production systems for a number of years, costs can decline from the manufacturing process as improvements are identified. Both of these factors (production volume and production experience) are incorporated into the time-based costs presented in Figures 3 and 5.

Figure 3 shows the declining costs of batteries, as assumed in the joint model used in staff's ACC analysis, with time on three platforms: a PHEV with 20 mile electric range (PHEV20), a BEV with 75 mile all-electric range (BEV 75), and a BEV with 100 mile all-electric range (BEV100). Costs for PHEV battery systems are higher than BEVs (on a per kWh basis) primarily because the relative cost of auxiliary systems (battery thermal management and controls) increases with smaller batteries.

[28] High volume production is assumed by 2025 on world-wide platforms (greater than 100,000 units/yr).

Figure 3: Battery System Direct Manufacturing Cost vs. Time (2009$)



As described in the LEVIII ISOR Section III-A-4.3, battery cost projections (above) were developed jointly with the U.S. EPA and NHTSA and leveraged analysis by Argonne National Laboratory (ANL), as well as input from manufacturers. Figure 4 shows battery cost reductions with increasing production of battery packs.[29]

Figure 4: Battery System Direct Manufacturing Cost vs. Production Scale (2009$) (ANL, 2010)

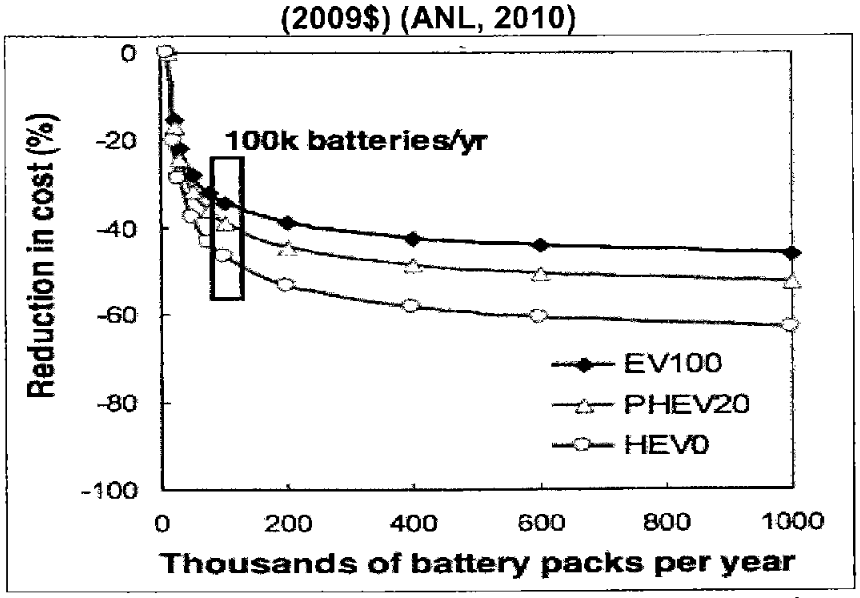
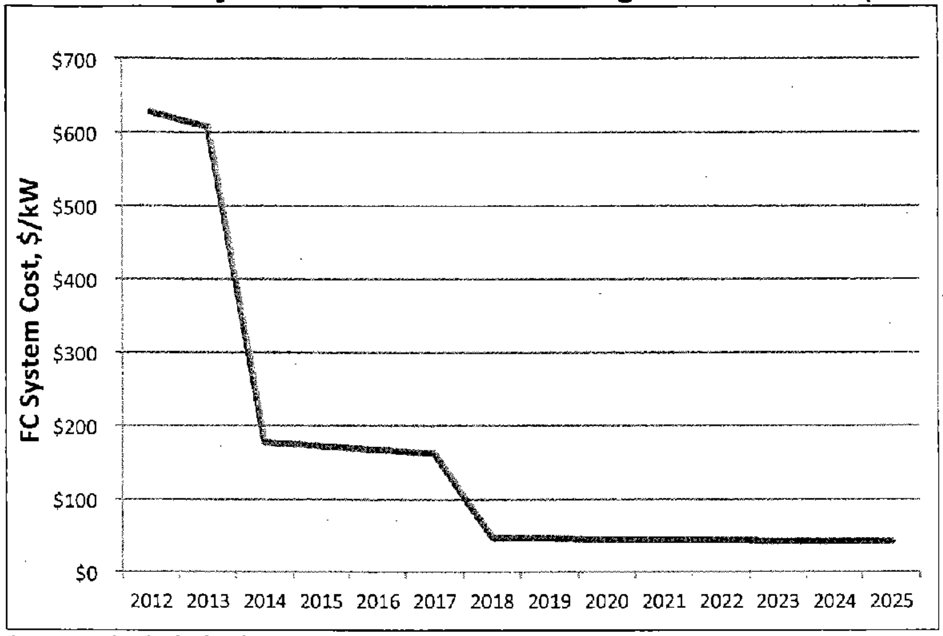


Figure 5 shows the declining cost of fuel cell systems as a function of time, as assumed in the joint model used in staff's ACC analysis.

[29] ANL, 2010. Argonne National Laboratory. D.J.Santini et al, EVS-25, Nov 5-9 2010. "Modeling of Manufacturing Costs of Lithium-Ion Batteries for HEVs, PHEVs, and EVs."

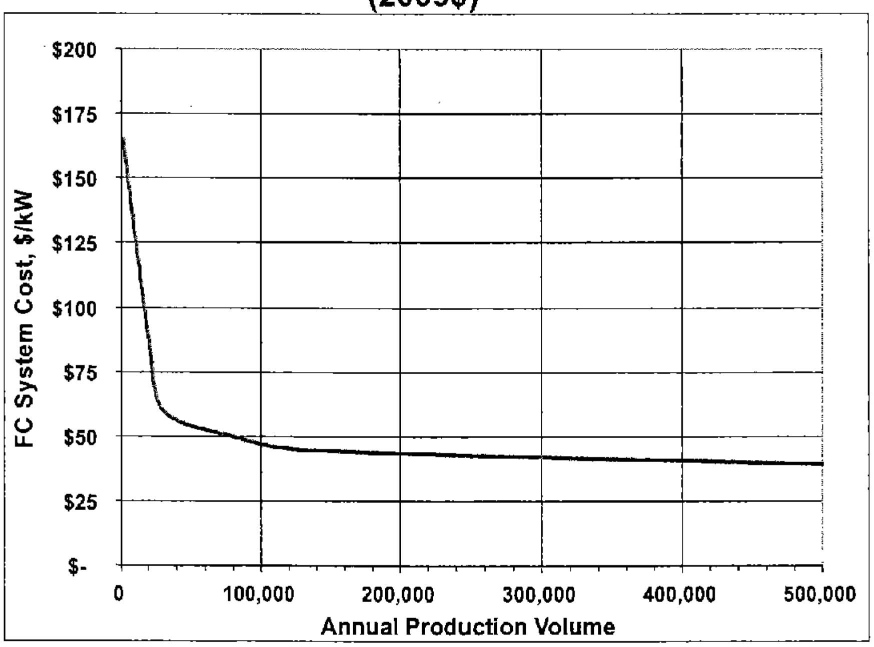
Figure 5: Fuel Cell System Direct Manufacturing Cost vs. Time (2009$)*



*does not include hydrogen storage

Fuel cell cost projections relied, in part, on high volume cost functions developed by Directed Technologies Incorporated (DTI), one of two long-term contractors evaluating future system costs for the U.S. DOE. Figure 6 below show DTI's fuel cell system costs based on annual production volumes.

Figure 6: Fuel Cell System Direct Manufacturing Costs vs. Production Scale (2009$)[30]



[30] DTI, 2010. Directed Technologies Inc., 2010 U.S. DOE Merit Review. June 7-11, 2010. "Mass Production Cost Estimation for Automotive Fuel Cell Systems".

Staff's proposed requirements push production volumes to levels that reduce incremental ZEV prices below what would have occurred in the existing regulation. It also encourages multiple platforms, and brings a selection of vehicles to a larger portion of the market (well beyond early adopters).

Lastly, staff considered expected ZEVs under future GHG fleet standards for LDVs. Without a ZEV regulation, the California proposed GHG standards would likely result in approximately 6 percent of annual sales by 2025 would be ZEVs and TZEVs. This level of penetration would not likely achieve the cost reductions needed for commercialization in the timeframe needed to meet long term emission reduction goals.

2.2.4 IVM Treatment

As discussed above, staff is proposing to reduce the sales volume which separates an IVM from an LVM from 60,000 annual sales in California to 20,000 annual sales, starting in 2018. Four manufacturers would remain IVMs (Subaru, Volvo, Jaguar Land Rover, and Mitsubishi). This raises the issue of what should be the ZEV requirements for these smaller manufacturers? Currently, IVMs are allowed to meet their entire ZEV requirement with credits from conventional PZEVs. Due to the proposed removal of PZEVs as a compliance option for ZEV in 2018 and subsequent model years, staff considered what ZEV requirements, if any, should apply to IVMs beginning in 2018.

These manufacturers are significantly smaller than other manufacturers in terms of research and development funds, California sales, and worldwide sales. However, most have displayed ZEV or TZEVs at recent auto shows, and have active ZEV development programs. This is necessary to remain competitive with LVMs. What limits the ability of IVMs is the potential of having to develop multiple technologies given their relatively smaller research, development, and demonstration (RD&D) budgets. Therefore, staff proposes that IVMs be subject to the ZEV mandate, but have no limits on the type of ZEVs, other than NEVs, they produce. For example, an IVM could fulfill the requirements by producing only TZEVs (e.g. PHEVs). By comparison, a LVM that choses to produce TZEVs must also produce specified numbers of ZEVs. Further flexibilities for IVMs will be discussed throughout the following subsections.

2.2.5 Excess PZEV and AT PZEV Credits Treatment

Staff's proposal to remove new production of PZEVs and AT PZEVs as compliance options for the ZEV program for model years 2018 and beyond will likely leave manufacturers with banked PZEV and AT PZEV credits. Manufacturers' PZEV and AT PZEV banks reflect over compliance with the ZEV regulation, as well as old multipliers offered for early compliance. In a shift toward requiring manufacturers to place vehicles in order to comply with the regulation rather than use banked credits, staff believes it is appropriate to limit the use of banked ZEV credits in 2018 and subsequent model years. Staff proposes to first discount the banked PZEV and AT PZEV credits, then cap their use at 25 percent of a manufacturer's portion of its overall

ZEV requirement that may be fulfilled with credits from TZEVs. Banked PZEV and AT PZEV credits could not be used to comply with any of the portion of the requirement that must be met with ZEVs. Staff's proposed discount for the PZEV and AT PZEV credit banks after model year 2017 compliance may be found in Table 2.11 below.

Table 2.11: Proposed Credit Discounts for PZEV and AT PZEV Credit Banks

	Affected Manufacturer Size	Discount	Equivalency
PZEV	LVM	93.25%	1 TZEV(20 mile) = ~51 PZEVs
PZEV	IVM	75%	1 TZEV(20 mile) = ~14 PZEVs
AT PZEV	IVM and LVM	75%	1 TZEV(20 mile) = ~5 AT PZEVs

The cap on usage of PZEV and AT PZEV credits for 25 percent of the portion of a manufacturer's ZEV requirement that may be met with TZEVs, equals approximately 7 percent to 14 percent of a manufacturer's overall ZEV requirement each year.

For IVMs, for model years 2018 and 2019, staff proposes to not cap the usage of banked PZEV and AT PZEV credits as a way to increase flexibility for these smaller manufacturers as they develop new products. For 2020 and subsequent model years, staff proposes to cap the usage of PZEV and AT PZEV credits to 25 percent of an IVM's overall requirement. Staff also proposes to cap NEV credits in the same manner as banked PZEV and AT PZEV credits. Therefore, all PZEV, AT PZEV, and NEV credits would be under the same cap in 2018 and subsequent model years. The proposed allowed percentages are enumerated in Table 2.12 below.

Table 2.12: Proposed Limits on Banked PZEV and AT PZEV Credits, and NEV Credits for 2018 and Subsequent Model Years:

	2018	2019	2020	2021	2022	2023	2024	2025
Allowed Usage in an LVM's TZEV portion of Requirement	Up to 25%							
OR								
Allowed Usage in an LVM's overall Requirement	13.9%	10.7%	9.2%	8.3%	7.8%	7.4%	7.1%	6.8%
Allowed Usage in an IVM's overall Requirement	100%	100%	Up to 25%					

Staff's proposal helps to move manufacturers from relying on banked ZEV credits for compliance, and helps to ensure ZEVs and TZEVs will be produced in compliance with the regulations.

2.2.6 ZEV Treatment and Credits

Currently, ZEV credits for Type III, Type IV, and Type V ZEVs are scheduled to decrease for 2018 and subsequent model years. Below, Table 2.13 shows credit levels currently in the regulation for 2018 and subsequent model years.

Table 2.13: Current ZEV Types and Credit Levels

	Definition	2009 through 2017	2018 and Subsequent
NEVs	Low Speed Neighborhood Electric Vehicles	0.30	0.30
Type 0	<50 Mile BEVs	1	1
Type I	>50 - <75 Mile BEVs	2	2
Type I.5	>75 - <100 Mile BEVs	2.5	2.5
Type II	>100 Mile BEVs	3	3
Type III	>100 Mile FCVs (with fast refueling) OR >200 Mile BEVs	4	3
Type IV	>200 Mile FCVs (with fast refueling)	5	3
Type V	>300 Mile FCVs (with fast refueling)	7	3

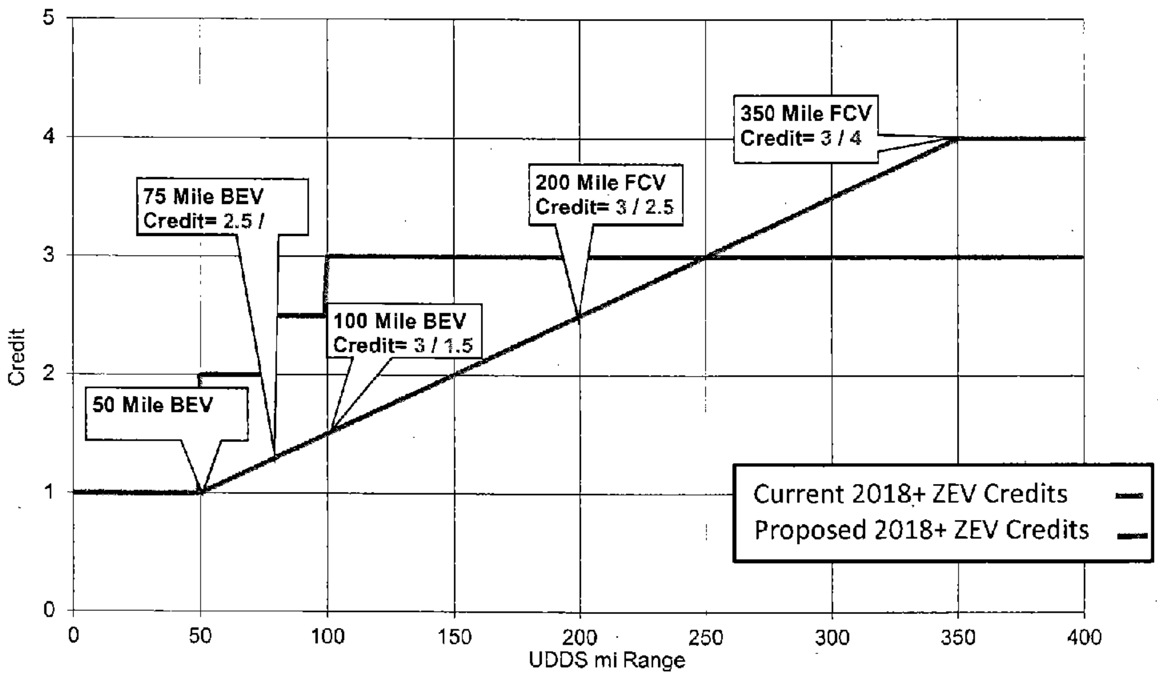
The current system of tiered credit levels encourages manufacturers to produce a vehicle meeting the range threshold rather than rewarding the actual mileage of the vehicle. Staff considered several ways of amending the current crediting system. Credit factors such as a vehicle's physical size, weight, a manufacturer's monetary investment in the vehicle technology, refueling capabilities, refueling access, long term vehicle cost potential, GHG well-to-wheel (WTW) performance, as well as others were considered and discussed at a May 2010 workshop. In the spirit of simplicity, many factors were discarded due to the subjective nature of the factor, such as a manufacturer's investment in the technology. Other factors had little to do with the vehicle's design and engineering, or the manufacturer would have no control over the amount of credit earned. Staff considered including a vehicle's size in a future credit system, which would encourage ZEV technologies to be placed on larger platform vehicles, and credit based on the vehicle's footprint and range. As staff explored this option, it appeared that longer range vehicles would generally be on larger platforms, which reduced the need to credit the vehicle's footprint as well as its range.

For the reasons stated above, and in an effort to simplify the regulation, staff is proposing to base the amount of credits earned by each ZEV exclusively on the vehicle's urban dynamometer driving schedule (UDDS) range. Credits for ZEVs would range from 1 and 4 credits each, with a minimum 50 mile range ZEV earning 1 credit and a 350 mile range ZEV earning 4 credits. Below is the staff's proposed credit equation for ZEVs:

ZEV Credit = (0.01) * (UDDS range) + 0.5

Figure 7 below shows the amount of credit various vehicles would receive using staff's proposed ZEV credit equation, along with the current credit structure.

Figure 7: Proposed ZEV Credits As Compared to Current ZEV Credits (2018 and Subsequent Model Years)



Essentially, a ZEV will receive half as much credit in 2018 and subsequent model years as was earned in 2017 and earlier model years. To align credits earned by NEVs in 2018 and later model years, staff proposes to reduce NEV credits by 50percent as well, from 0.30 to 0.15 credits each.

Additionally, staff proposes BEVx credit will be equivalent to that received by BEVs, based on range. Like in 2012 through 2017 model years, manufacturers will be allowed to meet up to 50 percent of the portion of their requirement that must be met with pure ZEVs with credits from BEVxs.

2.2.7 TZEV Treatment and Credits

AT PZEVs were included as a compliance option in the ZEV regulation to accelerate the development and manufacturing capacity of the component technologies that are also necessary to build ZEVs. These components include traction motors, power electronics, batteries, battery management systems, and hydrogen storage tanks. About 350,000 AT PZEVs have been placed in California since 2004. ZEV technologies have improved at a faster pace than normal market forces would have otherwise expected due to commercialization of AT PZEVs. As a result, the industry is now progressing to a "transition" phase where ZEV component production is increasing, and the resulting component costs are decreasing.

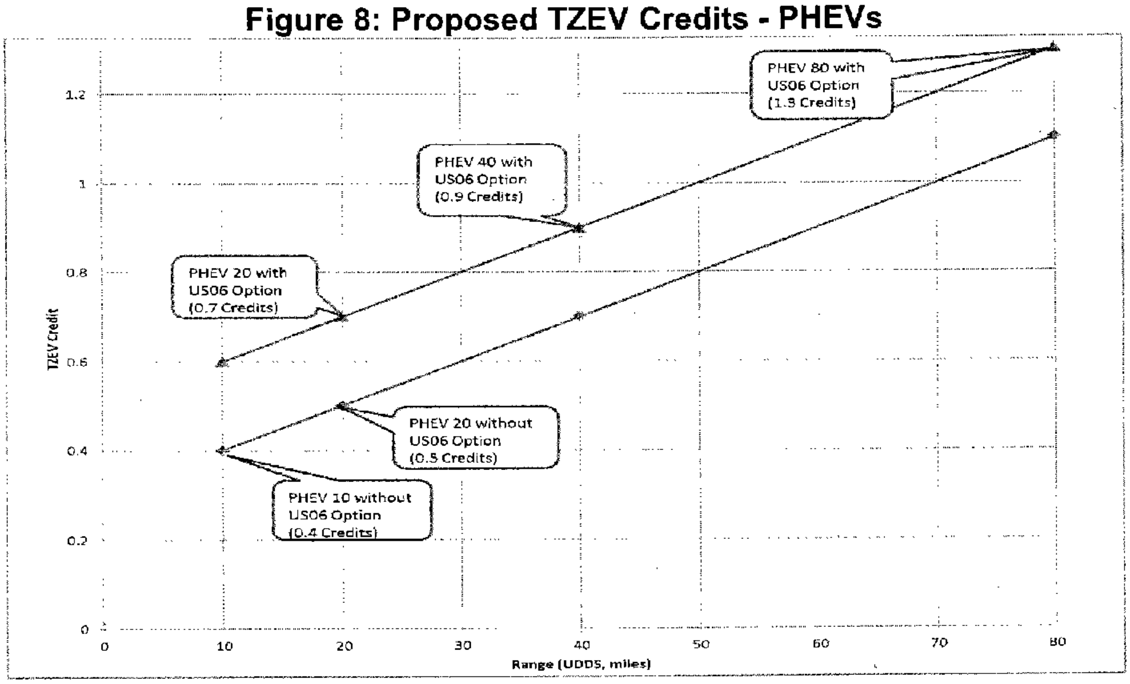
The emphasis of the AT PZEV compliance option within the ZEV regulation was the initial introduction of these component technologies into production vehicles. TZEVs will encourage further evolution of these ZEV components and technologies by significantly "raising the bar" for qualifying vehicles. In this way, staff believes the overall California fleet will incorporate more ZEV-component intensive vehicles, and will provide more significant emissions reduction benefits from actual zero-emission VMT and zero-emissions fuel use. For this reason, staff is proposing a simplified TZEV credit system for 2018 and subsequent model years based primarily on zero emission VMT capability. Table 2.14 below shows staff's proposed equation for TZEV zero emission VMT allowance.

Table 2.14: TZEV Zero-Emission VMT Allowance

UDDS Test Cycle Range (R_{cda})	Credit
<10 miles	0.0
$\geq$10 miles range	TZEV Credit = [(0.01) * EAER + 0.3]
>80 miles (credit cap)	1.3

TZEVs with at least 10 miles all electric UDDS range will be eligible for zero emission VMT allowance. Manufacturers may earn an extra allowance of 0.2 if the vehicle is capable of driving 10 miles all electric on the US06. Figure 8 below shows the total credit amount manufacturers would be eligible for in 2018 and subsequent model years.

Figure 8: Proposed TZEV Credits - PHEVs



Staff also proposes a fixed allowance for HICE vehicles of 0.75. HICE vehicles that also have all-electric range would also be eligible for a zero emission VMT allowance, but subject to an overall credit cap of 1.25.

New technologies, performance features, and vehicle types have recently emerged that are challenging to assess under the current ZEV regulatory structure. A key example of such a development is the range-extended BEV explained earlier in this staff report: a BEV with an APU range extender. This is particularly challenging when many of these vehicles are only just now being announced or introduced into the market and little is known about them. PHEV driver behavior is still relatively unknown and staff cannot predict performance results based on vehicle attributes. Over the next two to three years, staff commits to studying PHEV and BEVx user-behavior to find a more refined attribute-based methodology that can better correlate with desirable zero-emission VMT and emissions reductions.

2.2.8 Travel Provision

During the development of the TAR, the involved agencies jointly met with states that have adopted California's air quality regulations through the Clean Air Act, often referred to as Section 177 ZEV states. "Several states mentioned activities they have underway to develop the infrastructure needed to support electrified vehicles." (EPA, 2010, pp.2-11) As proposed above, staff believes it is appropriate to extend the travel provision for Type I, Type I.5, and Type II ZEVs (BEVs) through 2017. However, for 2018 and subsequent model years, staff believes BEVs will be reaching commercial levels, and be available in most states. Nissan has announced that the Leaf will be available for model year 2012 in over half of the United States.[31] From that perspective, staff believes it is not appropriate to extend the travel provision for BEV credits past the 2017 model year.

Commercialization of FCVs lags commercialization of BEVs by several years. BEVs have entered the marketplace this year, while the first FCVs in volume production are not expected until 2015 or later, and then only in those regions such as California and New York that are preparing the necessary hydrogen fueling infrastructure. Thus staff proposes to extend travel for FCV credits. Travel would be extended for FCVs until there are clear plans for sufficient hydrogen infrastructure in Section 177 ZEV states to support these vehicles.

2.2.9 GHG Over-Compliance Credits

On July 29, 2011, President Barack Obama announced a joint agreement between the U.S. EPA, NHTSA, the state of California, the United Auto Workers (UAW) and thirteen manufacturers to improve GHG emission performance of all PCs by 2025.[32]

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[31] Nissan, 2011. Press Release, July 19,2011. "Nissan To Launch All-Electric Leaf As Upgraded 2012 Model In New U.S. Markets" http://www.nissannews.com/pressrelease/2682/185/nissan-launch-all-electric-leaf-upgraded-2012-model.

[32] White House, 2011. United States White House. Press Release. July 29, 2011. "President Obama Announces Historic 54.5 MPG Fuel Efficiency Standards." http://www.whitehouse.gov/the-press-office/2011/07/29/president-obama-announces-historic-545-mpg-fuel-efficiency-standard. Accessed September 9, 2011

California submitted a letter to U.S. EPA Administrator Lisa Jackson and United States Department of Transportation (U.S. DOT) Secretary Ray LaHood on July 28, 2011 affirming its commitment to a one-national GHG tailpipe standard. The following statement was included in the July 28, 2011 commitment letter:

> "California commits to propose that its revised ZEV program for the 2018-2021 MYs include a provision providing that over-compliance with the federal GHG standards in the prior model year may be used to reduce in part a manufacturer's ZEV obligation in the next model year."[33]

Staff proposes to allow a manufacturer that complies with its national light-duty fleet GHG standard to use those over-compliance credits to offset a portion of its ZEV requirement in 2018 through 2021 model years. Table 2.15, below, enumerates the percentage of ZEV credits a manufacturer may off-set with GHG over-compliance credits.

Table 2.15: Maximum Percentage of ZEV Credit Offset Each Model Year

2018	2019	2020	2021
50%	50%	40%	30%

The percentages in Table 2.15 represent two caps: 1) the total percentage of a manufacturer's requirement able to be met with GHG-ZEV over-compliance credits, and 2) the maximum percentage allowed to be met within the portion of the regulations that must be met with ZEVs. Manufacturers will not be limited (other than by the cap on the total requirement) on use of GHG-ZEV over-compliance credits within the TZEV category.

Based on historical compliance with the ARB LEV II regulation and from NHTSA's Corporate Average Fuel Economy (CAFE) program, manufacturers often run debits and credits in alternating model years that balance out due to carry-back and carry-forward provisions. Staff projects that fully compliant manufacturers will typically operate with 1 to 4 grams carbon dioxide per mile (gCO_2/mile) of credits or debits GHG credits as a normal course of action as part of the GHG program. It is not the intent of the ZEV-GHG over-compliance provisions to reward this small fluctuation in g/mi credits that naturally occur from program compliance or to reward accumulated GHG emission reductions that occurred before model year 2018.

To award consistent and planned over-compliance with the GHG fleet standard, staff proposes that manufacturers be eligible to utilize the ZEV-GHG over-compliance provisions only if particular conditions are met before the regulation start date and in each model year (i.e., between 2018-2021) of the program. First, staff proposes that the following two preconditions must be met in order for manufacturers to qualify for use of the ZEV-GHG over-compliance provision:

[33] ARB, 2011a. California Air Resources Board. Commitment Letter. July 28, 2011. http://www.epa.gov/oms/climate/letters/carb-commitment-ltr.pdf.

1. Model year 2017 GHG precondition: A company must have no GHG program debits in model year 2017 and no outstanding debits from previous model years.

2. Model year 2017 ZEV precondition: A company must have no ZEV program debits in model year 2017 and no outstanding debits from previous model years.

Staff proposes a manufacturer must submit an application to ARB by May 1, 2018 documenting the company's intent to use the ZEV-GHG over-compliance provision. The application must include test model, vehicle sales, and GHG standard data for documenting federal compliance model year 2017 data for the GHG program. The application must also declare any existing credits or debits from the 2012-2016 GHG fleet regulations. Lastly, a manufacturer must submit its projected product plan information for model years 2018-2021 that documents its expected GHG program over-compliance by at least 2 gCO_2/mile in each model year through the entire period without receiving GHG program credits from any other automaker for model years 2018 through 2021.

To lessen reporting issues and allow manufacturers adequate planning time, staff proposes ZEV-GHG over-compliance credits be based on the manufacturer's previous model year compliance. For example, a manufacturer generating ZEV-GHG over-compliance credits to meet ZEV requirements in model year 2019 would calculate GHG over-compliance based on model year 2018. Annually, manufacturers would be required to report credits/debits from the model year, any remaining credits/debits from previous model years, and projected credits/debits for future years through 2021. Also, staff proposes at a minimum, the manufacturer must over-comply by at least 2 gCO_2/mile each year, and must not include the following credits and multipliers in calculating a manufacturer's GHG fleet standard over-compliance:

1. Additional credit earned from additional incentive multipliers greater than 1.0 (i.e. truck technology credit multipliers), and

2. Banked GHG gCO_2/mile credits from previous model years or from other manufacturers.

Note, that California is not proposing to include advanced electric-drive vehicle technology multiplier incentives in the 2017 and subsequent GHG standards. However, manufacturers will have the option of directly complying with California's standards or complying with the federal standards. In the event of a given manufacturer selecting the federal compliance option, the manufacturer will also not be allowed to include the multiplier received for advanced electric drive vehicle technologies in their ZEV-GHG over-compliance calculation.

Staff proposes the following equation be used to calculate a manufacturer's ZEV-GHG over-compliance credits for use in California and Section 177 ZEV states:

ZEV Credit Calculation (for given model year):

$$\frac{\textbf{(Manufacturer U.S. Sales of PC \& LDT) * (gCO}_2\textbf{/mile below manufacturer GHG standard)}}{\textbf{(manufacturer GHG standard)}}$$

Manufacturers will be required to remove the gCO_2/mile credits used to calculate ZEV offset credits from their GHG fleet standard banks.

In the event that a manufacturer is not generating a GHG compliance credit or receives GHG credit from any other automaker for any model year from 2018 through 2021, the company would no longer be eligible for the ZEV-GHG over-compliance program, and would be subject to the full requirements and penalties of the ZEV regulation.

2.2.10 Minor Amendments

Counting ZEVs in Applicable Sales Volume
Each model year, manufacturers calculate their applicable vehicle sales volume to which their ZEV requirement is applied. In 2003, staff modified the regulation to not count a manufacturer's ZEVs produced in the manufacturer's applicable sales volume. This was to prevent NEV manufacturers from generating a larger requirement than could be met, due to NEVs earning less than one ZEV credit. When considering the effect of this provision on developing future requirements, staff concluded removing this provision for manufacturers would simplify the program and not have an adverse effect on manufacturers.

Staff proposes to end this provision for ZEVs for 2018 and subsequent model years, and include all ZEVs produced in the manufacturer's applicable sales volume. However, staff proposes that NEV manufacturers would not include NEVs in their applicable sales volumes to prevent manufacturers from facing a larger requirement than could be fulfilled.

Amendment to Applicable Sales Volume Determination "Previous Years Method"
Since 2003, staff has allowed each manufacturer to choose its applicable sales volume determination method. As stated previously, a manufacturer's applicable sales volume is the number of vehicles a manufacturer's requirement is applied to for a model year. Manufacturers may choose to use their current year sales, or an average of previous year sales, from the fourth, fifth, and sixth model years prior to the model year with which they are complying. For example, for the 2011 model year,

manufacturers may choose their applicable sales volume based on 2011 sales, or on an average of 2005, 2006 and 2007 model year sales. Manufacturers are allowed to switch methods each year. This provision causes uncertainty for ARB when trying to determine how many ZEVs and TZEVs will be made each year. Also, manufacturers are able to take advantage of a low sales volume year to reduce their obligation for up to nine years, which greatly impacts the number of ZEVs required.

Staff proposes a manufacturer's applicable sales volume to be based on an average of the second, third, and fourth years back. For example, for 2019, a manufacturer's applicable sales volume would be based on an average of 2016, 2017, and 2018 model year sales. This change would make the applicable average more contemporaneous and helps even out the sales bumps year to year. However, staff understands unforeseen circumstances cannot be planned for, and should be considered in regards to a manufacturer's ZEV requirement. An example of an unforeseen circumstance could be a severe economic downturn or a natural disaster. Staff proposes that manufacturers could apply to the Executive Officer to use a current model year for their applicable sales volume, for a maximum of two model years. Manufacturers applying to the Executive Officer would need to do so by January 1 of the year following the compliance model year. For example, a manufacturer applying to use a current model year for their applicable sales volume for model year 2020, would need to apply to the Executive Officer no later than January 1, 2021. If a manufacturer does switch to the same year method, then switch back, it only continues to benefit from a bad year for four years, as it is included into its previous second, third, and fourth year average.

Amendments to Carry Back Provision

Currently, manufacturers are allowed to carry a ZEV credit deficit for up to three model years. For example, a manufacturer who does not meet its ZEV requirement in model year 2016 would not be subject to penalties for non-compliance until after model year 2018 compliance, and would be allowed to make up deficits with credits from ZEVs in model years 2017 and 2018. Up to this point, all manufacturers have been in full compliance with the ZEV regulation, and have not had to make use of this provision. However, this provision creates uncertainty in the number of ZEVs to be delivered for sale each year.

In an effort to strengthen and provide more certainty of the number of ZEVs to be delivered to California for a given model year, staff proposes to shorten a manufacturer's allowed deficit to one year. This means, for example, a manufacturer could fail to submit the required amount of ZEV credits in 2019, and proceed to make up the credit deficit in 2020 model year compliance. After model year 2020 compliance, the manufacturer would be subject to ZEV penalties.

Removing Placed In Service Requirement
Currently, for manufacturers to receive full credit for ZEVs, each ZEV must be placed in service.[34] This requirement was added in 2001 to encourage manufacturers to place ZEVs, particularly NEVs, with end-users and further ZEV commercialization and markets. Manufacturers currently receive one credit for each vehicle delivered for sale, and earn the rest of the credits for each vehicle when it is placed in service (i.e. sold or leased to an end user). Staff believes this requirement will no longer be necessary for BEVs in 2018 and subsequent model years as requirements increase. This greatly simplifies tracking and acknowledges the maturing market for BEVs. However, staff will continue to require all FCVs and NEVs to be placed in service in order to earn credit through the regulation. FCVs need to be tracked by vehicle identification number (VIN) for purposes of the travel provision, and accounting across states. The regulation will also retain ARB's authority to request VINs of delivered ZEVs to verify the vehicles have been delivered to California.

Additional minor modifications are discussed in Section 9 of this ISOR.

[34] CCR 1962.1(h)(7) states "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."

3 EFFECT OF PROPOSED CHANGES

This section provides an assessment of the industry wide number of vehicles that may be produced due to the proposed changes. Sections 5, 6 and 7 then use these estimates to project the economic and environmental impacts of the proposed changes. Staff is proposing limited amendments to the 2012 through 2017 timeframe which have little impact on the numbers of vehicles produced in compliance with the ZEV requirements. Staff's analysis of manufacturer's current ZEV credit banks is in subsection 3.1. Staff's analysis of the effects of the proposed changes to Type V credits, and decreased IVM requirement is presented below in subsection 3.2. The bulk of staff's analysis focuses on the 2018 through 2025 timeframe, and can be found below in subsection 3.3.

3.1 Overall Effects of Manufacturer's Banked ZEV Credits

Manufacturers have over complied with the ZEV regulation, which has caused them to have banks of excess ZEV credits. A manufacturer may bank an unlimited amount of credits from each vehicle category. Table 3.1 below shows manufacturer's ZEV bank balances as of September 30, 2011.

Table 3.1: Manufacturer Current Bank Balances (g/mi NMOG)*

Manufacturer	ZEVs (excluding NEVs)	NEVs	Enhanced AT PZEVs	AT PZEVs	PZEVs
BMW	106.000	0.000	0.000	0.000	209.547
Chrysler Group	55.611	665.316	0.000	0.000	0.000
Ford	274.687	1,069.090	0.000	596.272	1,135.289
FUJI Heavy Industries/Subaru	0.000	0.000	0.000	0.000	65.662
General Motors	408.156	787.166	0.000	454.352	120.388
Honda	404.105	804.666	0.000	946.318	62.655
Hyundai	31.360	0.000	0.000	0.000	22.378
KIA	22.647	0.000	0.000	0.000	0.000
Land Rover	0.000	0.000	0.000	0.000	10.139
Mazda	0.000	0.000	0.000	0.000	246.998
Mercedes Benz	28.520	193.066	0.000	9.849	6.278
Mitsubishi	1.400	0.000	0.000	0.000	53.432
Nissan	189.321	0.000	0.000	0.000	1,523.912
Tesla	0.000	0.000	0.000	0.000	0.000
Toyota	1,116.293	0.000	7.721	6,723.705	734.941
Volkswagen	35.558	0.000	0.000	17.130	11.929
Volvo	0.000	0.000	0.000	0.000	108.493

Zipcar	0.000	0.000	0.000	0.000	17.083
TOTALS	**2,673.657**	**3,519.305**	**7.721**	**8,747.627**	**4,329.126**

*Manufacturer ZEV bank balances are posted each year, on September 30, on the following website: http://www.arb.ca.gov/msprog/zevprog/zevcredits/2010zevcredits.htm

Manufacturers can comply in innumerable ways with the regulation. Manufacturers may fulfill their entire requirement with credits from ZEVs, or produce more AT PZEVs to fulfill the portion of the requirement that may be met with PZEVs. The regulation defines the upper limits of how the various credit categories can be used to fulfill a manufacturer's requirement.

Taking the manufacturer's current credit banks into account, staff analyzed potential credit usage in the 2012 through 2017 timeframe, and in the 2018 through 2025 timeframe.

For 2012 through 2017 model year, it is difficult to determine the impact of banked PZEV and AT PZEVs credits on actual PZEV and AT PZEV production. PZEVs and AT PZEVs are a compliance option within the regulation. For example, some manufacturers use NEV credits in lieu of producing AT PZEVs. Staff is proposing to allow manufacturers to use their banked PZEV and AT PZEV credits to meet up to 25 percent of the TZEV portion of their requirement in 2018 and subsequent model years. This could incentivize manufacturers to continue producing PZEV and AT PZEVs through model year 2017, as discussed below.

As shown above in Table 3.1, manufacturers currently have no banked TZEV (referred to in the table as Enhanced AT PZEV) credits, except for one manufacturer. It is possible that LVMs might use ZEV credits, and NEV credits, as allowed, to meet some of the TZEV portion of their requirement. Still, staff predicts most LVMs will produce TZEVs to fulfill this portion of their 2012 through 2017 requirement.

Looking at LVM's minimum ZEV requirement, and assuming manufacturers only used banked credits to comply with the regulation in 2012 through 2017, most LVMs would be able to comply through model year 2014 using only banked ZEV credits. Four out of six LVMs would be able to comply through model year 2015, and one LVM would likely be able to meet their 2016 minimum ZEV obligation with banked credits.

In order to complete an analysis of possible credit usage in 2018 and subsequent model years, multiple assumptions must be made. Though many manufacturers have announced plans to produce ZEV program vehicles (see Section 1), few shed light on expected volumes. For the purposes of this analysis, staff did not assume an increase in manufacturer's banked ZEV credits. It is clear that most manufacturers will likely need to produce TZEVs, since there are few TZEV credits currently in manufacturer's ZEV banks.

Assuming LVMs keep their current credit banks constant through model year 2017, meaning they are meeting their yearly obligations through model year 2017 by producing vehicles and not using banked credits, most manufacturers would be able to comply only with their model year 2018 minimum ZEV requirement.

This credit analysis leads to two conclusions: 1) most manufacturers will likely need to produce TZEVs to meet a portion of their 2012 and subsequent model year requirements, and 2) manufacturers will run out of pure ZEV credits, and will need to produce ZEVs in order to meet their future requirements.[35]

3.2 Effects of Proposed Changes: 2009 through 2017 Model Years

Decreased IVM Requirements: 2015 through 2017 Model Years
Staff is proposing to decrease the overall requirement that applies to IVMs from 14 percent to 12 percent credits each year for model years 2015 through 2017. Table 3.2 shows the differential in expected PZEVs due to staff's proposed change.

Table 3.2: Effect of Decreased IVM Requirements in 2015 through 2017

	Existing IVM Requirement	**Proposed IVM Requirement**	**Differential**
Annual Credit Percentage	14%	12%	2% less per year
Annual Percentage of IVM Sales That Are PZEV	70%	60%	10% less per year
Cumulative PZEV Sales	617,000	530,000	87,000 fewer cumulatively

The proposed decreased PZEV requirements for IVMs will likely result in a cost savings over existing requirements. Because IVMs will be required to start complying with TZEVs in 2018, IVMs will likely use cost savings from decreased PZEV production to invest in research, development, and demonstration (RD&D) in TZEV technologies (the reason for the proposed change).

3.3 Effects of Proposed Changes: 2018 and Subsequent Model Years

2018 – 2025 Model Year Likely Compliance Scenario Development
Manufacturers are offered much flexibility in complying with the ZEV regulation. As explained above, LVMs must comply with a minimum amount of credit from producing ZEVs. Staff proposes that LVMs be allowed to meet the rest of their requirement with credits from producing TZEVs. Thus LVMs may fulfill their entire requirement with credits from ZEVs, but may not fulfill their entire requirement with credits from TZEVs. However, IVMs are allowed to fulfill their entire requirement with credits from TZEVs, although they may use ZEV credits if desired. Due to these uncertainties, and the wide array of ZEVs and TZEVs that could be produced to comply with staff's proposed ZEV requirements, staff developed a likely compliance scenario to be used for its analyses.

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[35] Confidential information, regarding historical credit usage patterns, was used to determine the effects of manufacturer's banked credits.

First, staff made the broad assumption that LVMs would fulfill their obligation with the maximum allowed percentage of TZEV credits. This is based on a belief that initial the market for TZEVs may be greater than for BEVs due to the latter's range limitations. Most LVMs have announced TZEV demonstration or production programs set to start prior to model year 2018.

Second, staff assumed a combination of BEVs and FCVs would be produced to comply with the ZEV requirements. Table 3.3 provides the assumed fraction of the total ZEVs produced that would be BEVs or FCVs.

Table 3.3: Fraction of ZEV Technologies 2018 and Subsequent Model Years

	2018	2019	2020	2021	2022	2023	2024	2025
FCVs	17.5%	18.6%	22.0%	25.0%	29.2%	31.8%	35.4%	40.0%
BEVs	82.5%	81.4%	78.0%	75.0%	70.8%	68.2%	64.6%	60.0%

Staff developed an average weighted credit using the above percentages in Table 3.3 to establish the minimum number of ZEVs produced each year. Each regulated manufacturer has a ZEV credit requirement. To translate the number of credits into a number of vehicles, a credit per vehicle must be assumed. Staff assumed all FCVs produced would have a 350 mile range, earning 4 credits each, and all BEVs produced would, on average, have a 100 mile range, earning 1.5 credits each. The average weighted credit used each year is enumerated in Table 3.4 below:

Table 3.4: Average Weight Credits Used in Likely Compliance Scenario

	2018	2019	2020	2021	2022	2023	2024	2025 and beyond
Average Weighted Credit	1.9	2.0	2.1	2.1	2.2	2.3	2.4	2.5

Using these base assumptions, a number of analyses were run to determine the effect of staff's proposed amendments.

3.3.1 Manufacturer Size Definition Amendments

Staff's proposed amendments to manufacturer size definitions will affect most IVMs, bringing nearly 97% of manufacturers' vehicle sales in California subject to the full LVM ZEV requirements. Table 3.5 shows the size classifications for LVMs and IVMs under staff's proposed amendments

Table 3.5: Proposed Size Classifications for Manufacturers 2018 and Beyond

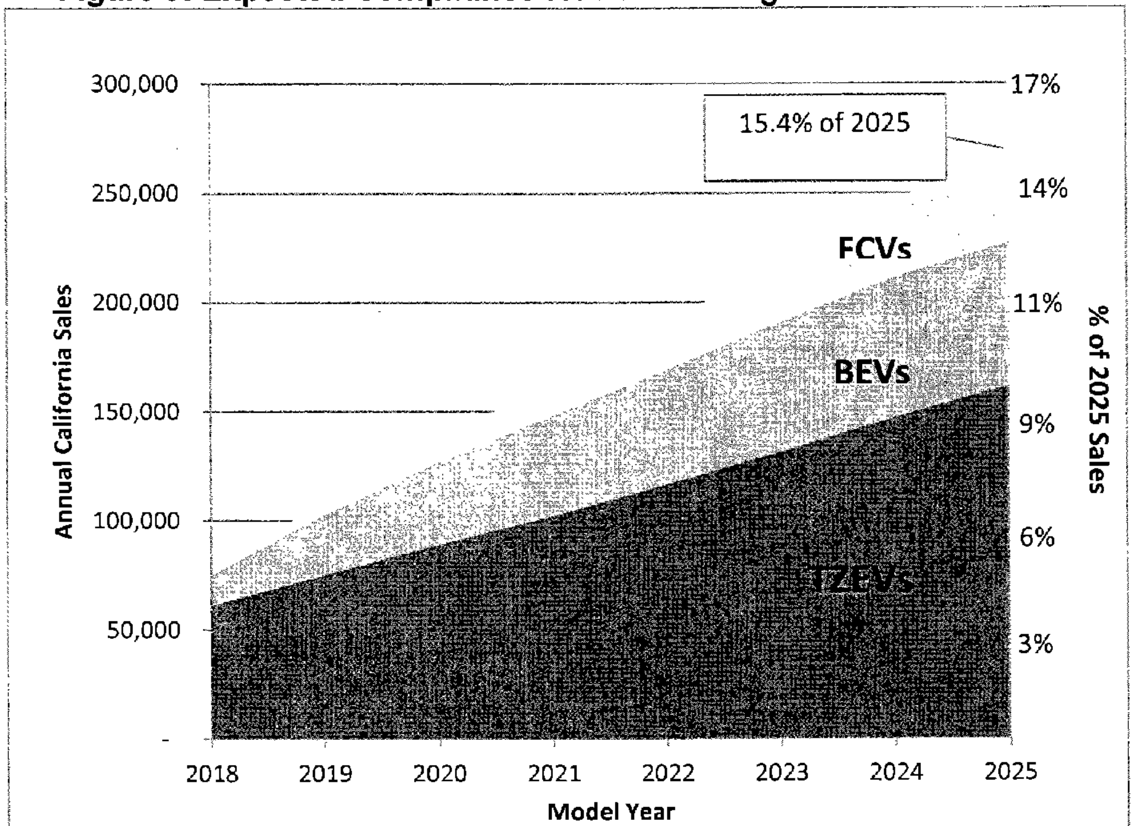
LVMs (>20,000 CA Sales)	IVMs (<20,000 CA Sales – >4,500 CA Sales)
• BMW • Chrysler • Daimler • Ford • General Motors • Honda • Hyundai • Kia • Mazda • Nissan • Toyota • Volkswagen **96.9% of California Sales**	• Jaguar Land Rover • Mitsubishi • Subaru • Volvo **2.8% of California Sales**

These size definitions greatly affect the overall number of ZEVs expected to be produced in compliance with the ZEV regulations. Additionally, IVMs previously allowed to meet their entire requirement with PZEVs will now be allowed to produce TZEVs. This is important for setting future standards and ensuring that most manufacturers will have some level of electric drive technology in their fleet. In 2025, if all IVMs take advantage of the flexibilities provided, over 30 percent of their annual sales will be TZEVs.

3.3.2 ZEV and TZEV Credit Calculations and Increased 2018 and Subsequent ZEV requirement

Putting all of the factors and assumptions discussed above together, staff has developed the following expected compliance scenario. As a result of staff's proposal, over 1.4 million ZEVs and TZEVs are expected to be produced cumulatively in California by 2025, which represents a 200 percent increase over the current ZEV requirements. Over 500,000 ZEVs (excluding TZEVs) are expected to be produced cumulatively in California by 2025. Figure 9, below, shows the total number of vehicles expected to be produced each year in compliance with staff's proposal. By model year 2025, staff expects 15.4 percent of new sales will be ZEVs and TZEVs.

Figure 9: Expected Compliance for 2018 through 2025 Model Years



The expected numbers for each model year are enumerated in Table 3.6 below. These numbers are based on future sales projections from ARB's Emissions Inventory Model, (EMFAC) 2011[36].

Table 3.6: Number of Vehicles Expected Annually – 2018 through 2025 Model Year (Expected Compliance Scenario - Rounded to Nearest 100)

	2018	2019	2020	2021	2022	2023	2024	2025	Cumulative TOTAL
FCVs	2,900	6,200	10,600	15,400	21,600	27,800	35,200	43,600	163,300
BEVs	13,900	27,300	37,700	46,300	52,600	59,500	64,200	65,400	366,900
TZEVs	61,300	75,300	89,100	101,900	116,300	131,200	146,900	161,700	883,700
Total Vehicles	78,100	108,800	137,400	163,600	190,500	218,500	246,300	270,700	1,413,900

There are an innumerable number of compliance scenarios. As explained above, manufacturers are not required to make each technology stated in Table 3.6. LVMs

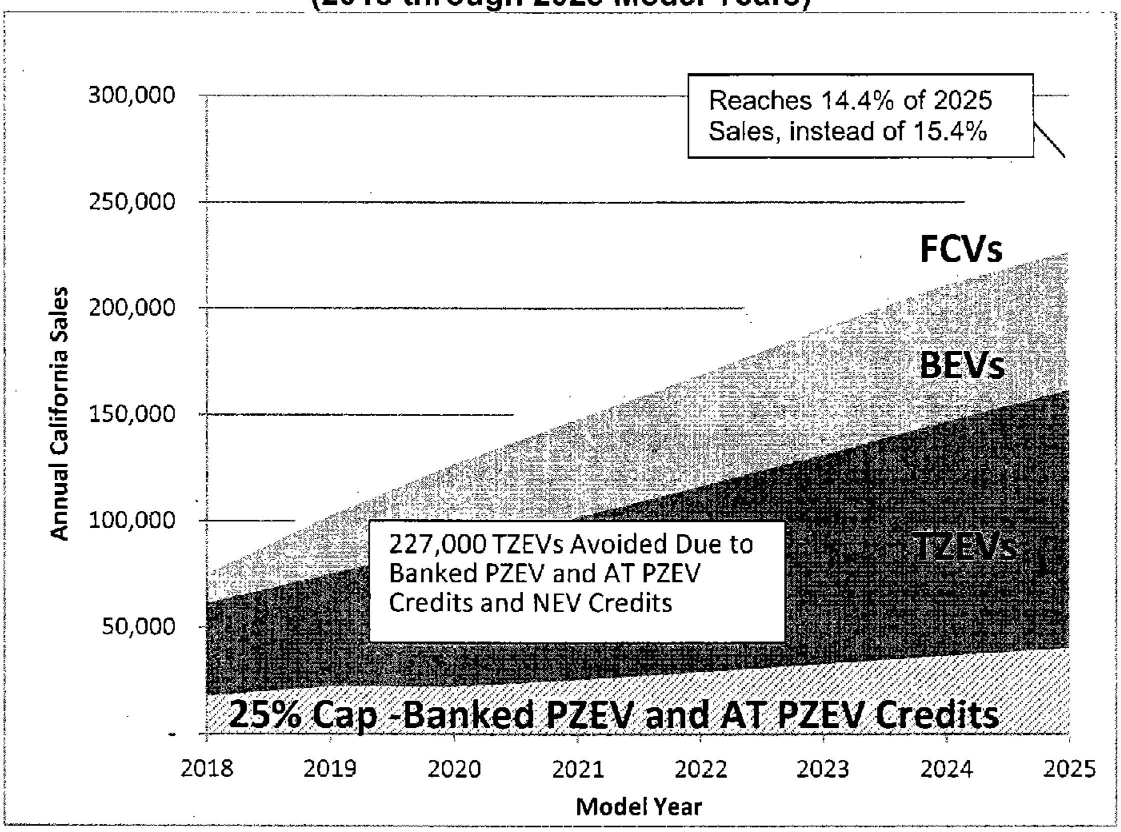
[36] ARB 2011b. California Air Resources Board. Emission Inventory Model, EMFAC 2011. http://www.arb.ca.gov/msei/msei.htm

may fulfill their entire requirement with credits from ZEVs, either BEVs or FCVs, or a mixture of both. If LVMs were to only pursue BEV technology to meet their minimum ZEV requirement, the number of ZEVs would nearly double each year; if only FCVs were used to meet their minimum ZEV requirements, the total number of ZEVs would be reduced by one third compared to numbers shown in Table 3.6.

3.3.3 Compliance Flexibility: Use of Banked PZEV and AT PZEV Credits

Staff is proposing to allow manufacturers to use PZEV and AT PZEV credits banked up to 2017 model year for 2018 through 2025 model year compliance, even though PZEV and AT PZEVs will be removed as compliance options. NEV credits, banked or new, would also be under the same cap as banked PZEV and AT PZEV credits. Figure 10 shows the amount of the 2018 through 2025 model year ZEV requirements that could be met with historical banked PZEV and AT PZEV credits, and NEV credits.

Figure 10: Impact of Banked PZEV AT PZEV Credits, and NEV Credits (2018 through 2025 Model Years)

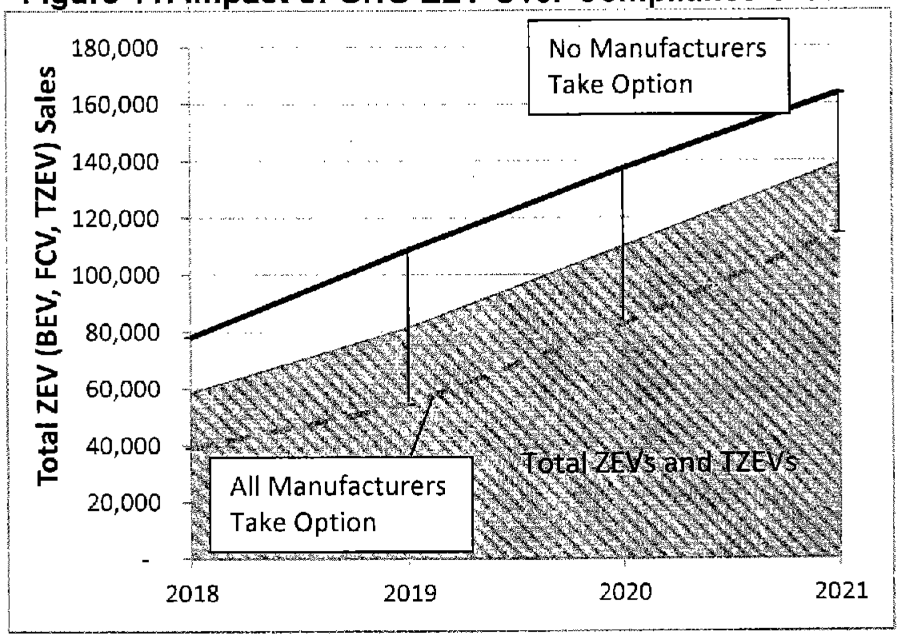


If all manufacturers use banked PZEV and AT PZEV credits to the maximum extent allowed in 2018 through 2025 model years, they will avoid up to 227,000 TZEVs cumulatively. This is about a 25 percent reduction in TZEVs from the values shown above in Table 3.6.

3.3.4 Compliance Flexibility: GHG-ZEV Over-Compliance Credits

Staff does not know which manufacturers will take advantage of the GHG-ZEV over-compliance provisions in model years 2018 through 2021, the only four model years these credits will be available. In Figure 11 below, the minimum (if zero manufacturers use this option) and maximum (if all manufacturers use this option) cases are shown.

Figure 11: Impact of GHG-ZEV Over-Compliance Credits

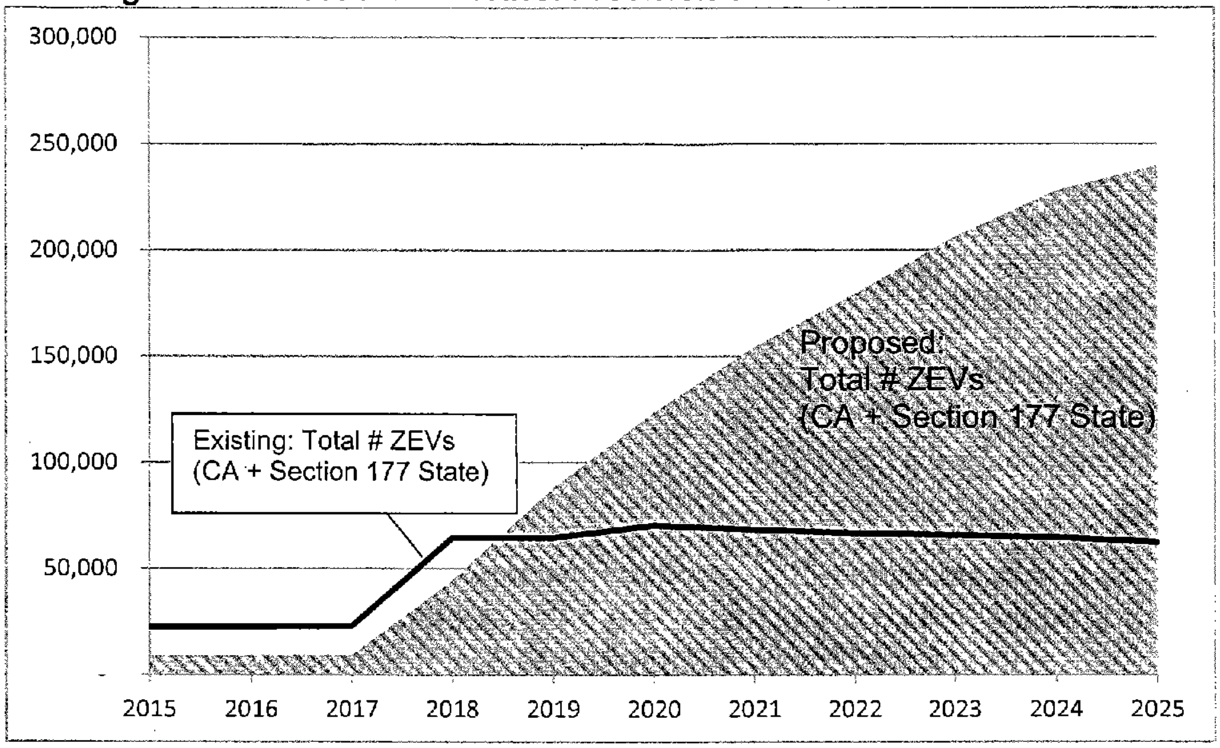


The hash marked area in Figure 11 represents total ZEV and TZEV sales if manufacturers responsible for half of vehicle sales take advantage of the GHG-ZEV over-compliance provision. The error bars indicate the impact if all manufacturers use this provision, or if no manufacturers use this provision. Staff's best guess at this point of time is manufacturers accounting for sales between 15 percent and 50 percent of total sales may be able to use the over compliance provision.

3.4 Effects of Proposed Changes: Travel Provision

Staff is proposing to extend the travel provision for BEVs through 2017 model year. This will likely result over 40,000 fewer BEVs placed in the Section 177 ZEV states, assuming the volume of vehicles sold in Section 177 ZEV states was twice as much as the volume of vehicles sold in California. This provision will be sunset for BEVs after 2017 model year. Due to this sunset, there will be a dramatic increase the total amount of ZEVs a manufacturer must produce in compliance with California and the Section 177 ZEV state regulations. Figure 12, below, shows the likely increase in the total number of BEVs placed in compliance with the ZEV regulation in California and in the Section 177 ZEV states.

Figure 12: Effect of BEV Travel Provision Sunset in 2017 Model Year



As shown above, the existing regulation requires manufacturers to place more BEVs than staff's proposal during 2015 to 2017 model years. However, due to staff's proposed extension of travel for BEVs, manufacturers are allowed to produce fewer BEVs in compliance with the regulation, and required to significantly ramp up their volumes in later years.

During the development of this ISOR, manufacturers and Section 177 ZEV states have discussed options regarding amendments to the travel provision. Some states have indicated that they would like to have ZEVs in their states prior to model year 2018, while others continue to prepare for increased volumes starting in 2018. Manufacturers have indicated the need for TZEVs to travel, which is not currently permitted under the regulation, and is not being proposed. Some manufacturers have also requested a reduction in the required volumes of ZEVs and TZEVs in the Section 177 ZEV states in model years 2018 and beyond. At the time of release of this ISOR, manufacturers and Section 177 ZEV states were still discussing these various issues.

4 REGULATORY ALTERNATIVES

As part of the regulatory development process, staff considered four alternatives regarding the number of vehicles required to be produced in 2018 and subsequent model years. A consistently calculated scenario of expected ZEV and TZEV sales used to comply for each of the four alternatives is presented below in Table 4.1. The options were then evaluated in the context of two of staff's primary objectives: commercialization of ZEV technology to ensure reduced incremental costs and addressing long-term GHG and criteria emission goals.

Table 4.1: Alternatives – Annual Combined ZEV and TZEVs (Rounded)

	2018	2019	2020	2021	2022	2023	2024	2025
Staff Proposal	78,000	109,000	137,000	164,000	191,000	218,000	246,000	271,000
Alt A (Lower)	44,000	56,000	83,000	122,000	157,000	195,000	229,000	261,000
Alt B (Higher)	120,000	161,000	191,000	218,000	246,000	274,000	302,000	325,000
Alt C* (Existing Program)	54,000	54,000	60,000	60,000	61,000	61,000	62,000	62,000

*Assumes PZEVs and AT PZEVs are removed and covered in LEV III.

4.1 Alternative A: Lower ZEV Requirements

Alternative A combines aspects of a proposal from a subset of auto manufacturers with staff's assumptions on amendments to the travel provision. This alternative includes a gradual phasing in (reduction) of the ZEV and TZEV credit values, increasing the fraction of the ZEV requirement that may be met with credits from TZEVs, and lower overall requirements.[37] Compared to staff's proposal, the number of ZEVs required is much lower in the early years, consists of a much higher portion of TZEVs relative to ZEVs, but gets closer to the staff proposal in terms of annual volume by 2025.

Staff rejected Alternative A because it could undercut the launch of and resultant commercialization of pure ZEVs (BEVs and FCVs). To achieve full commercialization and place the industry on a pathway consistent with meeting long term goals, volume sales of ZEVs need to ramp up quickly. Alternative A delays the ramp up. While lower numbers of ZEVs would result in lower compliance costs to manufacturers, progress toward lowering unit costs through increased volume is also delayed, pushing out the date at which a sustainable market is reached. Although TZEVs are an important bridging technology, too much uncertainty surrounds the availability of

[37] Manufacturers proposed reducing the number of ZEVs and TZEVs required to be placed in the Section 177 ZEV states. Staff modified the manufacturer's original proposal to reflect a one-third reduction in vehicle requirements in California as well as the Section 177 ZEV states for purposes of analyzing Alternative A.

low-carbon biofuels and understanding of how much zero emission VMT is achieved with TZEVs to depend fully on TZEVs to achieve long term emission reductions.

4.2 Alternative B: Higher ZEV Requirements

Alternative B represents a proposal from a group of non-governmental organizations, the California Clean Car Coalition. This alternative is similar to the staff proposal, except the jump in volume requirement between 2017 and 2018 is much greater (more than a doubling), and requirements for subsequent years are higher by 20 to 50 percent compared to staff's proposal.

Staff rejected this proposal due to the steep jump in volume requirement between the model year 2017 and 2018 requirements and increased overall compliance costs.

4.3 Alternative C: Do Not Amend Program

Staff also considered not recommending any amendments to the ZEV regulation. In this case, PZEVs and AT PZEVs would continue to be an option for compliance through model year 2018 and require no more than 1.7 percent of manufacturer's new vehicles to be ZEVs in 2018 and subsequent model years. Additionally, manufacturers would be required to produce more ZEVs in the Section 177 ZEV states, due to the travel provision expiring for Type I, I.5, and II ZEVs (BEVs) following model year 2014, and expiring for Type III, IV, and V ZEVs (FCVs) following model year 2017. Staff rejected this alternative because it is not consistent with achieving a commercial market for ZEVs or TZEVs.

5 ECONOMIC IMPACTS

This section discusses the economic impacts of the ZEV requirements on regulated manufacturers inside and outside California, individual consumers, and local and State government. For the manufacturers, the impact is from higher manufacturing costs, which is expressed as an incremental price above a baseline 2016 gasoline vehicle, and the total compliance costs (calculated as the sales multiplied by the individual incremental prices for any given year). The economic impacts to consumers are presented in a variety of ways, including the impact of the incremental price they would see when purchasing a ZEV (assuming the manufacturer passes all of the costs of compliance to the ZEV compliance vehicles), juxtaposed with the cost savings they would recover when operating the vehicle, the incremental costs to all vehicles if the compliance costs of the ZEV program were spread across the entire new vehicle fleet and a discussion of other factors influencing the price of ZEVs in the marketplace. For local and State government, impacts are presented qualitatively.

5.1 Legal Requirement

Sections 11346.3 and 11346.5 of the Government Code require state agencies to assess the potential for adverse economic impacts on California business enterprises and individuals when proposing to adopt or amend any administrative regulation. The assessment shall include consideration of the impact of the proposed regulation on California jobs, business expansion, elimination, or creation, and the ability of California businesses to compete. State agencies are also required to estimate the cost or savings to any state or local agency and school districts in accordance with instruction adopted by the Department of Finance. This estimate is to include any nondiscretionary costs or savings to local agencies and the costs or savings in federal funding to the state.

5.2 Directly Affected Businesses

At present, there are no companies in California whose sales volumes are high enough for them to be considered IVMs to make them subject to the existing ZEV requirements or the proposed amendments. There are three California-based businesses that could be subject to this regulation in the future. Three motor vehicle manufacturing plants are located in California: a Fremont facility and Palo Alto facility owned by Tesla Motor Company, and an assembly facility in Benicia owned by Coda. Due to staff's proposed amendment to count ZEVs in a manufacturer's applicable sales volume (as discussed in section 2.2.10, above), these three California manufacturers could become subject to the ZEV regulation if their individual California sales volume each exceed 4,500 vehicles per year.

Outside of California, LVMs and IVMs subject to the ZEV regulation are directly affected by the proposed amendments. As described in Section 2.2.1, nearly all manufacturers are required to comply with the current ZEV regulation. The largest six vehicle manufacturers, which account for nearly 80 percent of California's LDV market, are currently required to make ZEVs, which results in a greater economic impact. The eight IVMs are allowed to comply with PZEVs, which are nearer to conventional technology, and are usually less financially impacted. However, due to staff's proposed amendments which redefine the size of the IVM and LVMs (discussed in Section 2.2.1), it is projected that 12 manufacturers, accounting for approximately 97 percent of all LDV PC and LDT sales, will be directly regulated to make ZEVs starting in 2018 model year.

5.2.1 Potential Impact on Manufacturers

Manufacturers may take many different paths to comply with the ZEV regulation. In general, as a result of staff's proposed amendments, regulated manufacturers are likely to adjust their future vehicle product portfolios and accelerate development and production of advanced technology vehicles. This will have a direct impact on research, development, and production programs, and a secondary impact on the suppliers of components and infrastructure. A manufacturer's involvement in advanced technologies for global markets and the manufacturer's quantity of banked ZEV credits, will also affect the impact from the regulation. The impact of the proposed amendments will affect manufacturers differently depending on the size of their California sales, company resources, and technology expertise.

Technology Choice

In general, manufacturers with larger market shares, like Toyota and General Motors, sell a larger variety of cars and trucks. Though staff predicts most ZEVs and TZEVs will be primarily PCs, manufacturers' compliance strategies for the ZEV regulation may take into account a specific technology best suited for varying platform sizes. For example, manufacturers with a broad mix of cars and trucks may pursue multiple technologies to apply across their varied platforms. However, manufacturers with fewer and more consistent platforms may pursue a single technology that applies well to their model mix. Examples of platform specific considerations for the various technologies follow:

- BEVs may predominantly be on small car platforms given the relationship between vehicle weight, range and cost associated with batteries. Namely, to minimize cost and maximize range, batteries are applied to the smallest or lightest vehicles. Additionally, smaller platforms are a better match with vehicles limited to 100 to 150 miles electric range that may be predominantly used in urban areas.

- FCVs may predominantly be on mid-sized car and light truck platforms given their longer-range performance and the capability to scale up powertrain output with less additional weight compared to batteries (adding range is a function of adding hydrogen storage capacity which can be done more cost effectively than adding batteries on a BEV in larger vehicle platforms).

- PHEVs may be developed on a wide range of platforms depending on the size of the battery used. The more battery dominant the drive-train, the smaller the platform that will likely be used.

5.2.2 Incremental Direct Manufacturing System Costs Estimates

For manufacturers, incremental cost represents the added cost to manufacture advanced vehicle components and higher material costs (e.g. lithium for batteries and platinum for fuel cells). In some cases, specific advanced vehicles are more complex than conventional cars (e.g. PHEVs have both combustion engines and batteries). Determining incremental costs is important to evaluate the impact to manufacturers when coupled with total sales.

For this analysis, staff estimated incremental direct manufacturing system costs for each model year of the regulation and compared them to a 2008 baseline gasoline vehicle.[38] Model year 2008 is used as a technology reference for the GHG-reduction effectiveness calculations because it is the year with the most comprehensive dataset (e.g., for sales, footprint, technology, CO_2 emissions for every model), and it closely matches the vehicle simulation modeling baseline. As a result, incremental technology costs are also indexed to the 2008 technology level. Subsequent calculations of incremental compliance costs for new proposed regulations are relative to the technology required to comply with existing regulations, including model year 2016 GHG standards. A description of cost impacts for each technology follows:

Plug-in Hybrid Electric Vehicles

The variation in the incremental costs for PHEVs between vehicle classes is smaller than the BEV technology given the smaller battery pack size. However, PHEVs will remain inherently more complex than BEVs because of the combustion engine.

Battery Electric Vehicles

The incremental costs are particularly sensitive to the vehicle's electric range given its direct relationship to the size of the battery pack.

Fuel Cell Vehicles

FCVs are expected to have higher incremental costs when first introduced into the market compared to BEVs, but will decline rapidly with production volumes (2012 vs. 2025 system costs shown in Table 5.1).

The most expensive components of ZEVs are the battery modules and fuel cell systems. To better understand the declining costs of these advanced components, Table 5.1, below shows the direct manufacturing costs of the battery packs and fuel

[38] As described in the LEVIII ISOR, staff developed a comprehensive model for projecting the incremental costs of advanced vehicle technologies in future years. This modeling effort was conducted jointly with the U.S. EPA and NHTSA in support of the Federal rulemaking, and was first presented in the Technical Assessment Report (EPA, 2010). This analysis was revised in 2011 and is outlined in the LEVIII ISOR Section III-A-4.3.

cell systems[39] for midsized platforms. Because, as shown in the table below, incremental system costs decrease with increased volume, staff's proposal will have the effect of decreasing per vehicle direct manufacturing system costs as compared to the existing requirements. Incremental system costs are shown for multiple years between 2012 and 2025, revealing the declining cost of batteries and fuel cells over time as production volumes rise.

Table 5.1: Incremental Direct System Manufacturing Costs* (2009$)

	2012	2015	2020	2025
System per-vehicle costs ($)[a]				
PHEV20 battery pack	8,078	6,462	3,309	2,647
BEV100 battery pack	21,367	17,094	8,752	7,002
FCV fuel cell system	18,908	10,208	5,220	4,756
System per-unit costs				
PHEV20 battery pack ($/kWh)	1053	842	431	345
BEV100 battery pack ($/kWh)	605	484	248	198
FCV fuel cell system ($/kW)	163	88	45	41

*Based on midsize car / small multipurpose vehicle class, as compared to a 2008 baseline; Figures 3 and 4, in Section 2.2.3, show the system costs graphically.

Battery packs and fuel cell stacks are assumed to last the life of the vehicle (no replacement). As compared to BEVs where the system cost is predominantly the battery pack, FCVs include three major sub-systems in addition to the electric drive components shared by both technologies. The three sub-systems include the fuel cell system (fuel cell stack and auxiliary equipment), the hydrogen storage assembly, and the hybrid battery pack (similar size to existing conventional hybrids).

The table above shows that incremental system costs decline with volume production – an important reason that the ZEV requirements ramp up through the program years. It is also important to point out that the incremental system costs of FCVs drop below the incremental system costs of BEVs in the later years of the program. This factor was used in the staff's estimates of vehicle technology mix in the expected compliance scenario.

5.2.3 Vehicle Package Incremental Prices

To determine the total impact to manufacturers, staff analyzed incremental vehicle prices for each ZEV technology. Incremental vehicle prices include the direct manufacturer costs, as shown above, as well as an indirect cost multiplier (ICM). As described the LEVIII ISOR Section III-A-4.3, the ICM markup includes a number of indirect cost components, including overhead, warranty, RD&D, depreciation, marketing, and dealer profit. Table 5.2 below shows the ICM values used in the full ACC analysis. The "High 2" complexity category was used for the BEV and PHEV platforms, whereas "High 1" was used for FCV platforms (and non-battery components for PHEVs).

[39] These costs differ from those in Table 6.1 as they do <u>not</u> include all other package components such as electric motors, power electronics, or small combustion engines for PHEVs, and are compared to a 2008 baseline rather than a 2016 baseline vehicle.

Table 5.2: (Un-Modified) Indirect Cost Multipliers

Tech Complexity Level	Near term (2017-2021)	Long term (2022-2025)
High 1	1.56	1.35
High 2	1.77	1.50

Note: ICM factors shown are approximate; mark-up factors involve separate components for warranty and non-warranty related indirect costs

These ICM factors for advanced vehicles are conservative estimates about how these advanced technology cost factors (by battery and fuel cell stack developers, in-house or at supplier companies) may ultimately affect automakers' indirect costs. Hereafter, the ICM values in Table 5.2, above, will be referred to as "un-modified ICMs".

For comparison, an alternate ICM value of 1.33 (modified ICM) was also analyzed to represent the scenario where the auto industry better manages the associated complexity and indirect costs associated with the emerging advanced technologies. Staff believes that this lower ICM is of higher likelihood as ZEVs are commercialized and automakers work in-house and with suppliers to minimize the cost factors inherent to the ICM framework. The National Academy of Sciences (NAS) similarly suggests lower ICM values in its 2011 technology assessment for hybrid and plug-in vehicles due to the likelihood that many of the indirect costs (e.g., engineering, labor, overhead, and integration costs) would otherwise be double counted.[40]

Table 5.3 below, shows the sensitivity of incremental vehicle prices to the ICM assumption. All values are referenced to a MY2016 average baseline technology.

Table 5.3: ICM Sensitivity Analysis of Incremental Vehicle Price

	Un-Modified ICM		*Modified ICM*	
	2020	**2025**	**2020**	**2025**
PHEV20 (6.6 kWh)	10,249	8,448	7,969	7,312
BEV100 (30 kWh)	14,593	10,829	11,428	9,406
FCV (3.3 kg H_2)	9,811	7,513	8,224	7,387

All technologies on subcompact platforms.

As shown, the use of a 1.33 ICM factor would bring down BEV and PHEV costs by $1000 to $3000 per vehicle; the lower ICM would reduce FCV costs by $200 to $1500. Staff believes that the 1.33 is likely to be a maximum ICM for the cost multiplier for the indirect costs of conventional hybrids and PHEVs and that BEV technology is likely to have a lower cost multiplier (though higher gross per-vehicle indirect cost) due their reduced OEM integration complexity (i.e., without combustion engine and associated integration issues). Nonetheless, the un-modified, more conservative ICMs were utilized for consistency with the LEV III analysis (and related joint-agency technology cost analysis).

Table 5.4, below, shows incremental ZEV technology prices for model years 2016 and 2025. Model year 2016 was chosen as the reference vehicle technology for this

[40] NAS, 2011. National Academy of Sciences. 2010. Committee on the Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy; National Research Council "Assessment of Fuel Economy Technologies Light Duty Vehicles".

analysis, as it is the final model year of the currently adopted GHG regulations.[41] So for example, for the 2025 model year comparison, a 2025 model year vehicle with 2016 technology was compared with a 2025 model year vehicle equipped with technology necessary for meeting the new proposed standards in 2025.

Table 5.4: Incremental technology package prices above average MY2016 baseline technology (2009$)[1]

Vehicle Class	Technology Package (energy capacity) [2]	Incremental Vehicle Price in 2016	Incremental Vehicle Price in 2025
Subcompact	PHEV20 [3] (6.6 kWh)	13,233	8,448
	PHEV40 (13.4 kWh)	16,580	10,259
	BEV75 [4] (23 kWh)	17,010	9,405
	BEV100 (30 kWh)	19,655	10,829
	FCV [5] (3.3 kg H_2)	19,060	7,513
Midsize car / Small MPV	PHEV20 (7.7 kWh)	13,807	8,876
	PHEV40 (15.5 kWh)	17,818	11,043
	BEV75 (27 kWh)	17,562	9,794
	BEV100 (35 kWh)	20,785	11,551
	FCV (3.8 kg H_2)	23,472	9,334
Large Car	PHEV20 (9.1 kWh)	17,280	11,205
	PHEV40 (18.7 kWh)	23,134	14,390
	BEV75 (30 kWh)	20,820	11,628
	BEV100 (40 kWh)	23,959	13,363
	FCV (4.3 kg H_2)	33,238	13,406

1 Refer to the LEVIII ISOR Section III-A-4.3 and Appendix R for additional vehicle packages
2 Energy capacity for BEV/PHEV is kWh rated battery pack capacity, kg H_2 for FCV
3 EPA and NHTSA designation for a PHEV is a "range extended electric vehicle" or REEV.
4 For BEVs and PHEVs, the residential charging equipment costs are included in these technology packages.
5 FCV costs include the fuel cell system (as shown in later figures), the hydrogen storage system, the hybrid battery module, and other EV components and power electronics similar to the BEV technology package.

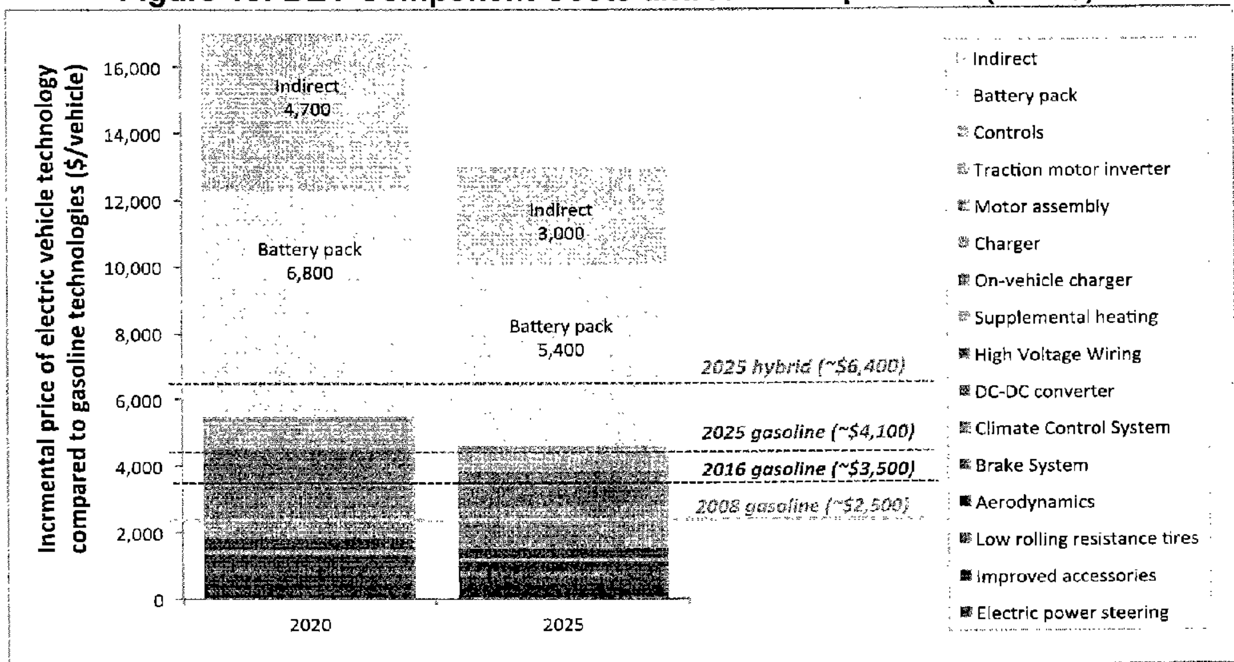
5.2.4 Component Costs and Baseline Comparisons

Figures 13 and 14, below, show the individual component costs of BEVs and FCVs, along with the ICM, above reference 2016 model year technology. The figures show the break-out for various components within the vehicle, displaying the relative difference in cost between individual parts and the projected cost reduction from learning effects between 2020 and 2025. Several gasoline vehicle reference points are shown for context. Note that these two figures show a baseline 2008 powertrain (i.e., engine and transmission) at $2500, and a model year 2016 vehicle would represent about $1000 per vehicle in additional cost. Also note that several of the BEV and FCV components that are shown (aerodynamics, low rolling resistance tires, improved accessories) in the figures are also likely to be deployed widespread on future gasoline vehicles. As described in Section 5, the battery costs are the dominant

41 Staff notes that model year 2008 is the technology level from which vehicle attributes are well characterized and is the fundamental reference for technology, cost, and emission-reduction effectiveness in ARB staff's joint work with the federal agencies on LEV III assessment. The average projected incremental price for model year 2016 non-ZEV vehicle modifications related to the LEVIII GHG program is $951 per vehicle over the model year 2008 reference.

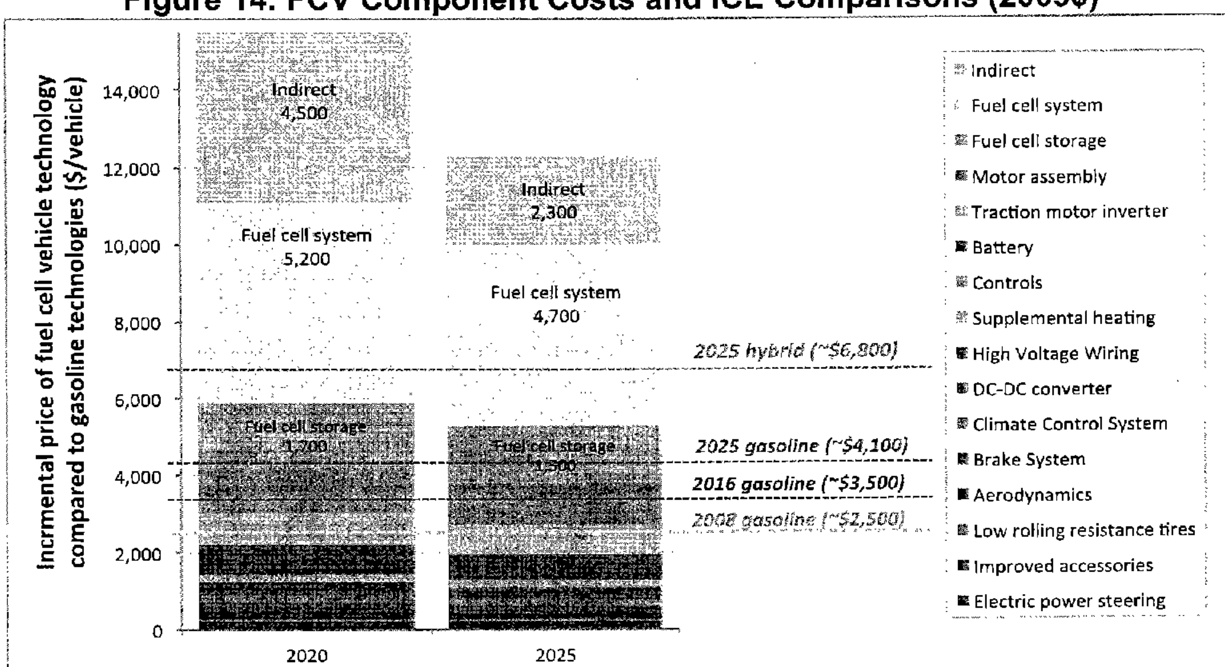
factor for BEVs, and the fuel cell system coupled with the hydrogen storage assembly dominate the costs for FCVs.

Figure 13: BEV Component Costs and ICE Comparisons (2009$) *



*Component costs reflect subcompact 100 mile BEV

Figure 14: FCV Component Costs and ICE Comparisons (2009$)*



*Component costs reflect mid-size 350 mile FCV

5.2.5 Annual Manufacturer Costs

For manufacturers, an annual compliance cost is calculated by multiplying the total advanced vehicles required due to staff's proposal by the incremental prices for each vehicle type and size. Due to staff's proposal to increase the 2018 and subsequent model year ZEV requirement, regulated manufacturers will experience an increase in compliance costs as compared to current ZEV requirements. Table 5.5 shows the annual impact to manufacturers (for two model years: 2020 and 2025) due to staff's proposed changes, and the difference in impact as compared to the existing regulation.

The compliance costs in Table 5.5, below, include the un-modified ICM mark-up. It was important to directly capture all of these cost components in the estimated compliance cost. The small fraction associated with assumed profit would represent future expenditures on required RD&D or costs to supplier systems.

Table 5.5: Estimated Annual Compliance Costs for 2020 and 2025* (2009$)

	2020			2025		
	Sales - Rounded (vehicles)	**Average Incremental Vehicle Price**	**Total Cost (millions)**	**Sales – Rounded (vehicles)**	**Average Incremental Vehicle Price**	**Total Cost (millions)**
Staff Proposal						
BEV	39,000	12,900	$502	65,000	9,500	$618
FCV	11,000	12,400	$136	44,000	9,300	$411
PHEV	93,000	10,900	$1,017	164,000	8,900	$1,465
Total	143,000	11,600	$1,655	272,000	9,200	$2,494
Existing Regulation						
BEV	22,000	13,000	$287	16,997	9,700	$164
FCV	6,000	10,800	$65	11,331	8,000	$90
PHEV	35,000	10,400	$363	33,993	8,700	$295
Total	63,000	11,400	$715	62,321	8,800	$550
Total Incremental Costs			**$940**			**$1,983**

* Costs are based on incremental ZEV technology vehicle prices above non-ZEV model year 2016 technology

The incremental costs in Table 5.5 above represent an average of incremental prices amongst various platforms, found in Table 5.4. Lower incremental costs in the "Existing Regulation" case are due to lower volumes being assumed on smaller platforms with lower incremental prices. The higher volumes required by staff's proposal result in ZEV technologies moving into larger platforms, and therefore have a higher incremental price per vehicle.

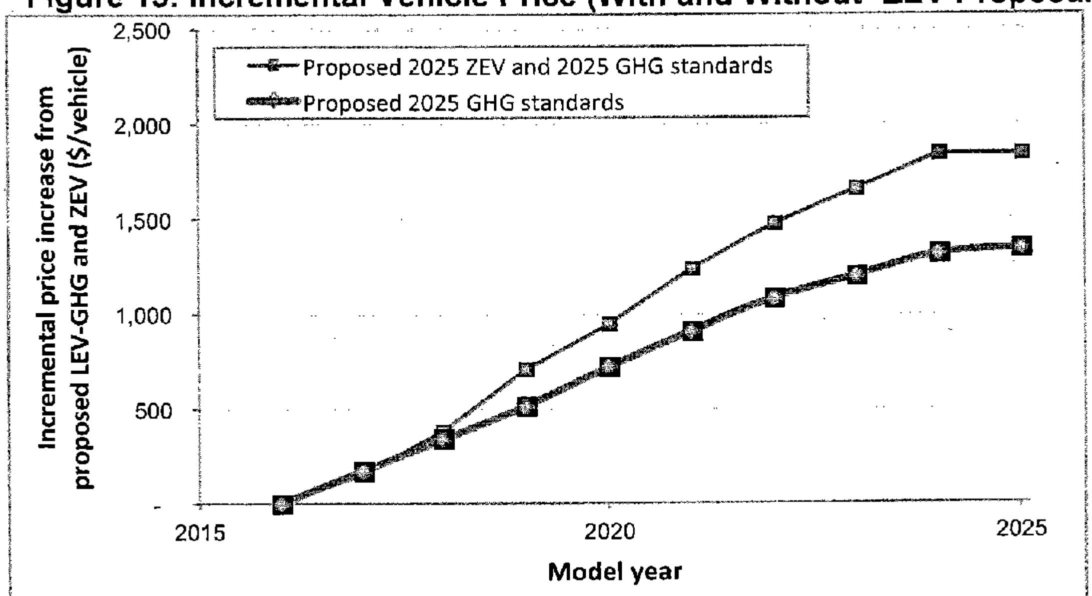
Staff estimates the entire incremental compliance cost for the ZEV proposal alone, above the existing regulation for the years 2018-2025, to be approximately $10.5 billion. However, subsection 5.2.6 will discuss the cost of the proposed amendments to the ZEV regulation in context with compliance with LEV III fleet average standards.

5.2.6 Incremental Price Increase in the Context of Advanced Clean Cars

The ZEV regulation must be considered in conjunction with the proposed LEV III amendments. Vehicles produced as a result of the ZEV regulation are part of a manufacturer's light-duty fleet and are therefore included when calculating fleet averages for compliance with the LEV III GHG amendments. Because the ZEVs have ultra-low GHG emission levels that are far lower than non-ZEV technology, they are a critical component of automakers' LEV III GHG standard compliance strategies. As such the ZEV program cost is considered as the difference in complying with the LEV III GHG fleet standard without the proposed amendments to the ZEV regulation versus with the proposed amendments to the ZEV regulation.

Assuming that all of the associated direct manufacturing and ICMs are passed on to consumers, the average incremental price increase that results from the proposed LEV III GHG fleet standards and proposed ZEV regulation over the 2017 through 2025 timeframe will differ from the average increase resulting from compliance with only the LEV III GHG amendments. The average incremental vehicle price due to proposed LEV III GHG standards, but with no amendments to the current ZEV regulation, in 2025 is expected to be $1,340. The average incremental vehicle price considering the proposed LEV III GHG fleet standards and the proposed ZEV requirements in 2025 model year increases to $1,840, a $500 incremental increase. Using the modified ICM, the incremental price increase due to the proposed ZEV requirements would by $370 instead of $500. Figure 15 below shows the incremental vehicle prices, with and without staff's proposed amendments to the ZEV regulation. In the broader context of the overall fleet, the ultra-low GHG ZEV technology is a major component of compliance with the LEV III GHG fleet standards for the overall light duty fleet. In that fleet context, the overall cost of the ZEV program is the difference in costs between the "GHG-plus-ZEV" and the "GHG only" scenarios.

Figure 15: Incremental Vehicle Price (With and Without* ZEV Proposal)



*Proposed 2025 GHG Standards means 2025 GHG standards with no change to the current ZEV requirements.

Table 5.6 summarizes the total incremental cumulative cost of the ZEV program in two different contexts. First, the incremental cost of the expected deployment of ZEV technology is summed versus the reference model year 2025 as if the current requirements for the ZEV regulation remained unchanged. This cumulative ZEV incremental technology cost is equivalent to $10.5 billion over 2018 through 2025 model years. In the second context, the amended ZEV program vehicle cost is compared in combination with compliance with the LEV III amendments. As illustrated above in Figure 15, the difference between LEV III GHG with the existing ZEV regulation and GHG with the proposed ZEV regulation in each model year (times the number of total vehicles sales) is the equivalent cost premium of the ZEV program. In this overall fleet context where the ZEV technology produces substantial GHG reductions in the LEV III program, the additional cost of the amended ZEV program is $4.6 billion over 2018-2025 model years.

Table 5.6: Estimated Compliance Costs for ZEV regulation in two contexts

	Program cost, MY2018-2025
ZEV technology - Incremental compliance cost from proposed ZEV amendments to current ZEV program	$10.5 billion
Incremental compliance - Incremental cost to comply with GHG program with new ZEV program (versus without new ZEV program) through each model year	$4.6 billion

5.3 Potential Impacts to Individuals (Car Buyers)

For individual consumers, incremental price represents the added price they would pay for a ZEV compliant car over a baseline vehicle, creating a higher "initial" or "up front" cost. For this analysis, staff estimated incremental prices for each model year of the regulation and compared them to 2016 baseline vehicle technology. Determining incremental prices is important to evaluate the potential upper bounds impact to individual consumers, and is later coupled with operating cost savings to determine payback periods.

Staff's proposed amendments will likely decrease the per-vehicle initial cost to consumers compared to the existing regulation because of the impact of higher production volume reducing incremental costs, but costs will remain $7,500 to $14,500 higher than the 2016 vehicle technology in 2025. The incremental price per vehicle can be found in subsection 5.2.3 above.

5.3.1 Lifetime Costs and Consumer Payback[42]

With significant changes in technology and in alternative fuels, car buyers have the opportunity to think about the cost of their personal transportation choices differently by considering both initial purchase prices and in-use costs such as fuel, maintenance and other factors. As shown below in Table 5.7[43], ZEVs' incremental price increase is paid back over the life of the car. Table 5.7 below outlines the lifetime costs and consumer savings resulting from staff's proposed amendments. Lifetime costs include varying fuel costs due to improved efficiency and using an alternative fuel, electric

[42] See Appendix C for cost inputs and assumptions.
[43] A further explanation on lifetime costs can be found in the LEVIII ISOR Section III-A-4.4.

charging equipment purchases, and vehicle and equipment purchase incentives. The table shows the incremental prices for vehicles purchased in 2025 and then shows lifetime consumer savings.

Table 5.7: Lifetime Costs and Consumer Payback[a] (2009$)

Technology Package[b]	Incremental Vehicle Price in 2025[c]	Lifetime Consumer Savings[d]
PHEV20 (7.7 kWh)	8,876	10,382
PHEV40 (15.5 kWh)	11,043	10,565
BEV75 (27 kWh)	9,794	10,594
BEV100 (35 kWh)	11,551	10,594
FCV (3.8 kg H2)	9,334	6,067

[a] Costs based on incremental vehicle prices above a 2016 baseline technology
[b] Based on mid-size car / small multipurpose vehicle
[c] Vehicle prices, including residential charging equipment/installation costs for plug-in vehicles
[d] Average car lifetime in California is 14 years, 186,000 miles; Future fuel savings discounted by 5%. Fuel prices from CEC (e.g., for 2025, gasoline = $4.02/gal); electricity = $0.15/kWh; Hydrogen = $6/kg

ARB estimates the median life in California for PCs is 14 years, or approximately 186,000 miles. For two vehicle types shown, the consumer payback occurs within the median life of the vehicle. The "consumer payback period" is the year at which the cumulative fuel savings equals the incremental purchase price. Though the payback period will not occur within the life of the vehicle for the three other vehicle types, consumers will still experience $6,000 to $10,000 in lifetime savings. Note that these savings are based on average annual VMT; to the extent that consumers travel more or less than average or own their vehicles for longer or shorter than the median life, savings could be higher or lower.

As discussed further in this subsection 5.2.4, manufacturers may also spread some or all of the compliance cost of ZEVs across their whole vehicle fleet, which would reduce the incremental cost per ZEV vehicle, as well as the consumer payback period. The LEV III ISOR shows when costs for LEV and ZEV compliance are considered in a join context, the average payback period is 3 years for model year 2025 vehicles. Other factors that impact the actual cost of ZEVs to consumers are discussed below in subsection 5.3.2.

5.3.2 Other Cost Factors

This section has so far laid out the incremental price of ZEVs compared to conventional cars as well as the incremental impact of the ZEV amendments in the context of the entire ACC program. But there are other factors that may influence the price, operating cost savings and operational benefits of ZEVs. Some of these are discussed below.

These additional economic factors are not quantified as a part of staff's analysis of the proposed amendments, but can be evaluated at a future time when they are better understood.

- International Factors: If a manufacturer is developing ZEVs for other markets outside of the United States, it will be better prepared to meet staff's proposed

ZEV requirements in 2018 and subsequent model years. Coupled with the production plans for BEVs and PHEVs from manufacturers, substantial international investments are being made into advanced battery production and development. These trends are outlined in several studies, including Roland Berger[44,45] and the International Energy Agency's recent EV Roadmap[46]. As global markets grow, the production capacity is growing rapidly which helps to bring costs down.

National government support for battery manufacturing, vehicle development, and incentives are also influential factors in international market costs (e.g. China, Japan, United States).[47] The European Union (EU), particularly France and Germany, have strong policies and incentives supporting FCVs, BEVs, and PHEVs. China has substantial vehicle incentives, infrastructure funding, and manufacturing subsidies in place. South Korea has national support for hydrogen infrastructure. Japan has infrastructure support for both electricity and hydrogen. In addition to centralized financial support, national emission regulation targets will also influence advanced vehicle programs. The EU, China, and Japan all have aggressive gCO_2/kilometer targets for the 2020-2025 timeframe.[48]

- Vehicle Maintenance – Although BEVs and FCVs still have some moving parts, the number of components and fluids that need to be serviced is likely to be lower than conventional vehicles. Although this is difficult to estimate today, it is expected that BEVs and FCVs will have lower maintenance costs over the life of the vehicles. As an example, Ford has recently stated that maintenance costs of its upcoming Focus BEV could be $1,200 lower than the conventional Focus over 10 years.[49]

- Low Carbon Fuel Standard (LCFS) credit value – Depending on policy decisions by ARB and the California Public Utilities Commission (CPUC), LCFS credit value for electricity may be returned to electricity providers and ultimately ZEV drivers. A recent research study identified the potential revenue this would provide for BEV users. With California's 2020 grid, the value could range from $75 per vehicle per year (at $25 per tonne CO_2 equivalent) to $300 per vehicle

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[44] Roland Berger, 2010a. Roland Berger Strategy Consultants "Powertrain 2020: Li-Ion Batteries – The Next Bubble Ahead"
[45] Roland Berger, 2011. Roland Berger Strategy Consultants. "Automotive Landscape 2025: Opportunities and Challenges Ahead"
[46] IEA, 2011. International Energy Agency, June 2011. "Technology Roadmap – Electric and Plug-in Hybrid Electric Vehicles"
[47] PRTM, 2011. PRTM and World Bank, April 2011 "The China New Energy Vehicles Program – Challenges and Opportunities"
[48] ICCT, 2011. International Council on Clean Transportation, April 2011 Update. "Global Light-Duty Vehicles: Fuel Economy and Greenhouse Gas Emissions Standards"
[49] PluginCars, 2011. PluginCars.com. Zach McDonald. February 9, 2011. "Ford Pushes Key Marketing Message: Lower Maintenance Costs." http://www.plugincars.com/ford-pushes-key-marketing-message-electric-cars-lower-maintenance-costs-106793.html Accessed September 26, 2011.

per year (at $100 per tonne CO_2 equivalent).[50] This could result in a fueling rebate, or discount on electricity rates for PHEVs and BEVs.

- Fuel tax change – The current state and national gasoline taxes are no longer sufficient as the LDV fleet becomes more efficient and as alternative fuels are introduced. Several national studies have identified the scale of the funding gap and potential solutions Congress could consider.[51,52] This may change into a VMT-based tax, which would treat all fuels equally, or may become an energy-based tax which would favor alternative fuels with lower WTW energy usage. Currently, hydrogen and electricity for transportation do not pay road taxes, though their contribution to the funding shortfall is small.

- Feebates – A revenue neutral feebate policy on new vehicles would increase purchase costs for vehicles with higher carbon emissions while reducing costs for vehicles with lower carbon emissions. A recent study prepared for ARB analyzed a California specific feebate policy and the potential benefits and challenges.[53] As financial purchase incentives are discontinued in the next few years, a feebate policy could create a permanent cost offset for efficient advanced vehicles without relying on government funds.

- Battery grid services - For BEVs and PHEVs, there may be additional revenue opportunities in the future for battery second-life usage[54,55] and vehicle-to-grid services. However, these factors are speculative at this point and would require a number of barriers to be addressed. California stakeholders, such as the CEC, CPUC, and Electric Power Research Institute (EPRI), are studying these concepts.

- Non-Monetary Factors affecting Purchase Behavior – It is important to note that initial purchase price, lifetime costs, and payback estimations are not the dominant factors to all buyers; a certain fraction of consumers will consider non-monetary factors when purchasing their vehicle. The convenience of charging a vehicle at home and work, the synergies of integrating vehicles with the electric grid, the attractiveness of electric drive characteristics (reduced noise, low speed torque from FCVs and BEVs), energy security benefits (reduced oil consumption), making a "green" purchasing decision (reducing emissions), access to high-occupancy vehicle lanes, and even the ability to

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[50] UC Davis, 2011a. University of California, Davis. Chris Yang. June 23, 2011. "Fuel Electricity and Plug-in Electric Vehicles in an LCFS."
[51] Carnegie, 2011. Carnegie Endowment, 2011. "Road To Recovery – Transforming America's Transportation" http://carnegieendowment.org/files/road_to_recovery.pdf
[52] Greene, 2011. David Greene, Transportation Research Part D, 2011. "What is greener than a VMT tax? The case for an indexed energy user fee to finance U.S. surface transportation"
[53] UC Davis, 2011b. University of California, Davis. D. Bunch and D. Greene, February 2011. "Potential Design, Implementation, and Benefits of a Feebate Program for New Passenger Vehicles in California: Final Report."
[54] NREL, 2011b. National Renewable Energy Laboratory. J. Neubauer and A. Pesaran. June 2011. *"The ability of battery second use strategies to impact plug-in electric vehicle prices and serve utility energy storage applications."*
[55] UC Berkeley, 2011. University of California, Berkeley. B.Williams and T.Lipman. April 2011. *" Analysis of the combined vehicle and post vehicle use value of lithium ion plug-in vehicle propulsion batteries."* (Draft Final)

directly connect renewable power to BEVs and PHEVs at home may influence the value customers consider in purchasing these vehicles.[56,57]

5.4 Potential Impact on Business Competitiveness

Automobile manufacturing in California represents a small fraction of the State's economy, less than 0.5 percent. The California businesses impacted by this regulation are largely indirectly affected as affiliated businesses such as gasoline service stations, automobile dealers, and automobile repair shops. Affiliated businesses are mostly local businesses. These businesses compete within the State and generally are not subject to competition from out-of-state businesses. Therefore, the proposed regulations are not expected to impose significant competitive disadvantages on affiliated businesses.

5.5 Potential Impact on Business Creation, Elimination or Expansion

California businesses that purchase the same LDVs as consumers would, like consumers, pay higher prices for the vehicles but save on operating costs, as is discussed in Section 5.3 above.

It is very likely that savings from reduced vehicle operating costs would end up as expenditures for other goods and services. These expenditures would flow through the economy, causing expansion or creation of new businesses in several sectors. Staff's economic analysis shows that as the expenditures occur, jobs and personal income increase. As discussed in the LEV III ISOR, the Environmental Revenue Dynamic Assessment Model (E-DRAM) was used to assess the overall impact of the regulation on California's economy. Specifically, E-DRAM was used to estimate impacts on California's output of goods and services, personal income, and employment. In the analysis for the full ACC program which includes the proposed amendments to the ZEV regulation, jobs increase by 0.1 percent in 2025, and 0.2 percent in 2030 compared to the baseline economy that excludes the proposed ACC program. Similarly, personal income grows by $1 billion in 2020, by $3 billion in 2025, and $6 billion 2030. The estimates of the regulation's impact on these economic factors are used to assess the potential impacts on business creation, elimination, or expansion in California.

Staff's proposed amendments will likely increase benefits to companies specializing in ZEVs and ZEV infrastructure. The creation of these businesses cannot be fully attributed to staff's proposed amendments. Business and job creation from advanced vehicle technologies is part of the clean technology sector, which is currently experiencing higher than average job growth in California and nationally.[58] However,

[56] UC Davis, 2010. University of California, Davis. J.Axsen and K.Kurani. July 2010. *"Reflexive Layers of Influence (RFI): A model of social influence, vehicle purchase behavior, and pro-societal values."*
[57] UC Davis, 2011c. University of California, Davis. T.Turrentine et al. Mary 2011. *"The UC Davis MINI E Consumer Study."*
[58] Brookings, 2011. The Brookings Institution. M. Muro, J. Rothwell, and D. Saha. "Sizing the Clean Economy: A National and Regional Green Jobs Report"

staff's proposal will likely increase opportunities for California-based manufacturers to generate credits through production of ZEVs and TZEVs to increase flexibility for regulated manufacturers who may purchase credits for ZEV regulation compliance. Some specific sectors are discussed below.

5.5.1 Manufacturing

Staff's proposed amendments will require increased manufacturing of ZEV and PHEV componentry. There is very little vehicle component and final assembly in California, most of it occurring in other parts of the United States and internationally. However, as the ZEV amendments are expected to increase demand for these components and vehicles, these businesses would likely expand, which could offset any reductions experienced in the conventional vehicle segment.

In California, smaller manufacturers not currently mandated to build ZEVs under the regulation do have plans to increase ZEV and ZEV component production. One vehicle assembly plant in the state, formerly a joint venture between General Motors and Toyota that produced conventional vehicles, was recently purchased by Tesla, a California company developing BEVs. Tesla intends to use the facility to manufacture the Model S BEV due to arrive on the market in mid-2012. At one time, the Fremont facility employed approximately 4,000 people. Under Tesla's plans, it may employ nearly 1,000 people. Coda Automotive, another California BEV company has announced plans to assemble vehicles in Benicia, California.[59]

5.5.2 Infrastructure

Staff's proposed amendments will increase demand for fueling infrastructure in California. There are several California-based companies developing electric vehicle charging equipment, including Coulomb, AeroVironment, Better Place, Clipper Creek, and 350Green. Additional non-California based electric vehicle supply equipment (EVSE) providers are installing equipment in the state to support the growing BEV and PHEV markets – including ECOtality, Leviton, and General Electric. Many of these companies are leveraging external grants, for example U.S. DOE awards, and marketing and installing chargers in California.[60]

Several major companies are entering the EVSE market and using traditional large retail outlets. General Electric is planning to distribute its EVSE, the WattStation, through Lowes home improvement stores.[61] Ford and its EVSE supplier, Leviton, are partnering with Best Buy and its Geek Squad for retail and distribution of their equipment to homes.[62] Over time, it is expected that partnerships will grow and innovative business models will emerge for servicing and installing EVSE.

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[59] BusinessTimes, 2011. San Francisco Business Times, September 12, 2011. "Coda to assemble electric cars in Benicia" http://www.bizjournals.com/sanfrancisco/news/2011/09/12/coda-to-assemble-evs-in-benicia.html

[60] Coulomb, 2011. Coulomb ChargePoint America. Website. http://chargepointamerica.com/. Accessed September 20, 2011

[61] Green Car Congress, 2011a. Green Car Congress.com, July 18, 201.1 "GE Energy partners with Lowe's to provide EV chargers for home and commercial use; Siemens Energy providing chargers to Town of Cary, NC" http://www.greencarcongress.com/2011/07/gesiemens-20110718.html Accessed September 9, 2011.

[62] Green Car Congress, 2011b. Green Car Congress.com, January 13, 2011 "Ford developed home charging station for the Focus with Leviton" http://www.greencarcongress.com/2011/01/ford-20110113.html

Staff's proposal will also create a demand for hydrogen fueling stations[63]. Several companies are already active in developing these stations, including Air Products, Praxair, and Linde. Most of the hydrogen dispensed at these stations is expected to be produced within the state, primarily from central production facilities and then transported by truck to retail outlets. The Clean Fuels Outlet (CFO) ISOR provides more information regarding future hydrogen fueling demand, and infrastructure development.

5.6 Potential Costs to Local and State Agencies

The proposed amendments are not expected to result in an increase in costs for local and state agencies in the next three to five years. However, as advanced vehicles enter the fleet in larger numbers (10-15 years from now), there will likely be an impact to state and local revenue from vehicle and fuel sales taxes.

As a result of the projected fleet from the proposed ACC program, large revenue losses could occur in later years unless fuel tax policy changes occur. The vast majority of the fuel tax loss will result from gasoline vehicles given that the existing tax structure applies only to gasoline and diesel fuel and has not changed over the years to adjust for inflation or changes in consumption levels. Although a small portion of the funding shortfall, ZEVs will result in a loss of fuel taxes because there are currently no road taxes on hydrogen and electricity sold for vehicles. Between 2017 and 2025, if gasoline taxation rates remain the same, California fuel tax revenue losses would be approximately $3.8 billion[64], only a small portion of which would be associated with the ZEV population. These state revenue losses will partially be offset by higher vehicle sales tax revenues given the higher incremental vehicle prices.

Although not a direct effect of the ZEV regulation, local governments will need to devote resources to planning and implementing electric charging and hydrogen infrastructure. These impacts are becoming clear as the Nissan Leaf and General Motors Volt are entering California communities, and as new hydrogen stations are being constructed today. These impacts can include the need to prepare city inspectors and permitting officials to approve residential charging equipment; the need for city planning officials to identify appropriate public and workplace charging; and the need for local officials to help evaluate and permit hydrogen stations.

To reduce the impact on local agencies, there are a number of programs designed to help communities implement planning programs for alternative fuels.[65,66,67] For

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[63] CaFCP, 2009. California Fuel Cell Partnership. CaFCP Action Plan, February 2009. "Hydrogen Fuel Cell Vehicle and Station Deployment Plan: A Strategy for Meeting the Challenge Ahead" http://www.cafcp.org/sites/files/Action_Plan_FINAL.pdf

[64] See Appendix C for more information.

[65] Sonoma, 2011. County of Sonoma (CA), General Services Department, July 2011. "Electric Vehicle Charging Station Program and Installation Guidelines"

[66] Rocky Mountain Institute, 2009. Rocky Mountain Institute, February 24, 2009. "Project Get Ready: Helping Communities Become Electrified Vehicle Pioneers"

electric charging infrastructure, the U.S. DOE and the CEC are both providing grants directly to local governments for planning purposes. To augment this resource, several partnerships are preparing guidance documents with best practices for local governments to aid in their implementation. For electric charging, one partnership is the California Plug-Electric Vehicle (PEV) Collaborative. For hydrogen, the California Fuel Cell Partnership has been working for a number of years to help local governments become prepared in planning, siting, and safety review of new stations. The U.S. DOE's Clean Cities coalitions (California has 13 of these cities) also are instrumental in helping local governments become prepared for a number of alternative fuels.

Implementation of the ZEV regulation requires staff resources to oversee annual compliance by manufacturers with ZEV program credits. As the regulation compliance requirements increase in future years, and more manufacturers are classified as LVMs, this state oversight role may require additional resources.

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[67] RolandBerger, 2010b. Roland Berger Strategy Consultants in collaboration with Rocky Mountain Institute, 2010. "PEV Readiness Study."

6 EMISSIONS AND HEALTH IMPACTS

Staff's proposed ZEV amendments will result in an emissions benefit as compared to current ZEV regulations, as will the entire ACC program as compared to no ACC program. Staff performed a combined LEV, ZEV, and CFO emissions analysis, which can be found in Section V of the LEV ISOR. For the purposes of the ZEV regulation analysis, staff's emissions assessment includes both criteria pollutant, particulate matter (PM) and GHG emissions, accounting for both tailpipe emissions in PHEVs, and upstream emissions from all advanced technologies considered. As illustrated below, the ZEV requirements provide benefits beyond that achieved by using a fleet NMOG + NOx average as proposed in the LEV III criteria emission regulation. This is primarily because upstream criteria and PM emissions will be reduced after accounting for higher electricity and hydrogen production and lower gasoline production at refineries. However, because vehicles produced for the ZEV regulation are counted in the LEV III GHG fleet average standard, and because the GHG fleet average standard accounts for differences in upstream emissions for electricity and hydrogen, the ZEV regulation does not result in further GHG emission improvements beyond the LEV III GHG program.

The recently updated EMFAC 2011 was used to assess the vehicle emission impacts of staff's proposal. Using EMFAC, staff modeled the proposed requirements and compared these results to a vehicle fleet under the current ZEV regulation (ARB, 2011b). A separate model was used to estimate upstream emissions, including production and delivery of electricity and hydrogen and vehicle manufacturing emissions.[68] Emission impacts from the Regulatory Alternatives A (lower case) and B (higher case) are not presented here, although impacts from Alternative C (existing regulation) are shown.

As stated in Section 1, climate change poses a serious threat to the economic well-being, public health, natural resources, and environment of California. According to staff's 2009 analysis, ZEVs are the most important technology for the LDV to achieve long-term GHG emission reductions. As for criteria pollutant emissions, NOx emissions in the greater Los Angeles region must be reduced by two thirds to meet the current ozone attainment goal, even after considering all of the regulations in place today, with the most significant share of needed emission reductions coming from long-term advanced clean air technologies. In the San Joaquin Valley, the SIP identified the need to reduce NOx emissions by 80 tons/day in 2023 through the use of long-term and advanced technology strategies. To put this in context, this is equivalent to eliminating the NOx emissions from all on-road vehicles operating in these regions. This implies ZEVs are needed as a critical part of the future California fleet to achieve climate change goals and critical criteria pollutant emission reductions.

[68] See Section V LEV III ISOR for more information.

6.1 California Environmental Quality Act

ARB is the lead agency for the proposed regulation and has prepared an environmental analysis pursuant to its certified regulatory program. The California Environmental Quality Act (CEQA) at Public Resources Code section 21080.5 allows public agencies with regulatory programs to prepare a plan or other written document in lieu of an environmental impact report or negative declaration once the Secretary of the Resources Agency has certified the regulatory program. ARB's regulatory program has been certified by the Secretary of the Resources Agency.[69] As required by ARB's certified regulatory program for the proposed regulations, the environmental analysis is included as Appendix B to this ISOR for the rulemaking.[70]

Appendix B to the ISOR is an Environmental Analysis (EA) that provides an evaluation of the potential for environmental impacts associated with the proposed ACC Program. The proposed ACC program consists of amendments to the following regulations: LEV III, the E-10 Fuels Certification, Environmental Performance Label (EPL), ZEV, and the CFO. Four separate Regulatory Notices and Staff Reports have been prepared for these proposed amendments. A single coordinated analysis of the potential environmental impacts can be found in Appendix B. The EA assesses the potential for significant long or short term adverse environmental impacts associated with the proposed actions and an analysis of those impacts.[71] In accordance with ARB's regulations, the EA also describes any beneficial impacts.[72] The resource areas from the state CEQA Guidelines environmental checklist were used as a framework for assessing potentially significant impacts.[73]

If comments that are received during the public review period raise significant environmental issues, staff will summarize and respond to the comments in writing. The written responses will be included in the Final Statement of Reasons (FSOR) for the regulation. In accordance with ARB certified regulatory program, prior to taking final action on the proposed regulation, the decision maker will approve the written responses.[74] If the regulation is adopted, a Notice of Decision will be posted on ARB's website and filed with the Secretary of the Natural Resources Agency for public inspection.[75]

6.2 Impacts to Minority and Low Income Communities

This section provides information on the ARB's activities to reach out to minority and low-income communities in the development of the ACC regulations.

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[69] State CEQA Guidelines section 15251 (d); CCR, title 17, sections 60005-60008.)
[70] CCR, title 17, section 60005.
[71] CCR, title 17, section 60005, subd (b).
[72] CCR, title 17, section 60005, subd. (d).
[73] State CEQA Guidelines, Appendix G.
[74] CCR, title 17, section 60007, subd (a).
[75] CCR, title 17, section 60007, subd. (b).

ARB Environmental Justice Policy
ARB is has made inclusion of environmental justice an integral part of its activities. State law defines environmental justice as the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies.

The Board approved Environmental Justice Policies and Actions (Policies) on December 13, 2001. These Policies establish a framework for incorporating environmental justice into the ARB's programs consistent with the directives of State law. The Policies apply to all communities in California, but recognize that environmental justice issues have been raised more in the context of low-income and minority communities.

Outreach to Minority and Low Income Communities
Staff conducted workshops in communities with environmental justice concerns. The dates of all the workshops were as follows:

Date	Location
July 12, 2011	Fresno
July 19, 2011	Pacoima
July 26, 2011	Oakland

Each of the three workshops included an expert panel with opening remarks from a local community leader. The panels included one expert that focused on background information and environmental impacts of air pollution, one expert in the medical field that focused on the health impacts of air pollution, one expert from the American Lung Association of California that discussed its report titled "The Road to Clean Air," and in some workshops also had an expert speak about local concerns. For instance, in Fresno, one speaker addressed agriculture impacts of climate change. Having local community members and leaders participate in the workshops was greatly appreciated and added value and a local context to ARB's presence in these communities. After community members heard from the panel members, staff presented information about the ACC regulations and the CEQA scoping process.

There were a number of different comments and concerns expressed at each workshop and staff was able to engage in a constructive dialogue with attendees about many air quality and climate change related issues. In general, community leaders and community members were very supportive of the work ARB is doing to take steps to reduce emissions from PCs and LDTs.

6.3 Health Impacts

Staff estimates that, statewide, implementation of the ACC regulations from 2010 through 2025 will eliminate approximately 1,400 tons of PM2.5 and 40,000 tons of NO_X emissions from passenger vehicles. The estimate of the reduction of premature deaths associated with these emission reductions for both primary PM and secondary

PM (produced in the atmosphere from the precursor NO_X) are between 330 and 530. See the LEV III ISOR, subsection V.F for more details on this assessment of health impacts.

6.4 Emissions Impacts

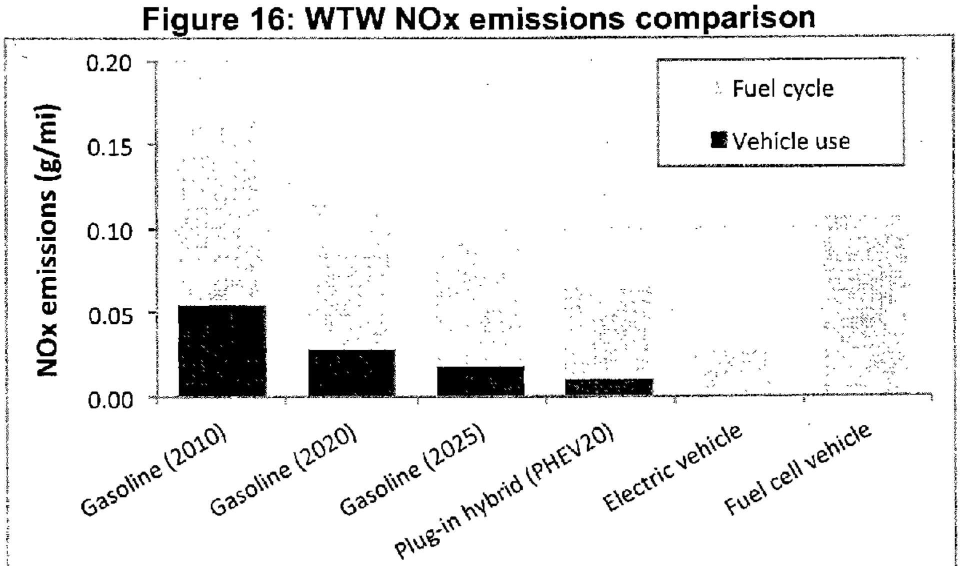
Staff analyzed the emissions impacts resulting from the ZEV proposal compared to the existing regulation. Similar to the cost analysis, this was done assuming manufacturers also complied with proposed LEV III fleet standard. Several scenarios were created to evaluate a LEV III fleet with and without the new ZEV proposal.[76]

WTW emissions profiles were derived from the upstream emissions factors and the LEV III fleet vehicle efficiency attributes. This information is summarized in Section V.E of the LEV III Staff Report.

6.4.1 Emissions Comparisons: Vehicle Technologies

BEVs, FCVs, and PHEVs are all ultra-low criteria pollutant and GHG emitting technologies, even on a WTW basis. WTW emissions include upstream emissions from fuel production and vehicle manufacturing, as well as vehicle emissions from PHEVs. Three categories of conventional vehicles are shown to emphasize that their emissions profiles are improving over time as a result of the proposed LEV III Criteria Pollutant and GHG regulations.

Figure 16: WTW NOx emissions comparison



[76] In developing this new analysis, it was not accurate to compare this to the ZEV emissions impacts from the 2008 staff analysis for two reasons. The proposed LEV III emissions regulations mean that the entire fleet will become cleaner with or without the ZEV regulation. Additionally, the 2008 staff analysis only included the South Coast air basin emission inventory.

Figure 17: WTW PM emissions comparison

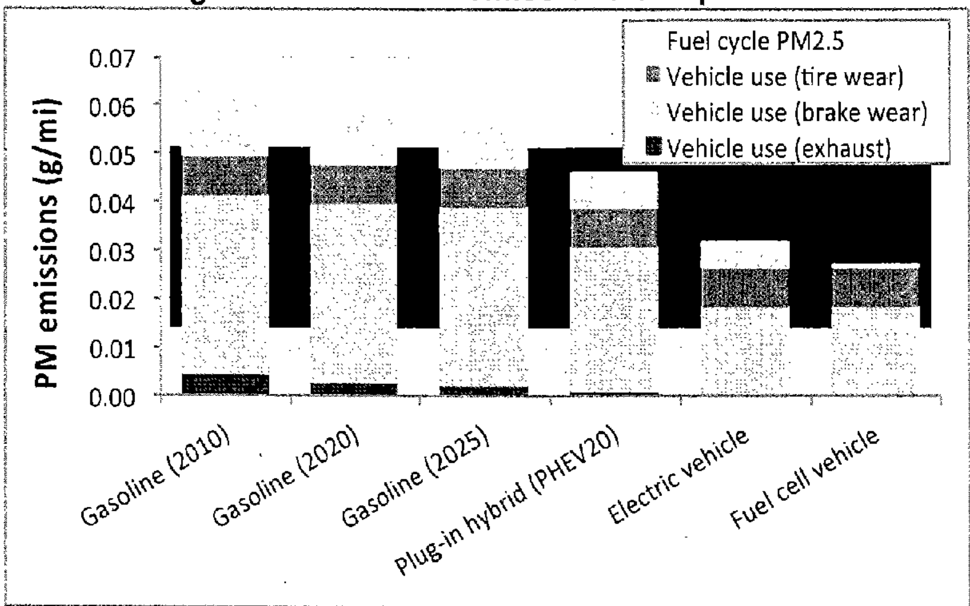
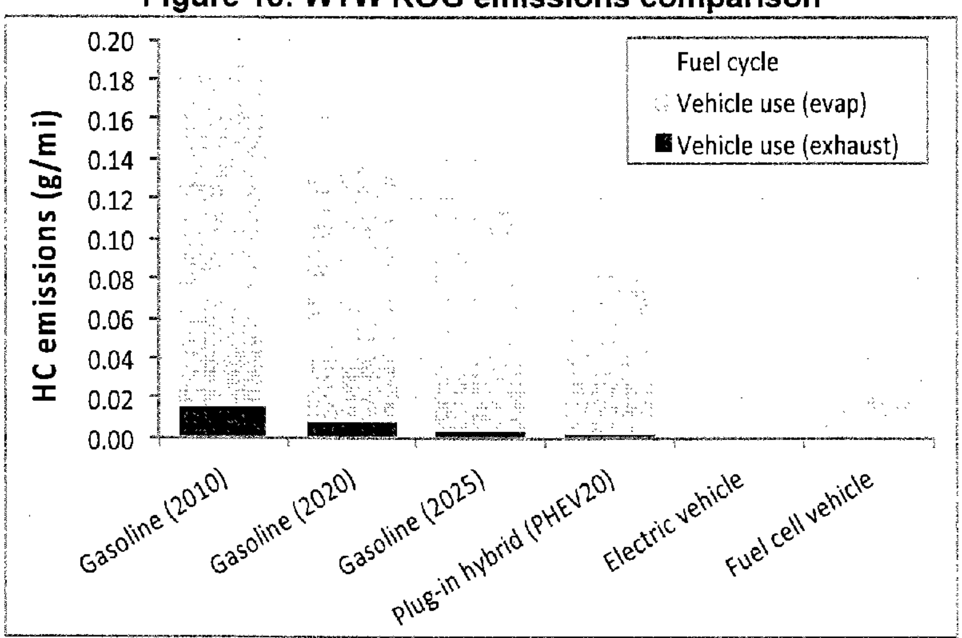
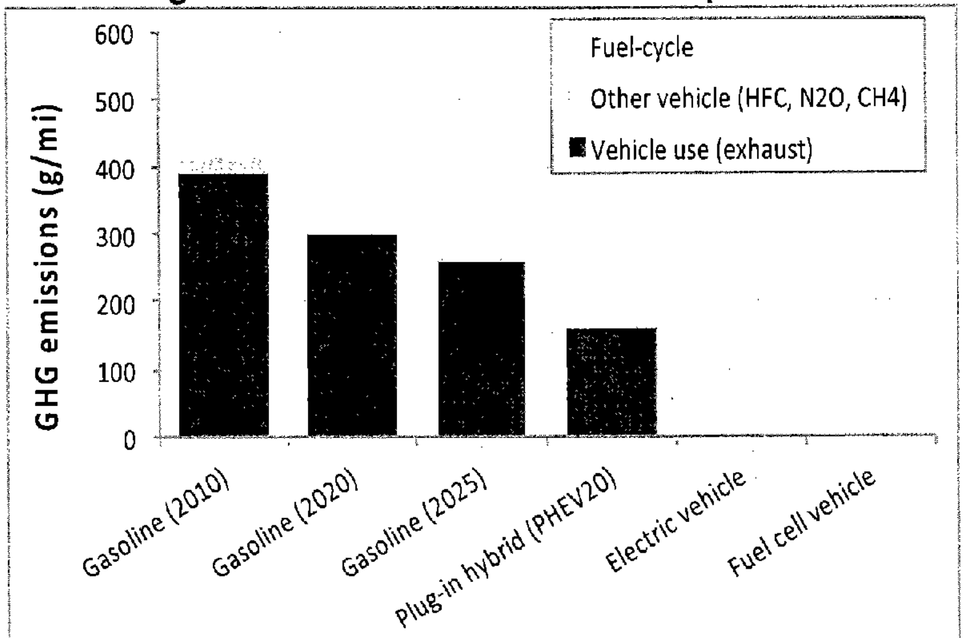


Figure 18: WTW ROG emissions comparison



*ROG means reactive organic gas

Figure 19: WTW GHG emissions comparison



6.4.2 Total Emissions – Criteria and PM

Overall, there will be a reduction in criteria pollutants as a result of the proposed ACC program standards. Criteria pollutant emission benefits for the ACC program are fully realized in the 2035-2040 timeframe when nearly all vehicles operating in the fleet are expected to be compliant with the proposed standards. By 2035 reactive organic gas (ROG) emissions would be reduced by an additional 34 percent, and NOx emissions, by an additional 37 percent, compared to 2035 without the proposed ACC rules. Under the proposed rule, the new PM2.5 standard is reduced to 3 mg/mi in 2020 and 1 mg/mi in 2028. With these standards, PM2.5 emissions will be essentially unchanged between 2010 and 2040 as growth in VMT offsets the tightening of the standard.

There is no benefit from including the ZEV proposal in terms of vehicle (tank-to-wheel or TTW) emissions. The LEV III criteria pollutant fleet standard is responsible for those emission reductions in the fleet; the fleet would become cleaner regardless of the ZEV regulation because manufacturers would adjust their compliance response to the standard by making cleaner conventional vehicles. However, upstream criteria and PM emissions are not captured in the LEV III criteria pollutant standard, so additional electricity and fuel production in the fleet results in increased upstream criteria pollutant emissions.

Table 6.1 presents the emissions impacts in WTW criteria pollutant and PM emissions in 2030 due to staff's proposal. 2030 was chosen as a reference year to account for a significant amount of fleet turn-over.

Table 6.1: Statewide Criteria and PM Emissions in 2030 (tons per day)[1]

2030	ROG	NMOG+ NOx	PM
LEVIII fleet WTW emissions without new ZEV proposal	231	233	56.4
LEVIII fleet WTW emissions with new ZEV proposal	225	229.5	56.2

[1] Refer to the LEVIII ISOR Section V and Appendix Q for additional details. Includes reduced petroleum upstream emissions and increased hydrogen and electricity production emissions

The upstream emissions from the production of hydrogen and electricity represents a very small fraction of the combined vehicle and upstream emissions impacts of the fleet, and is far outweighed by the reduction in gasoline production emissions, creating the net benefit shown in Table 6.1 and 6.2. Additionally, a portion of these upstream emissions are in non-urban areas.[77]

Table 6.2 below provides expanded details on the emission impacts shown in Table 6.1, and shows the WTW impacts for these emissions types.[78]

Table 6.2: Detailed Statewide Criteria and PM Emission Inputs in 2030 (tons per day)

2030	ROG	NOx	PM
LEVIII fleet vehicle emissions (TTW) [1]	126	116	26
Upstream emissions from LEVIII fleet without ZEV proposal (WTT)	105	117	30.4
LEVIII fleet WTW emissions benefits without new ZEV proposal	**231**	**233**	**56.4**
Increased upstream emissions from hydrogen	0.22	1.11	0.27
Increased upstream emissions from electricity	0.24	1.00	0.22
Reduced upstream refinery emissions due to ZEVs	-6.4	-5.6	-0.66
LEVIII fleet WTW emissions benefits with new ZEV proposal	**225**	**229.5**	**56.2**

Criteria and PM emissions benefits will vary by region throughout the state depending on the location of emission sources. Refinery emission reductions will occur primarily in the east Bay Area and South Coast region where existing refinery facilities operate. As refinery operations reduce production and emissions, the input and output activities, such as truck and ship deliveries, will also decline. This includes crude oil imported through the Los Angeles and Oakland ports, as well as pipeline and local gasoline truck distribution in all regions of the state.

The small increase in upstream emissions associated with new electricity and hydrogen transportation fuel production will occur in various regions. Hydrogen production will predominantly occur from existing centralized hydrogen facilities already operating to supply refinery and industrial applications. These facilities are primarily located in the large metropolitan areas near gasoline refinery operations. The majority of early FCV sales are expected to occur in the South Coast region, the hydrogen facilities in this region will likely be used to produce the fuel for the market.

[77] For details on how these emissions are incorporated into the full fleet, refer to the LEVIII ISOR Section V.E.
[78] Refer to the LEVIII ISOR Appendix Q for additional details and a graphical representation of the upstream portion of this analysis.

Electricity production increases will occur throughout the state at power facilities that supply regions where BEV and PHEV sales and use occur. Staff assumes that by 2020, emissions associated with plug-in vehicle charging will be characterized by new power facilities added to the grid between now and 2020. This is assumed to be cleaner natural gas facilities as well as new renewables to comply with California's 33 percent renewable portfolio standard (RPS).

The upstream emissions impacts are quantified in the LEVIII ISOR in Appendix V.E, and include an estimation of the split between urban and non-urban source locations.

6.4.3 Total Emissions - Climate Change

Overall, the ACC program would provide major reductions in GHG emissions. By 2025, CO_2 emissions would be reduced by almost 14 million metric tonnes (MMT) per year, which is 12 percent from baseline levels. In reduction increases in 2035 to 32 MMT which is a 27 percent reduction from baseline levels. By 2050, the proposed regulation will reduce emissions by more than 42MMT per year, which is a reduction of 33 percent from baseline levels.

The ZEV regulation does not provide GHG emission reductions in addition to the LEV III GHG regulation given that ZEV emissions are included in determining compliance with the GHG standard. Specifically, because the GHG standard includes upstream emissions, in addition to the vehicle emissions, there is no difference in GHG emissions under varying ZEV scenarios.

Given that climate change emissions remain in the upper atmosphere for long periods of time (50-100 years), climate impacts are a function of the cumulative emissions. As a result, early reduction in annual climate emission rates is important to ultimately stabilize the atmosphere. For the 2050 emission projections from this proposal, emission rates were assumed to remain fixed at the levels in this analysis: 2020 emission rates for upstream factors and 2025 emission rates for vehicle performance.

6.4.4 Energy Diversity and Energy Demand

The vehicle technologies expected to be used in compliance with the regulation typically use fuel more efficiently and/or use alternative fuels, and thus when fully commercialized will reduce demand for petroleum fuels. Reduced demand for gasoline and diesel alleviates the reliance on a single fuel source, creating a more robust fuel supply. Additionally, the erratic and increasing price trends of oil create economic losses for California. Reducing gasoline demand will also reduce the need for additional refining, transportation and distribution facilities, thus preventing additional air and water pollution as noted above.

Moreover, because electricity and hydrogen can be produced from renewable resources such as solar, wind, or hydropower, or biomass feedstock, the staff's proposed amendments would increase the number of vehicles using these fuels and help pave the way towards a sustainable energy future.

7 COST-EFFECTIVENESS

Cost-effectiveness is a measure of the cost incurred to achieve a specific outcome, and is a metric that is used to compare alternatives to achieve the same outcome. In ARB regulations, the specific outcome measured is vehicle emissions. Although a cost-effectiveness value with emissions is determined here, the ZEV regulation does not have explicit emission reduction targets given that the measure of compliance is the number of advanced vehicles sold. As a result, the cost effectiveness value is not the primary factor used to determine the proposed requirement. However, looking at the both the LEV III Criteria Pollutant and GHG regulations and ZEV regulation together, there will likely be a $290 savings per ton of CO_2 reduced in 2025 and $320 savings per ton CO_2 reduced in 2035. For criteria pollutants, the cost effectiveness of the three regulations will be $4 per ton of ROG plus NOx reduced.

8 SUMMARY AND STAFF RECOMMENDATION

Adoption of staff's proposed amendments to the ZEV regulation will begin a transformation of California's LDV fleet to one that uses a portfolio of fuels most of which will sustainable and exhibit low carbon emissions. As the technology-forcing piece of the ACC package, the ZEV regulation is the catalyst to this transformative process. Proposed amendments to the regulation focus on technologies that help meet mid- and long-term climate goals, while simplifying the program where needed as much as possible. By requiring increased numbers of ZEVs and TZEVs in the 2018 through 2025 model year timeframe, vehicle costs will decrease due increased production volumes driving down battery and fuel cell costs, which will help these advanced technologies achieve commercial success in the California LDV market. The following table is a summary of staff proposed changes:

Timeframe	Purpose of Proposed Amendment	Proposed Amendment
2009 – 2017 Model Year	*Compliance Flexibility*	Extend travel provision for BEVs
		Extend advanced demonstration provision
		Remove carry forward provision
		Reduce 2015 through 2017 requirement for IVMs
	Adjust Credits and Allowances	Increase credits for Type V ZEVs to 9 credits per vehicle
		Add Type I.5x and Type IIx vehicles
2018 and Subsequent Model Years	*Adjust Manufacturer Size Definitions*	Modify IVM and LVM size definitions
		Modify transitions for manufacturers changing size categories
	Focus Requirements on ZEVs and TZEVs	Remove PZEV and AT PZEVs from 2018 and beyond compliance
		Allow manufacturers to use banked PZEV and AT PZEVs, under a cap
	Increase 2018 + Requirements	Increase overall credit requirements and reduce the amount of credits earned per vehicle
	Provide Flexibility for IVMs	Allow IVMs to meet requirement with credits from TZEVs
		Continue Advanced Demonstration credits for non-LVMs
	Simplify Credit Calculations	Calculate ZEV and TZEV credits based on range
	Modify Travel Provision	Extend Travel Provision for FCVs only
	Encourage GHG Over Compliance	Allow manufacturers to offset part of the 2018 through 2021 ZEV requirement through over-compliance with GHG fleet standard
	Add New Vehicle	Add range extended BEVs as compliance option

Staff recommends that the Board amend sections 1962.1 and 1962.3(renumbered from 1962.2), Title 13, California Code of Regulations, and the incorporated test procedures and related regulations, and adopt section 1962.2, and the incorporated test procedures. The proposed amendments and adoptions are set forth in the Proposed Regulation Order in Appendix A.

9 SUMMARY AND RATIONALE FOR PROPOSED REGULATIONS

The need and rationale for the proposed amendments were discussed extensively in Chapter 2. In addition, in this chapter, staff provides a plain English description of the proposed amendments to the ZEV regulation.

Pursuant to Government Code section 11349.1, Government Code section 11346.2(b)(1), and title 1, California Code of Regulations, section 10, staff is providing a brief summary below that identifies each section in the regulation where amendments are proposed and describes the rationale for each proposed amendment.

§1962.1 Zero-Emission Vehicle Standards for 2009 through 2017 Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles.

Previously, section 1962.1 and incorporated test procedures applied to 2009 and subsequent model years. Section 1962.1 and its incorporated test procedures now apply to 2009 through 2017 model years, and a new section (section 1962.2) and its incorporated test procedures apply to 2018 and subsequent model years. Language is being changed throughout section 1962.1 to clarify the applicable model years. Also, the word "section" was changed to "subdivision" for clarification purposes. Also, the word "Transitional Zero Emission Vehicle" or "TZEV" has replaced the word "Enhanced Advanced Technology Partial Zero Emission Allowance Vehicle" or "Enhanced AT PZEV". Throughout, spelling and grammatical changes have also been made.

(a) The purpose of this subdivision is to define ZEV certification standards. This subdivision was amended to clarify that the standards apply to 2009 through 2017 model years, rather than just models.

(b)(1)(A) The purpose of this subdivision is to describe manufacturer's minimum percentage ZEV credit requirement. This subdivision was modified to clarify the origin of the production number that a manufacturer's requirement is to be based on, which is in the annual NMOG production report. The NMOG production report submitted by a regulated manufacturer to ARB indicates the number of vehicles delivered for sale in California, and to which standard each vehicle is certified. A sentence was added to ensure there were no discrepancies as to which production number is used to determine a manufacturer's requirement.

(b)(1)(B) The purpose of this subdivision is to calculate the number of vehicles to which the percentage ZEV requirement is applied. This subdivision was amended to organize the methods by applicable model years and to clarify the original intent of the language. This subdivision allows a manufacturer to switch production determination methods, explains that production averaging has no effect on a manufacturer's size determination, and clarifies how a manufacturer should treat vehicles delivered for sale by other manufacturers in their production determination.

(b)(1)(B)1. A clarifying sentence was added to explain that a manufacturer could base its ZEV obligation on the number of vehicles produced and delivered for sale in the same year, rather than on a three year average method.

(b)(1)(B)2. A sentence was added to clarify an example of how the prior year method works.

(b)(2)(D)1. The purpose of this subdivision is to describe the ZEV requirements for LVMs for model years 2012 through 2014. The language was amended to clarify the intent of the subdivision, which is that credits are required for compliance and are generated from manufacturers delivering ZEVs for sale.

(b)(2)(D)2. The purpose of this subdivision is to describe the ZEV requirements for LVMs for model years 2015 through 2017. The language was amended to clarify the intent of the subdivision, which is that credits are required for compliance and are generated from manufacturers delivering ZEVs for sale.

(b)(2)(D)4. The purpose of this subdivision is to describe how additional credits for ZEVs placed in transportation systems can be used to meet a manufacturer's ZEV requirement. The language was modified to clarify that the limit described applies to credits earned by ZEVs placed in transportation systems.

(b)(2)(E) This subdivision is being deleted because requirements for 2018 and subsequent model years have been moved to section 1962.2.

(b)(3) This subdivision allows IVMs to meet their entire ZEV requirement through delivering for sale PZEVs. This subdivision was amended to reduce the IVM's overall credit requirement in model years 2015 through 2017 to allow them more time to transition into more stringent requirements starting in model year 2018.

(b)(4) This subdivision describes how SVMs and ILVMs are not mandated to produce ZEVs by the ZEV regulation, but may earn and market ZEV credits. This subdivision was clarified to ensure SVMs and ILVMs are able to earn and market TZEV and AT PZEV credits.

(b)(5) This subdivision is being deleted because it is not necessary to clarify how a manufacturer is to count ZEVs and PZEV in a manufacturer's fleet average NMOG calculations. Section 1961 clearly explains how a PZEV and ZEV should be counted in a manufacturer's NMOG calculations.

(b)(7)(A) This subdivision explains how a manufacturer applies the ZEV regulation as the manufacturer increases its California production volume and is redefined as a differently sized manufacturer. Currently, manufacturers are given five years of lead time when transitioning into a larger size definition. For example, if a manufacturer were to increase in sales, such that its 2011 through 2013 sales average exceeded the current large volume manufacturer threshold of 60,000 sales, the manufacturer would be subject to the full ZEV requirements in model year 2019. However, due to staff proposed modifications for definition and lead time, the language is being modified to reflect that manufacturers starting their transition before 2018 will be subject to full ZEV requirements starting in model year 2018. This means, for example, if a manufacturer's 2013 through 2015 sales average (for the first time) is 61,000 vehicles, then instead of being subject to large volume manufacturer requirements in 2021, the manufacturer will be subject to large volume manufacturer requirements in 2018. Similar language is being added to reflect that when aggregation affects a manufacturer's size, the manufacturer will be subject to the stepped up requirements starting in the fourth model year or in 2018, whichever occurs first.

(b)(7)(C) This subdivision explains how to calculate California production volume in change of ownership situations. This subdivision was modified to explain how to determine the model year when a manufacturer is simultaneously producing two model years of vehicles at the time of a change of ownership, which is to be based on the earlier model year. Additionally, an example was added to clarify the application of the model year determination.

(c)(2)(A) This subdivision establishes which tailpipe emission standards a PZEV is to certify to in section 1961. This subdivision is being amended to separate the 2009 through 2014 model years standards from the 2015 through 2017 model year standards. This is due to new LEV III criteria pollutant fleet standards beginning in model year 2015. These will include new tailpipe standards for NMOG + NOx. Staff will also be proposing new emission certification categories that go beyond SULEV standards. Due to these change in LEV III, the language is being modified so that for a PZEV to earn credit within the ZEV regulation in 2015 and subsequent model years, the vehicle must be certified to the more stringent SULEV 30 or SULEV 20 standards, and meet LEV III zero-evaporative standards.

(c)(2)(B) This subdivision establishes which evaporative emission standards a PZEV is to certify to in section 1976, which is the zero evaporative standard. This subdivision is being amended to separate 2009 through 2014 model year standards from the 2015 through 2017 model year standards. This is due to new LEV III criteria pollutant fleet standards beginning in model year 2015. There will be two options for meeting the zero evaporative emissions requirement in model year 2015 and beyond. Option 1 is identical to the current "optional zero evaporative" requirement in that manufacturers must demonstrate a zero evaporative fuel system using a rig test and also meet a whole vehicle test value of 350 mg. Option 2 allows manufacturers to demonstrate a zero evaporative system by doing a "mini rig test" and by meeting a whole vehicle test value of 300 mg. In addition, if a manufacturer chooses this second option, they can average among the vehicles within a standard category. Option 1 and Option 2 are equivalent. Due to these change in LEV III, the language is being modified so that for a PZEV to earn credit within the ZEV regulation in 2015 and subsequent model years, the vehicle must be certified to LEV III zero evaporative standards, but can use either option.

(c)(3)(A) The purpose of this subdivision is to show the equation for determining a vehicle's zero emission VMT allowance. The table within this subdivision is being corrected to resolve inconsistencies in the zero emission VMT allowance equation. The language has also been clarified as to the UF to be used in determining a manufacturer's zero emission VMT allowance, which is according to Section 4.5.2 Equation 5 and the "Fleet UF" Utility Factor Equation Coefficients in Section 4.5.2, Table 3, in J2841 (March 2009). Also the language is being clarified that a vehicle may not earn more than 1.39 zero emission VMT PZEV allowances.

(c)(3)(B) This subdivision is being deleted because no automakers have included vehicles requiring or requesting such exemptions in any vehicle planned through 2017 model year.

(c)(4)(B)1. The purpose of this subdivision is to describe the varying types of advanced componentry allowances for which a manufacturer may qualify. This subdivision is being amended to remove Type C advanced componentry allowance. ZEV technology has advanced and staff now believes that the minimum qualifying system should be increased to the higher voltage Type D because (1) AT PZEVs need to make use of systems that more closely represent those that are needed for ZEVs, and (2) no manufacturers have certified, or have disclosed plans to certify, a Type C AT PZEV. The language prior to the table explaining the various advanced componentry types is being amended to reflect that there are four rather than five types of advanced componentry allowances. Additionally, the table is being updated with new language to reflect the intent of the electric drive system peak power output for Type F and Type G advanced componentry allowances and that the vehicle must travel 10 miles all electrically on either the UDDS or the US06 drive schedule.

(c)(4)(B)4. This subdivision is being deleted to remove Type C advanced componentry allowance. ZEV technology has advanced and staff now believes that the minimum qualifying system should be increased to the higher voltage Type D because AT PZEVs need to make use of systems that more closely represent those that are needed for ZEVs, and no manufacturers have certified, or have disclosed plans to certify, a Type C AT PZEV.

(c)(4)(B)9. The purpose of this subdivision is to establish severability, which allows that if any of 1962.1(c)(4)(B)1. – 8. is found, that the remainder of section 1962.1 remains in full force and effect. The text in this subdivision is being simplified to reflect the intent of the language.

(c)(7)(B) The purpose of this subdivision is to allow a PZEV which earns a zero emission VMT allowance to earn an additional credit multiplier if the vehicle is purchased or offered for an extended lease. This subdivision is being clarified to reflect the intent that the multiplier will no longer be available after model year 2011.

(d)(5)(A) The purpose of this subdivision is to define the various ZEV tiers for determining a vehicle's credit. This subdivision is being modified to define Type

I.5x and Type IIx vehicles (range extended BEVs), vehicles are referenced in two other places in section 1962.1.

(d)(5)(C) The purpose of this subdivision is to explain how a manufacturer earns ZEV credits, and how delivered for sale and placed in service is credited for each ZEV. The language is being modified to reflect that a vehicle must be delivered for sale and placed in service in the same state in order to earn the total credit amount. This change is due to some manufacturers having internet based sales, and questions surrounding the location of a vehicle's delivery and placement in service. Staff's proposed change clarifies the original intent of the provision. The language has also been modified to place a five year limit on 2012 and prior model year ZEVs to collect "placed in service" credit. This five year limit to ensure that the ZEVs offered to consumers are moderately current advanced technology and advanced technology components have not deteriorated. Additionally, the language and table have been modified to reflect the new Type I.5x and Type IIx category, and the amount of credits earned in the 2012 through 2017 timeframe. The table has also been amended to reflect that Type V ZEVs, which are 300 mile range FCVs, earn 9 credits each in the 2015 through 2017 timeframe. This modification gives FCVs additional incentives as compared to BEVs, which have been affected due to other modifications in this timeframe.

(d)(5)(D) The purpose of this subdivision is to allow a ZEV to earn an additional credit multiplier if the vehicle is purchased or offered for an extended lease. This subdivision is being clarified to reflect the intent that the multiplier will no longer be available after model year 2011.

(d)(5)(E) The purpose of this subdivision is allow manufacturers to count a ZEV delivered for sale and placed in service in California as if it were also delivered for sale and placed in service in a Section 177 ZEV state.

(d)(5)(E)1.a. This subdivision is being clarified to apply to manufacturers with a ZEV requirement only, which is the original intent of the text.

(d)(5)(E)1.b. This subdivision is being clarified to apply to manufacturers with a ZEV requirement only, which is the original intent of the text.

(d)(5)(E)2. This subdivision is being clarified to apply to manufacturers with a ZEV requirement only, which is the original intent of the text. This subdivision has also been clarified to allow Type I.5x and Type IIx vehicles under this provision, through 2017 model year. Additionally, this subdivision is being changed to reflect that both intermediate volume and LVMs may use this provision, not just LVMs. Also, manufacturers producing Type I, I.5, and II ZEVs, which are BEVs, may use this provision for those vehicles through 2017 model year, rather than just 2014 model year. California markets have matured and are well prepared for increased sales requirements. However, markets in Section 177 ZEV states need additional time to prepare for ZEVs, and some vehicle manufacturers need time to expand their BEV offerings to other states and to different climates.

(d)(5)(F) The purpose of this subdivision is to describe the specifications and requirements that a NEV must meet in order to received ZEV credit.

(d)(5)(F)3. The purpose of this section is to describe the warranty that must be offered for NEVs that qualify for credits under the ZEV regulation. The language is being simplified and clarified to better explain rules regarding prorated NEV warranties.

(d)(5)(F)5. This subdivision is being added to require that NEVs must meet the charging connection standard starting in model year 2014 to ensure all electric vehicles, including NEVs meet the same standard.

(d)(5)(G) This subdivision is being added to describe how Type I.5x and Type IIx vehicles earn ZEV credit. Type I.5x and Type IIx vehicles are BEVs equipped with an APU.

(d)(5)(G)1. This subdivision is being added to require Type I.5x and Type IIx vehicles to meet PZEV requirements, ensuring the vehicles are low emitting under all operation.

(d)(5)(G)2. This subdivision is being added to require Type I.5x and Type IIx vehicles to meet Type G advanced componentry requirements, that is, the vehicles must at least be able to run 10 all electric US06 miles before the APU turns on.

(d)(5)(G)3. This subdivision is being added to require the vehicle's UDDS range after the APU first starts is less than or equal to the vehicle's all electric UDDS test range prior to the APU start. The subdivision also clarifies that the APU may not start until the battery is being full depleted. These requirements ensure that the APU functionality is limited and that the unit is not relied upon instead of the battery electric power.

(d)(5)(G)4. This subdivision is being added to require that Type I.5x vehicles must have at least 75 miles electric urban dynamometer range and that Type IIx vehicles must have at least 100 miles electric urban dynamometer range. Staff established a minimum range of 80 miles for Type I.5x and Type IIx vehicles because the examples of "full function" BEVs coming to market all have at least 80 miles range. It is important that the minimum range for eligibility be equivalent to full function BEVs in the marketplace.

(g)(2)(A) This subdivision explains how the credits earned by a manufacturer are expressed in the ZEV bank. This subdivision is being amended to separate the 2009 through 2014 model years standards from the 2015 through 2017 model year standards. Up to model year 2014, ZEV credits are expressed in terms of g/mi NMOG. After model year 2015, the language is being modified to reflect that ZEV credits will now be expressed in terms of whole ZEV credits. This is due to new LEV III criteria pollutant fleet standards beginning in model year 2015.

(g)(2)(B) This subdivision explains how the credits earned by a manufacturer are expressed in the ZEV bank. This subdivision is being amended to separate the 2009 through 2014 model years standards from the 2015 through 2017 model year standards. Up to model year 2014, PZEV credits are expressed in terms of g/mi NMOG. After model year 2015, the language is being modified to reflect that PZEV credits will now be expressed in terms of whole ZEV credits. This is due to new LEV III criteria pollutant fleet standards beginning in model year 2015.

(g)(2)(C) This subdivision explains that various credit types are held in separate accounts within the ZEV bank. This subdivision is being amended to include a separate account for Type I.5x and Type IIx vehicles, since those credits are treated differently.

(g)(2)(D) This subdivision is being added to clarify how ZEV credits and debits are to be rounded. This amendment is meant to provide clarification and to avoid differences in calculating ZEV credits and debits.

(g)(2)(E) This subdivision is being added to explain how g/mi NMOG ZEV credits will be converted into ZEV credits after 2014 model year. This will be accomplished by dividing each manufacturer's 2014 model year g/mi NMOG ZEV credit balance by 0.035. This is due to ZEV credits being expressed in terms of whole ZEV credits starting in model year 2015.

(g)(2)(F) This subdivision is being added to explain how a manufacturer is to convert its PZEV and AT PZEV credits for use after model year 2017. Due to staff's proposed change no longer allowing a manufacture to meet part of its ZEV requirement with PZEV and AT PZEV credits, manufacturers will be left with banks of PZEV and AT PZEV credits. In a shift toward requiring manufacturers to place vehicles rather than use banked credits in order to comply with the regulation, it is appropriate to discount and limit the use of banked PZEV and AT PZEV credits in 2018 and subsequent model years. This provision allows manufacturers to convert those credits through discounting the value of the credits after model year 2017 model year compliance.

(g)(4) The purpose of this subdivision is to allow manufacturers to earn full credit for TZEVs and ZEVs placed in advanced demonstration programs, even if the vehicle is not delivered for sale or placed in service. This subdivision is being reorganized to into two subdivisions: (A) TZEVs and (B) ZEVs. This is due to advanced demonstration programs expiring for TZEVs in 2014 model year, and continuing for ZEVs through model year 2017. New text in subdivision (B) is duplicative, only extending the availability of advanced demonstration credits for

ZEVs, and describes guidelines for ZEVs placed in advanced demonstration programs.

(g)(5)(A) The purpose of this subdivision is to explain transportation system credits and the general guidelines for manufacturers placing ZEV program vehicles into transportation systems. This subdivision is being amended to explicitly restrict manufacturers from being able to use subdivision 1962.1(d)(5)(E) – the travel provision- for transportation system credits. This language is being added to clarify the original intent of the language: manufacturers are only allowed to travel vehicle credits, not additional credits earned by vehicles placed in specific applications.

(g)(5)(B) The purpose of this subdivision is to describe how manufacturers earn transportation system credits. This subdivision is being amended to allow Type I.5x and Type IIx vehicles to earn transportation system credits. This is because Type I.5x and Type IIx vehicles are a new vehicle category and are to be treated the same as ZEVs under most circumstances. The table in this subdivision is also being amended to award fewer credits for TZEVs and ZEVs placed in transportation system credits. Limiting the number of credits offered for reasons other than vehicle placement is to ensure ZEV and TZEV commercial success, and simplifies the regulation.

(g)(5)(C)1. The purpose of this subdivision is to describe the caps on the use of credits earned by manufacturers placing ZEVs in a transportation system. This subdivision is being amended to include Type I.5x and Type IIx vehicles. This is because Type I.5x and Type IIx vehicles are a new vehicle category and are to be treated the same as ZEVs under most circumstances.

(g)(5)(D) The purpose of this subdivision is to explain how ARB Executive Officer is to allocate transportation system credits to manufacturers. The intent of the language is being clarified to specify that vehicles must be placed in a transportation system for at least two years, as stated in 1962.1(g)(5)(A). This subdivision is also being amended to sunset after model year 2017 compliance. It is not necessary to continue these car sharing programs, when mostly third parties are running transportation system programs, and earning credit, rather than the manufacturers themselves. After meeting with the third parties responsible for transportation systems, staff believes it is more important to establish incentive programs for transportation system, rather than allow third parties to earn credit through transportation systems, and sell their credits to regulated manufacturers.

(g)(6) The purpose of this subdivision is to explain how a manufacturer submits credits for compliance with the regulation to ARB's Executive Officer, and how ZEV credits can be used to meet a manufacturer's obligation. This subdivision is being amended to separate 2009 through 2014 model years from the 2015 through 2017 model years. This is due to ZEV credits being expressed in terms of ZEV credits, instead of in g/mi NMOG ZEV credits, starting in model year 2015.

(g)(6)(A) The purpose of this subdivision is to explain how manufacturers are allowed to use NEV credits to meet its obligation. The table in this subdivision is being amended to extend the caps for NEV credits through 2017. The caps through 2014 were sufficient, and it is appropriate to extend the same caps through model year 2017.

(g)(6)(B) The purpose of this subdivision is to limit a large volume manufacturer's ability to bank a ZEV credit after it is earned. After the time limit is reached, the manufacturer may only use the banked ZEV credit to meet the portion of its requirement that can be met with TZEVs, AT PZEVs, or PZEVs. This subdivision is being amended to clarify the intent of the text: credits from ZEVs but not from NEVs are limited under this provision. Additionally, this subdivision is being amended to sunset the carry forward provisions for ZEVs after 2011 model year. Currently requirements plateau for three years at a time but hold steady indefinitely at a relatively low level for 2018 through 2025 model years. Because staff is proposing to increase volumetric requirements each year for model years 2018 through 2025, it is unlikely that manufacturers will be able to bank large volumes of credits for later use.

(g)(6)(C) The purpose of this subdivision is to limit to two years how long manufacturers other than LVMs are able to bank a ZEV credit after it is earned. This subdivision is being amended to clarify the intent of the text: credits from ZEVs but not from NEVs are limited under this provision. Additionally, this subdivision is being amended to sunset the carry forward provisions for ZEVs after 2011 model year. Currently requirements plateau for three years at a time but hold steady at a relatively low level for 2018 through 2025 model years. Because staff is proposing to increase volumetric requirements each year for model years 2018 through 2025, it is unlikely that manufacturers will be able to bank large volumes of credits for later use.

(g)(6)(D) This subdivision is being added to specify that manufacturers may use Type I.5x and Type IIx vehicles to meet up to 50 percent of the portion of a manufacturer's requirement that must be met with credits from ZEVs. Type I.5x and Type IIx vehicle credits are limited to ensure LVMs still produce pure ZEVs in the 2012 through 2017 timeframe.

(g)(7)(A) This subdivision describes the amount of time a manufacturer has to fulfill a ZEV obligation deficit. This subdivision is being amended to separate 2009 through 2014 model years from the 2015 through 2017 model years. This is due to ZEV credits being expressed in terms of whole ZEV credits, instead of in g/mi NMOG ZEV credits, starting in model year 2015. Additionally, the word "credits" is added throughout to clarify that a manufacturer is required to submit credits in compliance with the requirement, rather than vehicles. This subdivision is also being amended to clarify the intent that only credits from ZEVs are allowed to fulfill a ZEV deficit.

(g)(8) The purpose of this subdivision is to explain that a manufacturer will be subject to penalties if it fails to make up a ZEV deficit, and gives the equation for calculating the resulting ZEV penalty. This subdivision is being amended to separate 2009 through 2014 model years from the 2015 through 2017 model years. This is due to ZEV credits being expressed in terms of whole ZEV credits, instead of in g/mi NMOG ZEV credits, starting in model year 2015. Staff interprets the overall penalty for ZEV non-compliance to be $5,000 per whole credit not produced. The language in this subdivision is being amended to reflect this intent

(i)(2) This subdivision is being added to define "auxiliary power unit" because range extended BEVs are equipped with an auxiliary power unit.

(i)(3) This subdivision is being renumbered due to the addition of other definitions.

(i)(4) This subdivision is being renumbered due to the addition of other definitions.

(i)(5) This subdivision is being renumbered due to the addition of other definitions.

(i)(6) This subdivision defines Enhanced AT PZEVs. This subdivision is being amended to indicate that Enhanced AT PZEV is nomenclature used through 2011 model year, and that Transitional Zero Emission Vehicle or TZEV is interchangeable for Enhanced AT PZEV. This subdivision is being renumbered due to the addition of other definitions.

(i)(7) This subdivision is being renumbered due to the addition of other definitions.

(i)(8) This subdivision is being renumbered due to the addition of other definitions.

(i)(9) This subdivision is being added to define "proportional value" because this value is used to calculate the ratio applied to credits earned in Section 177 ZEV states for subdivision 1962.1(d)(5)(E).

(i)(10) This subdivision is being added to define "Range Extended Battery Electric Vehicle" because manufacturers are allowed to meet a portion of their obligation with this new type of vehicle.

(i)(11) This subdivision is being renumbered due to the addition of other definitions.

(i)(12) This subdivision is being renumbered due to the addition of other definitions.

(i)(13) This subdivision is being added to define "Transitional Zero Emission Vehicle" to redefine Enhanced AT PZEVs, and is the new nomenclature for these types of vehicles for 2012 and subsequent model years.

(i)(14) This subdivision is being renumbered due to the addition of other definitions.

(i)(15) This subdivision is being renumbered due to the addition of other definitions.

(j) The purpose of this subdivision is to define abbreviations used throughout section 1962.1. New abbreviations are being added as appropriate.

(l)(1)(A) The purpose of this subdivision is to clarify that credit balances for each type of ZEV regulation vehicle is required to be disclosed annually. This subdivision is being amended to include Type I.5x and Type IIx vehicles. This is because Type I.5x and Type IIx vehicles are a new vehicle category and are to be treated the same as ZEVs under most circumstances.

Health & Safety Code sections 38562 and 43018.5 are being added as references to reflect the contribution of those sections towards the GHG emission reductions referenced in sections 38562 and 43018.5. Health and Safety Code section 43204 was added as a reference because subdivisions 1962.1(c)(2)(D) and 1962.2(c)(2)(D) reference the warranty requirements of California Code of Regulations subdivisions 2037(b)(2) and 2038(b)(2) and, in turn, those subdivisions reference the requirements of Health and Safety Code section 43204.

List of Changes to "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles in the Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicle Classes"

The test procedures are included by reference in section 1962.1, and contain an exact copy of the regulatory text, including the amendments being proposed in section 1962.1 in Section C. Previously, section 1962.1 and incorporated test procedures applied to 2009 and subsequent model years. Section 1962.1 and its incorporated test procedure now apply to 2009 through 2017 model years, and a new section (section 1962.2) and its incorporated test procedures apply to 2018 and subsequent model years. Language is being changed throughout the test procedures to clarify the applicable model years. Additionally, due to the addition of a new Section E, existing Sections E through I have been renumbered accordingly.

Section B. Definitions and Terminology

"All-Electric Range" – This definition is being amended to remove language that applies to blended off vehicle charge capable hybrid electric vehicles because equivalent all electric range does not mean all electric range.

"Auxiliary power unit" – This definition is being amended to add language that specifies what auxiliary power unit means for the purposes of range extended BEVs. This definition conforms with the definition found in section 1962.1.

"Enhanced AT PZEV" – This definition is being amended to apply only to model year 2009 through 2011 vehicles, due to new nomenclature used in model year 2012 and subsequent model years. Additionally, clarification is being added to the definition that Transitional Zero Emission Vehicle or TZEV means Enhanced AT PZEV.

"Proportional value" – This definition is being added to define the value used to calculate the ratio applied to credits earned in Section 177 ZEV states for subdivision 1962.1 (d)(5)(E) (subdivision C.4.5(e) of test procedures).

"Range extended battery electric vehicle" – This definition is being added to define a new vehicle category with which manufacturers are allowed to meet a portion of their obligation.

"Transitional zero emission vehicle" – This definition is being added to redefine Enhanced AT PZEVs, and is the new nomenclature for these types of vehicles in 2012 and subsequent model years.

"Type I.5x"- This definition is being added to define a new vehicle category with which manufacturers are allowed to meet a portion of their obligation.

"Type IIx" - This definition is being added to define a new vehicle category with which manufacturers are allowed to meet a portion of their obligation.

"Zero Emission Vehicle Miles Traveled" – This definition is being amended to clarify that "VMT" means vehicle miles traveled.

Section C. Zero Emission Vehicle Standards

The amendments made throughout section 1962.1 have been duplicated in this section of the test procedure.

Section D. Certification Requirements

D.1. This subdivision exempts ZEVs from all mileage and service accumulation, durability-data vehicle, and emission-data vehicle testing, because ZEVs do not emit. This subdivision is being amended to ensure Type I.5x and Type IIx vehicles are not exempt from such requirements because these vehicles have tailpipe and evaporative emissions.

Section E. Determination of NEV Acceleration, Top Speed, and Constant Speed Range

This new subdivision is being added to specify testing methods for NEV certification.

Section G. Test Procedures for 2012 and Subsequent Model Off-Vehicle Charge Capable Hybrid Electric Vehicles.

G.12 This new subdivision is needed to establish the calculations that must be used to determine the GHG emissions values attributable to off vehicle charge capable hybrid electric vehicles for the 2017 and subsequent model years.

G.12.1 This subdivision is needed to calculate the combined city/highway GHG emissions value for an off-vehicle charge capable hybrid electric vehicle.

G.12.2 This subdivision is needed to calculate the city (urban) GHG emissions value for off-vehicle charge capable hybrid electric vehicles.

G.12.2.1 This subdivision is needed to provide the equation used to calculate the urban GHG emissions value for off vehicle charge capable hybrid electric vehicles.

G.12.2.2 This subdivision is needed to define the "Charge-Depleting to Charge-Sustaining Range" that is used in the calculations in subsections G.12.2.5 and G.12.3.

G.12.2.3 This subdivision is needed to provide the utility factors for urban and highway cycles that are used in the calculations in subsections G.12.2.1 and G.12.3.

G.12.2.4 This subdivision is needed to provide the equation used to calculate the charge-depleting GHG rate from electricity use in each test cycle used in the calculation in subsection G.12.2.1.

G.12.2.5 This subdivision is needed to provide the equation used to calculate the urban or highway charge-depleting electricity use used in the calculation in subsection G.12.2.4.

G.12.2.6 This subdivision is needed to provide the equation used to calculate the weighted CO_2 mass emissions of the charge-sustaining test used in the calculation in subsection G.12.2.1.

G.12.3 This subdivision is needed to calculate the highway GHG emissions value for off vehicle charge capable hybrid electric vehicles.

Section K. Advanced Technology Demonstration Program Data Requirements
This new subdivision is being added to specify what is required of manufacturers to submit to ARB's Executive Officer for approval of credits earned in an advanced technology demonstration program, according to subdivision 1962.1(g)(4) (subdivision C.7.4 of test procedures). These data requirements have been available in Manufacturers Advisory Correspondence 06-02, and have now been added to these test procedures.

K.1. The purpose of this subdivision is to request a project description, including a general description, goal, objectives, and location of the advanced demonstration project.

K.2. The purpose of this subdivision is to request vehicle data, including the vehicle's model, model year, date placed in program, and vehicle identification number of the vehicle being demonstrated.

K.3. The purpose of this subdivision is to request the vehicle specifications including its class, curb weight, payload, electric range, fuel economy, fuel type, refueling time, electric motor output, hybrid energy storage, and fuel cell stack type, if applicable. This information is necessary for staff to gain more knowledge regarding the vehicle's technology.

Section L. Fast Refueling Capability

This new subdivision is being added to outline the criterion to verify a Type III, Type IV, and Type V ZEV's fast refueling capability. These criterion for fast refueling capability have been available in Manufacturers Advisory Correspondence 06-02, and have now been added to these test procedures.

§1962.2 Zero-Emission Vehicle Standards for 2018 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles.

This new section 1962.2, CCR, title 13 is being added to describe the ZEV requirements for 2018 and subsequent model years, and is similar in style and structure to section 1962.1.

(a) The purpose of this subdivision explains the ZEV emission standard, and allows ARB's Executive Officer to certify vehicles as ZEVs that meet the definition of the standard.

(b) The purpose of this subdivision is to outline the percentage ZEV requirements for manufacturers.

(b)(1) The purpose of this subdivision is to describe the percentage ZEV requirement, and how to calculate the number of vehicle to which the percentage ZEV requirements applies.

(b)(1)(A) The purpose of this subdivision is to describe the basic credit percentage requirement for each year that must be ZEVs, and that the ZEV requirement is to be based on the manufacturer's annual NMOG production report. This is a report submitted by a regulated manufacturer to ARB that indicates the number of vehicles delivered for sale in California, and to which standard each vehicle is certified.

(b)(1)(B) The purpose of this subdivision is to calculate the number of vehicles to which the percentage ZEV requirement is applied. This subdivision also describes that production averaging has no effect on a manufacturer's size determination and clarifies how a manufacturer should treat vehicles delivered for sale by other manufacturers in their production determination.

(b)(1)(B)3. The purpose of this subdivision is to allow manufacturers to elect a same year calculation method if the manufacturer applies to ARB's Executive Officer under the circumstances if the manufacturer's volume of PCs and LDTs produced and delivered for sale in California has decreased by 40 percent from the previous year due to circumstances that were unforeseeable and beyond its control. A manufacturer may only elect this option for 2 years.

(b)(1)(D) The purpose of this subdivision is to exclude NEVs produced by the manufacturer itself or by a subsidiary from a manufacturer's applicable sales volume to which the ZEV requirement is applied. This prevents manufacturers producing only NEVs from generating a larger requirement than can be fulfilled, since each NEV is worth less than one ZEV credit.

(b)(2) The purpose of this subdivision is to describe the ZEV requirements for LVMs.

(b)(2)(E) The purpose of this subdivision is to describe the requirements and allowed usage of credits from TZEVs for model year 2018 through 2025. The table describes the portion of the requirement that must be met with credits from ZEVs and the portion of the requirement that is allowed to be met with credits from TZEVs.

(b)(2)(F) The purpose of this subdivision is to describe the requirements and allowed usage of credits from TZEVs for 2026 and subsequent model years.

(b)(3) The purpose of this subdivision is to describe how IVMs are allowed to meet their 2018 and subsequent model year requirements, which is with credits from TZEVs.

(b)(4) The purpose of this subdivision is to exempt SVMs from meeting ZEV percentage credit requirements, but to allow a SVM to earn, bank, market, and trade credits for the ZEVs and TZEVs it produces.

(b)(7) The purpose of this subdivision is to describe the lead time and method for determining when and how a manufacturer is subject to requirements as it increases and decreases in size definition.

(b)(7)(A) The purpose of this subdivision is to describe that a manufacturer increasing in size, either due to aggregation or through increase in the manufacturer's sales, will become subject to more stringent requirements after the manufacturer has three consecutive sales averages above the intermediate or large volume thresholds.

(b)(7)(B) The purpose of this subdivision is to describe that a manufacturer decreasing in size will become subject to less stringent requirements after the manufacturer has three consecutive sales averages below the intermediate or small volume thresholds.

(b)(7)(C) This subdivision explains how to calculate California production volume in change of ownership situations.

(c) This subdivision describes the requirements and credits for TZEVs.

(c)(1) This subdivision introduces the rest of the subdivision.

(c)(2) This subdivision outlines the requirements that a vehicle must meet in order to be eligible for credit through the ZEV regulation.

(c)(2)(A) This subdivision describes that a manufacturer must certify to SULEV tailpipe standards, even if the vehicle is bi-fuel, fuel flexible and dual-fuel capable.

(c)(2)(B) This subdivision describes the evaporative emissions standards a TZEV must certify to in order to receive credit.

(c)(2)(C) This subdivision describes the on-board diagnostic requirements for 150,000 miles that a TZEV must meet in order to receive credit.

(c)(2)(D) This subdivision describes the warranty a manufacturer must provide for each TZEV in order to receive credit.

(c)(3) This subdivision describes the allowances a TZEV can earn.

(c)(3)(A) This subdivision describes how a manufacturer is to calculate its zero emission VMT allowance. The table in this subdivision describes equations manufacturers must use to determine their zero emission VMT allowance and that TZEVs with less than 10 all electric UDDS does not qualify for this allowance.

(c)(3)(A)1. This subdivision allows TZEVs with 10 miles all electric range on the US06 drive schedule to receive additional credits.

(c)(3)(E) This subdivision describes the minimum requirements for HICE vehicles and the amount of credit each HICE vehicle is to earn.

(d) This subdivision describes the requirements and credits for ZEVs.

(d)(5) This subdivision describes the various types of credits for 2018 and subsequent model year ZEVs.

(d)(5)(A) This subdivision describes how a manufacturer is to calculate the amount of credit earned by each ZEV, which is based on range, according to the equation in this subdivision.

(d)(5)(A)1. This subdivision requires all ZEVs to have greater than 50 UDDS all electric miles in order to receive credit.

(d)(5)(A)2. This subdivision caps the amount of credit that may be received through the equation in subdivision 1962.2(d)(5)(A) for each ZEV.

(d)(5)(E) This subdivision allows manufacturers to count hydrogen FCVs delivered for sale and placed in service in California to be counted toward meeting the manufacturer's requirement in the Section 177 ZEV states that have adopted the ZEV regulation. This is due to hydrogen FCVs being dependent on hydrogen infrastructure, which is less robust in the Section 177 ZEV states.

(d)(5)(F) This subdivision describes how NEVs are eligible to receive 0.15 credits.

(d)(5)(F)1. This subdivision describes the technical specifications that NEVs must meet in order to receive credit. These specifications guarantee only the most advanced NEVs are eligible to receive credit.

(d)(5)(F)1.a. This subdivision describes the acceleration requirements that a NEV must meet in order to receive credits.

(d)(5)(F)1.b. This subdivision describes the top speed requirements that a NEV must meet in order to receive credits.

(d)(5)(F)1.c. This subdivision describes the constant speed range requirements that a NEV must meet in order to receive credits.

(d)(5)(F)2.. This subdivision describes the battery requirements that a NEV must meet in order to receive credits.

(d)(5)(F)3. This subdivision describes the warranty requirements that a NEV must meet in order to receive credits.

(d)(5)(F)4. This subdivision describes the charging requirements that a NEV must meet in order to receive credits.

(d)(5)(G) This subdivision describes the requirements manufacturers must meet in order for BEVxs, which is a BEV with an APU for back-up power to be eligible to receive credit.

(d)(5)(G)1. This subdivision describes the emissions requirements a BEVx must meet in order to receive credit to ensure the vehicle is low-emitting under all circumstances.

(d)(5)(G)2. This subdivision requires the vehicle's UDDS all electric range after the APU first starts is less than or equal to the vehicle's all electric UDDS test range prior to the APU start. The subdivision also clarifies that the APU may not start until the battery is being full depleted. These requirements ensure that the APU functionality is limited and that the unit is not relied upon instead of the battery electric power.

(d)(5)(G)3. This subdivision requires that in order to receive credit, BEVxs must have at least 80 miles UDDS all electric range.

(g) The purpose of this subdivision it to describe the generation and use of credits, as well as the calculations of penalties if the manufacturer is unable to make up a deficit in meeting its ZEV obligation.

(g)(1) This subdivision allows manufacturers to bank ZEV credits produced in excess of its requirement.

(g)(2) This subdivision describes how manufacturers are to calculate and maintain credits earned under this regulation.

(g)(2)(A) This subdivision describes that credits from ZEVs shall be expressed in terms of credits, and that those credits may be applied toward meeting a manufacturer's ZEV requirement.

(g)(2)(B) This subdivision describes that credits from TZEVs shall be expressed in terms of credits, and that those credits may be applied toward meeting a manufacturer's ZEV requirement.

(g)(2)(C) This subdivision describes that a manufacturer's various credits will be maintained in separate accounts within the ZEV bank.

(g)(2)(D) This subdivision describes how ZEV credits and debits are to be rounded. The language is meant to provide clarification and to avoid differences in calculating ZEV credits and debits.

(g)(3) This subdivision allows manufacturers to earn credit for MDVs produced as ZEVs or TZEVs, and apply those credits towards its ZEV obligation.

(g)(4) This subdivision outlines how manufacturers other than LVMs are to earn advanced demonstration credits for ZEVs and BEVxs.

(g)(4)(B) This subdivision describes the requirements and limits for manufacturers other than LVMs that place ZEVs in advance demonstration programs, and earn credit as if the vehicle was delivered for sale.

(g)(5) This subdivision describes how ZEV credits earned by vehicle placed in transportation systems may be used in 2018 and subsequent model years.

(g)(5)(C) This subdivision describes the limits on the use of transportation system credits for meeting a manufacturer's requirement.

(g)(5)(C)1. This subdivision describes the treatment and limits on the use of transportation system credits earned by ZEVs and BEVxs for meeting a manufacturer's requirement.

(g)(5)(C)2. This subdivision describes the treatment and limits on the use of transportation system credits earned by TZEVs for meeting a manufacturer's requirement.

(g)(6) This subdivision describes how a manufacturer submits credits for compliance with the regulation to ARB's Executive Officer, and how ZEV credits can be used to meet a manufacturer's obligation.

(g)(6)(A) This subdivision describes how discounted PZEV and AT PZEV credits and NEV credits may be used to meet a portion of a manufacturer's obligation, and that these credits expire after model year 2025.

(g)(6)(B) This subdivision describes how BEVx credits may be used to meet a portion of a manufacturer's obligation.

(g)(6)(C) This subdivision describes how a manufacturer applies for, generates, calculates, and uses GHG-ZEV over compliance credits.

(g)(6)(C)1. This subdivision allows a manufacturer to apply to ARB's Executive Officer to be eligible to generate GHG-ZEV over-compliance credits, no later than May 1, 2018.

(g)(6)(C)1.a. This subdivision disqualifies a manufacturer with any outstanding 2017 and previous model year debits from compliance with the GHG fleet standards, according to sections 1961.1 and 1961.3.

(g)(6)(C)1.b. This subdivision disqualifies a manufacturer with any outstanding 2017 and previous model year debits from compliance with the ZEV regulations, according to sections 1962.1.

(g)(6)(C)1.c. This subdivision requires a manufacturer to submit documentation of its projected product plan to show systematic over compliance by at least 2.0 gCO_2/mi of its section 1961.3 requirements for 2018 through 2021 model year, and commitment to do so in each year.

(g)(6)(C)2. This subdivision describes how a manufacturer is to calculate its over compliance with section 1961.3, which will be based on the previous model year.

(g)(6)(C)2.a. This subdivision requires that a manufacturer must over comply with section 1961.3 by at least 2.0 gCO_2/mi and describes the equation used for calculating GHG-ZEV over compliance credits for use towards meeting a manufacturer's ZEV requirement.

(g)(6)(C)2.b. This subdivision prohibits the use of multipliers earned under subdivision 1961.3(b)(9) to calculate a manufacturer's GHG-ZEV over compliance credits.

(g)(6)(C)2.c. This subdivision prohibits the use of banked gCO_2/mi credits to be used in the GHG-ZEV over compliance credit calculation.

(g)(6)(C)3. The purpose of this subdivision to limit the way GHG-ZEV over compliance credits may be used to meet a manufacturer's requirement in model years 2018 through 2021, as well as the limits on how the GHG-ZEV over compliance credits may be used towards meeting the minimum portion of a manufacturer's requirement that must be met with ZEVs. This subdivision also prohibits a manufacturer from banking these credits for use in subsequent model years, and requires a manufacturer to remove the gCO_2/mi used to calculate the GHG-ZEV over compliances credits from its GHG compliance bank, and cannot bank for future compliance toward 1961.3.

(g)(6)(C)4. This subdivision describes what is required of a manufacturer when submitting GHG-ZEV over compliance credits.

(g)(6)(C)4.a. This subdivision provides that a manufacturer who is granted the ability to generate GHG-ZEV over compliance credits and fails to over-comply by at least 2.0 gCO_2/mi will be subject to the full ZEV requirements for the model year and future model year, and will no longer be eligible to receive GHG-ZEV over compliance credits.

(g)(7) This subdivision describes the requirement and time limit to fulfill a ZEV deficit, as well as the penalties a manufacturer would be subject to if the manufacturer failed to make up a ZEV deficit.

(g)(7)(A) This subdivision describes the amount of time – one year – a manufacturer has to fulfill a ZEV obligation deficit, and that only credits from ZEVs may be used to fulfill a manufacturer's deficit.

(g)(8) This subdivision describes the penalties for failure to comply with the ZEV regulation, and the equation used to calculate a manufacturer's penalty because a manufacturer incurs a penalty if out of compliance with the regulation.

(h) This subdivision describes the documents used to certify and determine compliance with the ZEV regulation.

(h)(1) This subdivision names the test procedures used for certification to determine compliance with the ZEV regulation: "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."

(h)(2) This subdivision names the test procedures for determining compliance with NEV requirements.

(i) This subdivision holds the definitions for section 1962.2.

(i)(1) This subdivision defines "auxiliary power unit" because range extended BEVs are equipped with an auxiliary power unit.

(i)(2) This subdivision defines "charge depletion range actual" because a TZEVs charge depletion range actual is used to calculate its zero emission VMT allowance.

(i)(3) This subdivision defines "discounted PZEV and AT PZEV credits" because manufacturers are allowed to use discounted PZEV and AT PZEV credits in meeting a portion of their overall requirement.

(i)(4) This subdivision defines "energy storage device" because a TZEV's extended warranty covers the vehicle's energy storage device.

(i)(5) This subdivision defines “hydrogen fuel cell vehicle” because manufacturers are allowed to meet a portion of their obligation with hydrogen fuel cell vehicles, and these vehicles are eligible for subdivision 1962.2(d)(5)(E).

(i)(6) This subdivision defines “hydrogen internal combustion engine vehicle” because manufacturers are allowed to meet a portion of their obligation with hydrogen internal combustion engine vehicles.

(i)(7) This subdivision defines “majority ownership situations” because manufacturers are to aggregate their sales with another manufacturer for determination of size definition in majority ownership situations.

(i)(8) This subdivision defines “manufacturer US PC and LDT Sales” because manufacturer's US PC and LDT sales are used to calculate a manufacturer GHG-ZEV over compliance credits.

(i)(9) This subdivision defines “neighborhood electric vehicles” because manufacturers are allowed to meet a portion of their obligation with neighborhood electric vehicles.

(i)(10) This subdivision defines “placed in service” because in order for hydrogen FCVs to be eligible for subdivision 1962.2(d)(5)(E), the vehicles must be placed in service.

(i)(11) This subdivision defines “proportional value” because this value is used to calculate the ratio applied to credits earned in Section 177 ZEV states for subdivision 1962.2(d)(5)(E).

(i)(11) This subdivision defines “range extended battery electric vehicle” because manufacturers are allowed to meet a portion of their obligation with range extended BEVs.

(i)(12) This subdivision defines “section 177 state” because the federal Clean Air Act allows other states to adopt this ZEV regulation and the term is used throughout subdivision 1962.2(d)(5)(E) .

(i)(13) This subdivision defines “transitional zero emission vehicle” because manufacturers are allowed to meet a portion of their obligation with transitional zero emission vehicles.

(i)(14) This subdivision defines “zero emission vehicle” because manufacturers are required to comply with the regulation with zero emission vehicles.

(i)(15) This subdivision defines “zero emission vehicle fuel” because this phrase is used in the definition for transitional zero emission vehicle.

(j) This subdivision lists the abbreviations used throughout section 1962.2.

(k) This subdivision ensures that each section of 1962.2 is severable, meaning that if a section is to be deemed unenforceable, the remainder of the section remains in full force and effect.

(l) This subdivision requires that records for the vehicles subject to the ZEV regulation be subject to public disclosure.

(l)(1) This subdivision requires that a manufacturer's annual production data and credits per ZEVs and TZEV produces are subject to public disclosure.

(l)(2) This subdivision outlines the details for a manufacturer's annual credit balance.

(l)(2)(A) This subdivision requires individual ZEV credit balances from each vehicle category be subject to public disclosure.

(l)(2)(B) This subdivision requires credits earned for vehicles placed in advanced demonstration programs be subject to public disclosure.

(l)(2)(C) This subdivision requires credits earned for vehicles placed in transportation systems be subject to public disclosure.

(l)(2)(D) This subdivision requires credits earned, including credits purchased or traded with another party, including the parties themselves be subject to public disclosure.

List of Changes to "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles in the Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicle Classes"

This test procedure is included by reference in section 1962.2, and contains an exact copy of the regulatory text, including the amendments being proposed in section 1962.1 in Section C. Sections A, B, D, E, F, G, H, I, J, K, and L are identical to those in the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles in the Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicle Classes," as amended in this rulemaking.

§1962.3 Electric Vehicle Charging Requirements

(a) This subdivision describes the vehicles subject to the requirements of section 1962.3. This subdivision is being amended to include range extended BEVs, to make this section applicable to NEVs starting in model year 2014, to delete the requirement that only ZEVs earning more than one credit must comply with these requirements, and to remove hybrids only capable of Level 1 charging from the requirement, because these vehicles are not anticipated in the future.

(b)(1) This subsection specifies the definitions applicable to section 1962.3. This subdivision is being amended to include the definitions from 1962.2 because this part of the CCR holds requirements for 2018 and subsequent model years.

(b)(2) This subsection defines Level 1 charging. This subdivision is being deleted because vehicles only capable of Level 1 charge are not anticipated in the future.

(c)(1) This subdivision specifies the requirements for an applicable vehicle's on board charger. This subdivision is being clarified to reflect the original intent that a vehicle's charging port and system is also required to meet the specific AC Level 1 and Level 2 charging contained in Society of Automotive Engineers J1772, JAN2010, titled "SAE Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler". This subdivision has also been clarified from 3.3 kilovolt amps to kWs to be more precise, and an alternative is being added to allow vehicles with smaller battery packs to comply with the section 1962.3 requirements if the vehicle is able to fully charge in less than 4 hours.

Health & Safety Code sections 38562 and 43018.5 are being added as references to reflect the contribution of those sections towards the GHG emission reductions referenced in sections 38562 and 43018.5.

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ETA-NTP004: "Electric Vehicle Constant Speed Range Tests" (February 2008)

Spreadsheets Used for Tables and Figures

On October 11, 2009, AB 1085 was signed into law and became effective on January 1, 2010. The legislation was subsequently amended by SB 855, which was signed into law and became effective on October 19, 2010, and is intended to provide all of the information relied on by ARB staff in proposing the adoption, amendment, or repeal of a regulation, including all information related to, but not limited to, air emissions, public health impacts, and economic impacts. The information will be posted on the following website:
http://www.arb.ca.gov/msprog/clean_cars/clean_cars_ab1085/clean_cars_ab1085.htm

Appendix A

PROPOSED REGULATION ORDER

PROPOSED 2012 AMENDMENTS TO THE CALIFORNIA ZERO EMISSION VEHICLE REGULATION

Appendix A-1. §1962.1 Zero Emission Vehicle Standards for 2009 through 2017 Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles

Appendix A-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

Appendix A-3. §1962.2 Zero Emission Vehicle Standards for 2018 and subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles

Appendix A-4. 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

Appendix A-5. §1962.3 California Vehicle Charging Requirements

APPENDIX A-1

PROPOSED REGULATION ORDER

Zero Emission Vehicle Regulation: 2009 through 2017 Model Years

Title 13, California Code of Regulations

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Appendix A-1
PROPOSED 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 underline to indicate additions and ~~strikeout~~ to indicate deletions, compared to the preexisting regulatory language.]

§ 1962.1 Zero-Emission Vehicle Standards for 2009 ~~and Subsequent~~through 2017 Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles.

(a) ***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.

(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~~subdivision (b)(1)(C), produced by the manufacturer and delivered for sale in California that must be ZEVs, subject to the conditions in this ~~section~~subdivision 1962.1(b). 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 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

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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 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 LDT1s, 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 LDT1s, 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~~ 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 NEVs and Type 0 ZEVs 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 NEVs and Type 0 ZEVs, 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, or in model year 2018 (whichever occurs first) rather than the sixth model year when a manufacturer ceases to be a small or ~~intermediate~~ independent low 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 fourth 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 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, 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 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). 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) (zero-fuel evaporative emissions standards). For 2015 through 2017 model years, certify the vehicle to the evaporative emission standards in subdivision 1976(b)(1)(G);

(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 and F.5.5, respectively, 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," 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 5 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 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 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 the same state (i.e California) in order to earn the total credit amount. 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 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. Manufacturers with a ZEV requirement producing 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. Manufacturers with a ZEV requirement producing 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 section 177 state, including requirements based on ~~section~~subdivision 1962.1(b)(2)(B).

2. ***Provisions for 2010 through 2017 Model Years.*** Manufacturers with a ZEV requirement producing ~~Specified model year~~ ZEVs, including Type I.5x and Type IIx vehicles, 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

(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 that model year. 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.

(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 that model year. 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.

(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 [v~~i~~] 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~~-and subsequent~~ through 2017, 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 (d)(5)(E)2. and as provided in ~~section~~subdivision (g)(5)(C) below . In model years 2009 through 2011, a~~n~~ ~~Enhanced AT PZEV~~ TZEV, 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, 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:***
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

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:***
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

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.

(~~4~~5) "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~~6) "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~~7) "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~~8) "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.

(9) "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.

(10) "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~~11) "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~~12) "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).

(13) "Transitional Zero Emission Vehicle" means a PZEV that has an allowance of 1.0 or greater, and makes use of a ZEV fuel.

(~~10~~14) "Type 0, I, I.5, II, III, IV, and V ZEV" all have the meanings set forth in section 1962.1(d)(5)(A).

(~~11~~15) "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.

APPENDIX A-2

California Environmental Protection Agency
AIR RESOURCES BOARD

PROPOSED

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]

Existing intervening text that is not amended is indicated by "* * * *". Page numbers in the table of contents will be amended in the final complete version of these test procedures.

[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.]

Date of Release: December 7, 2011
Scheduled for Consideration: January 26-27, 2012

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.

"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.

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

"Zero-emission <u>Vehicle Miles Traveled" or zero emission</u> 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

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 LDT1s, 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 LDT1s, 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~~ 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 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~~subdivision C.2.1(b) and (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.

2.2 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.

(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, <u>or in model year 2018 (whichever occurs first),</u> comply with all ZEV requirements for large volume manufacturers

Requirements will begin in the fourth model year rather than the sixth model year when a manufacturer ceases to be a small ~~or intermediate~~ <u>independent low</u> 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. <u>Requirements will begin in the fourth 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 or subsequent years due to the aggregation requirements in majority ownership situation.</u>

(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. <u>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.</u> 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 <u>calendar year occurs and the manufacturer is producing both 2010 and 2011</u> model year <u>vehicles</u> 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.* Certify the vehicle to the evaporative emission standards in ~~section~~subdivision 1976(b)(1)(E), title 13, CCR (zero-fuel evaporative emissions standards). For 2015 through 2017 model years, certify the vehicle to the evaporative emission standards in subdivision 1976(b)(1)(G);

(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~~	$EAER_u \times (1 - UF_{Rcda})/11.028$
~~R_{cda}~~ $EAER_u$ > 40 miles	~~$EAER_{u40}$/ 29.63~~ $(EAER_{u40}) \times [1 - (UF_{40}{*}R_{cda}/EAER_u)]/$ 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 and F.5.4, 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 5 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.~~

(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 the same state (i.e California) in order to earn the total credit amount. 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) Manufacturers with a ZEV requirement producing 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) Manufacturers with a ZEV requirement producing 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 section 177 state, including requirements based on ~~section~~subdivision C.2.2(B).

(2) *Provisions for 2010 and Subsequent Model Years.* Manufacturers with a ZEV requirement producing ~~Specified model year~~ ZEVs, including Type I.5xs and Type IIxs, 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

(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 that model year. 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.

(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 that model year. 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.

(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 ~~and subsequent~~ through 2017, 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.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~~ TZEV, 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, 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:
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

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:
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

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. 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, February 1, 2008, and "Electric Vehicle Constant Speed Range Tests," ETA-NTP004 Revision 3, February 1, 2008.

~~E~~F. Test Procedures for 2012 and Subsequent Model Zero-Emission Vehicles (including Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles) and All 2012 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.

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 FE.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 = $\int v(t) * i(t)\, dt$
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

3.7 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°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

~~F~~G. Test Procedures for 2012 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 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.

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.]

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°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~~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 ~~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:

$$\text{ERF}_u\ (\%) = \left(\frac{EAER_u}{R_{cda}}\right) * 100$$

The Highway Electric Range Fraction (ERF_h) is calculated as follows:

$$\text{ERF}_h\ (\%) = \left(\frac{EAER_h}{R_{cdah}}\right) * 100$$

11.7 Equivalent All-Electric Range Energy Consumption.

The Urban Equivalent All-Electric Range Energy Consumption ($EAEREC_u$) shall be calculated as follows:

$$\text{EAEREC}_u\ (\text{wh/mi}) = \frac{E_{cd}}{EAER_u}$$

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:

$$\text{EAEREC}_h\ (\text{wh/mi}) = \frac{E_{cd}}{EAER_h}$$

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:

$$(\text{Amp-hr}_{\text{final}})_{\min} = (\text{Amp-hr}_{\text{initial}}) - 0.01 * \left(\frac{NHV_{fuel} * m_{fuel}}{V_{system} * K_1}\right)$$

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:

$$EAER_{u40}\ (\text{miles}) = \left(\frac{ERF_u \times 40\,mi}{100}\right)$$

~~G~~H. Off-Vehicle Charge Capable Hybrid Electric Vehicle Exhaust Emission Test Sequence.

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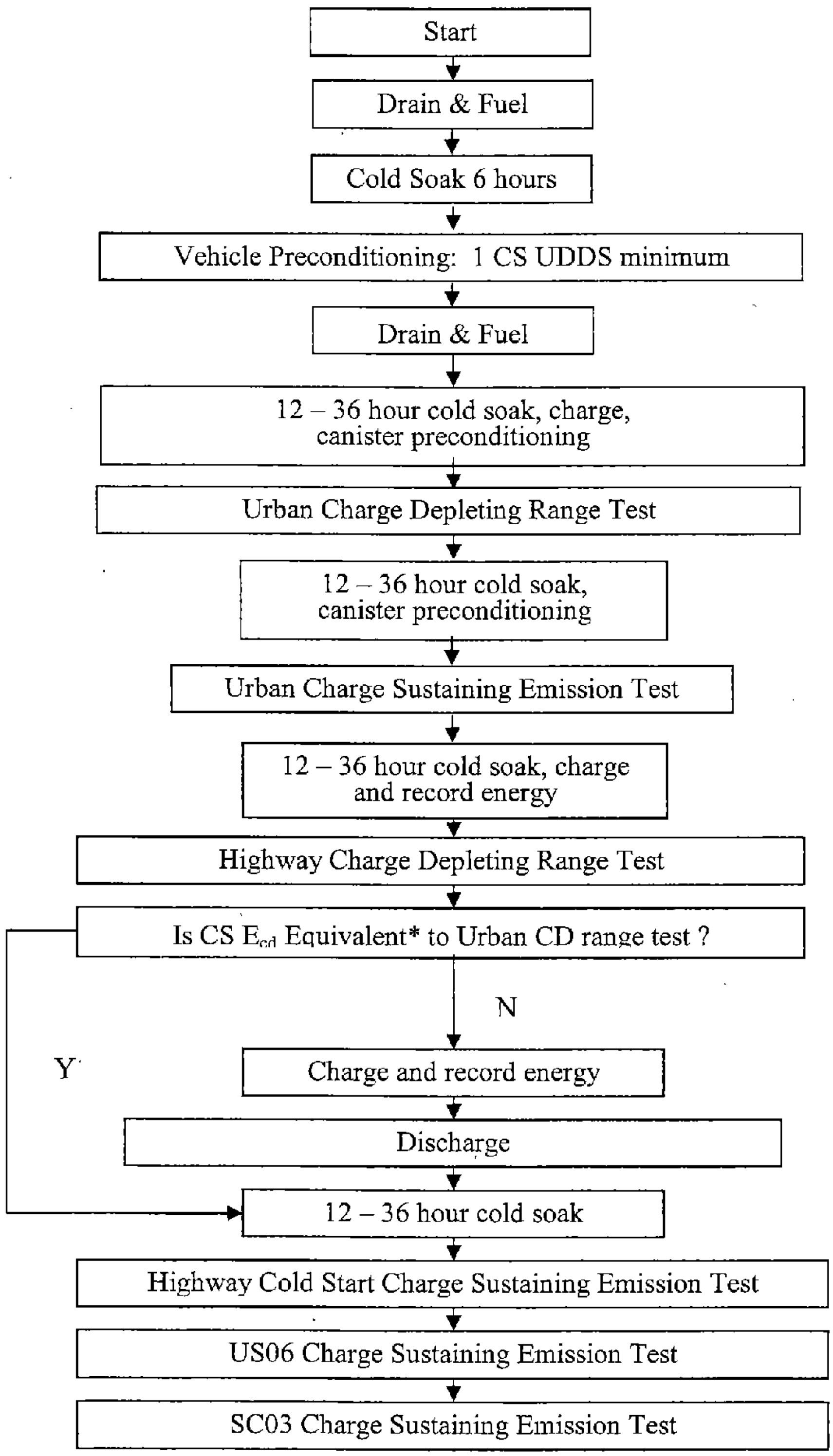
Off-Vehicle Charge Capable HEV Exhaust Emissions Test Sequence

* Equivalent to within ± 1% of AC energy used to charge battery to full state of charge



~~H~~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

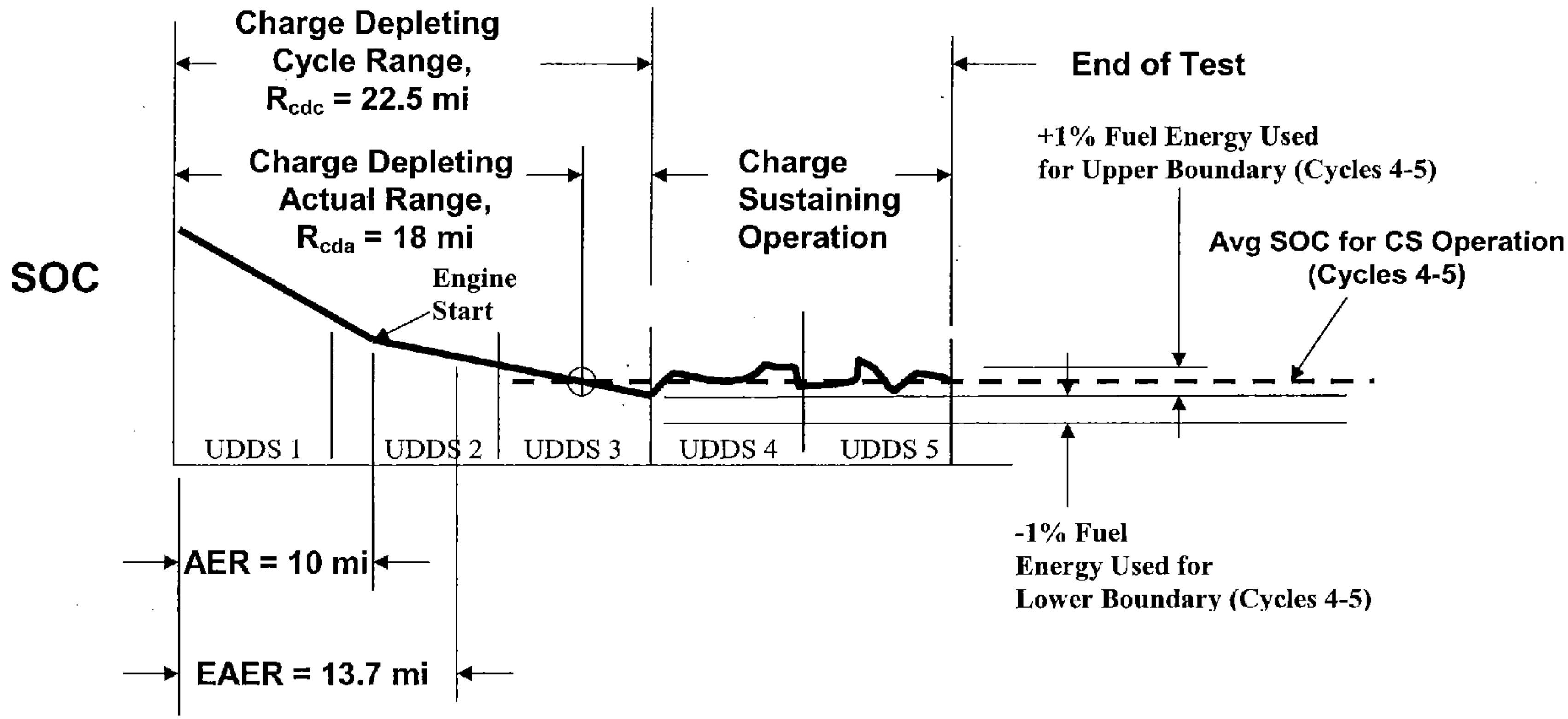
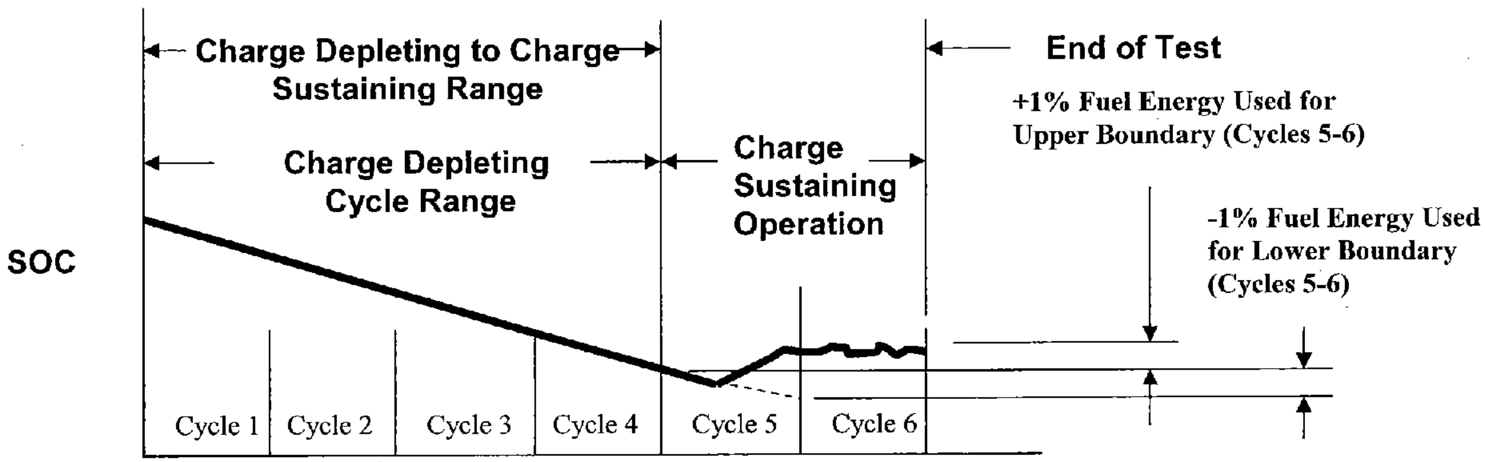


Figure 1

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

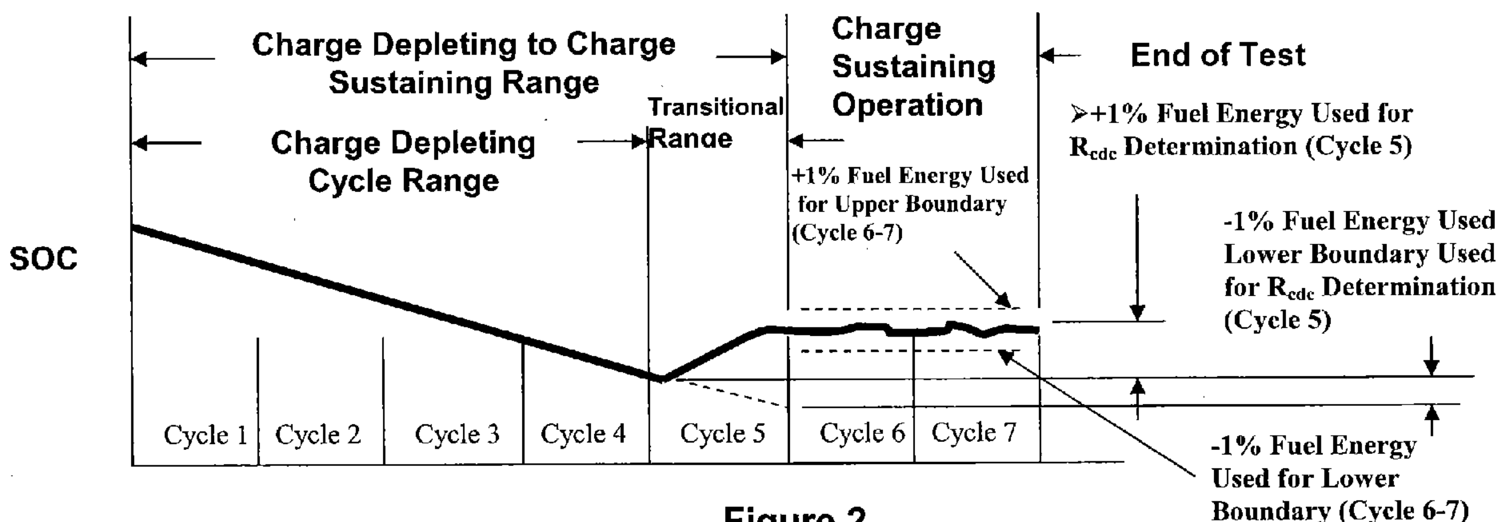


Figure 2

IJ. 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°F and 86°F for a period of 20 minutes and dividing the grams of emissions by 20. The resulting grams per minute shall be multiplied by 3.0 minutes per mile for a grams per mile value.

6. Hybrid Electric Vehicle FTP Emission Test Provisions.

Alternative procedures may be used if shown to yield equivalent results and if approved in advance by the Executive Officer of the Air Resources Board.

6.1 Vehicle Preconditioning.

To be conducted pursuant to the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" 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:

$(Amp\text{-}hr_{final})max$	=	Maximum allowed Amp-hr stored in battery at the end of the test
$(Amp\text{-}hr_{final})min$	=	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.

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:

$$(rpm_{final})_{max} = \sqrt{(rpm_{initial})^2 + 0.01 * \frac{(2 * NVH_{fuel} * m_{fuel})}{(1 * K_3)}}$$

$$(rpm_{final})_{min} = \sqrt{(rpm_{initial})^2 - 0.01 * \frac{(2 * NVH_{fuel} * m_{fuel})}{(1 * K_3)}}$$

Where:

$(rpm_{final})max$	=	The maximum flywheel rotational speed allowed at the end of the test
$(rpm_{final})min$	=	The minimum flywheel rotational speed allowed at the end of the test
$(rpm_{initial})^2$	=	The squared flywheel rotational speed at the beginning of the test
NHV_{fuel}	=	Net heating value of consumable fuel, in Joules/kg
m_{fuel}	=	Total mass of fuel consumed during test, in kg
K_3	=	Conversion factor, 4□^{2}/(3600 sec^2-rpm^2)
I	=	Rated moment of inertia of the flywheel, in kg-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.

APPENDIX A-3

PROPOSED REGULATION ORDER

Zero Emission Vehicle Regulation: 2018 and Subsequent Model Years

Title 13, California Code of Regulations

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Appendix A-3
PROPOSED 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 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 40 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;

(B) ***Evaporative Emissions.*** Certify the vehicle to the evaporative emission standards in subdivision 1976(b)(1)(G);

(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 all electric R_{cda} capability will generate an allowance according to the following equation:

UDDS Test Cycle Range (R_{cda})	*Allowance*
<10 all electric miles	0.0
≥10 all electric miles	TZEV Credit = [(0.01) * R_{cda} + 0.3]
>80 miles (credit cap)	1.3

1. Allowance for US06 Capability. TZEVs with US06 all electric range capability (R_{cda}) 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.*** 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).

(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 80 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 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 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). Manufacturers may not use transportation system credits earned by ZEVs to comply with requirements specified in subdivision 1962.2(d)(5)(F)

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 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. Manufacturers may not use transportation system credits earned by TZEVs to comply with requirements specified in subdivision 1962.2(d)(5)(F)

(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. 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 May 1, 2018, 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(b)(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).

a. 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)

(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 <u>February 1, 2008</u> ~~December 1, 2004~~.

(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) "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).

(4) "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.

(5) "Hydrogen fuel cell vehicle" means a ZEV that is fueled primarily by hydrogen, but may also have off-vehicle charge capability.

(6) "Hydrogen internal combustion engine vehicle" means a TZEV that is fueled exclusively by hydrogen.

(7) "Majority ownership situations" means when one manufacturer owns another manufacturer more than 33.4%, for determination of size under CCR Section 1900.

(8) "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.

(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.

(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 DMV.

(11) "Proportional value" means the ratio of a manufacturer's California applicable sales volume to the manufacturer's Section 177 state applicable sales vome. In any given model year, the same applicable sales volume calculation method must be used to calculate proportional value.

(12) "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).

(13) "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).

(14) "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).

(15) "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.

(16) "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.
"$EAER_{u40}$" means the equivalent all-electric range that a 40 mile R_{cda} plug-in hybrid electric vehicle achieves.
"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
"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.
"UDDS" means urban dynamometer driving cycle.
"UF" means utility factor.
"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.

APPENDIX A-4

PROPOSED

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.]

Date of Release: December 7, 2011
Scheduled for Consideration: 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.

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.

"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.

"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" 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.

"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.

"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

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) 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]*

(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 40 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;

(b) *Evaporative Emissions.* Certify the vehicle to the evaporative emission standards in subdivision 1976(b)(1)(G);

(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 all electric R_{cda} capability will generate allowance according to the following equation:

UDDS Test Cycle Range (R_{cda})	*Allowance*
<10 all electric miles	0.0
≥10 miles range	TZEV Credit = [(0.01) * R_{cda} + 0.3]
>80 miles (credit cap)	1.3

(1) Allowance for US06 Capability. TZEVs with US06 all electric range capability (R_{cda}) 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) + 0.5

(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]*

(e) *Counting Specified ZEVs Placed in Service in a Section 177 State and in California.* 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).

(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 80 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 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 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). Manufacturers may not use transportation system credits earned by ZEVs to comply with requirements specified in subdivision C.4.5(f).

(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 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. Manufacturers may not use transportation system credits earned by TZEVs to comply with requirements specified in subdivision C.4.5(f).

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. 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 May 1, 2018, 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(b)(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 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).

a. 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).

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.

F. Test Procedures for 2012 and Subsequent Model Zero-Emission Vehicles (including Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles) and All 2012 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.

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°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 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.

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:

(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°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

G. Test Procedures for 2012 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 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 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°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 FG.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°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 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°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 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 °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 °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 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:

$$EAEREC_u\ (wh/mi) = \frac{E_{cd}}{EAER_u}$$

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:

$$EAEREC_h\ (wh/mi) = \frac{E_{cd}}{EAER_h}$$

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:

$$(Amp\text{-}hr_{final})_{min} = (Amp\text{-}hr_{initial}) - 0.01 * \left(\frac{NHV_{fuel} * m_{fuel}}{V_{system} * K_1}\right)$$

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.

11.9 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:

$$EAER_{u40}\ (\text{miles}) = \left(\frac{ERF_u \times 40\,mi}{100} \right)$$

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.

$$GHG_{highway} = \sum_{j=1}^{N_{highway}} (UF_j\} * (\frac{Y_{CD.j}}{D_j} + GHG_{cd.AC.j}) - \sum_{j=1}^{N_{highway}} (UF_i) * G_{upstream} + (1 - \sum_{j=1}^{N_{highway}} (UF_j)) * (Y_{cs.highway})$$

(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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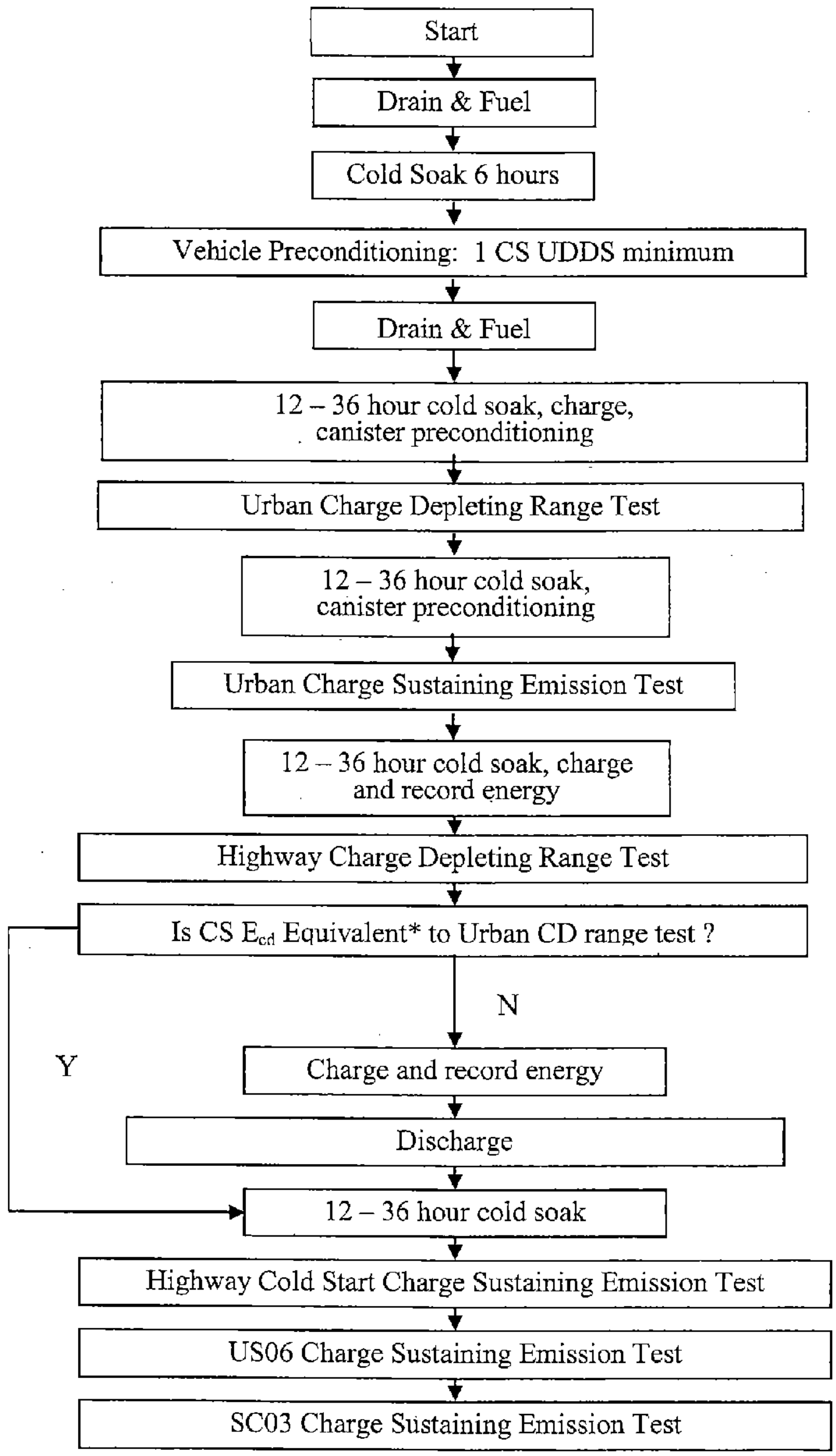
Off-Vehicle Charge Capable HEV Exhaust Emissions Test Sequence

* Equivalent to within ± 1% of AC energy used to charge battery to full state of charge



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

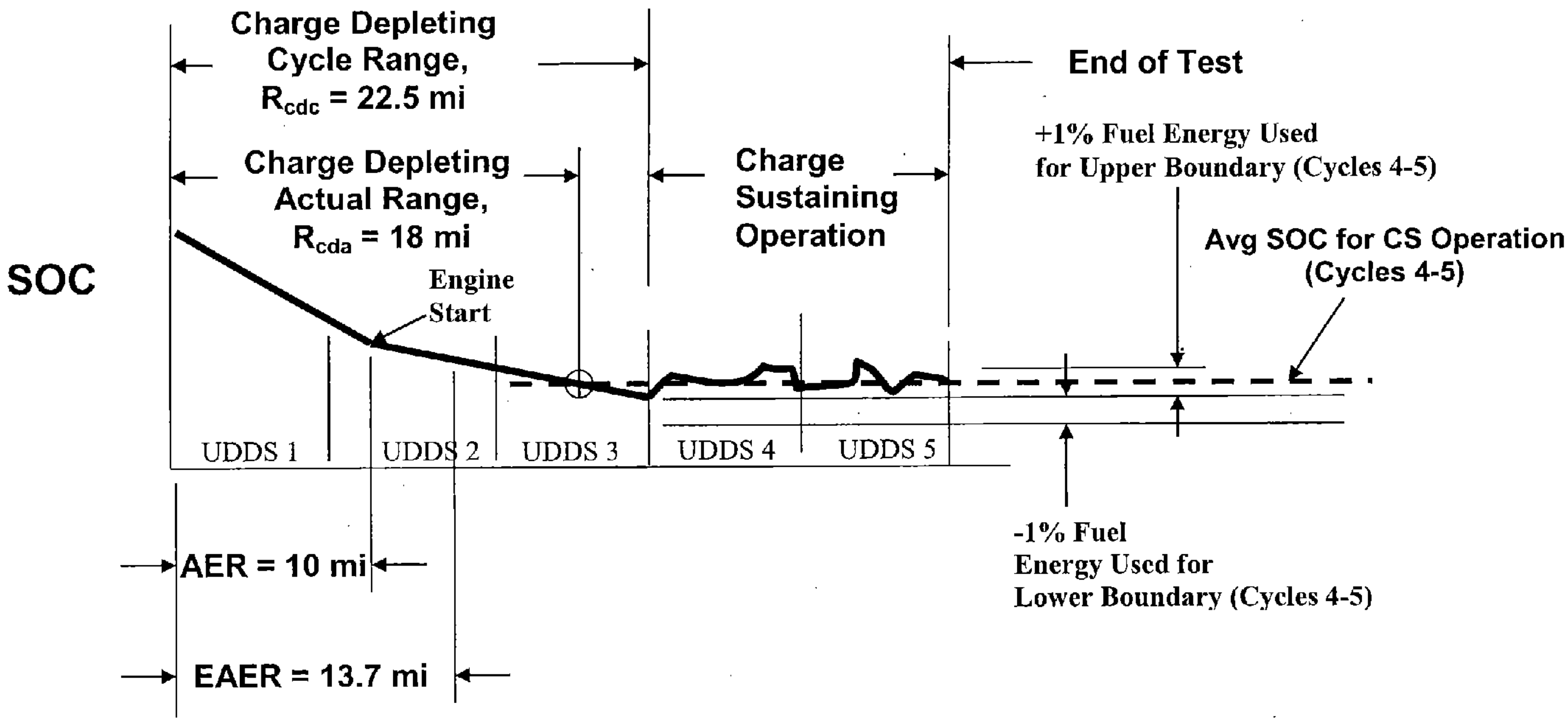
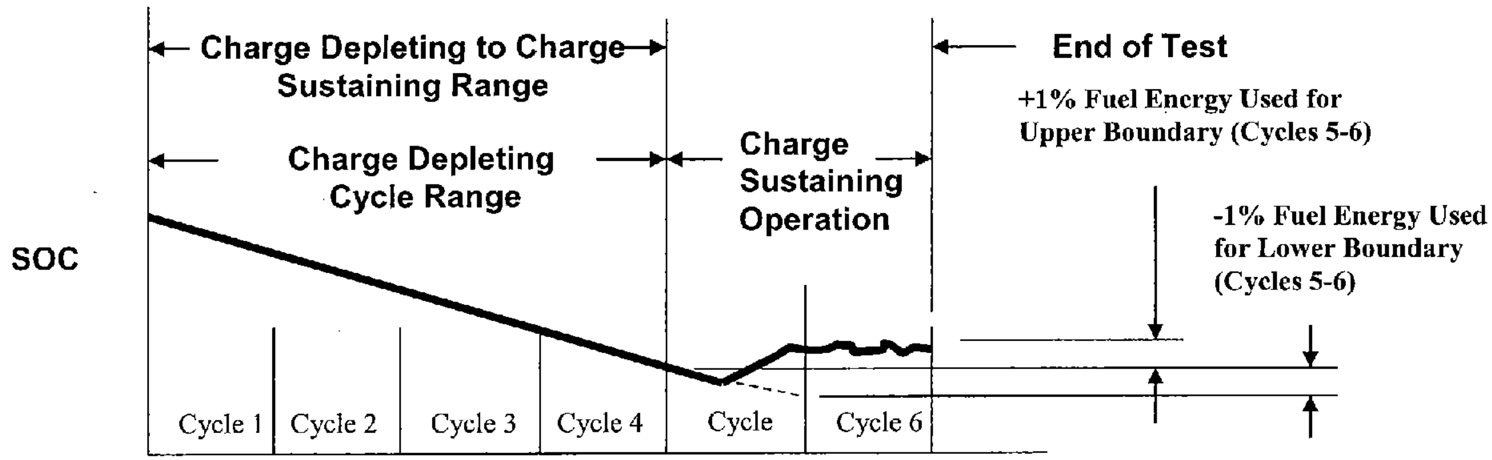


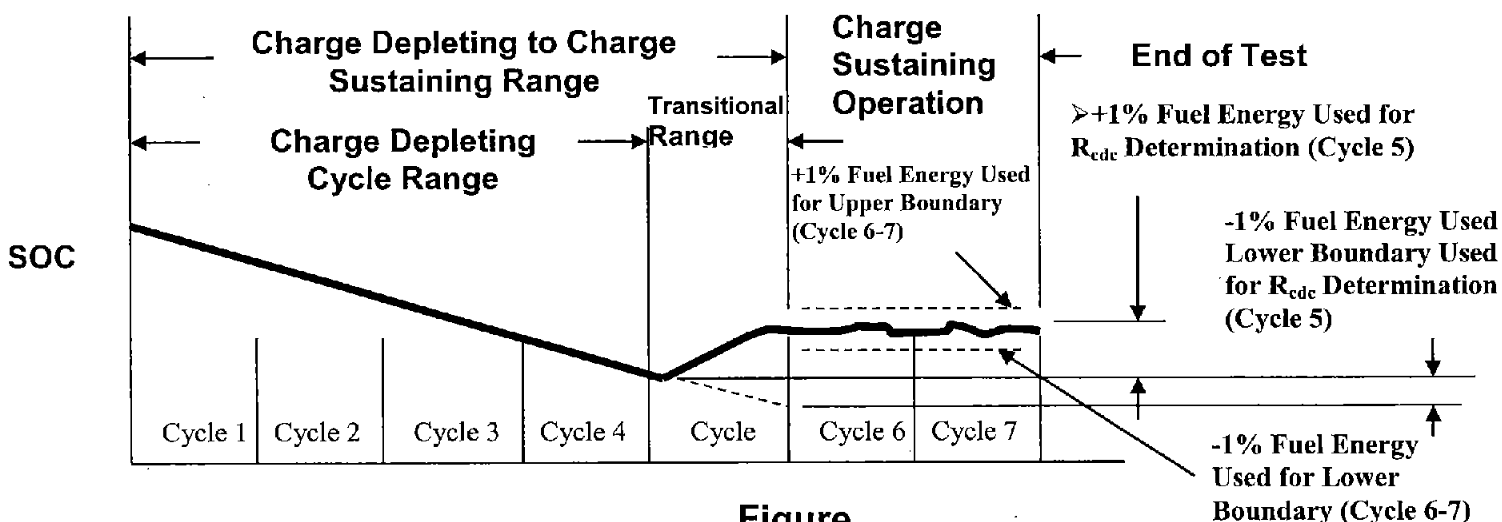
Figure 1

Date of Release: December 7, 2011
Scheduled for Consideration: 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

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°F and 86°F for a period of 20 minutes and dividing the grams of emissions by 20. The resulting grams per minute shall be multiplied by 3.0 minutes per mile for a grams per mile value.

6. Hybrid Electric Vehicle FTP Emission Test Provisions.

Alternative procedures may be used if shown to yield equivalent results and if approved in advance by the Executive Officer of the Air Resources Board.

6.1 Vehicle Preconditioning.

To be conducted pursuant to the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" 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:

(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
$(\text{Amp-hr}_{initial})$	=	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:

$$(rpm_{final})_{max} = \sqrt{(rpm_{initial})^2 + 0.01 * \frac{(2 * NVH_{fuel} * m_{fuel})}{(1 * K_3)}}$$

$$(rpm_{final})_{min} = \sqrt{(rpm_{initial})^2 - 0.01 * \frac{(2 * NVH_{fuel} * m_{fuel})}{(1 * K_3)}}$$

Where:

$(rpm_{final})max$	=	The maximum flywheel rotational speed allowed at the end of the test
$(rpm_{final})min$	=	The minimum flywheel rotational speed allowed at the end of the test
$(rpm_{initial})^2$	=	The squared flywheel rotational speed at the beginning of the test
NHV_{fuel}	=	Net heating value of consumable fuel, in Joules/kg
m_{fuel}	=	Total mass of fuel consumed during test, in kg
K_3	=	Conversion factor, 4□^{2}/(3600 sec^2-rpm^2)
I	=	Rated moment of inertia of the flywheel, in kg-m^2

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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 C.7.4. 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 Battery Electric Vehicles and hybrids – fuel fired heater (yes/no)
(k) For Fuel Cell Vehicles (FCVs), fuel cell stack: type, peak output, manufacturer and estimated design life.

APPENDIX A-5

PROPOSED REGULATION ORDER

Zero Emission Vehicle Regulation: Electric Vehicle Charging Requirements

Title 13, California Code of Regulations

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Appendix A-5
PROPOSED 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~~ JAN2010, SAE Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler, which is incorporated herein by reference. All such vehicles must be equipped with an on-board charger with a minimum output of 3.3 ~~kilovolt amps.~~kilowatts, or, sufficient power to enable a complete charge in less than 4 hours.

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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.

APPENDIX B

DRAFT ENVIRONMENTAL ANALYSIS FOR THE ADVANCED CLEAN CARS PROGRAM

APPENDIX B

Draft Environmental Analysis

prepared for the

Advanced Clean Cars Program

Analyzing Amendments to California's Low-Emission Vehicle Criteria Pollutant and Greenhouse Gas (LEV III), Zero Emission Vehicle (ZEV), and Clean Fuels Outlet (CFO) Regulations

California Air Resources Board
1001 I Street
Sacramento, California, 95812

Date of Release: December 7, 2011

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ES. EXECUTIVE SUMMARY

This document is an Environmental Analysis (EA) that evaluates the environmental impacts of the proposed Advanced Clean Cars (ACC) Program. The proposed ACC Program represents a new approach to controlling emissions from passenger vehicles, i.e., passenger cars (PCs), light-duty trucks (LDTs), and medium-duty vehicles (MDVs), by combining the control of smog and soot "criteria" air pollutants and their precursors, toxic air contaminants, and greenhouse gases (GHGs) into a coordinated regulatory package. Thus, the EA structure and analysis recognize the interdependent technologies that manufacturers would apply to passenger motor vehicles to respond to the coordinated regulatory program as a whole, along with the resultant environmental impacts.

A. OVERVIEW OF ADVANCED CLEAN CARS PROGRAM

Despite significant progress in reducing smog-forming and particulate matter emissions from the passenger vehicle fleet, California needs further reductions to meet health-based, State and federal ambient air quality standards. In addition, climate change continues to pose a serious threat to the economic well-being, public health, natural resources, and the environment of California.

To address the challenge presented by climate change and to meet the State's goal of an 80 percent reduction in GHG emissions by 2050, as expressed in Executive Order S-3-05, vehicular GHG emissions must be drastically reduced. This 40-year outlook is a far longer time horizon than those employed by the federal agencies under the Clean Air Act (CAA), or federal agency requirements to develop corporate average fuel economy (CAFE) standards. Policies developed under this longer timeframe deliver a continuous message to both the manufacturers and consumers that California is committed to significant changes to clean up the cars and lights trucks we drive.

Over the past three years California has worked with federal agencies to ensure that stringent criteria pollutant and GHG standards for light- and medium-duty vehicles, if adopted, will help achieve the dramatic reductions that meet California's needs. Together, these standards will provide consumers with the next generation of vehicles, designed to reduce multiple pollutants, while preserving vehicle choice and saving money.

1. California's Advanced Clean Cars Program and Its Economic Benefits

Continuing its leadership role in developing innovative and ground-breaking emission control programs, Air Resources Board (ARB) staff has developed the ACC Program. It is a pioneering approach consisting of a "package" of regulations that, although separately constructed, reflect prior practice and achieve synergy by addressing both ambient air quality needs and climate change in a coordinated manner.

The ACC Program combines three programs to control smog-forming, particulate matter, TAC, and GHG emissions in a single coordinated package of requirements for model years 2015 through 2025. One goal is to promote the development of environmentally superior cars that will continue to deliver the performance, utility, and safety vehicle owners have come to expect. The three programs involve amendments to existing regulations for Low-Emission Vehicles (LEV III), Zero Emission Vehicles (ZEV), and Clean Fuels Outlets (CFO). To achieve further criteria emission reductions from the passenger vehicle fleet, staff is proposing several amendments representing a significant strengthening of the existing LEV program. The LEV amendments include improvements to consumer labeling, patterned on California's revolutionary environmental performance label (EPL), to provide important emissions information in a graphical, easy-to-understand format. The ZEV program will act to focus vehicle technology development by requiring manufacturers to produce increasing numbers of ZEVs and plug-in hybrid electric vehicles in the 2018-2025 model years. Proposed amendments to the CFO regulation that will assure ultra-clean fuels, such as hydrogen, are available to meet vehicle demands resulting from the projected increase in number of ZEVs operating in the State.

The proposed ACC Program is intended to generate economic benefits for California. The State is a clear leader in innovation and venture capital investment, which will benefit from the ACC package. California received over half of all clean-tech venture capital investments in the U.S. in the last quarter and is well poised to continue to serve as an economic hub for technology and job creation related to clean vehicles in the coming years. These regulations, especially the ZEV rules, are creating the jobs of the 21st century now in California.

Three innovative automakers have opened businesses in California, and are pushing the market forward, creating jobs in the process. Tesla Motors has resurrected auto manufacturing in California by purchasing and retooling the former NUMMI plant in Fremont, California to produce its Model S sedan. Operation of the Tesla facility is expected to create about 1,000 manufacturing jobs. CODA Automotive opened its new global headquarters in Los Angeles, which will allow the company to grow significantly in coming years. The company also has an assembly plant in Benicia, California, where final assembly of its sedan occurs. Southern California is also home to the global headquarters of ZEV producer, Fisker Automotive, as well as engineering and design facilities for many larger automakers and their clean cars programs.

In addition to job-forming benefits through the automakers, additional economic benefit can be derived from other employment generation and from the effects of the ACC Program on reduced fuel and vehicle operating costs for consumers. The job and economic center of the plug-in electric vehicle charging sector is in California, which is expected to produce additional jobs in the State. In the tradition of California's innovation-driven economy, these companies are helping to develop the early market for ZEVs with novel financing and charging options. Fuel cost savings and other vehicle operating cost savings will materialize for the California consumer as a result of the ACC Program. Cost savings increase consumer purchasing power over time by returning funds to them for other economic purposes. The resulting effect can be an overall increase in economic output and job creation in the State. As the vehicle fleet and fuels industry respond to the new standards, economic modeling suggests an increasingly positive economic impact to the State, leading to thousands of additional jobs this decade, and tens of thousands in the next.

2. Greenhouse Gas Emissions Goals

Recognizing the increasing threat of climate change to the well-being of Californians and the environment, in 2002 the Legislature adopted and the Governor signed AB 1493 (Chapter 200, Statutes 2002, Pavley). AB 1493 directed ARB to adopt the maximum feasible and cost-effective reductions in GHG emissions from light-duty vehicles. Vehicle GHG emissions included carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) that are emitted from the tailpipe, as well as emissions of HFC134a, the refrigerant then used in most vehicle air conditioning systems.

As directed by AB 1493, ARB adopted what is commonly called the Pavley regulations, the first in the nation to require significant reductions of GHGs from motor vehicles. These regulations, covering the 2009 - 2016 and later model years, call for a 17 percent overall reduction in GHG emissions from the light-duty fleet by 2020 and a 25 percent overall reduction by 2030. They also formed the foundation for the federal GHG and fuel economy programs for light-duty vehicles for 2012-2016 model years.

After the Board adopted the Pavley regulations, the Legislature adopted and the Governor signed AB 32, the California Global Warming Solutions Act (Chapter 488, Statutes 2006, Nuñez/Pavley.) AB 32 charges ARB with the responsibility of monitoring and regulating GHG emissions in the State. AB 32 also directed ARB to prepare a Scoping Plan outlining the State's strategy to achieve the maximum feasible and cost-effective reductions in furtherance of reducing GHG emissions to 1990 levels by 2020. Measure T1 of the Scoping Plan anticipates an additional 3.8 million metric tons of carbon dioxide equivalent (MMT CO_2e) reduction from the passenger vehicle fleet by 2020 beyond the reductions from the 2009 - 2016 AB 1493 standards.

Although originally part of the LEV program, ARB established the ZEV program as a stand-alone regulation in 1999, in recognition of the increasing maturity of zero emission technologies and the critical role they can play in achieving California's air quality standards and GHG reduction goals. Since then, the program has been modified several times to address the pace of development of zero emission technologies. At its March 2008 hearing, the Board directed staff to redesign the 2015 and later model year ZEV program by strengthening the requirement and focusing primarily on zero emission technologies, i.e., battery electric vehicles (BEV), hydrogen fuel cell vehicles (HFCV), and plug-in hybrid electric vehicles, to ensure that these low GHG technology vehicles transition from the demonstration phase to full commercialization in a reasonable timeframe to meet long-term emission reduction goals.

Beyond 2025, the driving force for lowering GHG emissions in California will be climate change. To meet the State's 80 percent GHG reduction goal by 2050, the new vehicle feet will need to be primarily composed of advanced technology vehicles by 2035 to have nearly an entire advanced technology fleet by 2050, including both new and used vehicles. Accordingly, the ACC Program coordinates the goals of the LEV, ZEV, and CFO programs to lay the foundation for the commercialization and support of these ultra-clean vehicles.

3. Criteria Emission Standards

To achieve further criteria emission reductions from the passenger vehicle fleet, ARB staff is proposing several amendments representing a significant strengthening of the LEV program. The major elements of the proposed LEV III program are:

- A reduction of fleet average emissions of new PCs, LDTs, and medium-duty passenger vehicles (MDPVs) to super ultra-low-emission vehicle (SULEV) levels by 2025.
- The replacement of separate NMOG and oxides of nitrogen (NO_x) standards with combined NMOG plus NO_x standards. The combined ROG and NOx standard will decline (e.g., from 0.100 for passenger cars and light-duty trucks and 0.119 for light-duty trucks and medium-duty passenger vehicles in 2015 to 0.030 for all vehicle categories by 2030).
- More stringent particulate matter (PM) standards for light- and medium-duty vehicles.
- An increase of full useful life durability requirements from 120,000 miles to 150,000 miles, which guarantees vehicles operate longer at these extremely low emission particulate levels.
- A backstop to assure continued production of super ultra-low-emission vehicles after PZEVs as a category is moved from the ZEV to the LEV program in 2018.
- Zero fuel evaporative emission standards for PCs and LDTs, and more stringent evaporative standards for MDVs.

4. Greenhouse Gas Emission Standards

For the 2017 - 2025 model year standards, ARB proposes to use the U. S. Environmental Protection Agency (U.S. EPA) approach and adopt separate standards for CO_2, CH_4, and N_2O. The proposed GHG emission standards would reduce new passenger vehicles carbon dioxide (CO_2) emissions from their model year 2016 levels by approximately 34 percent by model year 2025, from about 251 to about 166 grams of CO_2 per mile (gCO_2/mile), based on the projected mix of vehicles sold in California. The basic structure of the standards includes two categories, passenger cars and light-duty trucks that are consistent with federal categories for light-duty vehicles. The standard targets would reduce car CO_2 emissions by about 36 percent and truck CO_2 emissions by about 32 percent from model year 2016 through 2025.

The CH_4 and N_2O standards will reflect the same stringency as the original GHG standards. The net result is, like the current 2009 - 2016 California GHG standards, the proposed 2017 - 2025 standards account for all major sources of vehicle GHG emissions, including upstream emissions associated with vehicle fuels. In addition, California is proposing to align its vehicle air conditioning system requirements with federal requirements.

5. Phasing In Maximum Feasible and Cost-Effective Technologies

Vehicle manufacturers need sufficient lead time to implement new technologies across their vehicle lines both from a feasibility and cost-effectiveness standpoint. Manufacturers will be resource challenged over the next 15 years as they strive to develop and implement technologies ranging from advanced gasoline and diesel engines to electric and fuel cell vehicles, while at the same time lowering criteria emissions of their combustion engines. The phase-in of the ACC Program requirements recognizes this by providing manufacturers with significant lead time and considerable compliance flexibility.

The technology for controlling vehicle emissions is well understood and manufacturers have a wide range of emission control technologies available to achieve "near-zero-at-the-tailpipe" (SULEV) emissions. Many of these technologies are already being used today on vehicles meeting LEV II requirements, and staff anticipates that with ongoing improvements to the effectiveness of these technologies, particularly catalyst technology, manufacturers will be able to meet the proposed requirements for smog forming emissions under the LEV III element of the ACC package. For some vehicles, specifically the heavier vehicles with larger displacement engines, additional emission control componentry, such as secondary air and hydrocarbon absorbers may be required to achieve the proposed emission levels.

The proposed GHG standards are also predicated on many existing and emerging technologies that increase engine and transmission efficiency, reduce vehicle energy loads, improve auxiliary and accessory efficiency, and recognize increasingly electrified vehicle subsystems with hybrid and electric drivetrains. Many technologies reduce both criteria emissions and GHGs, with this synergy enhancing technologies, cost effectiveness and demonstrating the importance of California analyzing the passenger vehicle fleet program as a whole.

Previous rulemakings (i.e., California's 2009 - 2016 and federal 2012 - 2016 standards) established an original technical basis for the proposed GHG standards. This rulemaking builds on this existing technical foundation with new technical data and the understanding of evolving state-of-the-art engine, transmission, hybrid, and electric-drive technologies. As part of this effort, and without conceding any of California's separate authority, staff has been working with the U.S. EPA and the National Highway Traffic Safety Administration (NHTSA) since early last year to develop a unified national GHG program for motor vehicles beyond 2016. Importantly, while California proposes accepting national program compliance at manufacturers' option, California is doing so because it believes the proposed standards are stringent enough to meet State GHG emission reduction goals.

B. Environmental Impacts

The EA presents a programmatic evaluation of a full range of environmental impact topics related to implementation the proposed ACC Program. The EA discusses both beneficial and adverse effects on the environment as a result of the projected compliance responses to the proposed regulatory amendments, such as changes in State's vehicle fleet mix, uses of different technologies, construction of fuel outlets and relevant manufacturing facilities, and resulting reductions of pollutant emissions. A summary of key findings is presented below.

1. Criteria Emissions Reductions

Reduction of criteria air pollutant emissions is a substantial, beneficial, environmental impact of implementing the ACC Program. Table ES-1 provides the emission benefits for calendar years 2023, 2025, 2035, and 2040 for the criteria pollutants, reactive organic gas (ROG), oxides of nitrogen (NO_X), and particulate matter ($PM_{2.5}$) respectively. Emission benefits are fully realized in the 2035 - 2040 timeframe when nearly all vehicles operating in the fleet are expected to be compliant with the proposed ACC standards. By 2035, statewide ROG emissions would be reduced by an additional 34 percent, NOx emissions by an additional 37 percent, and $PM_{2.5}$ emissions by 10 percent from the baseline.

Table ES-1 Statewide Emission Benefits of the ACC Program: Reactive Organic Gas (ROG), Oxides of Nitrogen (NO_X) and Particulate Matter ($PM_{2.5}$)

Calendar Year	Adjusted Baseline	Proposed Regulation	Benefits	Percent Reduction
Statewide ROG (tons/day)				
2023	189.6	182.9	6.6	3%
2025	175.5	164.44	11.1	6%
2035	141.1	93.6	47.4	34%
Statewide NO_X (tons/day)				
2023	201.3	185.6	15.7	8%
2025	183.6	161.2	22.4	12%
2035	136.8	86.4	50.4	37%
Statewide $PM_{2.5}$ (tons/day)				
2023	26.7	26.0	0.6	2%

Table ES-1 Statewide Emission Benefits of the ACC Program: Reactive Organic Gas (ROG), Oxides of Nitrogen (NO_X) and Particulate Matter ($PM_{2.5}$)				
Calendar Year	Adjusted Baseline	Proposed Regulation	Benefits	Percent Reduction
2025	27.2	26.3	0.9	3%
2035	29.7	26.8	2.9	10%

2. GHG Emission Reductions

Reduction of GHG emissions is another substantial, beneficial, environmental impact of implementing the proposed ACC Program, including reductions in CAPs, GHG, and TACs. Table ES-2 provides the emission benefits for calendar years 2020, 2025, 2035, and 2050 for GHG. By 2025, CO_2 equivalent emissions would be reduced by almost 14 Million Metric Tons (MMT) per year, which is 12 percent from baseline levels. Carbon dioxide equivalent is a standardized measurement unit used to compare the emissions from various GHGs based upon their global warming potential. 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/Year, 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.

Table ES-2 Statewide GHG Emission Benefits of the ACC Program (with Rebound)				
Calendar Year	Adjusted Baseline	Proposed Regulation	Benefits	Percent Reduction
Statewide GHG Emissions (tons/day)				
2020	111.2	108.1	3.1	3%
2025	109.9	96.3	13.7	12%
2035	114.8	83.2	31.5	27%
2050	131.0	88.3	42.7	33%

3. Other Environmental Impacts

In addition to the analysis of changes in air pollutant emissions, the EA evaluates the potential direct and indirect environmental effects of implementation of the proposed ACC Program in relation to a full spectrum of other environmental resources topics. The primary sources of these impacts are the compliance responses to the proposed regulatory amendments that cause changes in the physical environment. Potential changes to the physical environment would result primarily from landscape disturbance occurring from constructing and operating fueling facilities required for compliance with the proposed CFO regulation amendments or battery manufacturing facilities expected to be needed to achieve compliance with the proposed ZEV regulation amendments.

The EA examined all the environmental topics presented in the environmental checklist contained in Appendix G of the CEQA Guidelines. When potentially significant environmental impacts are identified, feasible mitigation measures have been presented to substantially reduce the effects. ARB does not, however, possess the authority to require project-specific mitigation measures for facilities approved by other land use or permitting agencies. 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. 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.

Among the range of environmental issues addressed in the EA, the following topics contained potentially significant environmental effects that may be unavoidable: aesthetics, biology, cultural resources, geology and soils, hazards (accidental releases), hydrology and water quality, noise, traffic (construction), and utilities. Only less-than-significant environmental effects would occur related to the following topics: agriculture and forest resources, land use and planning, mineral resources, population and housing, and recreation. As noted previously, substantial beneficial environmental effects would result from implementation of the proposed ACC Program related to air quality and GHG emissions.

1.0 INTRODUCTION AND BACKGROUND

This document is an Environmental Analysis (EA) that provides an evaluation of the environmental impacts of the proposed Advanced Clean Cars (ACC) Program. The proposed ACC Program represents a new approach to controlling emissions from passenger vehicles (i.e., passenger cars [PC], light-duty trucks [LDT1 and LDT2], and medium-duty vehicles [MDV]) by combining the control of smog-causing, toxic air contaminants (TACs), criteria air pollutants and precursors (CAPs) and greenhouse gas (GHGs) into a single coordinated regulatory package.

The proposed ACC Program consists of amendments to the following regulations:

- Low-Emission Vehicle Criteria Pollutant and Greenhouse Gas (LEV III),
- Zero Emission Vehicle (ZEV), and
- Clean Fuels Outlet (CFO).

The proposed California Evaporative Emission Regulations; Manufacturer Size Definition Changes; Environmental Performance Label (EPL); On-Board Diagnostic System Requirement for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines; and the E10 Certification Fuel are part of LEV III.

Additional details about the proposed amendments to these regulations are provided in Chapter III (Project Description). Three separate Regulatory Notices and Staff Reports (Initial Statement of Reasons) have been prepared for these proposed LEV III, ZEV, and CFO amendments and will be presented to the Board with a single coordinated analysis of emissions and the associated environmental impacts and benefits as presented in this EA.

If adopted, the proposed regulatory amendments would integrate the requirements for reducing CAPs and GHGs from cars and light-duty trucks for model years 2015- 2025 in California. These requirements would apply to the vehicle types listed in Table 1-1. For the purposes of this environmental impact analysis, these vehicle classes are collectively referred to as "light- and medium-duty vehicles."

A description of the background, standards, and requirements of the existing LEV I and II, ZEV, and CFO regulations, along with detailed information about the proposed amendments, is also provided in the respective Staff Reports.

Table 1-1. Vehicle Types Subject to the Advanced Clean Cars Program	
Vehicle Type	**Example Models**
Passenger Cars (all weights)	Honda Fit, Ford Fusion, Chrysler 300, Chrysler Sebring, Chevrolet Malibu, Toyota Camry, Dodge Avenger
Light-Duty Trucks	
Light-Duty Truck 1 (0-3,750 lb LVW)	Ford Ranger, Ford Escape, Toyota RAV4, Jeep Compass, Hyundai Tucson, Mitsubishi Outlander, Nissan Rogue
Light-Duty Truck 2 (3,751 lb LVW – 8,500 lb GVWR)	Ford F150, Chevrolet Tahoe, Dodge Caravan
Medium-Duty Vehicles (8,501 – 14,000 lb GVWR)	Ford F250 and F350 Ford Club Wagon, Chevrolet 2500 and 3500 Silverado, GMC 2500 and 3500 Sierra, and Savana and Express Vans, Chrysler 2500 and 3500 Ram Trucks
Notes: There are several classifications for vehicles based on weight. Different measures of weight are considered. Curb weight is defined as the actual weight of the vehicle without carrying any load. Loaded vehicle weight (LVW) is defined as the curb weight plus 300 pounds (lb). Gross vehicle weight rating (GVWR) is the maximum, designed loaded weight of the vehicle. This means the curb weight of the vehicle plus a full payload.	

A. ARB's Certified Regulatory Program and Environmentally Mandated Projects under the California Environmental Quality Act

1. CEQA Requirements Under ARB's Certified Regulatory Program

The California Air Resources Board (ARB or the Board) is the lead agency for the proposed ACC Program and has prepared this EA pursuant to its California Environmental Quality Act (CEQA) Certified Regulatory Program. Public Resources Code (PRC) Section 21080.5 allows public agencies with regulatory programs to prepare a plan or other written document in lieu of an environmental impact report or negative declaration once the Secretary of the Resources Agency has certified the regulatory program. ARB's regulatory program was certified by the Secretary of the Resources Agency (California Code of Regulation [CCR], Title 14, hereafter "CEQA Guidelines" Section 15251[d]). As required by ARB's Certified Regulatory Program, and the policy and substantive requirements of CEQA, ARB has prepared this EA to assess the potential for significant adverse and beneficial environmental impacts associated with the proposed action and to provide a succinct analysis of those impacts (CCR, Title 17, Section 60005[a] and [b]). The resource areas from the CEQA Guidelines Environmental Checklist (Appendix G) were used as a framework for assessing potentially significant impacts. In accordance with ARB's Certified Regulatory Program, for proposed regulations this EA is included in the package prepared for the rulemaking (CCR, Title 17, Section 60005).

ARB has determined that adoption and implementation of the proposed ACC Program is a "project" as defined by CEQA. CEQA Guidelines (CCR, Title 14, Section 15378[a]) defines a project as "the whole of an action, which has a potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment, and that is ... an activity directly undertaken by any public agency." Although the policy aspects and regulation amendments of the proposed ACC Program do not directly change the physical environment, the proposed ACC Program qualifies as a project under CEQA because it has the potential to result in a reasonably foreseeable indirect physical change in the environment from compliance responses to the regulations.

Furthermore, the requirements of PRC Section 21159 apply when ARB adopts a rule or regulation requiring the installation of pollution control equipment, or a performance standard or treatment requirement. For such projects, the CEQA Guidelines (CCR, Title 14, Section 15187) require ARB to conduct "an environmental analysis of the reasonably foreseeable methods by which compliance with that rule or regulation will be achieved." The analysis shall include reasonably foreseeable environmental impacts of the methods of compliance, reasonably foreseeable feasible mitigation measures related to significant impacts, and reasonably foreseeable alternative means of compliance that would avoid or eliminate significant impacts. The analysis should not engage in speculation and the detail of a project-level analysis is not required.

2. Public Review Process for the EA

In accordance with CCR, Title 17, Sections 60005 and 60007 and consistent with ARB's commitment to public review and input on regulatory actions, this EA is subject to a public review process through the posting of a Staff Report. The Staff Report, including this EA, is being posted for a public review period that begins on December 12, 2011 and ends at the close of the hearing on this item at the Board's regularly scheduled hearing set for January 26, 2012. This period complies with regulatory requirements for a minimum 45-day public review.

To conclude the public review period, the Board will hold a hearing on the proposed regulations. At the hearing, the Board will consider the Staff Report, including the EA and public comments received during the review period. The Board may accept, modify, or reject the staff recommendation for the proposed ACC Program. If modifications are requested, staff will address the changes and release the revised package, or relevant parts thereof, for one or more additional 15-day review and comment periods. At the conclusion of review(s), staff will compile all comments and responses, including any comments on the EA. The comments and written responses to comments, including environmental comments, will be incorporated into the Final Statement of Reasons (FSOR) for the regulation.

When the FSOR and full regulatory package are completed, including all public comments and responses to comments, they will be reviewed for final consideration and action at a subsequent Board meeting prior to transmittal to the Executive Officer and forwarding to the Office of Administrative Law for processing. However, because the U. S. Environmental Protection Agency (U.S. EPA) is concurrently working on a National Program and this program may influence ARB's decision, the conclusion of

ARB's consideration of the proposed ACC Program in California may be affected by the progress and outcome of relevant federal rulemakings announced for completion in 2012. Consequently, the Board may reserve its final action on this proposed regulation, including consideration of the EA and written responses to environmental comments, until after the federal rulemakings are substantially complete.

If the regulations are adopted, a Notice of Decision will be posted on ARB's website and filed with the Secretary of the Natural Resources Agency for public inspection.

B. Project Background

1. Previous Rulemakings

Light- and medium-duty vehicles are major contributors to emissions of CAPs and GHGs in California, and further reductions are needed for California to achieve mandated national and State ambient air quality standards for CAPs. GHG emission reductions are also needed from these vehicles to help meet the mandate established by Assembly Bill (AB) 32, Statutes of 2006. AB 32 calls for the reduction in statewide GHG emissions to 1990 levels by 2020. Additionally, former Governor Schwarzenegger's Executive Order S-3-05 requires further reductions of statewide GHG emissions to 80 percent below 1990 levels by 2050. Finally, AB 1493 (Chap. 200, Statutes of 2002) requires GHG emission reductions from California's passenger fleet.

Traditionally, CAPs from these vehicles have been controlled by two regulatory programs: 1) the LEV regulations designed to maximize emission reductions from light- and medium-duty vehicles and 2) ZEV regulations designed to encourage the development of very clean, advanced vehicle technologies. While operating essentially as separate regulations, significant synergies exist between the LEV and ZEV regulations, as well as between these vehicle programs and the CFO fuels program.

The previous LEV, ZEV, and CFO rulemakings are discussed in greater detail below.

a. Low-Emission Vehicle Criteria Pollutant and Greenhouse Gas (LEV III)

i. Criteria Pollutants

The LEV regulation was first adopted in 1990 and is now commonly referred to as LEV I. LEV I phased in a set of fleet-average emission standards for CAPs emitted by light-duty vehicles for model years 1994-2003, including PCs, LDTs, and MDVs. In 1999, ARB adopted a set of amendments to the LEV I regulation, known as LEV II. LEV II established a set of emission standards for model years 2004-2010 that were generally more stringent than the standards under LEV I and required the then increasingly popular class of sport utility vehicles (SUVs) to meet the same emission standards as passenger cars. The standards established by LEV II are in effect today. The requirements of LEV I and LEV II are included in CCR, Title 13, Sections

1960 - 1962, respectively. LEV-certified vehicles must also meet the evaporative standards in CCR, Title 13, Section 1976(b).

The CAPs regulated under LEV II include non-methane organic gas (NMOG), carbon monoxide (CO), oxides of nitrogen (NO_X), particulate matter, and non-methane hydrocarbons (NMHC). Formaldehyde, which is a TAC, is also regulated. LEV II addresses both exhaust emissions from vehicle tailpipes and evaporative emissions, which occur when fuel contained in the vehicle's fuel system evaporates and escapes into the surrounding air. LEV II also includes tailpipe emission standards for particulate matter generated by motor vehicles. LEV II also amended the test procedures required for manufacturers to demonstrate compliance. The California Supplemental Federal Test Procedure (SFTP) that addressed emissions resulting from aggressive operation, typified by high speeds and hard accelerations, and from air conditioner (AC) use was also adopted.

LEV II contains two major elements. One element consists of emission standard tiers to which various vehicle classes must certify. The other element consists of fleet-average emission standards. Fleet-average emission standards apply to the average emission rates of the various vehicle models marketed by a manufacturer, weighted by the number of vehicles sold or leased by the manufacturer in each vehicle class. Both the vehicle emission standards and fleet-average emission standards of LEV II became increasingly stringent for later model years from 2004 to 2010.

In meeting the fleet-average standards, manufacturers may certify their vehicles to any of the applicable emission standards as long as the fleet-average emissions of their new vehicles meet the fleet-average emission requirements for that model year. This flexibility enables a manufacturer to sell some higher-emitting vehicle models as long as enough lower-emitting vehicle models are sold to achieve the applicable fleet-average emission standards for the particular vehicle type and model year. Generally, the fleet-average emission standards differ according to the vehicle type (e.g., PC, LDT1, LDT2) and weight class (e.g., 0-3,750 lb LVW, 3,750 lb LVW-8,500 lb GVWR) and are more stringent for each newer model year vehicle. MDVs are also provided a tier of emission standards, but instead of a fleet-average requirement, they must certify an increasing percentage of their MDVs to more stringent emission tiers. The different types of vehicles subject to LEV II include PC and LDT1, and LDT2 and the fleet-average emission standards are expressed in units of grams per mile (g/mi).

The emission standards under LEV II also account for the "durability basis" of each vehicle type to address the fact that vehicles tend to generate higher emissions as they age. For instance, a fleet of light-duty vehicles with a GVWR less than 8,501 lb was required to meet an intermediate full useful life standard during the first 50,000 miles of the vehicle's life and slightly less stringent full useful life standard before it reaches 120,000 miles. Manufacturers are also subject to in-use emission verification of their vehicles; those vehicles failing to meet the certified emission standards are subject to recall by the manufacturer for corrective action. Manufacturers are also required to warrant the performance of all emission control systems.

The emission standards of LEV II are sophisticated in a number of ways to meet two basic objectives. One objective is to establish standards that achieve the maximally feasible emission reductions based on the state of motor vehicle technologies at the time. The other objective is to maintain competitive parity among the different vehicle manufacturers while allowing them to be responsive to market demands. For this reason, some of the requirements under LEV II are different for small-, intermediate- and large-volume manufacturers. Compliance with LEV II also involves different tiers of vehicle emissions performance, including LEVs, Ultra-Low-Emission Vehicles (ULEVs), and Super-Ultra-Low-Emission Vehicles (SULEVs). In complying with LEV II, each manufacturer earns emission credits if it over-complies with the fleet-average standards and emission debits if it fails to meet the fleet-average standard. Any credits accrued by the manufacturer can be banked for future use, used to offset any debits accrued by the manufacturer, or sold to another manufacturer. If a manufacturer has not earned sufficient credits to offset any accrued debits, it may purchase credits, if available from another willing manufacturer, or be subject to fiscal penalties.

The emission standards that apply to model year 2010 also apply to all subsequent newer model years, and therefore, are in effect at the time of writing this EA. All emission standards were and are equivalent to, or more stringent than, comparable emission standards established by U.S. EPA.

ii. Greenhouse Gases

In 2005, requirements to reduce GHG emissions from all PCs, LDTs, and medium-duty passenger vehicles (MDPVs) were incorporated into the LEV II regulation. These additional requirements, generally known as the Pavley regulations (AB 1493), apply to model years 2009-2016 and, thus, continue to be phased in at the time of writing this EA. These are also fleet-average standards and are expressed in units of g/mi of carbon dioxide equivalent (CO_2e). Expressing emissions in CO_2e takes the contributions of all GHG emissions to the greenhouse effect and converts them to a single unit equivalent, recognizing the varying global warming potential (GWP) of different GHGs. . The specific GHG emission standards incorporated into LEV II are found in CCR, Title 13, Section 1961.1.

The Pavley regulations takes into consideration that AC refrigerant leakage (i.e., direct emissions) and fuel use to power AC system usage (i.e., indirect emissions) increase GHG emissions. The rule provides credits as incentives to improve the leak-tightness and efficiency of AC systems.

Direct emissions of refrigerant contribute substantially to GHG emissions because of the high GWP of the refrigerant. The predominant refrigerant currently in use, hydrofluorocarbon-134a (HFC-134a, also referred to as R-134a, 1,1,1,2-tetrafluoroethane), is a potent GHG with a GWP of 1,430 (IPCC 2007b) (i.e., 1430 times as heat-trapping by weight as CO_2). It can slowly leak out of the AC system in a manner that may occur in any closed high-pressure system, such as permeation through hoses and seepage through fittings, connections, and seals. Larger loss may occur during accidents, maintenance and servicing, and vehicle disposal at the end of useful life. The Pavley regulations grant direct AC credit of up to 6 g/mi of CO_2e, if the manufacturer can demonstrate that the AC system meets a suite of low-leak requirements. These requirements include use of fitting technologies less prone to leakage and misassembling, low permeability hoses, and multiple lips to seal the shaft for a belt-driven compressor. A greater credit of up to 9 g/mi of CO_2e can be granted, if the AC is manufactured to use an alternative refrigerant with a low GWP.

Indirect emissions occur because use of an AC system in a vehicle adds a load to the engine, resulting in increased tailpipe emissions or, in the case of plug-in electric vehicles, decreased all-electric range. The Pavley regulations grant indirect AC credits of up to 9 g/mi of CO_2e for systems with single-evaporator configuration and up to 11 g/mi of CO_2e for systems with a dual-evaporator configuration, if the manufacturer can demonstrate that the AC system meets specific efficiency requirements. To receive credits the AC system must have management of outside and recirculated air; be optimized for efficiency by utilizing state-of-the-art, high efficiency evaporators, condensers, and other components; and have an externally controlled compressor that adjusts evaporative temperature to minimize the necessity of reheating cold air to satisfy occupant comfort. If all of these criteria are met, manufacturers are awarded credits that are prorated based on the size of the compressor.

The Pavley regulations also provides credits for the sale of alternatively fueled (e.g., E85) vehicles to the extent shown to be running on that fuel.

The GHG requirements under the LEV regulation also form the basis for federal GHG requirements for model years 2012-2016, which were finalized by U.S. EPA and the National Highway Traffic Safety Administration (NHTSA) in April, 2010 (75 Fed. Reg. 25324 [May 7, 2010]).

U.S. EPA similarly provides indirect AC credits in its rule for model years 2012-2016, although the maximum number of credits is 5.7 g/mi due to a different methodology used to calculate indirect emissions. Because federal GHG requirements are substantially equivalent to the GHG reductions beyond those expected from the original Pavley regulations, California has agreed to allow compliance with the federal regulation for model years 2012-2016 to be deemed compliance with the Pavley regulations (CCR, Title 13, Section 1961.1[a]). This, in turn, allows vehicle manufacturers to meet a single set of national GHG standards while achieving the reductions envisioned by the Pavley regulations. A broader discussion about the nexus between ARB's efforts and those of federal agencies is discussed later in this chapter.

iii. California Evaporative Emission Regulations

Evaporative emissions consist of fuel hydrocarbon vapors from a motor vehicle that are released into the atmosphere. Evaporative emissions are classified into three types: running loss, hot soak, and diurnal. Running loss emissions occur during vehicle operation, originating from various sources within the fuel system and from fuel vapor overflow of the on-board carbon canister. Hot soak emissions occur immediately after the termination of engine operation, when latent engine heat vaporizes residual fuel in the engine system. Diurnal emissions are caused by daily cycling of ambient temperatures when a vehicle is parked, where ambient temperature increases result in fuel tank vapor generation. Another type of emissions, refueling emissions, occurs during refueling of the vehicle when the entering liquid fuel volumetrically displaces the fuel vapors in the fuel tank.

One main source of vehicular evaporative emissions is the carbon canister, where excess vapors in the fuel tank are routed for storage instead of being released into the atmosphere. In many evaporative emission systems, the canister also captures fuel tank vapor emissions during refueling as part of onboard refueling vapor recovery (ORVR.) The carbon canister is regenerated during vehicle operation when the fuel vapors stored in the canister are purged into the engine's intake system and subsequently burned in the combustion process. Substantial evaporative emission losses from the canister occur when the generated fuel tank vapors routed to the canister are greater than its storage capacity, and thus, breakthrough of vapors from the canister occurs. In addition, small evaporative losses from the canister, called bleed emissions, result when hydrocarbon emissions escape the canister because of diffusion of adsorbed hydrocarbons as the vehicle rests over a period of time. Another main source of evaporative emissions is through permeation of fuel in elastomeric hoses, joints, and valves, as well as plastic fuel tanks.

Compliance with the current evaporative emission regulations, adopted as part of the LEV II Program, is based on meeting three separate certifications related to whole-vehicle emission standards. Specifically, these include the running loss emission standard, the three-day diurnal plus high-temperature hot soak (three-day) emission standard, and the two-day diurnal plus moderate-temperature hot soak (two-day) emission standard. The running loss emission standard ensures evaporative emission control during vehicle driving. The three-day emission standard ensures that the evaporative system can control evaporative emissions for three consecutive hot summer days. The two-day emission standard ensures an effective purging strategy of the vehicle carbon canister.

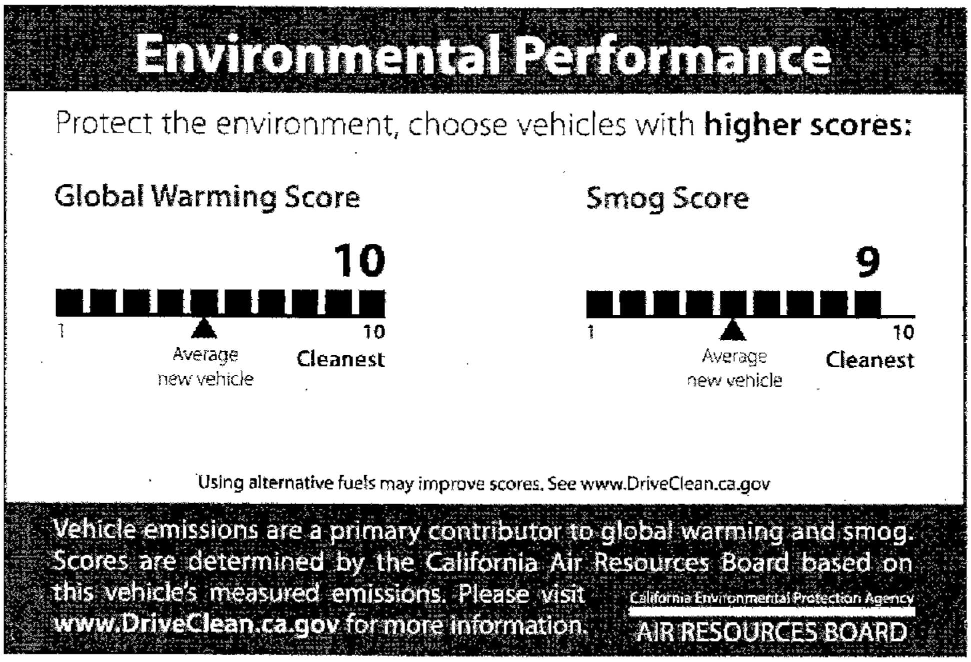
iv. Manufacturer Size Definition Changes

A manufacturer's California sales volume plays an important role in determining a manufacturer's treatment under various light-duty vehicle regulations. Size is based on a manufacturer's average PC, LDT, and MDV sales in California, and on the percentage amount that one manufacturer owns of another manufacturer. Two changes that affect the size definitions of manufacturers include: 1) staff proposes to decrease the intermediate volume manufacturer (IVM) (i.e., large volume manufacturer [LVM] threshold from 60,000 PCs, LDTs, and MDVs on average in California to 20,000 on average), and 2) staff proposes that two manufacturers' sales will be aggregated for determination of size if one manufacturer owns greater than 33.4 percent of another manufacturer. The effect of these changes is all current IVMs, except Volvo, Subaru, Jaguar/Land Rover and Mitsubishi, would be expected to become LVMs in 2018, and meet the full ZEV requirements starting that year. This proposed change is needed to assure that major manufacturers compete on a level playing field.

v. Environmental Performance Label Regulation

The EPL is a vehicle label showing the model's rating for GHG emissions (Global Warming Score) and CAP emissions (Smog Score). It is currently required on all new vehicles manufactured after January 1, 2009 and sold in California. The EPL is the result of AB 1229 (Nation), Statutes of 2005, and EPL requirements are found in CCR, Title 13, Section 1965. The EPL's appearance is shown in Figure 1-1.

Figure 1-1. Environmental Performance Label

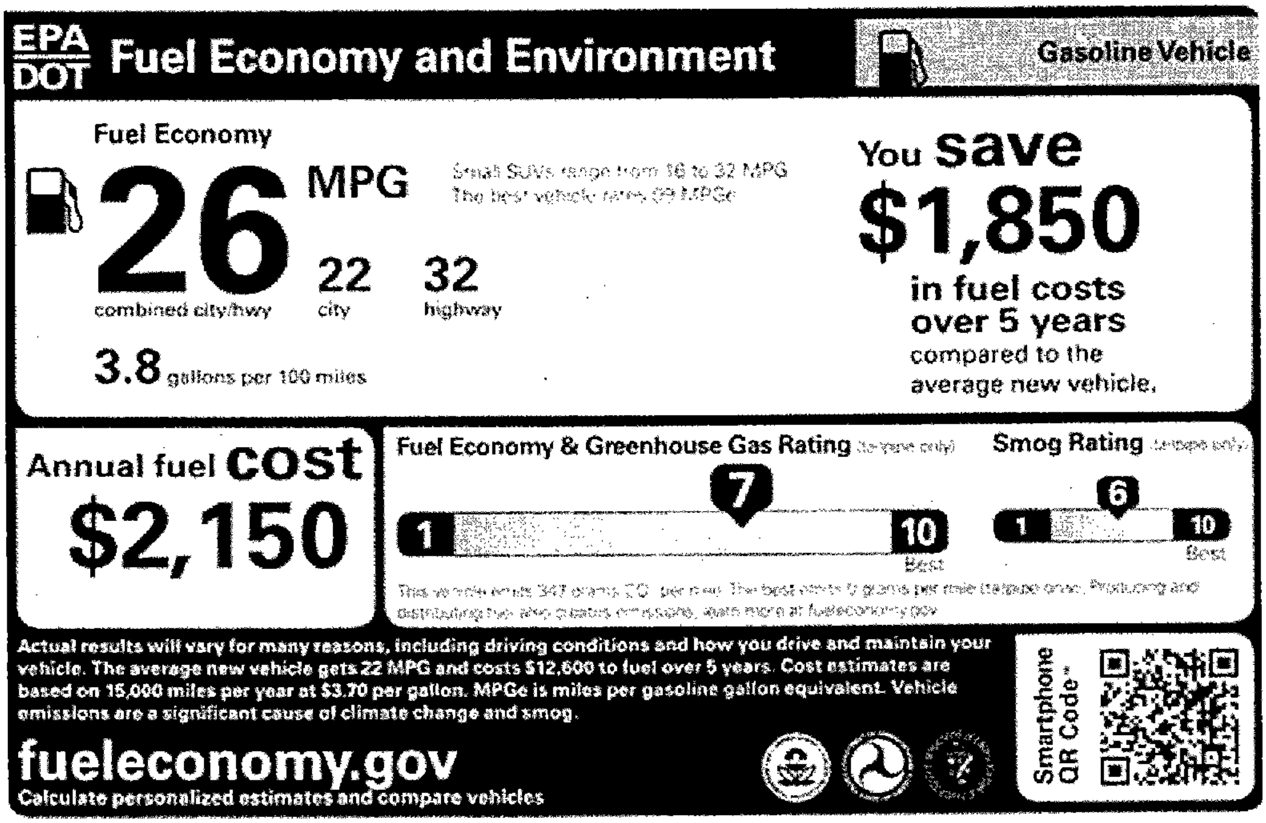


Source: ARB 2011a.

Since 1978, California's Smog Index Label has helped consumers assess the relative smog emissions from new cars. The current EPL regulation requires that both a Smog Score and Global Warming Score be posted on all new cars sold in California. The Smog Score is a simple rating that helps customers understand the level of CAP emissions generated by each particular vehicle model. The Global Warming Score provides a simple way for customers to understand the levels of GHGs emitted by each vehicle model. Both scores are based on a scale of 1 -10 with 10 being the cleanest and 5 representing the score for the average new light- or medium-duty vehicle.

In May 2011, U.S. EPA and NHTSA finalized a new Fuel Economy and Environment Label that is required on all new cars starting with model year 2013. However, the use of this new label is allowed earlier on a voluntary basis. The new Federal Fuel Economy and Environment Label is a redesign of the current fuel economy label found on all vehicles and will now include a Greenhouse Gas and Fuel Economy Rating that ranges from 1 to 10 with 10 being best and a Smog Rating, also from 1 to 10 with 10 being cleanest. The label's graphical representations are similar to and patterned on the Global Warming and Smog Scores on California's EPL shown above. The Fuel Economy and Environment Label is shown in Figure 1-2.

Figure 1-2. Fuel Economy and Environmental Label



Source: DOT and U.S. EPA 2011.

Details about the specific amendments proposed to EPL are presented in Chapter III (Project Description) Section A.1.d.

vi. On-Board Diagnostic System Requirement

Second generation on-board diagnostics (OBD II) systems, which have been required on all 1996 and newer vehicles, consist mainly of software designed into the vehicle's on-board computer to detect emission control system malfunctions as they occur by monitoring virtually every component and system that can cause an increase in emissions. When an emission-related malfunction is detected, the OBD II system alerts the vehicle owner by illuminating a warning light on the instrument panel. By alerting the owner of malfunctions as they occur, repairs can be sought promptly, which results in fewer emissions from the vehicle. Additionally, the OBD II system stores important information including identification of the faulty component or system and the nature of the fault, which would allow for quick diagnosis and proper repair of the problem by technicians. This helps owners achieve less expensive repairs and promotes repairs done correctly the first time.

Since originally adopted in 1989, the regulation has been updated regularly, with the last major update to the regulation occurring in 2006, as well as updates to the medium-duty diesel requirements occurring in 2009. Staff was not scheduled to go to the Board this year to update the OBD II regulation; however, manufacturers recently approached ARB staff and requested regulation changes that they indicated were needed immediately to ensure compliance when they certify their 2013 model year vehicles. Interested manufacturers and ARB staff held discussions about the proposal,, including a meeting on July 27, 2011. In response to the manufacturers' requests, staff is proposing changes to the OBD II regulation, CCR, Title 13, Section 1968.2. The proposed amendments to the OBD II regulation consist of relaxation of a few requirements (e.g., delays to the required start dates) and clarifications.

vii E-10 Certification Fuel

The California certification fuel used for testing exhaust and evaporative emissions on passenger cars, light-duty trucks, and medium-duty vehicles currently contains the oxygenate methyl tertiary butyl ether (MTBE) in the quantity of 10.8 to 11.2 volume percent (equivalent to 2.0 percent by weight). MTBE was banned for use in California gasoline starting December 31, 2003. As a result of the ban of MTBE, ethanol became the prevalent oxygenate used in California gasoline. After the ban, refiners began adding approximately 5.7 volume percent ethanol to gasoline, which is equivalent to 2.0 weight percent. California gasoline contained 5.7 percent ethanol until the end of 2009. In 2010, California refiners transitioned to producing gasoline containing 10 percent by volume ethanol (E10).

As part of the proposed ACC program, staff is proposing to amend certification test fuel specifications by eliminating requited testing with MTBE and requiring 10 percent ethanol by volume instead, as discussed in Section 5 of the Project Description. This proposed modification would better align the specifications of certification test fuel with the properties of in-use fuel. For evaporative emission testing, phase-in of the ethanol-containing certification test fuel is proposed to occur at the same model year percentages being proposed for the LEV III FTP 150,000-mile durability requirements applicable to the light-duty fleet.

b. Zero Emission Vehicle Regulation (ZEV)

ARB first adopted the ZEV requirement in 1990 as part of the LEV regulation discussed above and has since modified the ZEV regulation several times. The ZEV mandate provides more reasonable assurance that ZEVs will be produced in high enough volumes to provide a launch of the technology in the marketplace. The regulation includes specific regulatory mechanisms to reduce the risk of early ZEV market failure.

Under the existing ZEV regulation, manufacturers are required to produce a number of ZEV and ZEV-enabling technologies each year. The types of technologies manufacturers produce to comply with the regulation are listed in Table 1-2.

Table 1-2. Zero Emission Vehicle Types and Technologies

Vehicle Type	Technical Description	Credit Amount	Vehicle Examples
ZEV	Zero tailpipe emissions (i.e., no tailpipe): battery electric vehicles (BEV), and hydrogen fuel cell vehicles (FCV).	1.0 - 7.0	Nissan Leaf, Honda FCX Clarity
Transitional Zero Emission Vehicles (TZEV)	Vehicles certified to PZEV standards that also run on ZEV fuels for at least 10 miles (e.g. plug-in hybrid electric vehicles or hydrogen internal combustion engine vehicle)	1.0 - 2.5	GM Volt
Advanced Technology Partial Zero Emission Vehicle(AT PZEV)	Vehicles certified to PZEV standards and employing ZEV-enabling technologies (e.g. hybrids or compressed natural gas vehicles)	0.5 – 0.7	Toyota Prius
Partial Zero Emission Vehicle (PZEV)	Conventional gasoline vehicles certified to the most stringent tailpipe emission standards, zero evaporative emissions, and extended warranty.	0.2	Ford Focus PZEV

The ZEV regulation is based on a credit mechanism that affords manufacturers flexibility to produce various types of vehicle technologies. Credits are given to vehicles based on zero emission range, refueling capabilities, hybridization, and emissions performance. The credit amounts are also summarized in Table 1-2.

The vehicle types that earn credits to comply with the ZEV regulation also help manufacturers attain the fleet-average emission standards established by the existing LEV regulation (and the proposed LEV III regulation).

ZEV requirements are included in CCR, Title 13, Section 1962.1. Details about the specific amendments proposed to the ZEV regulation are presented in Chapter III (Project Description).

c. Clean Fuels Outlet Regulation (CFO)

The CFO regulation was originally developed in 1990 to apply to all alternative fuel vehicles (AFVs) that, when operated on a designated clean fuel, would achieve LEV emission standards. Types of designated clean fuels include natural gas, ethanol, methanol, and hydrogen. Electricity is specifically excluded from the definition of a designated clean fuel because of its non-liquid form and unique distribution and market characteristics that are unlike other fuels under this regulation. In essence, once the projected numbers of AFVs that use a specific clean fuel reach 20,000, the larger owner/lessors of gasoline retail outlets, i.e., gas stations, would be required to equip a specified number of their outlets with that alternative fuel. When the CFO regulation was written, it was projected that AFVs would be needed in the State's vehicle fleet to meet CAP emission standards; however, the need for AFVs to enter the fleet was negated by the innovation and introduction of cleaner-burning fuels and more advanced emission control technologies for conventional fuel vehicles (i.e., gasoline and diesel) that met LEV II standards.

During development of the original CFO regulation, ARB projected that most early AFVs would be flex or dual-fueled vehicles that could also operate on gasoline and this projection was confirmed by manufacturers' response. This assumption served as the basis for setting the initial trigger at 20,000 AFVs. Market-based analyses were used to determine that fuel providers could feasibly produce and sell alternative fuels at this market volume. California surpassed the 20,000 AFV trigger level for E-85 flex-fuel vehicles in mid-2000, but due in part to concerns over life-cycle emissions from substantially increased ethanol production and distribution, the regulation was never activated. Today, the use of ethanol-gasoline blends is promoted through the federal Renewable Fuels Standard (RFS), which applies to liquid fuels only, and California's Low Carbon Fuel Standard (LCFS). RFS and LCFS both place the responsibility on oil companies and fuel distributors to increase the amount of biofuels and other low-carbon fuels dispensed for transportation.

Thus, the CFO regulation compliments the ZEV regulation, because it ensures the availability of alternative fuels as AFVs are produced and sold in California.

The CFO regulation is included in CCR, Title 13, Sections 2300-2318. Details about the proposed version of the CFO regulation are presented in Chapter III (Project Description).

2. ARB Nexus with the U.S. Environmental Protection Agency and National Highway Traffic Safety Administration

There are currently no comparable federal CAP emission standards for 2015 and subsequent model passenger vehicles as stringent as this proposed California rule. However, U.S. EPA has indicated that it expects to issue a Notice of Proposed Rulemaking (NPRM) for their "Tier 3" next generation of CAP emission standards in January 2012, which will apply to 2017 and subsequent model year vehicles. Staff expects the Tier 3 program to be comparable to the California proposed rule in the applicable timeframe. This national rule is expected to be finalized in late-2012.

With regard to GHGs, U.S. EPA and NHTSA have been working together under the federal Clean Air Act and the Energy Independence and Security Act of 2007 to develop a coordinated national program of harmonized regulations to reduce emissions and improve fuel efficiency. The agencies issued a Final Rulemaking establishing standards for 2012-2016 model year vehicles on April 1, 2010 (U.S. EPA 2010c).

The federal agencies are now developing a rulemaking to set standards for model year 2017-2025 PC and LDT (U.S. EPA 2011a), which is consistent with the Presidential Memorandum regarding fuel efficiency standards (The White House Office of the Press Secretary 2010).

There are currently no comparable federal GHG emission standards that are as stringent as the proposed standards for 2017 and subsequent model passenger vehicles. (The current federal GHG emission standards for the 2016 and subsequent model years are comparable to those applicable in California in the 2016 model year). However, on November 16, 2011, an NPRM was issued by U.S. EPA and NHTSA for a joint rulemaking that proposes a coordinated federal GHG emission reduction and fuel economy program for light-duty vehicles, beginning in the 2017 model year. This national rule is expected to be finalized by the end of July 2012. There are no significant differences between the proposed California GHG regulations and those presented in the NPRM. Furthermore, staff does not expect there to be any significant differences between the proposed California GHG regulations and those in U.S. EPA's Final Rule.

D. ACC Program Objectives

Recognizing the need to attain national and State ambient air quality standards for CAPs, as well as the requirements of AB 1493 and AB 32 and the role of clean car standards in contributing to GHG emission reductions, the following project objectives are presented for the proposed ACC Program:

1. ***Ensure all Californians can live, work, and play in a healthful environment free from harmful exposure to air pollution*** – to protect and preserve public health and well-being, and prevent irritation to the senses, interference with visibility, and damage to vegetation and property (Health and Safety Code [HSC], Section 43000[b]) in recognition that the emission of air pollutants from motor vehicles is the primary cause of air pollution in many parts of the State (HSC, Section 43000[a]);

2. ***Achieve the maximum emissions reduction possible from motor vehicles*** – to attain the national and State ambient air quality standards for CAPs (HSC, Sections 43000.5[b] and 43018[a]);

3. ***Establish a uniform set of vehicle emission standards*** – to provide clarity to vehicle manufacturers about the emission-related requirements by integrating them into a single, coordinated package (HSC, Section 43000[c]);

4. ***Reduce dependence on petroleum as an energy resource*** – to reduce the State's reliance on petroleum and support the use of diversified fuels in the State's passenger vehicle fleet. In addition, petroleum use as an energy resource contributes substantially to the following public health and environmental problems: air pollution, acid rain, global warming, and the

degradation of California's marine environment and fisheries (PRC, Sections 25000.5[b] and [c]);

5. ***Decrease GHG emissions in support of statewide GHG reduction goals*** – to adopt "clean car standards," as identified in the Scoping Plan, which was developed for the purpose of reducing GHG emissions in California, as directed by AB 32, Statutes of 2006. As described in the Scoping Plan recommendations, "these types of compliance options will be key in ensuring that we are able to meet our reduction targets in a cost-effective manner" and "will play a central role in helping California meet its 2020 reduction requirements" and "figure prominently in California's efforts beyond 2020." More specifically, ARB has determined that the proposed ACC Program would need to achieve a reduction of at least 3.8 MMT CO_2e, as described in the Scoping Plan. Implementation of the proposed ACC Program would also provide further GHG reductions pursuant to AB 1493 (Pavley regulations) (Chap. 200, Statutes of 2002). Finally, implementation of the proposed ACC Program would also be a key measure to help California reduce GHGs to 80 percent below 1990 levels by 2050 to further reduce the threat of climate change, which is a goal identified in former Governor Schwarzenegger's Executive Order S-3-05 to minimize climate change impacts and achieve climate stabilization;

6. ***Ensure emission reductions*** – to ensure that emission reductions are real, permanent, quantifiable, verifiable and enforceable, as identified in the Scoping Plan (HSC, Section 38562[d]);

7. ***Improved automotive technologies and fueling infrastructure*** – to guide the acceleration of the development of environmentally superior passenger vehicles that will continue to deliver performance, utility, and safety demanded by the market, and to promote an infrastructure that is supportive of AFVs; and

8. ***Spur economic activity*** – to incentivize innovation that will transition California's economy into greater use of clean and sustainable technologies and to promote increased economic and employment benefits that will accompany this transition (AB 1493 Section 1[g]; HSC, Section 38501[e]).

E. Scope of Analysis and Assumptions

The degree of specificity required in a CEQA document corresponds to the degree of specificity inherent in the underlying activity it evaluates. The environmental analysis for broad programs cannot be as detailed as for specific projects (CCR, Title 14, Section 15146). For example, the assessment of a construction project would naturally be more detailed than for the adoption of a plan, because the construction effects can be predicted with a greater degree of accuracy (CCR, Section 15146 [a]). This analysis addresses a broad regulatory program, affecting statewide sales of millions of new passenger vehicles, from between six and 14 years from now, so a general level of detail is appropriate. The EA provides a good-faith effort to evaluate significant adverse impacts and beneficial impacts of the regulatory program and contains as much information as is currently available, without being speculative.

The scope of analysis in this environmental analysis is intended to help focus public review and to encourage that questions and comments are appropriate and meaningful. This analysis specifically focuses on potential significant, adverse and beneficial impacts on the physical environment resulting from compliance responses to the proposed changes to the existing State regulations regarding emissions from new light- and medium-duty vehicles sold in California, and from actions and infrastructure necessary to provide alternative vehicle fuels.

The analysis of potential significant, adverse environmental impacts from the proposed ACC Program is based on the following assumptions:

1. This analysis addresses the potential significant, adverse environmental impacts resulting from implementing the regulatory amendments of the proposed ACC Program compared to the existing regulations concerning emissions standards for light- and medium-duty vehicles, the availability of alternative fuels, and other applicable existing regulations.

2. The environmental baseline is defined by 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.

3. The analysis of environmental impacts and determinations of significance are based on a comparison 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.

4. The analysis in this EA addresses environmental impacts both within the State of California and outside the State to the extent they are reasonably foreseeable and do not require speculation.

5. The level of detail of impact analysis is necessarily and appropriately general, because the nature of the proposed ACC Program is programmatic and specific infrastructure and facility development projects will not occur solely from approval of this program. Specific projects implementing the proposed ACC Program will undergo their normally required environmental review and compliance processes. In addition, performance standards generally, and the proposed fleetwide CAPs and GHG emissions standards in the LEV III program in

particular, allow a wide variation in compliance responses, which will vary even further by manufacturer due to their differing baseline fleet characteristics that the analysis must necessarily project four to five model years into the future.

6. Because of the statewide reach of the proposed ACC Program and the longer-term future horizon of the achievement of a statewide fleet that is lower in both CAP and GHG emissions, the programmatic impact analysis applies generally across a broad geography, rather than at site- or project-specific locations. However, impact analyses do examine regional (e.g., air basin) and local issues, where feasible and appropriate. As a result, the character of the impact conclusions in the resource-oriented sections of Chapter 5, Impact Analysis and Mitigation, are generally cumulative, considering the potential effects of the full range of reasonably foreseeable methods of compliance, along with expected background growth in California and the U.S., as appropriate. Chapter 8 provides a summary of potential cumulative impacts of the proposed ACC Program in conjunction with other reasonably foreseeable future air quality programs (see "complementary measures" discussion below).

1. Environmental Checklist

An environmental checklist was used to identify and evaluate potential impacts of the proposed ACC Program as contained in Attachment 1. Further discussion is presented in Chapter 5, Impact Analysis, regarding the impacts of the proposed ACC Program, and potential mitigation strategies that can be implemented to lessen any identified potential significant adverse impacts.

2. Basis for Environmental Impact Analysis and Significance Determinations

The policy and direction of the existing LEV II (including the Pavley regulations that address GHG standards), ZEV, and CFO regulations established by previous rulemakings define the current requirements for compliance with emission standards for passenger vehicles in California. In addition, it is important to note that other existing measures are in place to reduce GHGs, as described in the Scoping Plan, to the extent they have been Board-adopted. These are called "reference measures" because they are already in effect and because they help define the existing baseline of GHG emissions in California.

CEQA requires that the baseline for determining the significance of environmental impacts is normally the existing physical conditions at the time the environmental review is initiated (CEQA Guidelines, CCR, Title 14, Section 15125[a]). Therefore, the significance determinations reflected in the EA are based on changes from existing physical conditions, in keeping with CEQA requirements.

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. Approval and implementation of the proposed ACC Program would result in the amendment of existing emission requirements and alternative fuel availability requirements for light- and medium-duty vehicles to a more stringent set of standards and requirements; in response, compliance methods would also change. Comparison of reasonably foreseeable methods of compliance in response to the proposed regulatory amendments with the current and likely compliance responses to the existing standards and requirements and other reference measures is the approach used to estimate the potential environmental effects attributable to the proposed ACC Program. That is, the approach compares one set of projections (2017 – 2025) with compliance responses as of 2016.

Other reasonably foreseeable actions are approved or proposed to take place in the time frame of the proposed ACC Program, but are not yet in effect. These are referred to as "complementary measures" (e.g., Environmental Standards for Hydrogen Production [requires GHG reductions and use of renewables in accordance with SB 1505]). They 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.

a. Adverse Environmental Impacts

The analysis of adverse effects on the environment and significance determinations for those effects in the EA reflect the programmatic nature of the analysis of the reasonably foreseeable methods of compliance by vehicle manufacturers, hydrogen fuel producers, fuel retailers, and battery recyclers, as well as consumers. These compliance responses are described in greater detail in Chapter 4. Thus, the EA analysis addresses broadly defined types of impacts without the ability to determine the specific project or vehicle locations, facility size and character, or site-specific environmental characteristics affected by the facilities. Environmental impacts may be determined to be potentially significant, because of the inherent uncertainties about the relationship between future infrastructure and vehicle design and environmentally sensitive resources or conditions. This is a conservative approach (i.e., tending to overstate environmental impacts), in light of these uncertainties, to satisfy the good-faith, full-disclosure intent of CEQA. When specific projects are proposed and subjected to project-level environmental review, it is expected that many of the impacts recognized as potentially significant in this EA and not already mitigated or avoided with this proposed Board approval can later be avoided or reduced to a less-than-significant level.

Another inherent uncertainty in the EA analysis is the degree of implementation of mitigation for potentially significant impacts. While ARB is responsible for adopting the regulatory amendments that comprise the proposed ACC Program, it does not have authority over the proposal, approval, or implementation of infrastructure and development projects. Also, because the vehicle standards are nearly all performance-based and not prescriptive, the ACC program is generally not mandating any particular technology(ies) on any particular vehicles. ARB also has no control over which vehicles or with which technology(ies) would be purchased and operated in which areas of the State. Other agencies are responsible for the environmental analyses of proposed facilities and infrastructure (e.g., alternative fueling stations, manufacturing facilities, and battery recycling outlets), definition and adoption of project-specific feasible mitigation, and monitoring of mitigation implementation. For example, local cities or counties must approve proposals to construct fueling stations. Additionally, State and/or federal permits may be needed for specific environmental resource impacts, such as take of endangered species, filling of wetlands, and streambed alteration.

Because ARB is not responsible for implementation of specific infrastructure projects (such as fueling stations), the programmatic analysis does not allow for a precise description of the details of project-specific mitigation. As a result, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, the EA takes the conservative approach in its post-mitigation significance conclusions (i.e., tending to overstate the risk that feasible mitigation may not be sufficient) and discloses, for CEQA compliance purposes, that potentially significant environmental impacts may be unavoidable, where appropriate. It is expected that facility and infrastructure projects would be able to feasibly avoid or mitigate to a less-than-significant level many of these potentially significant impacts as an outcome of their project-specific environmental review processes.

b. Beneficial Effects to the Environment

Where applicable, this EA also acknowledges various beneficial effects in each resource area that may result from ARB's adoption and implementation of the proposed ACC Program, consistent with ARB's Certified Regulatory Program requirements (CCR, Title 17, Section 60005[b]).

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2.0 PROJECT DESCRIPTION

The proposed Advanced Clean Cars (ACC) Program consists of amendments to existing regulations to provide a comprehensive approach to further reduce emissions of criteria air pollutants and precursors (CAPs) and greenhouse gases (GHGs) from light- and medium-duty vehicles in California. Toxic air contaminants (TACs) generally decrease in tandem with these. Accordingly, the proposed ACC Program would include more stringent emission standards for CAPs and GHGs, requirements for vehicle manufacturers to increase the proportion of zero emission vehicles (ZEVs) (e.g., hydrogen fuel cell vehicles [FCVs], battery electric vehicles [BEVs] sold in California), requirements for increased availability of alternative fuel stations to support the resultant increase in ZEVs, and changes to the types of emissions information that must be posted on new cars. The major components of the proposed ACC Program are discussed in greater detail below. As discussed further in Section E of this chapter, for CEQA purposes the "project" is the collective 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.

A. Amendments to the Low-Emission Vehicle and Greenhouse Gas Regulation (LEV III)

The proposed amendments to the Low-Emission Vehicle and Greenhouse Gas regulation (LEV III) would revise and update the standards currently in place under LEV II, which was summarized earlier in Chapter 1. LEV III would consist of a set of more stringent emission standards for the various light- and medium-duty vehicle classes and more stringent fleet average emission standards starting with model year 2015 and becoming more stringent through model year 2025. Like the existing LEV II regulation, LEV III would continue to address exhaust emissions of formaldehyde, non-methane organic gas (NMOG), carbon monoxide (CO), oxides of nitrogen (NO_X), particulate matter, and evaporative emissions of hydrocarbons (HC). In addition to establishing emission standards that are more stringent than current requirements, LEV III would also generally include the following changes regarding CAPs:

- LEV III would replace the separate standards for NMOG and NO_X with a combined standard that is based on the sum of these two pollutants.

- LEV III also would increase the "durability basis" from 120,000 miles to 150,000 miles. The extended durability basis would ensure the effectiveness of a vehicle's emissions control systems over the assumed operational life of the vehicle.

- LEV III would extend applicability of the California Supplemental Federal Test Procedure (SFTP) to medium-duty and alternative-fueled vehicles, and include two options for complying with the SFTP. The SFTP is designed to specifically address off-cycle emissions, which are those not normally accounted for in on-road driving cycles used for vehicle certification, resulting from aggressive operation, typified by high speeds and hard accelerations, and from air conditioner use. LEV III would also extend SFTP applicability throughout the full useful life of affected vehicles. SFTP II would also require standards for controlling exhaust emissions of particulate matter during off-cycle driving.

- LEV III would extend the zero fuel evaporative emissions standards to all vehicles subject to evaporative emission requirements and provide two options by which manufacturers could comply with these standards. The evaporative emissions standards would be fully phased in by model year 2022.

- The proposed LEV III regulation would also include more stringent standards for GHG emissions from light-duty vehicles for model years 2017-2025. As part of this proposal, ARB is working with the U.S. Environmental Protection Agency (U.S. EPA) and the National Highway Traffic Safety Administration (NHTSA) in their development of a national regulation that would require reductions in vehicle GHG emissions and consequent improvements in fuel efficiency that would also serve California's needs to reduce GHG emissions.

As part of LEV III, ARB proposes to continue awarding credits to manufacturers that utilize air conditioning (AC) system technologies that reduce direct emissions (from refrigerant leakage) and indirect emissions (from usage), but amend the credit formulas used as part of California's 2009-2016 model years-GHG standards (i.e., Pavley regulations) so that they align with U.S. EPA's methodology for 2017-2025 model years. Rather than specifying the suite of technologies that must be used by the manufacturer to receive credits, as currently required by the Pavley regulations, ARB proposes to adopt U.S. EPA's approach to award credits based on the individual technologies employed. Thus, direct credit would be given for the reduction of direct refrigerant emissions achieved through improvement of refrigerant containment and/or use of a refrigerant with a global warming potential (GWP) less than or equal to 150. Indirect credit would be given for the reduction of indirect emissions achieved through use of efficiency improvement technologies listed on a menu; however, the total credit would be capped to account for synergistic effects of the various efficiency improvement technologies for AC systems.

Overall, the goal of the proposed LEV III regulation is to make the emissions requirements for light- and medium duty vehicles sold in California generally consistent with requirements of the Tier 3 emission standards proposed by U.S. EPA, and consistent with the federal GHG standards and consequent fuel efficiency standards for motor vehicles.

1. Amendments to the California Evaporative Emission Regulations

To maintain continuity of vehicles certified to the zero evaporative emission standards and to expand the use of existing zero evaporative technology to the remaining vehicle classes, staff proposes to require new passenger cars, light-duty trucks, medium-duty vehicles, and heavy-duty vehicles that are gasoline-fueled, liquefied petroleum gas-fueled, and alcohol-fueled, to comply with the zero evaporative emission standards. This would require amending CCR, Title 13, Section 1976 and the incorporated "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles". The proposed lower evaporative emission standards are equivalent in stringency to the current optional LEV II zero evaporative emission standards.

2. Manufacturer Size Definition

To retain a level competitiveness, staff propose two changes to the size definitions of manufacturers:

1) Decrease the intermediate volume manufacturer (IVM) (i.e., large volume manufacturer [LVM] threshold from 60,000 PCs, LDTs, and MDVs on average in California to 20,000 on average); and

2) Aggregation of two manufacturers' sales for determination of size if one manufacturer owns greater than 33.4 percent of another manufacturer.

3. Amendments to the Environmental Performance Label

Some changes would also be made regarding the existing California Environmental Performance Label (EPL) regulation, which is described in Chapter 1, Section C.1.d. More specifically, compliance by manufacturers with the Federal Fuel Economy and Environment Label, as finalized in May 2011, would be deemed compliant with California EPL requirements. This would allow for one label depicting relative vehicle CAP and GHG emissions nationwide, incorporating both the substance and style of California's existing EPL.

4. Amendments to the On-Board Diagnostic System Requirements

The proposed amendments to the OBD II regulation would consist of relaxations to a few requirements (e.g., delays to the required start dates) and clarifications. The proposed relaxations would include the following:

- Delaying the start date for manufacturers to monitor the ability of a catalyst to generate a desired feedgas to promote better performance in a downstream after-treatment component (e.g., generate nitrogen dioxide for higher NOx conversion efficiency in a selective catalytic reduction [SCR] system) from the 2010 model year to the 2015 model year for light-duty vehicles and from the 2013 model year to the 2015 model year for medium-duty vehicles.

- Delaying the start date for manufacturers to monitor the non-methane hydrocarbon (NMHC) conversion capability of catalyzed particulate matter (PM) filters from the 2010 model year to the 2015 model year for light-duty vehicles and from the 2013 model year to the 2015 model year for medium-duty vehicles.

- Extending the allowance for a deficiency by an additional model year for manufacturers unable to meet the requirement to detect malfunctions of the PM filter when the filtering capability degrades to a level such that tailpipe emissions exceed the more stringent 2013 model year thresholds.
- Delaying the start date for manufacturers to monitor the tolerance compensation features of the fuel control system components on diesel vehicles from the 2013 model year to the 2015 model year.

While ARB staff believes all the requirements mentioned above are technically feasible for manufacturers to meet (and hence, are being delayed, not eliminated), circumstances, such as delays in technology development, have prevented manufacturers from implementing the requirements within the required deadlines (e.g., delay in the development of the PM sensor). Additionally, manufacturers have requested that ARB staff propose clarifications to a few requirements in the current OBD II regulations, including those that address hybrid vehicles. The OBD II requirements include software in the car computer that verifies if the diagnostics are running frequently enough. ARB staff is proposing to update these requirements to clarify how to track such data for hybrids and especially plug-in hybrid vehicles that can have all or some portion of driving trips where the engine emission controls are never even operated due to battery/electric vehicle operation. ARB staff has already discussed the proposed amendments with hybrid manufacturers and have come to an agreement regarding these changes, which would only consist of minor software revisions. Similar changes are also being proposed to account for the erasing of fault information in hybrids, which would also only also consist of minor software revisions.

5. Amendments to the Specifications for California Certification Fuel Regulation

Since MTBE was banned for use in California gasoline starting December 31, 2003, ethanol became the prevalent oxygenate used in California gasoline. California gasoline contained 5.7 percent ethanol until the end of 2009. In 2010, California refiners transitioned to producing gasoline containing 10 percent by volume ethanol. Currently, all gasoline in California contains 10 percent ethanol and will continue to contain 10 percent ethanol for the foreseeable future. While the type of oxygenate and oxygenate amount have changed in in-use California gasoline (i.e., fuel used by California consumers), the certification fuel used for emission testing has not, and is no longer representative of in-use fuel. The certification fuel in California is being updated to reflect the in-use fuel. Staff is proposing to amend existing regulations to require use of a certification fuel that contains 10 percent ethanol (E10 fuel). Staff is proposing that the E10 certification fuel to be required beginning 2014, and is also proposing that the E10 certification fuel would be available for optional use upon the Office of Administrative Law's filing of the LEV III rulemaking with the Secretary of State.

B. Amendments to the Zero Emission Vehicle Regulation (ZEV)

The proposed amendments to the ZEV regulation focus on technologies that help meet long-term CAP and GHG reduction goals, including having more battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) in the statewide vehicle fleet, simplifying the ZEV regulation where needed, and increasing requirements for 2018 model year and beyond. A brief description of the current ZEV regulation is provided in Chapter 1 and the amount of ZEV credits that manufacturers currently earned by various vehicle classes is summarized in Table 1-2.

The proposed amendments are divided into two timeframes: model years 2012 through 2017, and 2018 and subsequent model years. For 2012 through 2017, limited amendments are proposed to allow manufacturers to indefinitely bank ZEV credits for use in later years, and to increase the number of credits earned by long-range (300 mile or more) fuel cell vehicles (FCVs).

For 2018 and subsequent model years, the ZEV requirements would be increased, so that by 2025, 15 percent of a manufacturer's new vehicle sales would be required to be ZEVs (e.g., BEVs and FCVs) and Transitional Zero Emission Vehicles (TZEVs) (e.g., PHEVs). In addition to increasing the requirement, the proposed amendments would modify the amount and calculation of credits for ZEVs and TZEVs. Manufacturer's size definition requirements would also be amended, so that 97 percent of manufacturers would be required to fully comply with the regulation. The amendments would also modify the "carry-back" provision, so that manufacturers would be allowed to carry a deficit in their required ZEV credits for only one year, before being subject to penalties. Overall, these amendments would result in a greater proportion of ZEVs in the statewide light- and medium duty vehicle fleet.

C. Amendments to the Clean Fuels Outlet Regulation (CFO)

As explained in Chapter 1, the Clean Fuels Outlets (CFO) regulation was initially developed and approved in 1990 and updated by the Board in 2000, but never activated. As part of the proposed ACC Program, ARB would amend the CFO regulation with updated requirements. The requirements would account for the types of alternatively fueled vehicle (AFV) technologies feasible at this time, particularly those that are most effective at reducing CAPs and GHGs.

With the proposed changes, the CFO regulation would apply only to fuels for ZEVs, specifically hydrogen FCVs, and it would not address natural gas-, ethanol-, or methanol-fueled vehicles like the previously drafted regulation. The CFO regulation would require major refiners and importers of gasoline, instead of owners/lessors of gasoline retail outlets, to build new hydrogen fueling stations based on the projected number of hydrogen FCVs operating in the State. More specifically, major refiners and importers would be required to build retail hydrogen fueling stations when projections indicate there would be 20,000 or more FCVs operating within the State. The amendments would add an additional trigger to build outlets of 10,000 vehicles that would be applied within a specific air basin. Projections would be based on records provided by the Department of Motor Vehicles, and sale and lease forecasts from vehicle manufacturers.

Consistent with the current CFO regulation, the number of FCVs that are as part of an organization's fleet operation would be discounted by 75 percent before they are included in the total tally for the 10,000 and 20,000 trigger levels. This is because an organization operating an FCV fleet (e.g., a private company, government agency, or university campus) would be anticipated to have its own private hydrogen fueling station and would be less dependent on publicly available fueling stations. However, the regulation would provide for an adjustment to the fleet discount factor based on the availability of fuel for that fleet. The proposed regulation would also require vehicle manufacturers to provide ZEV production plans to ARB three years in advance (instead of two years) and to specify where vehicles would be deployed. These changes were designed to provide the refiners and importers with additional time to locate and build stations.

Once the trigger number of vehicles is reached, ARB would determine how many new fueling stations would be needed to support these vehicles, and then allocate the responsibility of establishing new stations among the major refiners and importers of gasoline based on their annual share of gasoline supplied to California. Once notified of their obligation, responsible parties would have approximately 2.5 years to meet their requirements. ARB would inform major refiners and importers of gasoline of the geographic areas where stations are needed to ensure that fueling stations would be constructed in locations that would be adequately accessible by the general public, but the major refiners and importers of gasoline would be responsible for identifying exact station locations. The protocol used to determine station locations would account for the need to provide adequate station coverage in the areas where FCVs are being marketed, leased, and sold. Requirements to build new hydrogen fueling stations would sunset when the number of hydrogen fueling stations statewide represents five percent of the total number of retail fuel outlets; however, major refiners and importers of gasoline would be required to continue operating and maintaining the hydrogen fueling stations that they previously built.

The regulation would also include additional requirements regarding BEVs and BEV-charging infrastructure. It would require ARB to assess the battery-charging infrastructure needs of BEVs within a specified period after the regulation is adopted. The purpose of ARB's assessment would be to determine where BEV drivers are charging their cars (e.g., at home, at workplaces, or at public charging locations), charging frequency, and under what conditions and locations would additional public charging stations be needed to adequately support BEV activity. Following its assessment, ARB would make recommendations regarding public battery-charging infrastructure.

The proposed amendments to the CFO regulation would complement the ZEV regulation, because they ensure the availability of hydrogen to FCVs as they are produced and sold in California. The amended CFO regulation would also ensure vehicle manufacturers and consumers that FCV ownership is a real and viable option for passenger transportation in California. Finally, the amendments would require ARB staff to monitor BEV deployment in an effort to have battery-charging opportunities keep pace with needs.

D. The "Project" as Three Combined Regulatory Amendment Packages.

The "project," as defined by CEQA, undergoing environmental review in this EA is the combined set of amendments to the LEV, ZEV, and CFO regulations. The amendments to these three regulations are analyzed as one project, because the regulations are related and compliance responses by vehicle manufacturers and fuel providers would have a combined effect on the statewide vehicle fleet, the ways light- and medium-duty vehicles are sold and leased, and the availability and use of alternative fuels. This is necessary to provide a comprehensive review of the combined, or cumulative, effect of these regulatory amendments.

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3.0 ENVIRONMENTAL SETTING

Existing physical conditions and the current regulatory framework relevant to each environmental topic are presented in this section. Refer to Chapter 4 for the analysis of environmental impacts and description of mitigation measures, if needed.

A. Aesthetics

1. Existing Conditions

California, by virtue of its size, setting, and topographic and climatic variation, exhibits tremendous scenic diversity. The varied landscape ranges from coastal to desert and valley to mountain. Innumerable natural features and settings combine to produce scenic resources that are treasured by residents and visitors alike.

Visibility is a factor that affects the ability to view and appreciate the aesthetic values in these features and settings and visibility is directly affected by the presence of airborne visibility-reducing particles. Visibility-reducing particles consist of suspended particulate matter, which is a complex mixture of tiny particles that consists of dry solid fragments, solid cores with liquid coatings, and small droplets of liquid. These particles vary greatly in shape, size and chemical composition, and can be made up of many different materials such as metals, soot, soil, dust, and salt (ARB 2009a).

2. Regulatory Setting

Applicable laws and regulations associated with aesthetics and scenic resources are discussed in Table 3.A-1.

Table 3.A-1. Applicable Laws and Regulations for Aesthetic Resources

Applicable Regulation	Description
Federal	
Federal Land Policy and Management Act of 1976 (FLPMA)	FLPMA is the enabling legislation establishing the Bureau of Land Management's responsibilities for lands under its jurisdiction. Section 102 (a) of the FLPMA states that ". . . . the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values .... " Section 103 (c) identifies "scenic values" as one of the resources for which public land should be managed.
Bureau of Land Management Contrast Rating System	The contrast rating system is a systematic process used by BLM to analyze visual impacts of proposed projects and activities. It is primarily intended to assist BLM personnel in the resolution of visual impact assessment.
Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users	This Act includes numerous provisions for improvements and changes to the implementation of transportation enhancement activities, which are funded by a ten percent set aside of Surface Transportation Program funds that are earmarked for transportation enhancement projects. This Act includes a list of qualifying transportation enhancement activities which include several items supportive of visual

Table 3.A-1. Applicable Laws and Regulations for Aesthetic Resources	
Applicable Regulation	**Description**
	quality enhancement such as acquisition of scenic easements and scenic or historic sites, scenic or historic highway programs, landscaping or other scenic beautification, and control and removal of outdoor advertising, among others. Transportation enhancement activities are not required to have a direct link to surface transportation, and they are sufficiently qualified if they merely relate to surface transportation.
National Historic Preservation Act (NHPA)	Under regulations of the NHPA, visual impacts to a listed or eligible National Register property that may diminish the integrity of the property's "setting . . .[or] . . . feeling" in a way that affects the property's eligibility for listing, may result in a potentially significant adverse effect. "Examples of adverse effects . . . include . . .: Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features." (36 CFR Part 800.5.)
State	
Ambient Air Quality Standard for Visibility-Reducing Particles	Extinction coefficient (measure of absorption of light in a medium) of 0.23 per kilometer — visibility of ten miles or more (0.07 — 30 miles or more for Lake Tahoe) due to particles when relative humidity is less than 70 percent. (Method: Beta Attenuation and Transmittance through Filter Tape.) This value is not to be exceeded (ARB 2010).
California Streets and Highways Code, Sections 260 through 263 – Scenic Highways	The State Scenic Highway Program promotes protection of designated State scenic highways through certification and adoption of local scenic corridor protection programs that conform with requirements of the California Scenic Highway Program.
Local	
County and City Controls	Most local planning guidelines to preserve and enhance the visual quality and aesthetic resources of urban and natural areas are established in the jurisdiction's General Plan. The value attributed to a visual resource generally is based on the characteristics and distinctiveness of the resource and the number of persons who view it. Vistas of undisturbed natural areas, unique or unusual features forming an important or dominant portion of a viewshed, and distant vistas offering relief from less attractive nearby features are frequently considered to be scenic resources. In some instances, a case-by-case determination of scenic value may be needed, but often there is agreement within the relevant community about which features are valued as scenic resources. In addition to federal and State designations, counties and cities have their own scenic highway designations, which are intended to preserve and enhance existing scenic resources. Criteria for designation are commonly included in the conservation/open space element of the city or County General Plan. Cities and counties can use open space easements as a mechanism to preserve scenic resources, if they have adopted open-space plans, as provided by the Open Space Easement Act of 1974 and codified in California Government Code (Section 51070 et seq.) According to the Act, a city or county may acquire or approve an open-space easement through a variety of means, including use of public money.

B. Agricultural and Forest Resources

1. Existing Conditions

Based on the value of agricultural products sold, California is the largest agricultural producer among all states in the U.S. California produces nearly half of the nation's grown fruits, nuts, and vegetables and is the nation's leading dairy state. California's agricultural abundance includes more than 400 commodities, many of which are produced solely in California. (CDFA 2010a). Of California's approximately 100 million acres of land, 43 million acres are used for agriculture (CDFA 2010b). Of this land area, 16 million acres are grazing land and 27 million acres are cropland. Approximately 9 million acres of irrigated land, or one-third of the State's cropland, is considered to be prime, unique, or of statewide importance.

Although California remains the nation's top agricultural producer, it has experienced significant farmland loss as a result of urbanization. The California Department of Food and Agriculture estimates that about 3.4 million acres of land in California's agricultural counties are now urbanized. Development consumes approximately 40,000 acres of agricultural land in California per year (CDFA 2010b). Other causes of agricultural land loss include the removal of agriculture for environmental purposes (such as the creation or enlargement of wildlife refuges) and withdrawals due to water shortages (CDFA 2010b).

California contains over 33 million acres of forests comprising a broad range of tree species, tree sizes, and levels of canopy closure (USFS 2008, p.124). Conifer forests and woodlands cover over 19 million acres and are most extensive in the Sierra, Modoc, and Klamath/North Coast bioregions of the State. Hardwood forests and oak woodlands cover over 13 million acres and extend mostly along the perimeter of the Sacramento and San Joaquin Valleys and throughout the coastal ranges (USFS 2008, p. 128). The most productive timber growing portion of California's forests are approximately 19 million acres of public and private timberland—that is, land capable of growing more than 20 cubic feet of wood per acre per year and statutorily available for timber management (USFS 2008, p. 127). In the case of public ownerships (53 percent of timberlands), many lands capable of timber production have been administratively withdrawn over the past two decades for a variety of purposes and have been directed to primary uses other than timber production. California has 9 million acres of privately owned timberland, of which 5.4 million acres are classified as timberland production zone where long-term tax and regulatory structures favor timber production over potential conversion to other uses (USFS 2008, p. 127).

2. Regulatory Setting

Table 3.B-1 below provides a general description of applicable laws and regulations that may pertain to agriculture and forest resources and the Proposed ACC Program.

Table 3.B-1. Applicable Laws and Regulations for Agriculture and Forest Resources	
Applicable Regulation	**Description**
Federal	
Farmland Protection Policy Act	The Farmland Protection Policy Act (FPPA) directs Federal agencies to consider the effects of Federal programs or activities on farmland, and ensure that such programs, to the extent practicable, are compatible with State, local, and private farmland protection programs and policies. The rating process established under the FPPA was developed to help assess options for land use on an evaluation of productivity weighed against commitment to urban development.
National Forest Management Act of 1976	The National Forest Management Act (NFMA) is the primary statute governing the administration of national forests. The act requires the Secretary of Agriculture to assess forest lands, develop a management program based on multiple-use, sustained-yield principles, and implement a resource management plan for each unit of the National Forest System. Goal 4 of the U.S. Forest Service's National Strategic Plan for the National Forests states that the nation's forests and grasslands play a significant role in meeting America's need for producing and transmitting energy. Unless otherwise restricted, National Forest Service lands are available for energy exploration, development, and infrastructure (e.g., well sites, pipelines, and transmission lines). However, the emphasis on non-recreational special uses, such as utility corridors, is to authorize the special uses only when they cannot be reasonably accommodated on non-National Forest Service lands.
State	
The California Land Conservation Act, also known as the Williamson Act (Govt. Code, § 51200)	The California Department of Conservation's Division of Land Resource Protection administers the Williamson Act program, which permits property tax adjustments for landowners who contract with a city or county to keep their land in agricultural production or approved open space uses for at least 10 years. Lands covered by Williamson Act contracts are assessed on the basis of their agricultural value instead of their potential market value under nonagricultural uses. In return for the preferential tax rate, the landowner is required to contractually agree to not develop the land for a period of at least 10 years. Williamson Act contracts are renewed annually for 10 years unless a party to the contract files for nonrenewal. The filing of a non-renewal application by a landowner ends the automatic annual extension of a contract and starts a 9-year phase-out of the contract. During the phase-out period, the land remains restricted to agricultural and open-space uses, but property taxes gradually return to levels associated with the market value of the land. At the end of the 9-year non-renewal process, the contract expires and the owner's uses of the land are restricted only by applicable local zoning. The Williamson Act defines *compatible use* of contracted lands as any use determined by the county or city administering the agricultural preserve to be compatible with the agricultural, recreational, or open space use of land within the preserve and subject to contract (Government Code, Section 51202[e]). However, uses deemed compatible by a county or city government must be consistent with the principles of compatibility set forth in Government Code, Section 51238.1. Approximately 16 million acres of farmland (about 50 percent of the State's total farmland) are enrolled in the program.

Table 3.B-1. Applicable Laws and Regulations for Agriculture and Forest Resources	
Applicable Regulation	**Description**
California Farmland Conservancy Program (Public Resources Code, §10200)	The program provides grant funding for agricultural conservation easements. Although the easements are always written to reflect the benefits of multiple resource values, there is a provision in the CFCP statute that prevents easements funded under the program from restricting husbandry practices. This provision could prevent restricting those practices to benefit other natural resources.
Farmland Mapping and Monitoring Program (FMMP) (Gov. Code §65570, PRC §612).	For this program, the California Department of Conservation assesses the location, quality, and quantity of agricultural lands and conversion of these lands over time. Agricultural designations include the categories of Prime Farmland, Farmland of Statewide Importance, Unique Farmland, Farmland of Local Importance, Grazing Land, Urban and Built-Up Land, and Other Land.
State Lands Commission Significant Lands Inventory	The State Lands Commission is responsible for managing lands owned by the State, including lands that the State has received from the federal government. These lands total more than four million acres and include tide and submerged lands, swamp and overflow lands, the beds of navigable waterways, and State School Lands. The State Lands Commission has a legal responsibility for, and a strong interest in, protecting the ecological and Public Trust values associated with the State's sovereign lands, including the use of these lands for habitat preservation, open space and recreation. Scoping Plan projects located within these lands would be subject to the State Lands Commission permitting process.
Local	
Open Space Element	State law requires each city and county to adopt a general plan containing at least seven mandatory elements including an open space element. The open space element identifies open space resources in the community and strategies for protection and preservation of these resources. Agricultural and forested lands are among the land use types identified as open space in general plans.

C. Air Quality

1. Existing Conditions

The effects of the proposed ACC Program are evaluated in detail as contained in each respective Staff Report and are summarized in this EA. This evaluation is extensive because benefitting air quality conditions in California is both one of the primary objectives of the proposed ACC Program and the agency's environmental protection mandate. This environmental setting discussion provides an overview of how air quality is regulated in California and the state of existing air quality conditions. Though the GHG environmental setting is presented separately in Section D below, it is important to note that mobile source control programs address CAPs and TACs, and in the case of GHGs, it's in part to reduce temperature that exacerbates smog and causes PM from wildfires.

a. California's Criteria Air Pollutant and Toxics Regulatory Programs

The federal, State, and local governments all share responsibility for reducing air pollution. ARB is California's lead air agency and controls emissions from mobile sources, fuels, and consumer products, as well as air toxics. ARB also coordinates local and regional emission reduction measures and plans that meet federal and State air quality limits. At the federal level, the U.S. EPA has oversight of State programs. In addition, U.S. EPA alone establishes emission standards for certain mobile sources such as ships, trains, and airplanes.

Two criteria air pollutants and their precursors, (CAPs) are of most health concern in California (i.e., ozone and particulate matter with an aerodynamic diameter of 2.5 micrometers or less [$PM_{2.5}$]). The health risk from diesel particulate matter is the largest air toxics risk, both regionally and at locations such as ports and rail yards. ARB actions are lowering these health risks, and substantial new emission reductions in both CAPs and diesel particulate matter will occur between now and 2020.

Ozone, a major component of "smog", is not directly emitted as a pollutant, but is formed in the atmosphere when reactive organic gases (ROG) and oxides of nitrogen (NO_X) emissions react in the presence of sunlight. Ozone concentrations often peak downwind of the emission sources, which contributes to the regional nature of ozone air pollution.

$PM_{2.5}$ is a mixture of pollutants generated by a variety of sources. $PM_{2.5}$ can either be emitted directly into the air in forms such as soot and smoke, or it can be formed in the atmosphere from the reactions of pollutants including NO_X, oxides of sulfur (SO_X), ROG, and ammonia. While the impacts of directly emitted $PM_{2.5}$ may be seen near sources of air pollution, $PM_{2.5}$ that is formed in the atmosphere has a regional impact similar to ozone.

California's mature air quality program leads the nation in terms of stringency of required emission controls, not only for mobile sources but also for stationary sources.

Reducing emissions from combustion sources is at the core of California's program to meet air quality standards for ozone and $PM_{2.5}$. California's climate and CAP programs are complementary, and the AB 32 regulations ARB is adopting will provide co-benefits that will be incorporated into future air quality plans for ozone and $PM_{2.5}$.

b. Ambient Air Quality Standards and the State Implementation Plan

CAPs are the most prevalent air pollutants known to be deleterious to human health and extensive health-effects criteria documents are available. The federal Clean Air Act (CAA) required the U.S. EPA to establish national ambient air quality standards (NAAQS). The California Clean Air Act (CCAA), which was adopted in 1988, required the ARB to establish California ambient air quality standards (CAAQS). In addition to CAPs, ARB has established CAAQS for sulfates, hydrogen sulfide, vinyl chloride, and visibility-reducing particulate matter. In most cases the CAAQS are more stringent than the NAAQS. Differences in the standards are generally explained by the health effects studies considered during the standard setting process and the interpretation of the studies. The NAAQS and CAAQS are presented in Table 3.C-1.

Table 3.C-1. Ambient Air Quality Standards and Designations

Pollutant	Averaging Time	California Standards [2,3]	National Standards [1] Primary [3,4]	National Standards [1] Secondary [3,6]
Ozone	1-hour	0.09 ppm (180 μg/m³)	–[6]	Same as Primary Standard
	8-hour	0.070 ppm (137 μg/m³)	0.075 ppm (147 μg/m³)	
Carbon Monoxide (CO)	1-hour	20 ppm (23 mg/m³)	35 ppm (40 mg/m³)	–
	8-hour	9 ppm (10 mg/m³)	9 ppm (10 mg/m³)	
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	0.030 ppm (56 μg/m³)	0.053 ppm (100 μg/m³)	Same as Primary Standard
	1-hour	0.18 ppm (338 μg/m³)	0.100 ppm (188 μg/m³)	
Sulfur Dioxide (SO_2)	24-hour	0.04 ppm (105 μg/m³)		–
	3-hour	–	–	0.5 ppm (1300 μg/m³)
	1-hour	0.25 ppm (655 μg/m³)	0.075 ppm (196 μg/m³)	–
Respirable Particulate Matter (PM_{10})	Annual Arithmetic Mean	20 μg/m³	–[6]	Same as Primary Standard
	24-hour	50 μg/m³	150 μg/m³	

Table 3.C-1. Ambient Air Quality Standards and Designations

Pollutant	Averaging Time	California Standards [2,3]		National Standards [1] Primary [3,4]	National Standards [1] Secondary [3,6]
Fine Particulate Matter ($PM_{2.5}$)	Annual Arithmetic Mean	12 µg/m³		15 µg/m³	Same as Primary Standard
	24-hour	–		35 µg/m³	
Lead[10]	30-day Average	1.5 µg/m³		–	–
	Calendar Quarter	–		1.5 µg/m³	Same as Primary Standard
	Rolling 3-Month Avg.	–		0.15 µg/m³	
Sulfates	24-hour	25 µg/m³		No National Standards	
Hydrogen Sulfide	1-hour	0.03 ppm (42 µg/m³)			
Vinyl Chloride[7]	24-hour	0.01 ppm (26 µg/m³)			
Visibility-Reducing Particle Matter	8-hour	Extinction coefficient of 0.23 per kilometer — visibility of 10 miles or more (0.07—30 miles or more for Lake Tahoe) because of particles when the relative humidity is less than 70%.	U		

1 National standards (other than ozone, PM, and those based on annual averages or annual arithmetic means) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration in a year, averaged over 3 years, is equal to or less than the standard. The PM_{10} 24-hour standard is attained when 99 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard. The $PM_{2.5}$ 24-hour standard is attained when 98 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard. Contact the U.S. EPA for further clarification and current federal policies.
2 California standards for ozone, CO (except Lake Tahoe), SO_2 (1- and 24-hour), NO_2, PM, and visibility-reducing particles are values that are not to be exceeded. All others are not to be equaled or exceeded. CAAQS are listed in the Table of Standards CCR, Title 17, Section 70200.
3 Concentration expressed first in units in which it was promulgated [i.e., parts per million (ppm) or micrograms per cubic meter (µg/m³)]. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.
4 National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.
5 National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
6 The 1-hour ozone NAAQS was revoked on June 15, 2005. The annual PM_{10} NAAQS was revoked in October 2006.
7 ARB has identified lead and vinyl chloride as toxic air contaminants with no threshold of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.
Source: ARB 2010

Federal clean air laws require areas with unhealthy levels of CAPs (i.e., ozone, carbon monoxide [CO], nitrogen dioxide [NO_2], sulfur dioxide [SO_2], particulate matter with an aerodynamic diameter of 10 micrometers or less [PM_{10}], $PM_{2.5}$, and lead) to develop plans, known as State Implementation Plans (SIPs). SIPs are comprehensive plans that describe how an area will attain national ambient air quality standards (NAAQS). The 1990 amendments to the federal CAA set deadlines for attainment based on the severity of an area's air pollution problem.

The SIP is a compilation of new and previously submitted plans, programs (such as monitoring, modeling, permitting, etc.), district rules, State regulations and federal controls. Many of California's SIPs rely on the same core set of control strategies, including emission standards for cars and heavy trucks, fuel regulations and limits on emissions from consumer products. State law makes ARB the lead agency for all purposes related to the SIP. Local air districts and other agencies, such as the Bureau of Automotive Repair and the Department of Pesticide Regulation, prepare SIP elements and submit them to ARB for review and approval. ARB forwards SIP revisions to the U.S. EPA for approval and publication in the Federal Register. The Code of Federal Regulations Title 40, Chapter I, Part 52, Subpart F, Section 52.220 lists all of the items which are included in the California SIP. At any one time, several California measures have been submitted to U.S. EPA for their approval into the SIP (ARB 2009b).

c. Air Districts

The CCAA requires that all local air districts in the State endeavor to achieve and maintain the CAAQS by the earliest practical date. The Act specifies that local air districts should focus particular attention on reducing the emissions from transportation operations and area-wide emission sources, and provides districts with the authority to regulate indirect sources.

There are 35 air pollution control districts or air quality management districts (together, referred to as air districts) across California. Air districts attain and maintain air quality conditions in their respective jurisdictions through a comprehensive program of planning, regulation, enforcement, technical innovation, and promotion of the understanding of air quality issues. The clean air strategy implemented by air districts includes the preparation of plans for the attainment of ambient air quality standards, adoption and enforcement of rules and regulations concerning sources of air pollution, and issuance of permits for stationary sources of air pollution. Air districts also inspect stationary sources of air pollution and respond to citizen complaints, monitor ambient air quality and meteorological conditions, and implement programs and regulations required by the CAA, and the CCAA, primarily on stationary sources.

d. Clean Vehicle and Diesel Risk Reduction Programs

i. Criteria Air Pollutant Control Programs

Over the last several decades, California has dramatically tightened emission standards for on-road and off-road mobile sources and the fuels that power them. California's emission control program for on-road motor vehicles is the strongest in the world. New cars are now 99 percent cleaner than their uncontrolled counterparts prior to the mid-1960s. Trucks are now 90 percent cleaner than before the mid-1960s, and will be 98 percent cleaner by 2010.

ARB rules adopted as part of the Diesel Emission Reduction Program and Goods Movement Program are primarily toxics control measures (e.g., California has identified diesel PM as a TAC, but also achieve significant CAP emission reductions.

Working in concert with the U.S. EPA, standards for goods movement sources have also been tightened dramatically. By requiring low-sulfur fuel, SO_X emissions from ship auxiliary engines will be cut 96 percent from before the mid-2000s by 2010. New locomotive engines are now 50 to 60 percent cleaner than before the mid-2000s. Harbor craft emission standards were cut roughly in half from before the mid-2000s. New cargo handling equipment will be 95 percent cleaner by 2011 than before the mid-2000s.

California has also profoundly lowered emission standards for off-road sources, from lawn and garden equipment, to recreational vehicles and boats, to construction equipment and other large off-road sources. From 2010 through 2014, these new off-road sources will be manufactured to operate with 80-98 percent fewer emissions than their uncontrolled counterparts.

ARB has worked closely with U.S. EPA to regulate large diesel, gasoline and liquid petroleum gas equipment, over which authority is split between California and the federal government, and by 2014, new large off-road equipment will be 98 percent cleaner. ARB has also made great strides in reducing emissions from the smaller engines under concurrent State control, like those used in lawn mowers, jet skis, recreational vehicles, and boats. From 2010 to 2015, these new off-road sources will be manufactured with 82-90 percent lower emission levels than their uncontrolled counterparts.

Adopted regulations have made significant strides in reducing emissions from those mobile sources already in use (i.e., the legacy fleet) by keeping existing vehicles cleaner longer, getting cleaner technology on older vehicles and equipment, and replacing older dirtier vehicles and equipment with cleaner ones. Whereas new engine emissions have been regulated for a long time, most of the in-use control programs have just begun to apply and have an impact.

Many programs and rules are currently in place to reduce emissions from the mobile-source legacy fleets. The Smog Check Program ensures that passenger vehicles stay clean as they age and on-board diagnostic systems identify emission control problems. Heavy-duty truck inspection programs help control smoke emissions and detect emission control mal-maintenance and tampering.

ARB has adopted well over 20 regulations in the last eight years. ARB's landmark regulations adopted in 2007 and 2008 will accelerate replacement of higher-emitting heavy-duty trucks, buses and construction equipment. Recently adopted regulations have required use of cleaner fuels, greatly reducing emissions from ships and harbor craft. ARB has adopted public and private fleet rules that require local governments and private companies to incorporate the cleanest vehicles and equipment into their fleets. Testing procedures and verification requirements for current emission control technology have been strengthened. In addition, other operational and emission control technology requirements that help reduce emissions from existing vehicle and equipment have been put into place.

Incentive programs have worked hand-in-hand with regulations, providing added emissions benefits. California is currently investing up to $140 million per year to clean up older, higher-emitting sources through the Carl Moyer Program. The Smog Check Breathe Easier Campaign pays motorists $1,000 to permanently retire their high polluting vehicles. Also, California Proposition 1B, also known as the Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006, was on the November 7, 2006 ballot in California as a legislatively-referred bond act, where it was approved. Proposition 1B authorized the State of California to sell $19.925 billion of general obligation bonds to fund transportation projects "to relieve congestion, improve the movement of goods, improve air quality, and enhance the safety and security of the transportation system." Local governments use special vehicle registration fees to fund projects that further reduce emissions from motor vehicles.

In 2007 the Board adopted a new statewide strategy for reducing emissions that contribute to high ozone and $PM_{2.5}$ levels. The 2007 State Strategy, together with local control strategies, is designed to allow California to meet the U.S. EPA's national ambient air quality standards for ozone and $PM_{2.5}$. As of April, 2010, ARB had adopted twelve regulations to reduce CAP emissions and fulfill commitments made in the 2007 State Strategy. Some of the rulemakings were technical corrections to existing rules or deadline modifications, and did not further reduce emissions.

The adopted rules are shown in Table 3.C-2.

Table 3.C-2. Rules Adopted Pursuant to the 2007 State Strategy

ARB Rules	Adoption Date
Enhanced Vapor Recovery for Above Ground Storage Tanks	June 2007
Modifications to Reformulated Gasoline Program – Phase 3	June 2007
Cleaner In-use Off-Road Equipment	July 2007
Light-Duty Vehicle Catalyst Replacement	October 2007
Clean Up Existing Harbor Craft	November 2007
Port Truck Modernization	December 2007/ December 2008
Ship Auxiliary Engines (Cold Ironing)	December 2007
Consumer Products	June 2008/ November 2008
Clean Fuel Requirements for Ship Main Engines	July 2008
Spark-Ignition Marine Engine and Boat Regulations	July 2008
Portable Outdoor Marine Tanks Evaporative Emission Standards (partial)	September 2008
Large Spark-Ignited Engines, Rule Amendment	November 2008
Small Off-Road Engine Regulation	November 2008
Cleaner In-Use Heavy-Duty Trucks	December 2008
Gasoline Dispensing Facility Hoses	May 2009
Enhanced Fleet Modernization Program (Car Scrap)	June 2009
Consumer Products	September 2009
Portable Equipment	January 2010
Commercial Harbor Craft	June 2010
Stationary Compression Ignition Engines	October 2010
Consumer Products	November 2010
Transport Refrigeration Units	November 2010
In-Use Off-Road Diesel-Fueled Fleets	December 2010
Truck and Bus Regulation	December 2010
Ocean-Going Vessels	June 2011
Transport Refrigeration Units	October 2011
California Reformulated Gasoline	October 2011

The SIP and Statewide Strategy are focused on areas with pollution levels that exceed national air quality standards for ozone and $PM_{2.5}$. However, most of the control measures adopted pursuant to the Statewide Strategy will reduce emissions, and improve air quality, throughout the State. These controls also fulfill commitments made in ARB's Diesel Risk Reduction Plan (ARB 2000) and Goods Movement Emission

Reduction Plan (Business, Transportation and Housing Agency and California Environmental Protection Agency 2007), and help all areas make progress towards attaining California's more protective State ambient air quality standards.

ii. Diesel Risk Reduction Plan

In September 2000, ARB adopted an aggressive plan to require cleaner diesel fuel and cleaner diesel engines and vehicles. The Diesel Risk Reduction Plan targets reductions of diesel emissions from year-2000 levels by 75 percent by 2010 and 85 percent by 2020. Since the adoption of the Diesel Risk Reduction Plan, some of the strategies in place today that are reducing diesel PM include:

- Cleaner diesel fuel. The sulfur level in California diesel fuel was lowered to less than 15 parts per million in July 2006. ARB's fuel regulation applies to fuels for on-road, off-road, and stationary engines, while the federal low sulfur diesel rule applies only to on-road vehicles.

- Cleaner new diesel engines. In 2001, ARB adopted new PM and NO_X emission standards to clean up new on-road diesel engines that power big-rig trucks, trash trucks, delivery vans, and other large vehicles. The new PM standard is a 90 percent reduction from the previous PM standard.

- Cleaner in-use diesel engines. ARB has adopted regulations aimed at reducing PM and other pollutants from in-use diesel engines through engine replacement, retrofit with verified diesel emission control system to the existing engine, vehicle replacement with an alternative-fueled vehicle or a vehicle with a new and cleaner diesel engine, and operational modifications including reduced operating time or reduced idling.

iii. Goods Movement Action Plan

Air pollution from international trade and all goods movement in California is a major public health concern at both regional and community levels. Goods movement is now the dominant contributor to transportation emissions in the State. In April 2006, ARB approved the Emission Reduction Plan for Ports and Goods Movement in California to reduce the emissions and health risk in communities near ports, rail yards, and high-traffic corridors. The plan will reduce emissions of diesel PM, the NO_X and SO_X that contribute to fine particles, and, to a lesser extent, the ROG that mixes with NO_X in the atmosphere to form regional ozone. The plan envisions emission reductions at each step in the goods movement path, from ship to shore to truck or locomotive to the final destination.

e. Stationary Source Regulatory Program

Basic elements of the federal CAA include stationary source emissions standards and permits. The ARB does not have authority to issue permits directly to stationary sources of air pollution. Primary responsibility for permitting all sources, except vehicular sources, rests with the local and regional air districts.

f. Air Toxics Programs

Air quality regulations also focus on TACs, or in federal parlance hazardous air pollutants (HAPs). In general, for those TACs that may cause cancer, there is no concentration that does not present some risk. In other words, there is no threshold level below which adverse health impacts may not be expected to occur. This contrasts with the CAPs for which acceptable levels of exposure can be determined and for which the NAAQS and CAAQS have been established (Table 3.C-1). Instead, the U.S. EPA and ARB regulate HAPs and TACs, respectively, through statutes and regulations that generally require the use of the maximum or best available control technology for toxics (MACT and BACT) to limit emissions. These, in conjunction with additional rules set forth by air districts, establish the regulatory framework for TACs.

i. Federal Hazardous Air Pollutant Programs

The U.S. EPA has programs for identifying and regulating HAPs. Title III of the CAA directed the U.S. EPA to promulgate national emissions standards for HAPs (NESHAP). The NESHAP may differ for major sources than for area sources of HAPs. Major sources are defined as stationary sources with potential to emit more than 10 tons per year (TPY) of any HAP or more than 25 TPY of any combination of HAPs; all other sources are considered area sources.

The CAA also required the U.S. EPA to promulgate vehicle or fuel standards containing reasonable requirements that control toxic emissions, at a minimum applying to benzene and formaldehyde. Performance criteria were established to limit mobile-source emissions of toxics, including benzene, formaldehyde, and 1-3-butadiene. In addition, Section 219 required the use of reformulated gasoline in selected areas with the most severe ozone nonattainment conditions to further reduce mobile-source emissions.

ii. State and Local Toxic Air Contaminant Programs

TACs in California are primarily regulated through the Tanner Air Toxics Act (AB 1807, Statutes of 1983) and the Air Toxics Hot Spots Information and Assessment Act (AB 2588, Statutes of 1987). AB 1807 sets forth a formal procedure for ARB to designate substances as TACs. This includes research, public participation, and scientific peer review before ARB can designate a substance as a TAC. To date, ARB has identified over 21 TACs, and adopted the U.S. EPA's list of HAPs as TACs. Most recently, diesel PM was added to the ARB list of TACs.

Existing sources of TACs also include mobile sources (i.e., diesel-fueled internal combustion engines) on nearby roadways. According to the ARB, on-road diesel-fueled vehicles contribute approximately 24 percent of the statewide total of TAC emissions, with an additional 71 percent attributed to other mobile sources such as construction, mining, and agricultural equipment, and transport refrigeration units.

g. Air Quality Conditions

As a result of the emission reduction regulations and programs described above, California has made significant progress in reducing public exposure to unhealthy levels of air pollution, and ambient concentrations are now significantly lower than they were 20 years ago. However, at the same time, the targets for defining clean air have become more stringent. As a result, despite continuing improvements in air quality, more areas violate the new standards. Changes to the national ozone standards provide an illustration of this situation.

To keep pace with the current science, U.S. EPA periodically reviews the NAAQS and revises them as needed to reflect the most recent health information. U.S. EPA initially established the federal ozone standard as a 1-hour standard to protect against short-term exposure impacts. In the late 1990s, the 1-hour standard was replaced with an 8-hour standard to protect against long-term exposure impacts. More recent health studies indicate the need for an even more health protective standard, and U.S. EPA is currently considering an even lower level for the 8-hour standard.

Table 3.C-3 shows how various areas of California compare under the original 1-hour and current 8-hour national ozone standards in 1990 and 2009.

Table 3.C-3. Compliance with Federal Ozone Air Quality Standards in California's Major Urban Areas

AREA	1-Hour Ozone Standard (0.12 ppm)		8-Hour Ozone Standard (0.08 ppm)	
	Area Met Standard in 1990	Area Met Standard in 2009	Area Met Standard in 1990	Area Met Standard in 2009
Monterey Bay Area	✓	✓	✓	✓
Sacramento Metro Area		✓		
San Diego		✓		
San Francisco Bay Area		✓		✓
San Joaquin Valley				
San Luis Obispo County*		✓		✓
Santa Barbara County		✓		✓
South Coast				
Ventura County		✓		

Notes: * Available data show no violation of standard at San Luis Obispo sites, but the current high concentration site was not yet operating. Therefore, is very likely the area violated both standards in 1990. Sacramento has attained the 1-hour standard, based on 2009 data, but U.S. EPA has not yet formally made the announcement.

i. Ozone Trends

California's highest ozone concentrations are now close to half of what they were in 1990. In the South Coast Air Basin, the most populous California air basin, concentrations have decreased approximately 35 percent since 1990, and today nearly half (45 percent) the population (more than 6 million people) live in areas where ozone air quality meets the federal standard. Other portions of the South Coast Air Basin also show substantial improvement. The areas, and population, experiencing the highest ozone levels have decreased in size dramatically, and residents of the air basin experience those elevated levels on fewer days. Since 1990, the annual number of days that exceed the federal ozone standard have been cut nearly in half. Generally, the greatest improvements have occurred in areas that had the largest number of unhealthy days in 1990.

Air quality in California's inland areas continues to remain a significant challenge, and progress in the San Joaquin Valley has been slower than in other parts of California. However, although concentrations in the San Joaquin Valley have seen only a modest decrease, the frequency of exposure to unhealthy air has decreased significantly since 1990, with the average number of days exceeding the federal 8-hour ozone standard declining by 22 percent. In the San Francisco Bay Area ozone concentrations were only slightly higher than the federal standard in 1990 and have decreased approximately 11 percent since then. Ozone concentrations in the region are now below the federal 1-hour standard.

ii. $PM_{2.5}$ Trends

While $PM_{2.5}$ concentrations have only been measured for approximately ten years, significant progress has already occurred in this short time period. Annual average $PM_{2.5}$ concentrations have declined by at least 20 percent since 2002 throughout much of California. Similar progress has been seen in reducing daily (24-hour) concentrations. As with ozone, some of the most significant progress has occurred in the coastal areas.

In the South Coast Air Basin, both annual average and daily $PM_{2.5}$ concentrations have decreased by 30 to 50 percent since 2001. In addition, the number of days above the federal 24-hour $PM_{2.5}$ standard has decreased over 80 percent, dropping from 120 days in 2001 to less than 20 days today.

The San Francisco Bay Area Air Basin met the federal annual average $PM_{2.5}$ standard in 2001, and $PM_{2.5}$ concentrations have decreased nearly 30 percent since then. Daily concentrations are only slightly above the federal standard and occur in only a small region in the East Bay.

We continue to face significant challenges to improving $PM_{2.5}$ levels in the San Joaquin Valley. Nevertheless, annual average concentrations have decreased approximately 10 percent since 2001 and the most recent year's data shows that values continue to decrease. While the Bakersfield region in the southern end of the San Joaquin Valley experiences the highest levels of $PM_{2.5}$, other monitors throughout the San Joaquin Valley are only reaching values at or near the federal standard.

iii. Toxic Air Contaminant Trends

ARB maintains a statewide air quality monitoring network for TACs that currently includes 17 monitoring stations measuring ambient concentrations of over 60 substances. Nine individual air toxics, including diesel PM, account for the majority of the potential health risk in California. Exposure to diesel PM is the largest health concern, accounting for approximately 80 percent of the statewide risk. Unlike other air toxics, there is currently no method for directly monitoring diesel PM concentrations in the ambient air. However, diesel PM concentrations can be estimated from levels of other co-pollutants such as NO_X and elemental carbon. Over the last 20 years, concentrations of these indicators have decreased substantially.

As a result of controls on motor vehicles, fuels, stationary sources, and consumer products, the public's exposure to other air toxics has also decreased dramatically. Between the early 1990's and today, the decrease in statewide average health risk ranged from approximately 20 percent for formaldehyde, to approximately 90 percent for perchloroethylene. Air toxics associated with motor vehicles and their fuels such as 1,3-butadiene and benzene have also seen significant decreases of 80 to 85 percent as a result of ARB's mobile source control program. In aggregate, the estimated cancer risk from air toxics has been reduced by approximately 60 percent since the early 1990s.

It is important to note, however, that the routine air toxics monitoring network is designed to reflect regional exposures. Although ongoing control programs have been effective in reducing regional levels, there may still be situations of localized toxics exposure due to proximity to individual sources. Specialized monitoring studies are often needed to better characterize these localized impacts, which often have very steep gradients that drop off quickly farther from the source. Thus, conducting monitoring to capture these gradients is generally resource intensive.

2. Regulatory Setting

Table 3.C-4 below provides a general description of applicable laws and regulations that may pertain to air quality and the Proposed ACC Program. See Table 3.D-1 for discussion of GHG-related laws and regulations. Though these are not directly related to CAPs, those identified in Table 3.D-X regulate GHGs that contribute to global warming, which in turn impacts compliance with the CAAQS and NAAQS (e.g., climate penalty, where rising temperatures increase ground level ozone and airborne health-damaging particles, despite the reductions achieved by programs targeting smog-forming emissions from cars, trucks and industrial sources).

Table 3.C-4. Applicable Laws and Regulations for Air Quality	
Regulation	**Description**
Federal	
Clean Air Act (40 CFR)	The Clean Air Act, which was last amended in 1990, requires U.S. EPA to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The Clean Air Act established two types of NAAQS. Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings. U.S. EPA Office of Air Quality Planning and Standards (OAQPS) has set NAAQS for six principal pollutants, which are called "criteria" pollutants. Title III of the CAA directed the EPA to promulgate national emissions standards for HAPs (NESHAP). The CAA also required the EPA to promulgate vehicle or fuel standards containing reasonable requirements that control toxic emissions, at a minimum to benzene and formaldehyde. Performance criteria were established to limit mobile-source emissions of toxics, including benzene, formaldehyde, and 1-3-butadiene. In addition, Section 219 required the use of reformulated gasoline in selected areas with the most severe ozone nonattainment conditions to further reduce mobile-source emissions.
Other Applicable Federal-Level Regulations	This includes all other applicable regulations at the federal level for portions of the project area that are outside of the U.S. (e.g., Canada).
State	
CCR (Titles 13 and 17)	ARB is the agency responsible for coordination and oversight of State and local air pollution control programs in California and for implementing the California Clean Air Act (CCAA). The CCAA, which was adopted in 1988, required the ARB to establish California ambient air quality standards (CAAQS).
Other Applicable State-Level Regulations	This includes all other applicable regulations at the State level for portions of the project area that are outside of California (e.g., AB 1807 and AB 2588).

D. Greenhouse Gases

1. Existing Conditions

a. Existing Climate

Climate is the accumulation of daily and seasonal weather events over a long period of time, whereas weather is defined as the condition of the atmosphere at any particular time and place (Ahrens 2003). Like its topography, California's climate is varied and tends toward extremes. Generally there are two seasons in California: 1) a long, dry summer, with low humidity and cool evenings and 2) a mild, rainy winter, except in the high mountains, where four seasons prevail and snow lasts from November to April. The one climatic constant for the State is summer drought.

California has four main climatic regions. Mild summers and winters prevail in central coastal areas, where temperatures are more equable than virtually anywhere else in the U.S. For example, differences between average summer and winter temperatures between San Francisco and Monterey for example are seldom more than 10°F (6°C). During the summer there are heavy fogs in San Francisco and all along the coast. Mountainous regions are characterized by milder summers and colder winters, with markedly low temperatures at high elevations. The Central Valley has hot summers and cool winters, while the Imperial Valley and eastern deserts are marked by very hot, dry summers, with temperatures frequently exceeding 100°F (38°C).

Average annual temperatures for the State range from 47°F (8°C) in the Sierra Nevada to 73°F (23°C) in the Imperial Valley. The highest temperature ever recorded in the U.S. was 134° (57°C), registered in Death Valley on 10 July 1913. Death Valley has the hottest average summer temperature in the Western Hemisphere, at 98°F (37°C). The State's lowest temperature was -45°F (-43°C), recorded on 20 January 1937 at Boca, near the Nevada border.

Among the major population centers, Los Angeles has an average annual temperature of 63°F (17°C), with an average January minimum of 48°F (9°C) and an average July maximum of 75°F (24°C). San Francisco has an annual average of 57°F (14°C), with a January average minimum of 42°F (6°C) and a July average maximum of 72°F (22°C). The annual average in San Diego is 64°F (18°C), the January average minimum 49°F (9°C), and the July average maximum 76°F (24°C). Sacramento's annual average temperature is 61°F (16°C), with January minimums averaging 38°F (3°C) and July maximums of 93°F (34°C).

Annual precipitation varies from only 2 in (5 cm) in the Imperial Valley to 68 in (173 cm) at Blue Canyon, near Lake Tahoe. San Francisco had an average annual precipitation (1971–2000) of 20 in (51 cm), Sacramento 17.9 in (45.5 cm), Los Angeles 13.2 in (33.5 cm), and San Diego 10.8 in (27.4 cm). The largest one-month snowfall ever recorded in the US, 390 in (991 cm), fell in Alpine County in January 1911. Snow averages between 300 and 400 in (760 to 1,020 cm) annually in the high elevations of the Sierra Nevada, but is rare in the Central Valley and coastal lowlands.

Sacramento has the greatest percentage (73 percent) of possible annual sunshine among the State's largest cities; Los Angeles has 72 percent and San Francisco 71 percent. San Francisco is the windiest, with an average annual wind speed of 11 mph (18 km/hr). Tropical rainstorms occur often in California during the winter.

b. Attributing Climate Change—The Physical Scientific Basis

Climate change is a long-term shift in the climate of a specific location, region or planet. The shift is measured by changes in features associated with average weather, such as temperature, wind patterns, and precipitation. According to the Intergovernmental Panel on Climate Change (IPCC), a scientific body established by the World Meteorological Organization (WMO) and by the United Nations Environment Programme (UNEP), available scientific evidence supports the conclusion that most of the increased average global temperatures since the mid-20th century is very likely due to human-induced increases in GHG concentrations. GHGs, which are emitted from both natural and anthropogenic sources, include water vapor, carbon dioxide, methane, nitrous oxide, halocarbons, and ozone. These gases play a role in the "greenhouse effect" that helps regulate the temperature of the earth.

The current post-industrial warming trend differs alarmingly from past changes in the Earth's climate because GHG emissions are higher and warming is occurring faster than at any other time on record within the past 650,000 years. Historical long-term as well as decadal and inter-annual fluctuations in the Earth's climate resulted from natural processes such as plate tectonics, the Earth's rotational orbit in space, solar radiation variability, and volcanism. The current trend derives from an added factor: human activities, which have greatly intensified the natural greenhouse effect, causing global warming. GHG emissions from human activities that contribute to climate change include the burning of fossil fuels (such as coal, oil and natural gas), cutting down trees (deforestation) and developing land (land-use changes). The burning of fossil fuels emits GHGs into the atmosphere, while deforestation and land-use changes remove trees and other kinds of vegetation that store ("sequester") carbon dioxide. Emissions of GHGs due to human activities have increased globally since pre-industrial times, with an increase of 70 percent between 1970 and 2004 (IPCC 2007b).

A growing recognition of the wide-ranging impacts of climate change has fueled efforts over the past several years to reduce GHG emissions. In 1997, Kyoto Protocol set legally binding emissions targets for industrialized countries, and created innovative mechanisms to assist these countries in meeting these targets. The Kyoto Protocol took effect in 2004, after 55 parties to the Convention had ratified it (Department of Environment 2010). Six major GHGs have been the focus of efforts to reduce emissions: CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6). They are regulated under the Kyoto Protocol.

The "global warming potential" (GWP) metric is used to convert all GHGs into "CO_2-equivalent" units. Importantly, metrics such as GWP have been used as an exchange rate in multi-gas emissions policies and frameworks. Each gas's GWP is defined relative to CO_2. For example, N_2O's GWP is 310, meaning a unit mass of N_2O warms the atmosphere 310 times more than a unit mass of CO_2. SF_6 and PFCs have extremely long atmospheric lifetimes, resulting in their essentially irreversible accumulation in the atmosphere once emitted. However, in terms of quantity of emissions, CO_2 dominates world and U.S. GHG emissions.

Because the major GHGs have longer lives, they build up in the atmosphere so that past, present and future emissions ultimately contribute to total atmospheric concentrations. Thus, while reducing emissions of conventional air pollutants decreases their concentrations in the atmosphere in a relatively short time, atmospheric concentrations of the major GHGs can only be gradually reduced over years and decades. More specifically, the rate of emission of CO_2 currently greatly exceeds its rate of removal, and the slow and incomplete removal implies that small to moderate reductions in its emissions would not result in stabilization of CO_2 concentrations, but rather would only reduce the rate of its growth in coming decades. Many of the same activities that emit conventional air pollutants also emit GHGs (e.g., the burning of fossil fuels to produce electricity, heat or drive engines and the burning of biomass). Some conventional air pollutants also have greenhouse effects, for example, soot/black carbon and tropospheric ozone.

In recent years there has been increased attention in the particle research community about the potential of black carbon (BC) to cause global warming. The major anthropogenic sources of BC are fossil fuels and biofuels (biomass burning for domestic energy). The ability of BC to absorb light energy and its role in key atmospheric processes link it to a range of climate impacts, including increased temperatures, accelerated ice and snow melt, and disruptions to precipitation patterns. It has been proposed that light absorbing particles in the atmosphere act as a GHG whose net forcing is warming only second to CO_2 (Ramanathan and Carmichael 2008). This estimate of the forcing due to BC is larger than most prior estimates including those of the IPCC 4th assessment report (IPCC 2007c).

Global warming is no longer a matter of the future or of places far away. Rather, climate change is already evident in California, and it is happening now. Climate change is a critical issue facing California's citizens, ecosystems, and economic vitality. Sea levels have risen by as much as seven inches along the California coast over the last century, increasing erosion and pressure on the State's infrastructure, water supplies, and natural resources. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and both snowmelt and rainwater running off sooner in the year. These climate driven changes affect resources critical to the health and prosperity of California. For example, forest wild-land fires are becoming more frequent and intense due to dry seasons that start earlier and end later. Agriculture is especially vulnerable to altered temperature and rainfall patterns, and new pest problems. The State's water supply, already stressed under current demands and expected population growth, will shrink under even the most conservative projected climate change scenario Almost half a million Californians, many without the means to adjust to expected impacts, will be at risk from sea level rise along Bay and coastal areas. California's infrastructure is already stressed and will face additional burdens from climate risks. And as the Central Valley becomes more urbanized, more people will be at risk from intense heat waves (CEC 2009).

Borrowing from recent findings by the IPCC, the projected climate change-related exposures are likely to affect the health status of people, particularly those with low adaptive capacity, increased deaths, disease and injury due to heat waves, floods, storms, fires and droughts (IPCC 2007a). In California, low socioeconomic status and minority communities are potentially more vulnerable to health impacts associated with increasing temperatures due to less access to cooling centers, air conditioning, and limited access to health care. In some instances, limited ability to speak and/or understand English will make it difficult for certain environmental groups to learn about the most up-to-date information on extreme heat events, their impacts, and adaptive strategies. The economic impacts of a warming world will also be felt by all, but especially by low income communities, as the price of energy and food (and possibly health care) increase due to a changing climate.

In summary, extreme events from heat waves to floods to droughts to wildfires and bad air quality episodes are likely to become more frequent in the future and pose serious challenges to Californians. The diversity and size of California's agricultural sector creates unique challenges in its responses to climate changes, as they will affect crop productivity that could lead to large losses. California's water and hydropower energy resources are also vulnerable to climate change. Without changes in operating rules for the water system in California the reliability of water supply will be severely affected. By end of this century electricity demand would increase by 20 to 50 percent even in the low or medium IPCC GHG emission scenarios. These changes represent substantial impacts to California's residents and an added considerable stress to the electricity generating sector. California is one of the few hot spots for biodiversity in the world and new studies, which complementing early studies, suggest that climate change can severely reduce biodiversity in California or at least eliminate important endemic species. Economic evaluations of potential impacts due to climate change show that climate change could impose substantial costs to Californians in the order of tens of billions of dollars per year.

California is exemplary in the nation for its commitment to State-funded climate change research, its efforts to understand the climate risks it faces, and its wide range of efforts to confront the challenge. Abundant scientific evidence now shows that climate change is not just a future problem, but is already observable now, with measurable impacts for the State's citizens, natural resources, and economic sectors. California's position as a national leader of State-sponsored climate change research provides us a unique perspective on how best to manage for the effects of climate change. California must pursue a dual approach to managing its climate risks (e.g., reducing GHGs, mitigation, minimizing the impacts of climate change, and adaptation) with the overall goal of ensuring public safety and welfare, continued economic vitality of the State's climate-sensitive sectors.

Climate change is a global problem. GHGs are global pollutants, unlike criteria air pollutants and toxic air contaminants (TACs), which are pollutants of regional and local concern. Whereas pollutants with localized air quality effects have relatively short atmospheric lifetimes (about 1 day), GHGs have long atmospheric lifetimes (1 year to several thousand years). GHGs persist in the atmosphere for long enough time periods to be dispersed around the globe. Although the exact lifetime of any particular GHG molecule is dependent on multiple variables and cannot be pinpointed, it is understood that more CO_2 is emitted into the atmosphere than is sequestered by ocean uptake, vegetation, and other forms of sequestration. Of the total annual human-caused CO_2 emissions, approximately 54 percent is sequestered through ocean uptake, uptake by northern hemisphere forest regrowth, and other terrestrial sinks within a year, whereas the remaining 46 percent of human-caused CO_2 emissions remains stored in the atmosphere (Seinfeld and Pandis 1998).

Similarly, impacts of GHGs are borne globally, as opposed to localized air quality effects of criteria air pollutants and TACs. The quantity of GHGs that it takes to ultimately result in climate change is not precisely known; suffice it to say, the quantity is enormous, and no single project alone would measurably contribute to a noticeable incremental change in the global average temperature, or to global, local, or micro climate. From the standpoint of CEQA, GHG impacts to global climate change are inherently cumulative.

c. Attributing Climate Change—Greenhouse Gas Emission Sources

Emissions of GHGs contributing to global climate change are attributable in large part to human activities associated with the transportation, industrial/manufacturing, utility, residential, commercial and agricultural sectors. In California, the transportation sector is the largest emitter of GHGs, followed by electricity generation. Emissions of CO_2 are byproducts of fossil fuel combustion. CH_4, a highly potent GHG, resulting primarily from off-gassing (the release of chemicals from nonmetallic substances under ambient or greater pressure conditions), is largely associated with agricultural practices and landfills. N_2O is also largely attributable to agricultural practices and soil management. CO_2 sinks, or reservoirs, include vegetation and the ocean, which both absorb CO_2 through sequestration and dissolution, respectively, two of the most common processes of CO_2 sequestration.

California is the 12th to 16th largest emitter of CO_2 in the world (CEC 2006a). California produced 484 million gross metric tons of CO_2 equivalent (CO_2e) in 2004 (ARB 2009c). CO_2e is a measurement used to account for the fact that different GHGs have different potential to retain infrared radiation in the atmosphere and contribute to the greenhouse effect (i.e., global warming potential [GWP]). The GWP is dependent on the lifetime, or persistence, of the gas molecule in the atmosphere. For example, as described in Appendix C, "Calculation References," of the General Reporting Protocol of the California Climate Action Registry (CCAR 2009), 1 ton of CH_4 has the same contribution to the greenhouse effect as approximately 21 tons of CO_2. Therefore, CH_4 is a much more potent GHG than CO_2. Expressing emissions in CO_2e takes the contributions of all GHG emissions to the greenhouse effect and converts them to a single unit equivalent to the effect that would occur if only CO_2 were being emitted.

The California GHG inventory compiles statewide anthropogenic GHG emissions and sinks. It includes estimates for CO_2, CH_4, N_2O, SF_6, nitrogen trifluoride (NF_3), HFCs, and PFCs. The current inventory covers years 2000 to 2008 (ARB 2009c).Combustion of fossil fuel in the transportation sector was the single largest source of California's GHG emissions, accounting for 36 percent of total GHG emissions in the State. This sector was followed by the electric power sector (including both in-state and out-of-state sources) (24 percent) and the industrial sector (21 percent).

d. Adaptation to Climate Change

According to the IPCC, which was established in 1988 by the World Meteorological Organization and the United Nations Environment Programme, global average temperature is expected to increase by 3–7°F by the end of the century, depending on future GHG emission scenarios (IPCC 2007d). Resource areas other than air quality and global average temperature could be indirectly affected by the accumulation of GHG emissions. For example, an increase in the global average temperature is expected to result in a decreased volume of precipitation falling as snow in California and an overall reduction in snowpack in the Sierra Nevada. Snowpack in the Sierra Nevada provides both water supply (runoff) and storage (within the snowpack before melting), which is a major source of supply for the State (including the project site). According to the California Energy Commission (CEC 2006b), the snowpack portion of the water supply could potentially decline by 30–90 percent by the end of the 21st century. A study cited in a report by the California Department of Water Resources (DWR) projects that approximately 50 percent of the statewide snowpack will be lost by the end of the century (Knowles and Cayan 2002). Although current forecasts are uncertain, it is evident that this phenomenon could lead to significant challenges in securing an adequate water supply for a growing population. An increase in precipitation falling as rain rather than snow also could lead to increased potential for floods because water that would normally be held in the Sierra Nevada until spring could flow into the Central Valley concurrently with winter storm events. This scenario would place more pressure on California's levee/flood control system (DWR 2006).

Another outcome of global climate change is sea level rise. Sea level rose approximately 7 inches during the last century and it is predicted to rise an additional 7–22 inches by 2100, depending on the future levels of GHG emissions (IPCC 2007d). If this occurs, resultant effects could include increased coastal flooding, saltwater intrusion (especially a concern in the low-lying Sacramento–San Joaquin River Delta, where pumps delivering potable water could be threatened), and disruption of wetlands (CEC 2006b). As the existing climate throughout California changes over time, the ranges of various plant and wildlife species could shift or be reduced, depending on the favored temperature and moisture regimes of each species. In the worst cases, some species would become extinct or be extirpated from the State, if suitable conditions are no longer available.

2. Regulatory Setting

Table 3.D-1. Applicable Laws and Regulations for Greenhouse Gases	
Federal	
Mandatory Greenhouse Gas Reporting Rule	On September 22, 2009, U.S. EPA issued a final rule for mandatory reporting of GHGs from large GHG emissions sources in the United States. In general, this national reporting requirement will provide U.S. EPA with accurate and timely GHG emissions data from facilities that emit 25,000 metric tons or more of CO_2 per year. This publically available data will allow the reporters to track their own emissions, compare them to similar facilities, and aid in identifying cost effective opportunities to reduce emissions in the future. Reporting is at the facility level, except that certain suppliers of fossil fuels and industrial greenhouse gases along with vehicle and engine manufacturers will report at the corporate level. An estimated 85 percent of the total U.S. GHG emissions, from approximately 10,000 facilities, are covered by this final rule.
National Program to Cut Greenhouse Gas Emissions and Improve Fuel Economy for Cars and Trucks	On September 15, 2009, U.S. EPA and the Department of Transportation's National Highway Traffic Safety Administration (NHTSA) proposed a new national program that would reduce GHG emissions and improve fuel efficiency for all new cars and trucks sold in the United States. U.S. EPA proposed the first-ever national GHG emissions standards under the CAA, and NHTSA proposed Corporate Average Fuel Economy (CAFE) standards under the Energy Policy and Conservation Act. This proposed national program would allow automobile manufacturers to build a single light-duty national fleet that satisfies all requirements under both Federal programs and the standards of California and other states. The President requested that U.S. EPA and NHTSA, on behalf of the Department of Transportation, develop, through notice and comment rulemaking, a coordinated National Program under the Clean Air Act (CAA) and the Energy Policy and Conservation Act (EPCA), as amended by the Energy Independence and Security Act (EISA), to reduce fuel consumption by and GHG emissions of light-duty vehicles for model years 2017-2025. U.S. EPA and NHTSA are developing the proposal based on extensive technical analyses, an examination of the factors required under the respective statutes and on discussions with individual motor vehicle manufacturers and other stakeholders. The National Program would apply to passenger cars, light-duty trucks, and medium-duty passenger vehicles (light-duty vehicles) built in those model years (76 FR 48758). The first part of this program (i.e., 2012-2016) is implemented. The next part (i.e., 2017-2025) is currently in process for which ARB is proposed to accept compliance thereof as also being acceptable for California compliance, similar to what was done for the first part .

Table 3.D-1. Applicable Laws and Regulations for Greenhouse Gases	
Endangerment and Cause or Contribute Findings	On December 7, 2009, U.S. EPA adopted its Proposed Endangerment and Cause or Contribute Findings for Greenhouse Gases under the CAA (Endangerment Finding). The Endangerment Finding is based on Section 202(a) of the CAA, which states that the Administrator (of U.S. EPA) should regulate and develop standards for "emission[s] of air pollution from any class of classes of new motor vehicles or new motor vehicle engines, which in [its] judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare." The rule addresses Section 202(a) in two distinct findings. The first addresses whether or not the concentrations of the six key GHGs (i.e., carbon dioxide [CO_2], methane [CH_4], nitrous oxide [N_2O], hydrofluorocarbons [HFCs], perfluorocarbons [PFCs], and sulfur hexafluoride [SF_6]) in the atmosphere threaten the public health and welfare of current and future generations. The second addresses whether or not the combined emissions of GHGs from new motor vehicles and motor vehicle engines contribute to atmospheric concentrations of GHGs and therefore the threat of climate change. The Administrator found that atmospheric concentrations of GHGs endanger the public health and welfare within the meaning of Section 202(a) of the CAA. The evidence supporting this finding consists of human activity resulting in "high atmospheric levels" of GHG emissions, which are very likely responsible for increases in average temperatures and other climatic changes. Furthermore, the observed and projected results of climate change (e.g., higher likelihood of heat waves, wild fires, droughts, sea level rise, higher intensity storms) are a threat to the public health and welfare. Therefore, GHGs were found to endanger the public health and welfare of current and future generations. The Administrator also found that GHG emissions from new motor vehicles and motor vehicle engines are contributing to air pollution, which is endangering public health and welfare. U.S. EPA's final findings respond to the 2007 U.S. Supreme Court decision that GHGs fit within the CAA definition of air pollutants. The findings do not in and of themselves impose any emission reduction requirements but rather allow U.S. EPA to finalize the GHG standards proposed earlier in 2009 for new light-duty vehicles as part of the joint rulemaking with the Department of Transportation.
State	
Executive Order S-3-05	Executive Order S-3-05, which was signed by former Governor Schwarzenegger in 2005, proclaims that California is vulnerable to the impacts of climate change. It declares that increased temperatures could reduce the Sierra's snowpack, further exacerbate California's air quality problems, and potentially cause a rise in sea levels. To combat those concerns, the Executive Order established total greenhouse gas emission targets. Specifically, emissions are to be reduced to the 2000 level by 2010, the 1990 level by 2020, and to 80 percent below the 1990 level by 2050. The Executive Order directed the Secretary of the California Environmental Protection Agency (CalEPA) to coordinate a multi-agency effort to reduce greenhouse gas emissions to the target

Table 3.D-1. Applicable Laws and Regulations for Greenhouse Gases	
	levels. The Secretary will also submit biannual reports to the governor and State legislature describing: progress made toward reaching the emission targets; impacts of global warming on California's resources; and mitigation and adaptation plans to combat these impacts. To comply with the Executive Order, the Secretary of the CalEPA created the California Climate Action Team (CCAT) made up of members from various State agencies and commission. CCAT released its first report in March 2006. The report proposed to achieve the targets by building on voluntary actions of California businesses, local government and community actions, as well as through State incentive and regulatory programs.
Assembly Bill 32, the California Global Warming Solutions Act, Statutes of 2006	In September 2006, former Governor Arnold Schwarzenegger signed AB 32, the California Global Warming Solutions Act of 2006. AB 32 establishes regulatory, reporting, and market mechanisms to achieve quantifiable reductions in GHG emissions and a cap on statewide GHG emissions. AB 32 requires that statewide GHG emissions be reduced to 1990 levels by 2020. This reduction will be accomplished through an enforceable statewide cap on GHG emissions that will be phased in starting in 2012. To effectively implement the cap, AB 32 directs ARB to develop and implement regulations to reduce statewide GHG emissions from substantial stationary and mobile source categories. AB 32 requires that ARB adopt a quantified cap on GHG emissions representing 1990 emissions levels and disclose how it arrives at the cap; institute a schedule to meet the emissions cap; and develop tracking, reporting, and enforcement mechanisms to ensure that the State achieves the reductions in GHG emissions necessary to meet the cap. AB 32 also includes guidance to institute emissions reductions in an economically efficient manner and conditions to ensure that businesses and consumers are not unfairly affected by the reductions.
Assembly Bill 1493, Statutes of 2002	In September 2004, ARB approved regulations to reduce GHG emissions from new motor vehicles. The Board took this action pursuant to Chapter 200, Statutes of 2002 (AB 1493, Pavley regulations) which directed the Board to adopt regulations that achieve the maximum feasible and cost effective reduction in greenhouse gas emissions from motor vehicles. The regulations, which took effect in 2006 following an opportunity for legislative review, apply to new passenger vehicles and light duty trucks beginning with the 2009 model year.
Executive Order S-1-07	Executive Order S-1-07, which was signed by former Governor Schwarzenegger in 2007, proclaims that the transportation sector is the main source of GHG emissions in California, at over 40 percent of statewide emissions. It establishes a goal that the carbon intensity of transportation fuels sold in California should be reduced by a minimum of 10 percent by 2020. This order also directed ARB to determine if this Low Carbon Fuel Standard could be adopted as a discrete early action measure after meeting the mandates in AB 32. ARB adopted the LCFS on April 23, 2009.

Table 3.D-1. Applicable Laws and Regulations for Greenhouse Gases	
Senate Bill 1368, Statutes of 2006	SB 1368 is the companion bill of AB 32 and was signed by former Governor Schwarzenegger in September 2006. SB 1368 requires the California Public Utilities Commission (PUC) to establish a GHG emission performance standard for baseload generation from investor owned utilities by February 1, 2007. The CEC must establish a similar standard for local publicly owned utilities by June 30, 2007. These standards cannot exceed the greenhouse gas emission rate from a baseload combined-cycle natural gas fired plant. The legislation further requires that all electricity provided to California, including imported electricity, must be generated from plants that meet the standards set by the PUC and CEC.
Senate Bill 1078, Statutes of 2002, Senate Bill 107, Statutes of 2006,and Executive Order S-14-08	SB 1078 (Chapter 516, Statutes of 2002) requires retail sellers of electricity, including investor-owned utilities and community choice aggregators, to provide at least 20 percent of their supply from renewable sources by 2017. SB 107 (Chapter 464, Statutes of 2006) changed the target date to 2010. In November 2008, former Governor Schwarzenegger signed Executive Order S-14-08, which expands the State's Renewable Energy Standard to 33 percent renewable power by 2020.
Senate Bill 97, Statutes of 2007	As directed by SB 97, the Natural Resources Agency adopted Amendments to the CEQA Guidelines for greenhouse gas emissions on December 30, 2009. On February 16, 2010, the Office of Administrative Law approved the Amendments, and filed them with the Secretary of State for inclusion in the California Code of Regulations. The Amendments became effective on March 18, 2010.
Senate Bill 375, Statutes of 2008	SB 375, signed in September 2008, aligns regional transportation planning efforts, regional GHG reduction targets, and land use and housing allocation. SB 375 requires Metropolitan Planning Organizations (MPOs) to adopt a Sustainable Communities Strategy (SCS) or Alternative Planning Strategy (APS), which will prescribe land use allocation in that MPO's Regional Transportation Plan (RTP). ARB, in consultation with MPOs, will provide each affected region with reduction targets for GHGs emitted by passenger cars and light trucks in the region for the years 2020 and 2035. These reduction targets will be updated every 8 years, but can be updated every 4 years if advancements in emissions technologies affect the reduction strategies to achieve the targets. CARB is also charged with reviewing each MPO's SCS or APS for consistency with its assigned targets. If MPOs do not meet the GHG reduction targets, transportation projects would not be eligible for funding programmed after January 1, 2012. This bill also extends the minimum time period for the Regional Housing Needs Allocation (RNHA) cycle from 5 years to 8 years for local governments located within an MPO that meets certain requirements. City or County land use policies (including General Plans) are not required to be consistent with the RTP (and associated SCS or APS). However, new provisions of CEQA would incentivize qualified projects that are consistent with an approved SCS or APS, categorized as "transit priority projects."

Table 3.D-1. Applicable Laws and Regulations for Greenhouse Gases

Executive Order S-13-08	Sea level rise is a foreseeable indirect environmental impact associated with climate change, largely attributable to thermal expansion of the oceans and melting polar ice. As discussed above in the environmental setting (subheading "Adaptation to Climate Change"), sea level rise presents impacts to California associated with coastal erosion, water supply, water quality, saline-sensitive species and habitat, land use compatibility, and flooding. Former Governor Arnold Schwarzenegger signed Executive Order S-13-08 on November 14, 2008. This executive order directed the California Natural Resources Agency (CNRA) to develop the 2009 California Climate Adaptation Strategy (CNRA 2009), which summarizes the best known science on climate change impacts in seven distinct sectors—public health, biodiversity and habitat, ocean and coastal resources, water management, agriculture, forestry, and transportation and energy infrastructure—and provides recommendations on how to manage against those threats. This executive order also directed OPR, in cooperation with the CNRA, to provide land use planning guidance related to sea level rise and other climate change impacts by May 30, 2009, which is also provided in the 2009 California Climate Adaptation Strategy (CNRA 2009) and OPR continues to further refine land use planning guidance related to climate change impacts. Executive Order S-13-08 also directed CNRA to convene an independent panel to complete the first California Sea Level Rise Assessment Report. This report is to be completed no later than December 1, 2010. The report is intended to provide information on the following: 1. Relative sea level rise projections specific to California, taking into account issues such as coastal erosion rates, tidal impacts, El Niño and La Niña events, storm surge, and land subsidence rates; 2. The range of uncertainty in selected sea level rise projections; 3. A synthesis of existing information on projected sea level rise impacts to State infrastructure (such as roads, public facilities and beaches), natural areas, and coastal and marine ecosystems; and 4. discussion of future research needs regarding sea level rise for California.

E. Biological Resources

1. Existing Conditions

California is one of the most biologically diverse areas in the world. Its varied topography and climate have given rise to a remarkable diversity of habitats and a correspondingly diverse array of both plant and animal species. California has more species than any other state in the U.S. and also has the greatest number of endemic species, those that occur nowhere else in the world (DFG 2007, p.11).

California contains examples of most of the major biomes in North America, including grassland, shrubland, deciduous forest, coniferous forest, alpine tundra, mountains, deserts, temperate rainforest, marine, estuarine, and freshwater habitats. Each of these biomes contains many different types of plant communities, such as redwood forests, vernal pool wetlands, or blue oak woodlands. Altogether, the State supports 81 types of forests, 107 types of shrub lands, and 52 types of plant communities dominated by herbaceous plants, in addition to 27 other types of vegetation (Sawyer and Keeler-Wolf 1995, vegetation series tables).

Some parts of the State are particularly rich in plant species diversity. Areas with the greatest number of plant species are the Klamath and inner North Coast ranges, the high Sierra Nevada, the San Diego region, and the San Bernardino Mountains. Other regions with considerable plant diversity are the outer North and Central Coast Ranges, the Cascade Range, the Sierra Nevada foothills, and the western transverse Range (DFG 2007, p.13).

California has a great number of animal species, representing large portions of wildlife species nationwide. The State's diverse natural communities provide a wide variety of habitat conditions for wildlife. The State's wildlife species include 84 species of reptiles (30 percent of the total number found in the U.S.); 51 species of amphibians (22 percent of U.S. species); 67 species of freshwater fish (8 percent of U.S. species); 433 species of birds (47 percent of U.S. species); and 197 mammal species (47 percent of U.S. species). Seventeen species of mammals, 17 species of amphibians, and 20 species of freshwater fish live here and nowhere else (DFG 2007, p. 13). Animal species are not equally distributed across the State. Some of California's natural communities are particularly rich in wildlife species, supporting hundreds of species each. Twenty-four habitats—including valley foothill riparian, mixed conifer, freshwater wetlands, mixed chaparral, and grasslands in the State—support more than 150 terrestrial animal species each. Oak woodlands also are among the most biological diverse communities in the State, supporting 5,000 species of insects, more than 330 species of amphibians, reptiles, birds and mammals, and several thousand plant species (DFG 2007, p.14).

2. Regulatory Setting

Biological resources in California are protected and/or regulated by a variety of federal, State, and local laws and policies. Key regulations and polices applicable to the proposed ACC Program are summarized in Table 3.E-1.

Table 3.E-1. Applicable Laws and Regulations for Biological Resources

Applicable Law	Description
Federal	
Federal Endangered Species Act	Designates and provides for protection of threatened and endangered plant and animal species, and their critical habitat.
Migratory Bird Treaty Act	Makes it unlawful to take or possess any migratory nongame bird (or any part of such migratory nongame bird) as designated in the Migratory Bird Treaty Act.
Clean Water Act	Requires the permitting and monitoring of all discharges to surface water bodies. Section 404 requires a permit from the U.S. Army Corps of Engineers (USACE) for a discharge from dredged or fill materials into Waters of the U.S., including wetlands. Section 401 requires a permit from a regional water quality control board (RWQCB) for the discharge of pollutants. By federal law, every applicant for a federal permit or license for an activity that may result in a discharge into a California water body, including wetlands, must request State certification that the proposed activity would not violate State and federal water quality standards.
Rivers and Harbors Act of 1899	Requires permit or letter of permission from USACE prior to any work being completed within navigable waters.
U.S. Environmental Protection Agency (U.S EPA) Section 404 (b)(1) Guidelines	Requires the USACE to analyze alternatives in a sequential approach such that the USACE must first consider avoidance and minimization of impacts to the extent practicable to determine whether a proposed discharge can be authorized.
California Desert Conservation Area Plan (CDCA)	Comprises one of two national conservation areas established by Congress at the time of the passage of the Federal Land and Policy Management Act (FLPMA). FLPMA outlines how BLM would manage public lands. Congress specifically provided guidance for the management of the CDCA and directed the development of the 1980 CDCA Plan.
Federal Noxious Weed Act of 1974 (P.L. 93-629) (7 U.S.C. 2801 et seq.; 88 Stat. 2148)	Establishes a federal program to control the spread of noxious weeds. Authority is given to the Secretary of Agriculture to designate plants as noxious weeds by regulation, and the movement of all such weeds in interstate or foreign commerce was prohibited except under permit.
Executive Order 13112, "Invasive Species," February 3, 1999	Federal agencies are mandated to take actions to prevent the introduction of invasive species, provide for their control, and minimize the economic, ecological, and human health impacts that invasive species cause.

Table 3.E-1. Applicable Laws and Regulations for Biological Resources	
Applicable Law	**Description**
Executive Order 11988, "Floodplain Management," May 24, 1977	Requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative.
Executive Order 11990, "Protection of Wetlands," May 24, 1977	Requires all federal agencies to consider wetland protection as an important part of their policies and take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands.
Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds," January 10, 2001	Requires that each federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations develop and implement a Memorandum of Understanding (MOU) with the U.S. Fish and Wildlife Service (USFWS) that shall promote the conservation of migratory bird populations.
Wild Free-Roaming Horses and Burros Act	Provides for the protection of wild free-roaming horses and burros. Directs BLM and the U.S. Forest Service (USFS) to manage wild horses and burros on lands under their jurisdiction.
Bald and Golden Eagle Protection Act	Declares it is illegal to take, possess, sell, purchase, barter, offer to sell or purchase or barter, transport, export or import a bald or golden eagle, alive or dead, or any part, nest or egg of these eagles unless authorized. Active nest sites are also protected from disturbance during the breeding season.
BLM Manual 6840 — Special Status Species Management (BLM 2001),	Establishes special status species policy on BLM land for plant and animal species and the habitats on which they depend. The policy refers species designated by the BLM State Director as sensitive.
Listed Species Recovery Plans and Ecosystem Management Strategies	Provides guidance for the conservation and management of sufficient habitat to maintain viable populations of listed species and ecosystems. Relevant examples include, but are not limited to, the Desert Tortoise Recovery Plan, Flat-tailed Horned Lizard Rangewide Management Strategy; Amargosa Vole Recovery Plan, Recovery Plan for Upland Species of the San Joaquin Valley, California.
State	
California Endangered Species Act of 1984 (Fish and Game Code, sections 2050 through 2098)	Protects California's rare, threatened, and endangered species.
Porter-Cologne Water Quality Control Act	Requires that each of the nine RWQCBs prepare and periodically update basin plans for water quality control. Each basin plan sets forth water quality standards for surface water and groundwater and actions to control nonpoint and point sources of pollution to achieve and maintain these standards.
Z'berg-Nejedly Forest Practice Act	Ensures that logging on timberland is performed in a manner that will preserve and protect fish, wildlife, forests and streams, enforced by CAL FIRE.

Table 3.E-1. Applicable Laws and Regulations for Biological Resources

Applicable Law	Description
California Forest Practice Rules 2010	State Board of Forestry and Fire Protection has authority delegated by legislature to adopt forest practice and fire protection regulations on nonfederal lands. These regulations carry out California legislature's mandates to protect and enhance the State's unique forest and wildland resources.
Wetlands Preservation (Keene-Nejedly California Wetlands Preservation Act) (Public Resources Code, Section 5810 et seq.)	California has established a successful program of regional, cooperative efforts to protect, acquire, restore, preserve, and manage wetlands. These programs include, but are not limited to, the Central Valley Habitat Joint Venture, the San Francisco Bay Joint Venture, the Southern California Wetlands Recovery Project, and the Inter-Mountain West Joint Venture.
California Wilderness Preservation System (Public Resources Code, Section 5093.30 et seq.)	Establishes a California wilderness preservation system that consists of State-owned areas to be administered for the use and enjoyment of the people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, provide for the protection of such areas, preserve their wilderness character, and provide for the gathering and dissemination of information regarding their use and enjoyment as wilderness.
Significant Natural Areas (Fish and Game Code section 1930 et seq.)	Designates certain areas such as refuges, natural sloughs, riparian areas, and vernal pools as significant wildlife habitat.
Protection of Birds and Nests (Fish and Game Code section 3503 and 3503.5)	Protects California's birds by making it unlawful to take, possess, or needlessly destroy the nest or eggs of any bird. Raptors (e.g., hawks and owls) are specifically protected.
Migratory Birds (Fish and Game Code section 3513)	Protects California's migratory birds by making it unlawful to take or possess any migratory nongame bird as designated in the Migratory Bird Treaty Act or any part of such migratory nongame birds.
Fur-bearing Mammals (Fish and Game Code sections 4000 and 4002)	Lists fur-bearing mammals which require a permit for take.
Fully Protected Species (Fish and Game Code Sections 3511,4700, 5050, and 5515)	Identifies several amphibian, reptile, fish, bird and mammal species which are Fully Protected. The California Department of Fish and Game (CDFG) cannot issue a take permit), except for take related to scientific research.
California Environmental Quality Act (CEQA Guidelines, CCR, Title 14, Section 15380)	CEQA defines rare species more broadly than the definitions for species listed under the State and federal Endangered Species Acts. Under section 15830, species not protected through State or federal listing but nonetheless demonstrable as "endangered" or "rare" under CEQA should also receive consideration in environmental analyses. Included in this category are many plants considered rare by the California Native Plant Society (CNPS) and some animals on the CDFG's Special Animals List.

Table 3.E-1. Applicable Laws and Regulations for Biological Resources	
Applicable Law	**Description**
Oak Woodlands (California Public Resources Code Section 21083.4)	Requires counties to determine if a project within their jurisdiction may result in conversion of oak woodlands that would have a significant adverse effect on the environment. If the lead agency determines that a project would result in a significant adverse effect on oak woodlands, mitigation measures to reduce the significant adverse effect of converting oak woodlands to other land uses are required.
Lake and Streambed Alteration Agreement (Fish and Game Code sections 1600 et seq.)	Regulates activities that may divert, obstruct, or change the natural flow or the bed, channel, or bank of any river, stream, or lake in California designated by CDFG in which there is at any time an existing fish or wildlife resource or from which these resources derive benefit. Impacts to vegetation and wildlife resulting from disturbances to waterways are also reviewed and regulated during the permitting process.
California Desert Native Plants Act of 1981 (Food and Agricultural Code section 80001 et seq. and California Fish and Game Code sections 1925-1926)	Protects non-listed California desert native plants from unlawful harvesting on both public and private lands in Imperial, Inyo, Kern, Los Angeles, Mono, Riverside, San Bernardino, and San Diego counties. Unless issued a valid permit, wood receipt, tag, and seal by the commissioner or sheriff, harvesting, transporting, selling, or possessing specific desert plants is prohibited.
Food and Agriculture Code, Section 403	The California Department of Food and Agriculture is designated to prevent the introduction and spread of injurious insect or animal pests, plant diseases, and noxious weeds.
Noxious Weeds (Title 3, California Code of Regulations, Section 4500)	List of plant species that are considered noxious weeds.
Regional and Local	
Regional Habitat Conservation Plans and Natural Communities Conservation Plan (HCP/NCCP)	HCPs and NCCPs establish a coordinated process for permitting and mitigating the incidental take of endangered species and conserving natural resources. Approved HCPs and NCCPs potentially relevant to proposed ACC Program include, but are not limited to, the Western Riverside County HCP; Lower Colorado River Multi-Species Conservation Plan; Coachella Valley Multi-Species HCP; Orange County Central/Coastal NCCP/HCP; Kern Water Bank HCP; Southeastern Lincoln County, NV HCP; and the Mojave and Colorado Desert regions and Solano Multispecies Habitat Conservation Plan.
Various City and County General Plans	General plans typically designate areas for land usages, guiding where new growth and development should occur while providing a plan for the comprehensive and long-range management, preservation, and conservation of and natural resources and open-space lands.
Various Local Ordinances	Local ordinances provide regulations for proposed projects for activities such as grading plans, erosion control, tree removal, protection of sensitive biological resources and open space.

F. Cultural Resources

1. Existing Conditions

Cultural resources include archaeological sites of prehistoric or historic origin, built or architectural resources older than 50 years, traditional or ethnographic resources, and fossil deposits of paleontological importance.

All areas within California have the potential for yielding as yet undiscovered archaeological and paleontological resources and undocumented human remains not interred in cemeteries or marked formal burials. These resources have the potential to contribute to our knowledge of the fossil record or local, regional, or national prehistory or history.

Archaeological resources include both prehistoric and historic remains of human activity. Built environment resources include an array of historic buildings, structures, and objects serving as a physical connection to America's past. Traditional or ethnographic cultural resources may include Native American sacred sites and traditional resources of any ethnic community that are important for maintaining the cultural traditions of any group. "Historical resources" is a term with defined statutory meaning and includes any prehistoric or historic archaeological site, district, built environment resource, or traditional cultural resource recognized as historically or culturally significant (PRC Section 21084.1; 14 CCR Section 15064.5[a]).

Paleontological resources, including mineralized, partially mineralized, or unmineralized bones and teeth, soft tissues, shells, wood, leaf impressions, footprints, burrows, and microscopic remains, are more than 5,000 years old and occur mainly in Pleistocene or older sedimentary rock units.

California was occupied by different prehistoric cultures dating to at least 12,000 years ago. Evidence for the presence of humans prior to about 8,000 years ago during the Paleoindian Period is relatively sparse and scattered throughout the State. With climate changes and the drying of pluvial lakes, subsistence during the Early and Middle Archaic Periods shifted to an increased emphasis on plant resources, evidenced by an abundance of milling implements in archaeological sites dating between 8,000 and 3,000 years ago. After approximately 3,000 years ago, during the Upper Archaic and Late Prehistoric Periods, the complexity of the prehistoric archaeological record reflects increases in specialized adaptations to locally available resources such as acorns and salmon, permanently occupied settlements, and the expansion of regional populations and trade networks, as well as the development of social stratification and craft specialization.

At the time of European contact, California was the home of approximately 310,000 indigenous people with a complex of cultures distinguished by linguistic affiliation and territorial boundaries. Distinct native Californian cultural groups spoke approximately 74 languages. At least 70 groups, with even more subgroups, inhabited the vast lands within the State. In general, these mainly sedentary, complex hunter-gatherer groups shared similar subsistence practices (hunting, fishing, and collecting plant foods), settlement patterns, technology, material culture, social organization, and religious beliefs. They situated permanent villages along the coast, interior waterways, and near lakes and wetlands. Population density among these groups varied, depending mainly on availability and dependability of local resources, with the highest density of people occurring in the Santa Barbara Channel area and the least in the State's desert region.

The effect of Spanish settlement and establishment of missions in California marks the beginning of a devastating disruption of native culture, with forced population movements, loss of land and territory (including traditional hunting and gathering locales), enslavement, and decline in population numbers from disease, malnutrition, starvation, and violence. California's native population was reduced to about 100,000 people by 1850; by 1900, there were only 20,000--less than seven percent of the pre-contact number (Smithsonian Institution 1978). Existing reservations were created in California by the federal government beginning in 1858 but encompass only a fraction of native lands. Many California groups continue to await federal tribal status recognition.

In 1848, shortly after California became a territory of the U.S., gold was discovered at Sutter's Mill. The resulting Gold Rush era influenced the history of the State and the nation. Thousands of people flocked to the gold fields along the Sierra foothills, and in 1850 California became the 31st State. After the completion of the transcontinental railroad in 1869, settlers and immigrants continued to pour into the State. Settlement of the American West was also encouraged by passage of the Swampland Acts of the mid 1800s-early 1900s and the Homestead Act of 1862, among others. The multi-ethnic character of the State today is one result of the Gold Rush, plus later waves of migration. Buildings and structures in today's urban cores, rural landscapes, coastlines, deserts, forests, and parks, as well as historic archaeological sites, reflect the importance of mining, the growth of agriculture, ranching and transportation networks, and the economic development of industries based on the State's wealth of natural resources, such as lumber, minerals, fish, and petroleum deposits, that contributed to the State's economy and its continuing growth and development. Architectural resources also reflect the development in California in the mid- to late-1900s of the defense, aerospace, communication and tourism industries.

Significant nonrenewable vertebrate or invertebrate fossils or unique geologic units have been documented throughout the State and are likely present in many out-of-state areas. Because the majority of California was underwater until the Tertiary Period, marine fossils older than 65 million years are not common and are exposed mainly in the mountains along the border with Nevada, the Klamath Mountains, Jurassic shales, sandstones and limestones along the edges of the Central Valley, and portions of the Coast and Transverse Ranges, and the Peninsular Ranges. As a result of changes in sea level and increases in tectonic activity during the Tertiary, marine as well as terrestrial fossils may be found scattered about the State, particularly along the coast, edges of the Central Valley, northeastern plateau, and southeastern deserts. Tertiary marine fossils have been found, for example, under the streets of Los Angeles during storm drain and subway construction. Dating between 1.8 million and 11,000 years ago, Pleistocene continental sedimentary rock units are found throughout the State and have yielded a variety of plant and vertebrate fossils. Pleistocene fossil localities include large lake deposits, such as Lake Manix in the Mojave Desert, marine terrace deposits along the coast, particularly the southern coast, and the La Brea Tar Pits, a well-known locality in Los Angeles that has produced a variety of extinct terrestrial fauna dating to the last Ice Age. Extinct Pleistocene fossils, including mammoths, have also been found during development projects near Sacramento, in Livermore, in southern California, and on the Channel Islands. Holocene-age deposits (less than 11,000 years old), such as those that blanket the majority of the Central Valley floor, are geologically immature and generally unlikely to contain fossils. One exception is the Lake Cahuilla deposits in today's Colorado Desert that have yielded freshwater fossils and small terrestrial vertebrates and date between 270 and at least 6,000 years ago.

2. Regulatory Setting

Applicable laws and regulations associated with cultural resources are discussed in Table 3.F-1.

Table 3.F-1. Applicable Laws and Regulations for Cultural Resources

Applicable Regulation	Description
Federal	
National Historic Preservation Act (NHPA) of 1966	Requires federal agencies to consider the preservation of historic and prehistoric resources. The Act authorizes the Secretary of the Interior to expand and maintain a National Register of Historic Places (NRHP), and it establishes an Advisory Council on Historic Preservation (ACHP) as an independent federal entity. Section 106 of the Act requires federal agencies to take into account the effects of their undertakings on historic properties and afford the ACHP a reasonable opportunity to comment on the undertaking prior to licensing or approving the expenditure of funds on any undertaking that may affect properties listed, or eligible for listing, in the NRHP.
National Environmental Policy Act of 1969	Requires federal agencies to foster environmental quality and preservation. Section 101(b)(4) declares that one objective of the national environmental policy is to "preserve important historic, cultural, and natural aspects of our national heritage... ." For any major federal actions significantly affecting environmental quality, federal agencies must prepare, and make available for public comment, an environmental impact statement (EIS).
Archaeological Resources Protection Act of 1979 (NRPA) (16 USC 470aa-470ll)	Requires a permit for any excavation or removal of archaeological resources from public lands or Indian lands. The statute provides both civil and criminal penalties for violation of permit requirements and for excavation or removal of protected resources without a permit.

Table 3.F-1. Applicable Laws and Regulations for Cultural Resources	
Applicable Regulation	**Description**
Advisory Council Regulation, Protection of Historic Properties (36 CFR 800)	Establishes procedures for compliance with Section 106 of the National Historic Preservation Act of 1966. These regulations define the Criteria of Adverse Effect, define the role of State Historic Preservation Officer (SHPO) in the Section 106 review process, set forth documentation requirements, and describe procedures to be followed if significant historic properties are discovered during implementation of an undertaking. Prehistoric and historic resources deemed significant (i.e., eligible for listing in the NRHP, per 36 CFR 60.4) must be considered in project planning and construction. The responsible federal agency must submit any proposed undertaking that may affect NRHP-eligible properties to the SHPO for review and comment prior to project approval.
National Park Service Regulations, National Register of Historic Places (NRHP) (36 CFR 60)	Sets forth procedures for nominating properties to the NRHP, and present the criteria to be applied in evaluating the eligibility of historic and prehistoric resources for listing in the NRHP.
Archaeology and Historic Preservation; Secretary of the Interior's Standards and Guidelines (FR 190:44716–44742)	Non-regulatory technical advice about the identification, evaluation, documentation, study, and other treatment of cultural resources. Notable in these Guidelines are the "Standards for Archaeological Documentation" (p. 44734) and "Professional Qualifications Standards for Archaeology" (pp. 44740–44741).
American Indian Religious Freedom Act of 1978	The American Indian Religious Freedom Act pledges to protect and preserve the traditional religious rights of American Indians, Aleuts, Eskimos, and Native Hawaiians. Before the act was passed, certain U.S. federal laws interfered with the traditional religious practices of many American Indians. The Act establishes a national policy that traditional Native American practices and beliefs, sites (and right of access to those sites), and the use of sacred objects shall be protected and preserved.
Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) (PL 101–601)	Vests ownership or control of certain human remains and cultural items, excavated or discovered on federal or tribal lands, in designated Native American tribes, organizations, or groups. The Act further: requires notification of the appropriate Secretary or other head of any federal agency upon the discovery of Native American cultural items on federal or tribal lands; proscribes trafficking in Native American human remains and cultural items; requires federal agencies and museums to compile an inventory of Native American human remains and associated funerary objects, and to notify affected Indian tribes of this inventory; and provides for the repatriation of Native American human remains and specified objects possessed or controlled by federal agencies or museums.
Department of Transportation Act of 1966, Section 4(f)	Section 4(f) of the Act requires a comprehensive evaluation of all environmental impacts resulting from federal-aid transportation projects administered by the Federal Highway Administration (FHA), Federal Transit Administration (FTA), and Federal Aviation Administration (FAA) that involve the use—or interference with use—of several types of land: public park lands, recreation areas, and publicly or privately owned historic properties of federal, state, or local significance. The Section 4(f) evaluation must be sufficiently detailed to permit the U.S. Secretary of Transportation to determine that there is no feasible and prudent alternative to the use of such land, in which case the project must include all possible planning to minimize harm to any park, recreation, wildlife and waterfowl refuge, or historic site that would result from the use of such lands. If there is a feasible and prudent alternative, a proposed project using Section 4(f) lands cannot be approved by the Secretary. Detailed

Table 3.F-1. Applicable Laws and Regulations for Cultural Resources	
Applicable Regulation	**Description**
	inventories of the locations and likely impacts on resources that fall into the Section 4(f) category are required in project-level environmental assessments.
State	
California Health and Safety Code Section and California Public Resources Code, Section	Disturbance of human remains without the authority of law is a felony (California Health and Safety Code, Section 7052). According to State law (California Health and Safety Code, Section 7050.5, California Public Resources Code, Section 5097.98), if human remains are discovered or recognized in any location other than a dedicated cemetery, there shall be no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent human remains until 1) the coroner of the county has been informed and has determined that no investigation of the cause of death is required; 2)and if the remains are of Native American origin, and if the descendants from the deceased Native Americans have made a recommendation to the landowner or the person responsible for the excavation work for means of treating or disposing of with appropriate dignity the human remains and any associated grave goods as provided in Public Resources Code Section 5097.98; or the Native American Heritage Commission was unable to identify a descendent or the descendent failed to make a recommendation within 24 hours after being notified by the Commission. According to the California Health and Safety Code, six or more human burials at one location constitute a cemetery (Section 8100), and disturbance of Native American cemeteries is a felony (Section 7052). Section 7050.5 requires that construction or excavation be stopped in the vicinity of discovered human remains until the coroner can determine whether the remains are those of a Native American. If the remains are determined to be Native American, the coroner must contact the Native American Heritage Commission, who has jurisdiction over Native American remains (California Health and Safety Code, 7052.5c; Public Resources Code, Section 5097.98).
Local	
City/County General Plans	Policies, goals, and implementation measures in county or city general plans may contain measures applicable to cultural and paleontological resources. In addition to the enactment of local and regional preservation ordinances, CEQA requires that resources included in local registers be considered (pursuant to section 5020.1(k) of the Public Resources Code). Therefore, local county and municipal policies, procedures, and zoning ordinances must be considered in the context of project-specific undertakings. Cultural resources are generally discussed in either the Open Space Element or the Conservation Element of the General Plan. Many local municipalities include cultural resources preservation elements in their general plans that include some mechanism pertaining to cultural resources in those communities. In general, the sections pertaining to archaeological and historical properties are put in place to afford the cultural resources a measure of local protection. The policies outlined in the individual general plans should be consulted prior to any undertaking or project.

Table 3.F-1. Applicable Laws and Regulations for Cultural Resources	
Applicable Regulation	**Description**
Cooperative Agreements Among Agencies	Cooperative agreements among land managing agencies (BLM, National Park Service, U.S. Forest Services, California State Parks, Bureau of Indian Affairs, Department of Defense, to name a few) the SHPO and ACHP may exist and will need to be complied with on specific projects. In addition, certain agencies have existing Programmatic Agreements (PA) requiring permits (CPUC, BLM) to complete archaeological investigations and employ the Secretary of Interior's Professional Qualification Standards and Guidelines (36 CFR 61).

G. Geology and Soils

1. Existing Conditions

a. Soils

California has a diverse, complex and seismically active geology that includes a vast array of landforms. Soils in California are as diverse as its geology, and are described and characterized individually and collectively with other soils, and their various compatible uses in soil surveys published by the U.S. Department of Agriculture. Soils are fundamental and largely non-renewable resources that are the basis for high-level sustained yields of agricultural commodities, forest products, and provide support to the wide variety of ecological communities throughout the State.

b. Geology

California's geologic history is associated with major episodes of tectonic activity including intrusive and extrusive volcanic activity, folding and faulting, and mountain building. The most recent period of mountain building is still going on, and practically all of the current landforms and geographic features are very young in geologic terms, only a few million years old. Rocks older than 600 million years, those of the Precambrian Era, are rare in California.

The oldest rocks, which are more than 1,000 million years old, are located in the eastern deserts and the eastern Transverse Ranges (San Bernardino and San Gabriel Mountains). The distribution of rocks of these ages suggests that the west coast of the North American Continent was well to the east of all but the southern end of what is now California. All of these very old formations have been extensively metamorphosed and, therefore, it is difficult to determine the conditions that existed when they were originally formed. Some of the oldest rocks (around 1,800 million years old) are located in the mountains around Death Valley and are much like the rocks exposed in the inner gorge of the Grand Canyon. Metamorphic rocks around 1,000 million years old are located in the San Gabriel Mountains and the Orocopia Mountains east of the Salton Sea. During the Paleozoic Era, beginning around 400 million years ago (mya), tectonic forces began the process of mountain building and appears to mark the first time the coast moved west into most of what is now California, and the ancestral Sierra Nevada mountains were emplaced. During the Mesozoic Era between 245 to 65 mya, mountain building continued and the beginnings of the Coast Ranges were formed.

The Cenozoic Era, between 65 mya and the present, was marked with continued uplift, erosion and deposition. The Pacific plate became completely overridden by the North American plate forming the San Andreas Fault system, and in turn other faults. Volcanic activity became widespread in the Sierra Nevada and Mojave Desert regions, and a number of deep marine basins formed along the central and southern California coast. About 5 mya, mountain building accelerated resulting in the uplifting of most of the modern mountain ranges, including the Sierra Nevada and the large fault-block ranges to the east, the Coast Ranges, the Transverse Ranges, and the Peninsular Ranges. This was followed by Pleistocene glaciations in the Sierra Nevada and, to a minor extent, in the San Bernardino Mountains; recent volcanic eruptions in the Mojave Desert and Great Basin regions; and the widespread volcanic activity that created the southern Cascade volcanoes (Mt. Shasta and Mt. Lassen) and the lava flows of the Modoc Plateau region.

2. Regulatory Setting

Applicable laws and regulations associated with soils, geology, and mineral resources are discussed in Table 3.G-1.

Table 3.G-1. Applicable Laws and Regulations for Geology and Soils

Federal	
Clean Water Act	This law was enacted to restore and maintain the chemical, physical, and biological integrity of the nation's waters by regulating point and nonpoint pollution sources, providing assistance to publicly owned treatment works for the improvement of wastewater treatment, and maintaining the integrity of wetlands. This includes the creation of a system that requires states to establish discharge standards specific to water bodies (National Pollution Discharge Elimination System [NPDES]), which regulates storm water discharge from construction sites through the implementation of a Storm Water Pollution Prevention Plan (SWPPP). In California, the State's NPDES permit program is implemented and administered by the local Regional Water Quality Control Boards.
Earthquake Hazards Reduction Act and National Earthquake Hazards Reduction Program Act	This Act established the National Earthquake Hazards Reduction Program to reduce the risks to life and property from future earthquakes. This program was significantly amended in November 1990 by the National Earthquake Hazards Reduction Program Act by refining the description of agency responsibilities, program goals and objectives.
State	
Alquist-Priolo Earthquake Fault Zoning Act, Public Resources Code (PRC), Section 2621–2630.	The Alquist-Priolo Earthquake Fault Zoning Act of 1972 (formerly the Special Studies Zoning Act) regulates development and construction of buildings intended for human occupancy to avoid the hazard of surface fault rupture. This act mitigates against surface fault rupture of known active faults beneath occupied structures, and requires disclosure to potential buyers of existing real estate and a 50-foot setback for new occupied buildings. This act groups faults into categories of active, potentially active, and inactive.

Table 3.G-1. Applicable Laws and Regulations for Geology and Soils	
Seismic Hazards Mapping Act, PRC Section 2690–2699.	The Seismic Hazards Mapping Act (the Act) of 1990 (Public Resources Code, Chapter 7.8, Division 2) directs the California Department of Conservation, Division of Mines and Geology (now called California Geological Survey) to delineate Seismic Hazard Zones. The purpose of the Act is to reduce the threat to public health and safety and to minimize the loss of life and property by identifying and mitigating seismic hazards. These include areas identified that are subject to the effects of strong ground shaking, such as liquefaction, landslides, tsunamis, and seiches. Cities, counties, and state agencies are directed to use seismic hazard zone maps developed by CGS in their land-use planning and permitting processes. The Act requires that site-specific geotechnical investigations be performed prior to permitting most urban development projects within seismic hazard zones.
California Division of Oil, Gas, and Geothermal Resources, PRC Section 3106.	Public Resources Code Section 3106 mandates the supervision of drilling, operation, maintenance, and abandonment of oil wells for the purpose of preventing: damage to life, health, property, and natural resources; damage to underground and surface waters suitable for irrigation or domestic use; loss of oil, gas, or reservoir energy; and damage to oil and gas deposits by infiltrating water and other causes. In addition, the California Division of Oil, Gas, and Geothermal Resources (DOGGR) regulate drilling, production, injection, and gas storage operations in accordance with California Code of Regulations (CCR) Title 14, Chapter 4, Subchapter 1.
Landslide Hazard Identification Program, PRC Section 2687(a)	The Landslide Hazard Identification Program requires the State Geologist to prepare maps of landslide hazards within urbanizing areas. According to Public Resources Code Section 2687(a), public agencies are encouraged to use these maps for land use planning and for decisions regarding building, grading, and development permits.
California Building Standards Code (CBSC) (CCR Title 24)	California's minimum standards for structural design and construction are given in the California Building Standards Code (CBSC) (CCR Title 24). The CBSC is based on the Uniform Building Code (International Code Council 1997), which is used widely throughout United States (generally adopted on a state-by-state or district-by-district basis) and has been modified for California conditions with numerous, more detailed or more stringent regulations. The CBSC provides standards for various aspects of construction, including (i.e., not limited to) excavation, grading, and earthwork construction; fills and embankments; expansive soils; foundation investigations; and liquefaction potential and soil strength loss. In accordance with California law, proponents of specific projects would be required to comply with all provisions of the CBSC for certain aspects of design and construction.
Caltrans Seismic Design Criteria	The California Department of Transportation (Caltrans) has Seismic Design Criteria (SDC), which is an encyclopedia of new and currently practiced seismic design and analysis methodologies for the design of new bridges in California. The SDC adopts a performance-based approach specifying minimum levels of structural system performance, component performance, analysis, and design practices for ordinary standard bridges. The SDC has been developed with input from the Caltrans Offices of Structure Design, Earthquake Engineering and Design Support, and Materials and Foundations. Memo 20-1 outlines the bridge category and classification, seismic performance criteria, seismic design philosophy and approach, seismic demands and capacities on structural components and seismic design practices that collectively make up Caltrans' seismic design methodology.

Table 3.G-1. Applicable Laws and Regulations for Geology and Soils	
Local	
Geotechnical Investigation	Local jurisdictions typically regulate construction activities through a process that may require the preparation of a site-specific geotechnical investigation. The purpose of a site-specific geotechnical investigation is to provide a geologic basis for the development of appropriate construction design. Geotechnical investigations typically assess bedrock and Quaternary geology, geologic structure, soils, and the previous history of excavation and fill placement. Proponents of specific projects that require design of earthworks and foundations for proposed structures will need to prepare geotechnical investigations on the physical properties of soil and rock at the site prior to project design.
Local Grading and Erosion Control Ordinances	Many counties and cities have grading and erosion control ordinances. These ordinances are intended to control erosion and sedimentation caused by construction activities. A grading permit is typically required for construction-related projects. As part of the permit, project applicants usually must submit a grading and erosion control plan, vicinity and site maps, and other supplemental information. Standard conditions in the grading permit include a description of BMPs similar to those contained in a SWPPP.
County General Plans (and EIR)	Some county General Plans provide a regulatory framework to address potential environmental impacts that may result from a proposed project. These include the General Plans for Solano, San Luis Obispo, Los Angeles, Kern, San Bernardino, Riverside, and Imperial counties.

H. Hazards and Hazardous Materials

1. Existing Conditions

Hazardous materials are substances with physical and chemical properties that could pose a substantial present or future hazard to human health or the environment when improperly handled, disposed, or otherwise managed. Hazardous materials are grouped into four categories based on their characteristics: toxic (causes human health effects), ignitable (has the ability to burn), corrosive (causes severe burns or damage to materials) and reactive (causes explosions or generates toxic gases). A hazardous waste is any hazardous material that is finished with its intended use and is discarded. This may include items, such as spent fuels, industrial solvents and chemicals, process water, and other spent materials (i.e., some types of batteries and fuel cells). California's hazardous waste regulations provides the following means to determine whether or not a waste is hazardous: (1) a list of criteria (toxic, ignitable, corrosive and reactive) that a waste may exhibit; (2) a list of those wastes that are subject to regulation (RCRA and mercury-containing); and (3) a list of chemical names and common names that are presumed to be hazardous in California.

2. Regulatory Setting

Table 3.H-1. Applicable Laws and Regulations for Hazards and Hazardous Materials	
Federal	
Clean Air Act (CAA) Act (42 USC Section 9601 et seq.)	The Clean Air Act is the law that defines U.S. EPA's responsibilities for protecting and improving the nation's air quality and the stratospheric ozone layer. The last major change in the law, the Clean Air Act Amendments of 1990, was enacted by Congress in 1990. Legislation passed since then has made several minor changes. The Clean Air Act, like other laws enacted by Congress, was incorporated into the United States Code as Title 42, Chapter 85. The House of Representatives maintains a current version of the U.S. Code, which includes Clean Air Act changes enacted since 1990.
Clean Water Act (CWA) (40CFR 112)	The 1972 amendments to the Federal Water Pollution Control Act (known as the Clean Water Act or CWA) provide the statutory basis for the NPDES permit program and the basic structure for regulating the discharge of pollutants from point sources to waters of the United States. Section 402 of the CWA specifically required U.S. EPA to develop and implement the NPDES program.
Safe Drinking Water Act (SDWA)	The Safe Drinking Water Act (SDWA) is the main federal law that ensures the quality of Americans' drinking water. Under SDWA, U.S. EPA sets standards for drinking water quality and oversees the states, localities, and water suppliers who implement those standards. SDWA was originally passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply. The law was amended in 1986 and 1996 and requires many actions to protect drinking water and its sources: rivers, lakes, reservoirs, springs, and ground water wells. SDWA does not regulate private wells which serve fewer than 25 individuals.
Federal Hazardous Materials Regulations (FHMR) Title 49, Code of Federal Regulations, Parts 100-180	The regulations establish criteria for the safe transport of hazardous materials. Compliance is mandatory for intrastate and interstate transportation.
Toxic Substances Control Act (TSCA) 15 U.S.C. Section 2601 et seq.	The Toxic Substances Control Act (TSCA) of 1976 provides U.S. EPA with authority to require reporting, record-keeping and testing requirements, and restrictions relating to chemical substances and/or mixtures. TSCA addresses the production, importation, use, and disposal of specific chemicals including polychlorinated biphenyls (PCBs), asbestos, radon and lead-based paint.

Table 3.H-1. Applicable Laws and Regulations for Hazards and Hazardous Materials	
Resource Conservation and Recovery Act (RCRA) 42 U.S.C. Section 6901 et seq. Title 40, Code of Federal Regulations (CFR)	The Resource Conservation and Recovery Act (RCRA) of 1976 gives U.S. EPA the authority to control hazardous waste from the "cradle-to-grave." This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also set forth a framework for the management of non-hazardous solid wastes. The 1986 amendments to RCRA enabled U.S. EPA to address environmental problems that could result from underground tanks storing petroleum and other hazardous substances. HSWA - the Federal Hazardous and Solid Waste Amendments - are the 1984 amendments to RCRA that focused on waste minimization and phasing out land disposal of hazardous waste as well as corrective action for releases. Some of the other mandates of this law include increased enforcement authority for U.S. EPA, more stringent hazardous waste management standards, and a comprehensive underground storage tank program. Federal regulations adopted by U.S. EPA are found in Title 40, Code of Federal Regulations (40 CFR).
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)	The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, was enacted by Congress on December 11, 1980. This law created a tax on the chemical and petroleum industries and provided broad Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. CERCLA also enabled the revision of the National Contingency Plan (NCP). The NCP provided the guidelines and procedures needed to respond to releases and threatened releases of hazardous substances, pollutants, or contaminants. The NCP also established the NPL. The Superfund Amendments and Reauthorization Act (SARA) of 1986 reauthorized CERCLA to continue cleanup activities around the country. Several site-specific amendments, definitions clarifications, and technical requirements were added to the legislation, including additional enforcement authorities. Also, Title III of SARA authorized the Emergency Planning and Community Right-to-Know Act (EPCRA).
Emergency Planning and Community Right-to-Know Act (EPCRA) (42 USC Section 9601 et seq.)	The Superfund Amendments and Reauthorization Act (SARA) of 1986 created EPCRA (40 CFR Parts 350-372), also known as SARA Title III, a statute designed to improve community access to information about chemical hazards and to facilitate the development of chemical emergency response plans by state/tribe and local governments. EPCRA required the establishment of state/tribe emergency response commissions (SERCs/TERCs), responsible for coordinating certain emergency response activities and for appointing local emergency planning committees (LEPCs).

Table 3.H-1. Applicable Laws and Regulations for Hazards and Hazardous Materials	
State	
Various California Air Pollution Control Laws (i.e., Bluebook)	Includes all relevant Health and Safety Code sections of law, plus those air pollution- related statutes from other California codes, and the California Code of Regulations (CCR) Titles 13 & 17 sections that pertain to ARB's air management program.
Hazardous Materials Transportation California Vehicle Code Sections 31301-31309	Regulations pertaining to the safe transport of hazardous materials are in California Vehicle Code Sections 31301-31309. All motor carriers and drivers involved in transportation of hazardous materials must comply with the requirements contained in federal and state regulations, and must apply for and obtain a hazardous materials transportation license from the California Highway Patrol (CHP). A driver is required to obtain a hazardous materials endorsement issued by the driver's country or state of domicile to operate any commercial vehicle carrying hazardous materials. The driver is required to display placards or markings while hauling hazardous waste, unless the driver is exempt from the endorsement requirements. A driver who is a California resident is required to obtain an endorsement from CHP.
Hazardous Waste Control Law California Health & Safety Code, Division 20, Chapter 6.5 CCR, Division 4.5, Title 22	California requirements and statutory responsibilities in managing hazardous waste in California – this includes the generation, transportation, storage, treatment, recycling, and disposal of hazardous waste. The statute and regulation are implemented by Cal/EPA DTSC.
CalARP Program CCR, Title 19, Division 2, Chapter 4.5, Sections 2735-2785	The purpose of the CalARP program is to prevent accidental releases of substances that can cause serious harm to the public and the environment, to minimize the damage if releases do occur, and to satisfy community right-to-know laws. This is accomplished by requiring businesses that handle more than a threshold quantity of a regulated substance listed in the regulations to develop a Risk Management Plan (RMP). An RMP is a detailed engineering analysis of the potential accident factors present at a business and the mitigation measures that can be implemented to reduce this accident potential.
Hazardous Material Business Plan & Area Plan Program Health and Safety Code Sections 25500 – 25520 CCR, Title 19, Division 2, Chapter 4, Article 3 & 4	The business and area plans program, relating to the handling and release or threatened release of hazardous materials, was established in California to protect the public health and safety and the environment. Basic information on the location, type, quantity, and the health risks of hazardous materials handled, used, stored, or disposed of in the State, which could be accidently released into the environment, is not now available to firefighters, health officials, planners, public safety officers, health care providers, regulatory agencies, and other interested persons. The information provided by business and area plans is necessary in order to prevent or mitigate the damage to the health and safety of persons and the environment from the release or threatened release of hazardous materials into the workplace and environment. CUPAs use information collected from the Business Plan and California Accidental Release Prevention (CalARP) programs to identify hazardous materials in their communities. This information

Table 3.H-1. Applicable Laws and Regulations for Hazards and Hazardous Materials	
	provides the basis for the Area Plan and is used to determine the appropriate level of emergency planning necessary to respond to a release.
Unified Program Administration Health and Safety Code, Chapter 6.11, Sections 25404-25404.8 CCR, Title 27, Division 1, Subdivision 4, Chapter 1, Sections 15100-15620	A CUPA is a Certified Unified Program Agency, which is authorized by the Secretary of Cal/EPA to carry out several of the hazardous waste/hazardous materials regulatory programs administered by the State in a coordinated and consistent manner. The 6 hazardous waste and materials program elements covered by the CUPA include: 1) Hazardous Waste Generators 2) Underground Tanks (UST) 3) Above Ground Tanks (AST) 4) Accidental Release Program (CalARP) 5) Hazardous Material Release Response Plans & Spill Notification (Community Right- to-Know) 6) Hazardous Materials Management Plans & Inventory Reporting The intent of the CUPA is to simplify the hazardous materials regulatory environment and provide a single point of contact for businesses to address inspection, permitting, billing, and enforcement issues.
Various Local Ordinances	Various ordinances and codes may be adopted at the local level to provide stricter requirements in the management of hazardous materials and waste activities within the jurisdiction.

I. Hydrology and Water Quality

1. Existing Conditions

a. Water Supply

California experiences a Mediterranean climate with cool, wet winters and warm, dry summers. Most precipitation (i.e., rain and snow) and peak stream runoff events occur primarily during October through April, and the most extreme events usually occur between November and March. Precipitation rates vary greatly across the State from northern to southern regions, and the State contains many desert regions where annual total precipitation is very low (i.e., less than about 6 inches). In mountainous areas, snowmelt can provide moderate to high runoff rates in the April to July period, and snowmelt generally contributes substantially to the seasonal and annual volume of water that is available for storage in reservoirs and sustained stream flows into the later summer months.

Many rivers are controlled by dams, reservoirs, and levees for a variety of purposes, including but not limited to, flood control, hydroelectric power generation, water storage and transport for municipal/domestic and agricultural water supply, recreation, and fish and wildlife uses. Most of the major rivers on the west side of the Sierra Nevada Mountains are controlled, to some degree, by large dams, reservoirs, and diversions and water conveyance canals. Smaller reservoirs are common at other locations throughout the State. Sierra Nevada Mountain runoff to the Sacramento River and San Joaquin River (i.e., approximately 25 million acre-feet [MAF] in above normal water year types) provides much of the surface water used in the State and managed and conveyed in State Water Project (SWP) and Central Valley Project (CVP) facilities operated by the California Department of Water Resources (DWR) and U.S. Bureau of Reclamation (U.S. BR), respectively (DWR 2011; USBR 2011b). Water from the Sacramento River and San Joaquin River flows into the Sacramento-San Joaquin Delta (Delta), where both the SWP and CVP operate pumps to export water to the southern portion of the State. California also conveys a substantial quantity of water from the Colorado River for agricultural uses in the Imperial Valley and Coachella Valley, and municipal uses in the Los Angeles region. Several large reservoirs are located in the Los Angeles and San Diego areas to store imported Delta and Colorado River water.

California contains vast quantities of groundwater in alluvial aquifers that cover approximately 40 percent of the land surface. Several large groundwater recharge and conjunctive use projects are part of the SWP/CVP operations to provide short-term and long-term sub-surface storage of surplus surface water for later withdrawal for municipal/agricultural uses. Groundwater pumping that exceeds the natural recharge can lead to "overdrafting", which refers to long-term drawdown of groundwater table elevations.

Both groundwater and surface water are used extensively in California for agricultural, municipal, and industrial water supplies. Current annual municipal and industrial water use for the California population of approximately 35 million residents ranges from 10-12 MAF, with demands being lower in drought years when higher levels of conservation occur. Approximately 35 MAF is used for agricultural production. In years with average available surface water supply, groundwater meets about 30 percent of California's urban and agricultural demand, increasing in drought years to about 40 percent or more. While water supplies typically have been sufficient to meet demands, significant water supply and water quality challenges exist at local levels, particularly during extreme drought year types when conservation and cutbacks for agriculture have occurred and the SWP/CVP operations are stressed to meet competing water demands and environmental requirements in the major rivers and Delta.

b. Water Quality

The water quality of surface waters and groundwater varies throughout California. Potential surface sources of water quality impairments include point sources (direct discharges to water bodies) and dispersed non-point sources (e.g., stormwater runoff). Continuous point-source discharges such as domestic wastewater treatment plants can be a source of elevated levels of organic carbon, nutrients (i.e., nitrogen and phosphorus), salinity, or trace metals and organic compounds relative to natural background water concentrations. Potential domestic wastewater discharges of pharmaceutical and other personal care products have been identified as potentially contributing endocrine disrupting compounds (EDCs) and related adverse long-term toxic effects to aquatic organisms. Urban stormwater runoff from residential, commercial, and industrial land uses can mobilize and convey trash, oils, grease, trace metals (e.g., copper and zinc) to drainage systems and natural receiving water bodies. Stormwater runoff from residential and agricultural areas can also contain sediment, pesticides, herbicides, nutrients (e.g., fertilizers), and pathogens (e.g., bacteria and viruses from fecal wastes of pets and livestock). Contaminants of concern that remain in the environment for an extended period after deposition with little degradation include synthetic organic compounds such as chlorinated hydrocarbon pesticides (e.g., dichlorodiphenyltrichloroethane [DDT]), which largely have not been produced or used in California since the late 1970's, polychlorinated biphenyl compounds (PCBs), and dioxin and furan compounds. Improperly managed construction activities-related erosion and stormwater runoff can contribute sediment.

Primary water quality issues vary around the State depending on the location and type of water resources present in an area, the size and extent of the watershed and regional water resources, the location of the water body with respect to potential pollutant sources, seasonal and climatic factors, and many other interacting physical, chemical, and biological processes. The State Water Resources Control Board (SWRCB) conducts monitoring of surface waters through the Surface Water Ambient Monitoring Program (SWAMP), in which the collected data is used in part to support water quality assessments by each Regional Water Quality Control Board for the Clean Water Act (CWA) Section 305(b) reporting process, which mandates the State to identify and prioritize funding efforts for protection, cleanup, and monitoring programs. The most recent Section 305(b) report released in 2002 identified that of the 32,536 miles of rivers/streams assessed, 27,449 were impaired for one or more beneficial uses, as was 361,128 of 576,013 acres of lakes/reservoirs assessed (SWRCB 2003).

Groundwater quality may be adversely affected by all of the sources contributing to surface water impairment discussed above, particularly in alluvial aquifers that are recharged directly through by infiltration and percolation of surface water. Direct inputs of wastes to groundwater include sub-surface sources such as inadequately contained solid waste landfills, failing residential and commercial septic system leachfields, and leaking underground storage tanks that contain fuels, oils, or other industrial chemicals. The level of the major dissolved minerals (e.g., calcium, magnesium, potassium, sodium, sulfate, chloride), or salinity, is an important groundwater quality parameter for drinking water acceptability, agricultural use (i.e., crop tolerance), and aquatic biota. Total dissolved solids (TDS) concentrations that exceed about 500 milligrams per liter (mg/L) reflect generally low salinity, whereas water with TDS levels above about 2,500 mg/L are undesirable for drinking and have severe limitations for agricultural irrigation. Salinity can be naturally high, such as coastal aquifers affected by seawater intrusion or in arid lands where eons of evaporative concentration and locations of prehistoric seas have raised salinity levels.

2. Regulatory Setting

Table 3.I-1 below provides a general description of applicable laws and regulations that may pertain to the Proposed ACC Program as it relates to hydrology, water quality, and water supply.

Table 3.I-1. Applicable Laws and Regulations for Hydrology, Water Quality, and Supply	
Applicable Regulation	**Description**
Federal	
National Flood Insurance Program	Designated floodplain mapping program, flooding and flood hazard reduction implementation, and federal subsidized flood insurance for residential and commercial property. Administered by the Federal Emergency Management Agency (FEMA).
Executive Order 11988	Requires actions to be taken for federal activities to reduce the risks of flood losses, restore and preserve floodplains, and minimize flooding impacts to human health and safety.
Clean Water Act (CWA)	Administered primarily by the U.S. Environmental Protection Agency (U.S. EPA). Pertains to water quality standards, state responsibilities, and discharges of waste to waters of the United States. Sections 303, 401, 402, and 404.
CWA Section 303	Defines water quality standards consisting of: 1) designated beneficial uses of a water, 2) the water quality criteria (or."objectives" in California) necessary to support the uses, and 3) an antidegradation policy that protects existing uses and high water quality. Section 303(d) requires states to identify water quality impairments where conventional control methods will not achieve compliance with the standards, and establish Total Maximum Daily Load (TMDL) programs to achieve compliance.
CWA Section 401	State certification system for federal actions which may impose conditions on a project to ensure compliance with water quality standards.
CWA Section 402	National Pollutant Discharge Elimination System (NPDES) permit program to control discharges of pollutants from point sources and nonpoint source stormwater. Section 402 mandates permits for municipal stormwater discharges, which are regulated under the NPDES General Permit for Municipal Separate Storm Sewer Systems (MS4) (MS4 Permit). Several of the cities and counties issue their own NPDES municipal stormwater permits for the regulations of stormwater discharges. These permits require that controls are implemented to reduce the discharge of pollutants in stormwater discharges to the maximum extent possible, including management practices, control techniques, system design and engineering methods, and other measures as appropriate. As part of permit compliance, these permit holders have created Stormwater Management Plans for their respective locations. These plans outline the requirements for municipal operations, industrial and commercial businesses, construction sites, and planning and land development. These requirements may include multiple measures to control pollutants in stormwater discharge. During implementation of specific projects, applicants will be required to follow

Table 3.I-1. Applicable Laws and Regulations for Hydrology, Water Quality, and Supply	
Applicable Regulation	**Description**
	the guidance contained in the Stormwater Management Plans as defined by the permit holder in that location.
CWA Section 404	Permit system for dredging or filling activity in waters of the U.S., including wetlands, and administered by the U.S. Army Corps of Engineers.
National Toxics Rule and California Toxics Rule	Applicable receiving water quality criteria promulgated by U.S. EPA for priority toxic pollutants consisting generally of trace metals, synthetic organic compounds, and pesticides.
State	
California Water Rights	The State Water Resources Control Board (SWRCB) administers review, assessment, and approval of appropriative (or priority) surface water rights permits/licenses for diversion and storage for beneficial use. Riparian water rights apply to the land and allow diversion of natural flows for beneficial uses without a permit, but users must share the resources equitably during drought. Groundwater management planning is a function of local government. Groundwater use by overlying property owners is not formally regulated, except in cases where the groundwater basin supplies are limited and uses have been adjudicated, or through appropriative procedures for groundwater transfers.
Public Trust Doctrine	Body of common law that requires the State to consider additional terms and conditions when issuing or reconsidering appropriative water rights to balance the use of the water for many beneficial uses irrespective of the water rights that have been established. Public trust resources have traditionally included navigation, commerce, and fishing and have expanded over the years to include protection of fish and wildlife, and preservation goals for scientific study, scenic qualities, and open-space uses.
Porter-Cologne Water Quality Control Act and California Water Code (Title 23)	The SWRCB is responsible for statewide water quality policy development and exercises the powers delegated to the State by the federal government under the CWA. Nine Regional Water Quality Control Boards (Regional Water Boards) adopt and implement water quality control plans (Basin Plans) which designate beneficial uses of surface waters and groundwater aquifers, and establish numeric and narrative water quality objectives for beneficial use protection. Regional Water Boards issue waste discharge requirements (WDRs) for discharge activities to water and land, require monitoring and maintain reporting programs, and implement enforcement and compliance policies and procedures. Other state agencies with jurisdiction in water quality regulation in California include the Department of Public Health (drinking water regulations), Department of Pesticide Regulation, Department of Toxic Substances Control, Department of Fish and Game, and the Office of Environmental Health and Hazard Assessment.

Table 3.I-1. Applicable Laws and Regulations for Hydrology, Water Quality, and Supply

Applicable Regulation	Description
Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California	Commonly referred to as the State Implementation Policy (or SIP), the SIP provides implementation procedures for discharges of toxic pollutants to receiving waters.
Thermal Plan	The Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Water and Enclosed Bays and Estuaries of California was adopted by the SWRCB in 1972 and amended in 1975. The Thermal Plan restricts discharges of thermal waste or elevated temperature waste to waters of the state. Generally, the Thermal Plan prohibits discharges from increasing ambient temperatures by more than 1°F over more than 25 percent of a stream cross section, increasing ambient temperatures by more than 4°F in any location, and prohibits discharge of waste that exceeds more than 20°F above the ambient temperature.
Statewide NPDES General Permit for Stormwater Associated with Land Disturbance and Construction Activity (Order No. 2009-0009-DWQ, NPDES No. CAR000002)	NPDES permit for stormwater and non-storm discharges from construction activity that disturbs greater than one acre. The general construction permit requires the preparation of a storm water pollution prevention plan (SWPPP) that identifies best management practices (BMPs) to be implemented to control pollution of storm water runoff. The permit specifies minimum construction BMPs based on a risk-level determination of the potential of the project site to contribute to erosion and sediment transport and sensitivity of receiving waters to sediment. While small amounts of construction-related dewatering are covered under the General Construction Permit, the RWQCB has also adopted a General Order for Dewatering and Other Low Threat Discharges to Surface Waters (General Dewatering Permit). This permit applies to various categories of dewatering activities and may apply to some construction sites, if construction of specific projects required dewatering in greater quantities than that allowed by the General Construction Permit and discharged the effluent to surface waters. The General Dewatering Permit contains waste discharge limitations and prohibitions similar to those in the General Construction Permit.
Statewide NPDES General Permit for Discharges of Stormwater Associated with Industrial Facilities (Order No. 97-003-DWQ, NPDES No. CAS000001)	NPDES permit for stormwater and non-storm discharges from types of industrial sites based on the Standard Industrial Classification (SIC). The general industrial permit requires the preparation of a SWPPP that identifies potential onsite pollutants, BMPs to be implemented, and inspection/monitoring.
Local	
Water Agencies	Water agencies enter into contracts or agreements with the federal and state governments to protect the water supply and to ensure the lands within the agency have a dependable supply of suitable quality water to meet present and future needs.
Floodplain Management	General Plans guide County land use decisions, and require the identification of water resource protection goals, objectives, and policies. Floodplain management is addressed through ordinances, land use planning, and development design review and approval. Local actions

Table 3.I-1. Applicable Laws and Regulations for Hydrology, Water Quality, and Supply

Applicable Regulation	Description
	may be coordinated with FEMA for the National Flood Insurance Program. Typical provisions address floodplain use restrictions, flood protection requirement, allowable alteration of floodplains and stream channels, control of fill and grading activities in floodplains, and prevention of flood diversions where flows would increase flood hazards in other areas.
Drainage, Grading, and Erosion Control Ordinances	Counties regulate building activity under the federal Uniform Building Code, local ordinances, and related development design review, approval, and permitting. Local ordinances are common for water quality protection addressing drainage, stormwater management, land grading, and erosion and sedimentation control.
Environmental Health	The Regional Water Boards generally delegate permit authority to County health departments to regulate the construction and operation/maintenance of on-site sewage disposal systems (e.g., septic systems and leachfields, cesspools).

J. Land Use and Planning

1. Existing Conditions

The manner in which physical landscapes are used or developed is commonly referred to as land use. Local governments possess the basic legal authority to control land use, which is part of the police powers to protect community health, safety, and welfare conferred to state governments under the U. S. Constitution and, in turn, delegated by the state to local governments. Cities and counties are the primary entities that determine the types of land use changes that can occur for specific purposes within their jurisdiction, as well as development standards for structures and other development on the land. In incorporated areas, land use decisions are made by the city. In unincorporated areas, land use decisions are made by the county. Sometimes other public agencies have land use authority, either by virtue of land ownership by agencies with sovereignty over local government, such as state or federal land management agencies, or because of other state or federal laws, such as the California Coastal Commission in the coastal zone or the State Lands Commission in submerged and other land held in trust for the public.

In California, the State Planning and Zoning Law (California Government Code section 65000 et seq.) provides the primary legal framework that cities and counties must follow in land use planning and controls. Planned land uses are designated in the city or county General Plan, which serves as the comprehensive master plan for the community. Also, city and county land use and other related resource policies are defined in the General Plan. The primary land use regulatory tool provided by the California Planning and Zoning Law is the zoning ordinance adopted by each city and county. Planning and Zoning Law requirements are discussed in the regulatory setting below.

When approving land use development, cities and counties must comply with the California Environmental Quality Act (CEQA), which requires that they consider the significant environmental impacts of their actions and the adoption of all feasible mitigation measures to substantially reduce significant impacts, in the event a project causes significant or potentially significant effects on the environment. In some cases, building permits may be ministerial, and therefore exempt from CEQA, but most land use development approval actions by cities and counties require CEQA compliance.

2. Regulatory Setting

Table 3.J-1 below provides a general description of applicable laws and regulations that may pertain to land use planning and the Proposed ACC Program.

Table 3.J-1. Applicable Laws and Regulations for Land Use Planning

Applicable Regulation	Description
Federal	
Federal Land Policy Management Act	The Federal Land Policy Management Act of 1976 (FLPMA) is the principal law governing how the BLM manages public lands. FLPMA requires the BLM to manage public land resources for multiple use and sustained yield for both present and future generations. Under FLPMA, the BLM is authorized to grant right-of-ways (ROWs) for generation, transmission, and distribution of electrical energy. Although local agencies do not have jurisdiction over the federal lands managed by the BLM, under FLPMA and the BLM regulations at 43 CFR Part 1600, the BLM must coordinate its planning efforts with state and local planning initiatives. FLPMA defines an Area of Critical Environmental Concern (ACEC) as an area within the public lands where special management attention is required (when such areas are developed or used or where no development is required) to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards. The BLM identifies, evaluates, and designates ACECs through its resource management planning process. Allowable management practices and uses, mitigation, and use limitations, if any, are described in the planning document and the concurrent or subsequent ACEC Management Plan. ACECs are considered land use authorization avoidance areas because they are known to contain resource values that could result in denial of applications for land uses that cannot be designed to be compatible with management objectives and prescriptions for the ACEC.

Table 3.J-1. Applicable Laws and Regulations for Land Use Planning	
Applicable Regulation	**Description**
U.S. Bureau of Land Management Resource Management Plans	Established by FLPMA, Resource Management Plans are designed to protect present and future land uses and to identify management practices needed to achieve desired conditions within the management area covered by the Resource Management Plans. Management direction is set forth in the Resource Management Plans in the form of goals, objectives, standards, and guidelines. These, in turn, direct management actions, activities, and uses that affect land management, and water, recreation, visual, natural, and cultural resources.
State	
State Planning and Zoning Law	California Government Code section 65300 et seq. establishes the obligation of cities and counties to adopt and implement general plans. The general plan is a comprehensive, long-term, and general document that describes plans for the physical development of the city or county. The general plan addresses a broad range of topics, including, at a minimum, land use, circulation, housing, conservation, open space, noise, and safety. In addressing these topics, the general plan identifies the goals, objectives, policies, principles, standards, and plan proposals that support the city or county's vision for the area. The general plan is also a long-range document that typically addresses the physical character of an area over a 20-year period. Although the general plan serves as a blueprint for future development and identifies the overall vision for the planning area, it remains general enough to allow for flexibility in the approach taken to achieve the plan's goals.
Subdivision Map Act (Government Code section 66410 et seq.)	In general, land cannot be divided in California without local government approval. The primary goals of the Subdivision Map Act are: (a) to encourage orderly community development by providing for the regulation and control of the design and improvements of the subdivision with a proper consideration of its relation to adjoining areas; (b) to ensure that the areas within the subdivision that are dedicated for public purposes will be properly improved by the subdivider so that they will not become an undue burden on the community; and (c) to protect the public and individual transferees from fraud and exploitation. (61 Ops. Cal. Atty. Gen. 299, 301 [1978]; 77 Ops. Cal. Atty. Gen. 185 [1994]). Dividing land for sale, lease or financing is regulated by local ordinances based on the state Subdivision Map Act (Government Code section 66410 et seq.).
Local	
General Plans	The most comprehensive land use planning is provided by city and county general plans, which local governments are required by State law to prepare as a guide for future development. The general plan contains goals and policies concerning topics that are mandated by State law or which the jurisdiction has chosen to include. Required topics are: land use, circulation, housing, conservation, open space, noise, and safety. Other topics that local governments frequently choose to address are public facilities, parks and recreation, community design, or growth management, among others. City and county general plans must be consistent with each other. County general plans must cover areas not included by city general plans (i.e., unincorporated areas).

Table 3.J-1. Applicable Laws and Regulations for Land Use Planning	
Applicable Regulation	**Description**
Specific and Community Plans	A city or county may also provide land use planning by developing community or specific plans for smaller, more specific areas within their jurisdiction. These more localized plans provide for focused guidance for developing a specific area, with development standards tailored to the area, as well as systematic implementation of the general plan. Specific and community plans are required to be consistent with the city or county's general plan.
Zoning	The city or county zoning code is the set of detailed requirements that implement the general plan policies at the level of the individual parcel. The zoning code presents standards for different uses and identifies which uses are allowed in the various zoning districts of the jurisdiction. Since 1971, State law has required the city or county zoning code to be consistent with the jurisdiction's general plan, except in charter cities.
Housing Element Law	State law requires each city and county to adopt a general plan containing at least seven mandatory elements including housing. Unlike the other general plan elements, the housing element, required to be updated every five to six years, is subject to detailed statutory requirements and mandatory review by a State agency, the California Department of Housing and Community Development (Department). Housing elements have been mandatory portions of local general plans since 1969. This reflects the statutory recognition that housing is a matter of statewide importance and cooperation between government and the private sector is critical to attainment of the State's housing goals. The availability of an adequate supply of housing affordable to workers, families, and seniors is critical to the State's long-term economic competitiveness and the quality of life for all Californians.

K. Mineral Resources

1. Existing Conditions

Mineral resources are all the physical materials that are extracted from the earth for use. Modern society is dependent on a huge amount and variety of mineral resources. Mineral resources are classified as metallic or non-metallic. As measured by consumption, the most important metallic resources are iron aluminum, copper, zinc and lead. The most important nonmetallic resources include crushed stone, sand and gravel, cement, clays, salt and phosphate. Mineral reserves are known deposits of minerals that can be legally mined economically using existing technology.

The California Geological Survey (CGS), formerly the California Division of Mines and Geology, classifies the regional significance of mineral resources in accordance with the California Surface Mining and Reclamation Act of 1975 and assists the CGS in the designation of lands containing significant aggregate resources. Mineral Resource Zones (MRZs) have been designated to indicate the significance of mineral deposits. The MRZ categories follow:

- **MRZ-1:** Areas where adequate information indicates that no significant mineral deposits are present or where it is judged that little likelihood exists for their presence.
- **MRZ-2:** Areas where adequate information indicates significant mineral deposits are present, or where it is judged that a high likelihood exists for their presence.
- **MRZ-3:** Areas containing mineral deposits the significance of which cannot be evaluated from available data.
- **MRZ-4:** Areas where available information is inadequate for assignment to any other MRZ.

Lithium and platinum are discussed below, as such relate to the proposed ACC Program.

a. Lithium Mining

i. Basic Processes

Lithium is an elemental metal that is necessary component of lithium-ion batteries. More vehicle manufacturers are considering the use of lithium-ion batteries in their battery electric vehicle (BEV) and hybrid plug-in vehicle models instead of nickel-metal hydride batteries (USGS 2011).

Lithium production comes from deposits in which the lithium has been concentrated above background crustal abundance by natural processes. Lithium deposits are found in brine, which is extracted from wells that penetrate lithium-bearing zones of sediment (e.g., aquifers) and pumped into shallow evaporation ponds, where it is evaporated under controlled conditions that eliminate deleterious elements and compounds, principally magnesium and sulfate (Gruber et al. 2011).

ii. Number of Facilities in California

There are no lithium mines in California. The only commercial lithium brine operation in the U.S. is operated by American Lithium Minerals, Inc. in western Nevada (American Lithium Inc. 2010; USGS 2011). Other nations that are substantial lithium producers include Chile, Argentina, Canada, Bolivia, and China.

a. Platinum Mining

i. Basic Processes

Platinum is a vital component of proton exchange membrane fuel cells, which is the leading type of fuel cell that would be used in fuel cell vehicles (FCVs). The mining of platinum starts with finding an ore body containing (PGM), usually associated with copper and nickel ores. The ore is attained through a combination of digging, drilling, and blasting, and then hauled by a haul dump vehicle to a refining facility.

ii. Number of Facilities in California

There are no platinum mines in California. The only primary platinum-group metal (PGM) mines in the U.S. are the Stillwater and East Boulder Mines in Montana (USGS 2011). Small quantities of PGMs were also recovered as byproducts of copper refining. South Africa, Russia, and Canada are the world's leading producers of platinum.

2. Regulatory Setting

Applicable laws and regulations associated with mineral resources are discussed in Table 3.K-1.

Table 3.K-1. Applicable Laws and Regulations for Mineral Resources

Federal	
Mining and Mineral Policy Act	The Mining and Mineral Act of 1970 declared that the Federal Government policy is to encourage private enterprise in the development of a sound and stable domestic mineral industry, domestic mineral deposits, minerals research, and methods for reclamation in the minerals industry.
State	
Surface Mining and Reclamation Act (SMARA)	The intent of SMARA of 1975 is to promote production and conservation of mineral resources, minimize environmental effects of mining, and to assure that mined lands will be reclaimed to conditions suitable for alternative uses. An important part of the SMARA legislation requires the State Geologist to classify land according to the presence or absence of significant mineral deposits. Local jurisdictions are given the authority to permit or restrict mining operations, adhering to the SMARA legislation. Classification of an area using Mineral Resource Zones (MRZ) to designate lands that contain mineral deposits are designed to protect mineral deposits from encroaching urbanization and land uses that are incompatible with mining. The MRZ classifications reflect varying degrees of mineral significance, determined by available knowledge of the presence or absence of mineral deposits as well as the economic potential of the deposits.
California Building Standards Code (CBSC) (CCR Title 24)	California's minimum standards for structural design and construction are given in the California Building Standards Code (CBSC) (CCR Title 24). The CBSC is based on the Uniform Building Code (International Code Council 1997), which is used widely throughout United States (generally adopted on a state-by-state or district-by-district basis) and has been modified for California conditions with numerous, more detailed or more stringent regulations. The CBSC provides standards for various aspects of construction, including (i.e., not limited to) excavation, grading, and earthwork construction; fills and embankments; expansive soils; foundation investigations; and liquefaction potential and soil strength loss. In accordance with California law, proponents of specific projects would be required to comply with all provisions of the CBSC for certain aspects of design and construction.

Table 3.K-1. Applicable Laws and Regulations for Mineral Resources	
Local	
Local Grading and Erosion Control Ordinances	Many counties and cities have grading and erosion control ordinances. These ordinances are intended to control erosion and sedimentation caused by construction activities. A grading permit is typically required for construction-related projects. As part of the permit, project applicants usually must submit a grading and erosion control plan, vicinity and site maps, and other supplemental information. Standard conditions in the grading permit include a description of BMPs similar to those contained in a SWPPP.
County General Plans (and EIR)	Some county General Plans provide a regulatory framework to address potential environmental impacts that may result from a proposed project

L. Noise

1. Existing Conditions

a. Acoustic Fundamentals

Acoustics is the scientific study that evaluates perception, propagation, absorption, and reflection of sound waves. Sound is a mechanical form of radiant energy, transmitted by a pressure wave through a solid, liquid, or gaseous medium. Sound that is loud, disagreeable, unexpected, or unwanted is generally defined as noise; consequently, the perception of sound is subjective in nature, and can vary substantially from person to person.

A sound wave is initiated in a medium by a vibrating object (e.g., vocal chords, the string of a guitar, the diaphragm of a radio speaker). The wave consists of minute variations in pressure, oscillating above and below the ambient atmospheric pressure. The number of pressure variation cycles occurring per second is referred to as the frequency of the sound wave and is expressed in hertz.

Directly measuring sound pressure fluctuations would require the use of a very large and cumbersome range of numbers. To avoid this and have a more useable numbering system, the decibel (dB) scale was introduced. A sound level expressed in decibels is the logarithmic ratio of two like pressure quantities, with one pressure quantity being a reference sound pressure. For sound pressure in air the standard reference quantity is generally considered to be 20 micropascals, which directly corresponds to the threshold of human hearing. The use of the decibel is a convenient way to handle the million-fold range of sound pressures to which the human ear is sensitive. A decibel is logarithmic; it does not follow normal algebraic methods and cannot be directly added. For example, a 65 dB source of sound, such as a truck, when joined by another 65 dB source results in a sound amplitude of 68 dB, not 130 dB (i.e., doubling the source strength increases the sound pressure by 3 dB). A sound level increase of 10 dB corresponds to 10 times the acoustical energy, and an increase of 20 dB equates to a 100-fold increase in acoustical energy.

The loudness of sound perceived by the human ear depends primarily on the overall sound pressure level and frequency content of the sound source. The human ear is not equally sensitive to loudness at all frequencies in the audible spectrum. To better relate overall sound levels and loudness to human perception, frequency-dependent weighting networks were developed. The standard weighting networks are identified as A through E. There is a strong correlation between the way humans perceive sound and A-weighted sound levels (dBA). For this reason the dBA can be used to predict community response to noise from the environment, including noise from transportation and stationary sources. Sound levels expressed as dB in this environmental analysis are A-weighted sound levels, unless noted otherwise.

Noise can be generated by a number of sources, including mobile sources (transportation noise sources), such as automobiles, trucks, and airplanes and stationary sources (nontransportation noise sources), such as construction sites, machinery, and commercial and industrial operations. As acoustic energy spreads through the atmosphere from the source to the receiver, noise levels attenuate (decrease) depending on ground absorption characteristics, atmospheric conditions, and the presence of physical barriers (walls, building façades, berms). Noise generated from mobile sources generally attenuate at a rate of 4.5 dB per doubling of distance. Stationary noise sources spread with more spherical dispersion patterns that attenuate at a rate of 6 to 7.5 dB per doubling of distance.

Atmospheric conditions such as wind speed, turbulence, temperature gradients, and humidity may additionally alter the propagation of noise and affect levels at a receiver. Furthermore, the presence of a large object (e.g., barrier, topographic features, and intervening building façades) between the source and the receptor can provide significant attenuation of noise levels at the receiver. The amount of noise level reduction or "shielding" provided by a barrier primarily depends on the size of the barrier, the location of the barrier in relation to the source and receivers, and the frequency spectra of the noise. Natural barriers such as berms, hills, or dense woods, and human-made features such as buildings and walls may be used as noise barriers.

b. Noise Descriptors

The intensity of environmental noise fluctuates over time, and several different descriptors of time-averaged noise levels are used. The selection of a proper noise descriptor for a specific source depends on the spatial and temporal distribution, duration, and fluctuation of both the noise source and the environment. The noise descriptors most often used to describe environmental noise are defined below.

- **Equivalent Noise Level (L_{eq}):** The energy mean (average) noise level.
- **Maximum Noise Level (L_{max}):** The highest A/B/C weighted integrated noise level occurring during a specific period of time.

- **Minimum Noise Level (L_{min}):** The lowest A/B/C weighted integrated noise level during a specific period of time.
- **Day-Night Noise Level (L_{dn}):** The 24-hour Leq with a 10-dB "penalty" applied during nighttime noise-sensitive hours, 10 p.m. through 7 a.m.
- **Community Noise Equivalent Level (CNEL):** Similar to the Ldn described above, but with an additional 5-dB "penalty" for the noise-sensitive hours between 7 p.m. to 10 p.m., which are typically reserved for relaxation, conversation, reading, and watching television.

Community noise is commonly described in terms of the ambient noise level, which is defined as the all-encompassing noise level associated with a given noise environment. A common statistical tool to measure the ambient noise level is the L_{eq} descriptor listed above, which corresponds to a steady-state A-weighted sound level containing the same total energy as a time-varying signal over a given time period (usually one hour). The Leq is the foundation of the composite noise descriptors such as L_{dn} and CNEL, as defined above, and shows very good correlation with community response to noise.

c. Effects of Noise on Humans

Excessive and chronic exposure to elevated noise levels can result in auditory and non-auditory effects on humans. Auditory effects of noise on people are those related to temporary or permanent hearing loss caused by loud noises. Non-auditory effects of exposure to elevated noise levels are those related to behavioral and physiological effects. The non-auditory behavioral effects of noise on humans are associated primarily with the subjective effects of annoyance, nuisance, and dissatisfaction, which lead to interference with activities such as communications, sleep, and learning. The non-auditory physiological health effects of noise on humans have been the subject of considerable research attempting to discover correlations between exposure to elevated noise levels and health problems, such as hypertension and cardiovascular disease. The mass of research infers that noise-related health issues are predominantly the result of behavioral stressors and not a direct noise-induced response. The extent to which noise contributes to non-auditory health effects remains a subject of considerable research, with no definitive conclusions.

The degree to which noise results in annoyance and interference is highly subjective and may be influenced by several non-acoustic factors. The number and effect of these non-acoustic environmental and physical factors vary depending on individual characteristics of the noise environment such as sensitivity, level of activity, location, time of day, and length of exposure. One key aspect in the prediction of human response to new noise environments is the individual level of adaptation to an existing noise environment. The greater the change in the noise levels that are attributed to a new noise source, relative to the environment an individual has become accustom to, the less tolerable the new noise source will be perceived.

With respect to how humans perceive and react to changes in noise levels, a 1 dB increase is imperceptible, a 3 dB increase is barely perceptible, a 6 dB increase is clearly noticeable, and a 10 dB increase is subjectively perceived as approximately twice as loud (Egan 1988). These subjective reactions to changes in noise levels was developed on the basis of test subjects' reactions to changes in the levels of steady-state pure tones or broad-band noise and to changes in levels of a given noise source. It is probably most applicable to noise levels in the range of 50 to 70 dB, as this is the usual range of voice and interior noise levels. For these reasons, a noise level increase of 3 dB or more is typically considered substantial in terms of the degradation of the existing noise environment.

d. Vibration

Vibration is the periodic oscillation of a medium or object with respect to a given reference point. Sources of vibration include natural phenomena (e.g., earthquakes, volcanic eruptions, sea waves, landslides) and those introduced by human activity (e.g., explosions, machinery, traffic, trains, construction equipment). Vibration sources may be continuous, (e.g., operating factory machinery or transient in nature, explosions). Vibration levels can be depicted in terms of amplitude and frequency, relative to displacement, velocity, or acceleration.

Vibration amplitudes are commonly expressed in peak particle velocity (PPV) or root-mean-square (RMS) vibration velocity. PPV is defined as the maximum instantaneous positive or negative peak of a vibration signal. PPV is typically used in the monitoring of transient and impact vibration and has been found to correlate well to the stresses experienced by buildings (Federal Transit Administration [FTA] 2006, California Department of Transportation [Caltrans] 2004). PPV and RMS vibration velocity are normally described in inches per second (in/sec).

Although PPV is appropriate for evaluating the potential for building damage, it is not always suitable for evaluating human response. The response of the human body to vibration relates well to average vibration amplitude; therefore, vibration impacts on humans are evaluated in terms of RMS vibration velocity. Similar to airborne sound, vibration velocity can be expressed in decibel notation as vibration decibels (VdB). The logarithmic nature of the decibel serves to compress the broad range of numbers required to describe vibration.

Typical outdoor sources of perceptible groundborne vibration include construction equipment, steel-wheeled trains, and traffic on rough roads. Although the effects of vibration may be imperceptible at low levels, effects may result in detectable vibrations and slight damage to nearby structures at moderate and high levels, respectively. At the highest levels of vibration, damage to structures is primarily architectural (e.g., loosening and cracking of plaster or stucco coatings) and rarely results in damage to structural components. The range of vibration that is relevant to this analysis occurs from approximately 50 VdB, which is the typical background vibration-velocity level, to 100 VdB, which is the general threshold where minor damage can occur in fragile buildings (FTA 2006).

e. Existing Sources and Sensitive Land Uses

The existing noise environment in most urban areas of California area is primarily influenced by transportation noise from vehicle traffic on the roadway systems (e.g., highways, freeways, primary arterials, and major local streets) and non-transportation noise from commercial and industrial operations. Other noise sources that contribute to the existing noise environment include passenger and freight on-line railroad operations and ground rapid transit systems; commercial, general aviation, heliport, and military airport operations (e.g., jet engine test stands, ground facilities and maintenance) and overflights; and to a much lesser extent construction sites, schools (i.e., play fields), residential and recreational areas (e.g., landscape maintenance activities, dogs barking, people talking), agricultural activities, and others. Those noted above are also considered sources of vibration in the project area. With regards to the affected entities, existing noise conditions vary depending on location, but are typically characterized as noisy urban industrial areas including such noise sources as stationary machinery, transportation (e.g., surface vehicles, heavy-duty diesel trucks, construction equipment), and other industrial-related activities. Table 3.L-1 shows typical ambient noise levels based on population density.

Table 3.L-1. Population Density and Associated Ambient Noise Levels

	dBA, L_{dn}
Rural	40-50
Suburban	
Quiet suburban residential or small town	45-50
Normal suburban residential	50-55
Urban	
Normal urban residential	60
Noisy urban residential	65
Very noise urban residential	70
Downtown, major metropolis	75-80
Under flight path at major airport, ½ to 1 mile from runway	78-85
Adjoining freeway or near a major airport	80-90

Notes: A-Weighted Decibel (dBA). An overall frequency-weighted sound level in decibels which approximates the frequency response of the human ear. Day-Night Level (Ldn).
Sources: Cowan, James P. 1994

Noise-sensitive land uses are generally considered to include those uses where noise exposure could result in health-related risks to individuals, as well as places where quiet is an essential element of their intended purpose. Residential dwellings are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Additional land uses such as parks, historic sites, cemeteries, and recreation areas are also generally considered sensitive to increases in exterior noise levels. Places of worship and transit lodging, and other places where low interior noise levels are essential are also considered noise-sensitive.

Those noted above are also considered vibration-sensitive land uses in addition to commercial and industrial buildings where vibration would interfere with operations within the building, including levels that may be well below those associated with human annoyance. Equipment such as electron microscopes and high-resolution lithographic equipment can be very sensitive to vibration, and even normal optical microscopes will sometimes be difficult to use when vibration is well below the human annoyance level. Manufacturing of computer chips is an example of a vibration-sensitive process. This category does not include most computer installations or telephone switching equipment because most such equipment is designed to operate in typical building environments where the equipment may experience occasional shock from bumping and continuous background vibration caused by other equipment (FTA 2006).

2. Regulatory Setting

The following provides a brief description of the Federal and State noise regulations that could be applicable to the ACC Program. Local regulations may also apply; however, because the specific siting of new hydrogen fueling stations automotive production facilities is not known at this time it would be speculative to present a discussion of applicable local regulations.

Table 3.L-2. Applicable Laws and Regulations for Noise Resources

Regulation	Description
Federal	
Federal Noise Control Act (1972) (U.S. Environmental Protection Agency [U.S. EPA]), 40 CFR 201-211	This act established a requirement that all federal agencies administer their programs to promote an environment free of noise that jeopardizes public health or welfare. U.S. EPA was given the responsibility for providing information to the public regarding identifiable effects of noise on public health or welfare, publishing information on the levels of environmental noise that will protect the public health and welfare with an adequate margin of safety, coordinating federal research and activities related to noise control, and establishing federal noise emission standards for selected products distributed in interstate commerce. This act also directed that all federal agencies comply with applicable federal, state, interstate, and local noise control regulations.
Quiet Communities Act (1978)	This act promotes the development of effective State and local noise control programs, to provide funds for noise research, and to produce and disseminate educational materials to the public on the harmful effects of noise and ways to effectively control it.
24 CFR, Part 51B (U.S. Department of Housing and Urban Development [HUD])	This regulation established standards for HUD-assisted projects and actions, requirements, and guidelines on noise abatement and control.

Table 3.L-2. Applicable Laws and Regulations for Noise Resources

Regulation	Description
Federal Aviation Administration (FAA) Order 1050.1D	This order contains policies and procedures for considering environmental impacts.
14 CFR, Part 150 (FAA)	These address airport noise compatibility planning and include a system for measuring airport noise impacts and present guidelines for identifying incompatible land uses. All land uses are considered compatible with noise levels of less than 65 dBA L_{dn}. At higher noise levels, selected land uses are also deemed acceptable, depending on the nature of the use and the degree of structural noise attenuation provided.
International Standards and Recommended Practices (International Civil Aviation Organization)	This contains policies and procedures for considering environmental impacts (e.g., aircraft noise emission standards and atmospheric sound attenuation factors).
32 CFR, Part 256 (Department of Defense Air Installations Compatible Use Zones [AICUZ] Program)	AICUZ plans prepared for individual airfields are primarily intended as recommendations to local communities regarding the importance of maintaining land uses which are compatible with the noise and safety impacts of military aircraft operations.
23 CFR, Part 772, Federal Highway Administration (FHWA) standards, policies, and procedures	These provide procedures for noise studies and noise abatement measures to help protect the public health and welfare, to supply noise abatement criteria, and to establish requirements for information to be given to local officials for use in the planning and design of highways.
29 CFR, Part 1910, Section 1910.95 (U.S. Department of Labor Occupational Safety and Health Administration [OSHA])	This regulation established a standard for noise exposure in the workplace.
Federal Transit Administration (FTA) Guidance (2006)	This guidance presents procedures for predicting and assessing noise and vibration impacts of proposed mass transit projects. All types of bus and rail projects are covered. Procedures for assessing noise and vibration impacts are provided for different stages of project development, from early planning before mode and alignment have been selected through preliminary engineering and final design. Both for noise and vibration, there are three levels of analysis described. The framework acts as a screening process, reserving detailed analysis for projects with the greatest potential for impacts while allowing a simpler process for projects with little or no effects. This guidance contains noise and vibration impact criteria that are used to assess the magnitude of predicted impacts. A range of mitigation is described for dealing with adverse noise and vibration impacts.
49 CFR 210 (Federal Rail Administration [FRA] Railroad Noise Emission Compliance Standards) and FRA Guidance (2005)	This section and guidance provides contains criteria and procedures for use in analyzing the potential noise and vibration impacts of various types of high-speed fixed guideway transportation systems.

Table 3.L-2. Applicable Laws and Regulations for Noise Resources	
Regulation	**Description**
State	
California Public Utilities Code (CPUC) Section 21670	The State Aeronautics Act of the CPUC establishes statewide requirements for airport land use compatibility planning and requires nearly every county to create an Airport Land Use Commission (ALUC) or other alternative.
Section 5000 et seq. (CCR, Title 21, Division 2.5, Chapter 6), California Airport Noise Regulations promulgated in accordance with the State Aeronautics Act	In Section 5006, the regulations state that: "The level of noise acceptable to a reasonable person residing in the vicinity of an airport is established as a CNEL value of 65 dBA for purposes of these regulations. This criterion level has been chosen for reasonable persons residing in urban residential areas where houses are of typical California construction and may have windows partially open. It has been selected with reference to speech, sleep and community reaction.
California Streets and Highways Code Section 216 (Freeway Noise in Classrooms)	This section, known as the Control of Freeway Noise in School Classrooms, requires that, in general, Caltrans abate noise from freeways to specified levels when the noise exceeds specified levels in school classrooms
California Government Code Section 65302 (Provision of Noise Contour Maps)	This section requires Caltrans to provide cities and counties with noise contour maps along State highways.
Title 24, Part 2, California Code of Regulations	These establish standards governing interior noise levels that apply to all new single-family and multi-family residential units in California. These standards require that acoustical studies be performed before construction at building locations where the existing L_{dn} exceeds 60 dBA. Such acoustical studies are required to establish mitigation that will limit maximum L_{dn} levels to 45 dBA in any habitable room.

M. Employment, Population, and Housing

1. Existing Conditions

The employed civilian labor force, unemployment rates, employment opportunities, and population estimates and projections for cities, counties, and states are collected every ten years by the U.S. Census Bureau (Census). The California Employment Development Department (EDD) collects statistics specific to California annually.

Population data for the State of California is collected during the ten year census cycles conducted by the United States Census Bureau. The 2010 Census shows California's total population at 37,253,956 individuals. Minors (9,295,040 individuals, under age 18) account for approximately 25 percent of the population, while adults (27,958,916 individuals, over age 18) account for approximately 75 percent of the population. Senior citizens (4,246,514 individuals, over age 65) account for approximately 15 percent of the adult population or 11 percent of the State's total population (U.S. Census Bureau 2010).

The State of California, Department of Finance (DOF) provides population projections after each ten year census cycle once the Census Bureau releases its Modified Age, Race, and Sex data. For the 2010 Census this data is not expected to be available until 2012. The current DOF projections are based on the 2000 Census and provide population projects in ten year increments through 2050. These projections show California's rate of population growth is expected to decline over time, as follows (DOF 2007):

- From 2000 to 2010: Population growth of approximately 14.7 percent (to 39,135,676)
- From 2010 to 2020: Population growth of approximately 12.8 percent (to 44,135,923)
- From 2020 to 2030: Population growth of approximately 11.6 percent (to 49,240,891)
- From 2030 to 2040: Population growth of approximately 10.1 percent (to 54,226,115)
- From 2040 to 2050: Population growth of approximately 9.7 percent (to 59,507,876)

Based on the 2010 Census, the actual rate of growth from 2000 to 2010 was approximately 9.2 percent, from 34,105,437 (DOF 2007) to 37,253,956 (U.S. Census Bureau 2010).

Current and projected employment data for the State of California is estimated by the State of California Employment Development Department (EDD). Total civilian employment in the State in during 2010 was 15,963,300 individuals (EDD 2011b). The EDD produces short-term (two year) projections of employment annually and long-term (ten year) projections of employment every two years. The current short-term (2010-2012) projections estimate that California's total occupational employment is expected to grow by 3.3 percent during that time (a net increase of 523,600 new jobs) and will reach 16.3 million jobs by the third quarter of 2012 (EDD 2011a). The long-term projections (2008-2018) estimate that California's occupational employment is expected to add over 1.6 million jobs during that decade to reach approximately 18.6 million jobs by 2018 (EDD 2010).

2. Regulatory Setting

Federal and state laws do not control population and employment. See housing-related regulations in Section J, Land Use and Planning.

N. Public Services

1. Existing Conditions

a. Law Enforcement

The U.S. Environmental Protection Agency (U.S. EPA) is an agency of the federal government of the United States charged with protecting human health and the environment, by writing and enforcing regulations based on laws passed by Congress. The Environmental Protection Agency's Criminal Investigation Division (U.S. EPA CID) primary mission is the enforcement of the United States' environmental laws as well as any other federal law in accordance with the guidelines established by the Attorney General of the United States (18 U.S.C. 3063). These environmental laws include those specifically related to air, water and land resources.

Statewide law enforcement service is provided by the California Highway Patrol (CHP). The CHP is responsible for protecting State resources and providing crime prevention services and traffic enforcement along the State's highways and byways.

Enforcement of environmental laws in California is the responsibility of the AG's Office and Cal/EPA. The Attorney General represents the people of California in civil and criminal matters before trial courts, appellate courts and the supreme courts of California and the United States. In regards to environmental issues, the Attorney General enforces laws that safeguard the environment and natural resources in the State. Recent actions by the Attorney General related to air quality and climate change issues include: legally defending the State's clean cars law against multiple challenges, filing numerous actions against the Bush Administration regarding regulation of global warming pollution, working with local governments to ensure that land use planning processes take account of global warming, promoting renewable energy and enhanced energy efficiency in California, and working with other State leaders and agencies to implement AB 32, the Global Warming Solutions Act of 2006 (DOJ 2011).

The California Environmental Protection Agency (Cal/EPA) was created in 1991 by Governor's Executive Order. Cal/EPA's mission is to restore, protect and enhance the environment, to ensure public health, environmental quality and economic vitality (Cal/EPA 2011a). The Cal/EPA is comprised of various boards, departments and offices, including: Air Resources Board, Department of Pesticide Regulation, Department of Toxic Substances Control, Office of Environmental Health Hazard Assessment, and State Water Resources Control Board (including the nine Regional Water Quality Control Boards) (Cal/EPA 2011b).

California's environmental laws are enforced by State and local agencies, each charged with enforcing the laws governing a specific media such as air, water, hazardous waste, solid waste, and pesticides (Cal/EPA 2011c). Enforcement agencies for these media are as follows:

- Air: Air Resources Board (part of Cal/EPA) and Local Air Districts.
- Water: State Water Resources Control Board (part of Cal/EPA), Regional Water Quality Control Boards (part of Cal/EPA), local waste water officials, and the California Department of Public Health.
- Hazardous Waste: Department of Toxic Substances Control (part of Cal/EPA) and Certified Unified Program Agencies (CUPA).
- Carcinogens/Reproductive Toxins: Prop. 65 through the Office of Environmental Health Hazard Assessment (part of Cal/EPA).
- Pesticides: Department of Pesticide Regulation (part of Cal/EPA) and County Agricultural Commissioners

Community law enforcement service is provided by local police and sheriff agencies (i.e., cities and counties, respectively) to prevent crime, respond to emergency incidents, and provide traffic enforcement on local roadways.

b. Fire Protection and Emergency Medical Response Services

The United States Forest Service is an agency of the United States Department of Agriculture that administers the nation's 155 national forests and 20 national grasslands, which encompass 193 million acres (780,000 km^2), including fire protection and response services. Major divisions of the agency include the National Forest System, State and Private Forestry, and the Research and Development branch. The Fire and Aviation Management part of the US Forest Service works to advance technologies in fire management and suppression, maintain and improve the extremely efficient mobilization and tracking systems in place, and reach out in support of our Federal, State, and International fire partners.

State-level fire protection and emergency response service is provided by the California Department of Forestry and Fire Protection (CAL FIRE), primarily in rural areas of the State. CAL FIRE is an emergency response and resource protection department. CAL FIRE protects lives, property and natural resources from fire, responds to emergencies of all types, and protects and preserves timberlands, wildlands, and urban forests.

Local and urban fire protection service is provided by local fire districts and/or local agencies (e.g., fire departments of cities and counties). In addition to providing fire response services most fire agencies also provide emergency medical response services (i.e., ambulance services) within their service areas.

c. Schools

Education is primarily a state and local responsibility in the United States. States and communities, as well as public and private organizations, establish schools, develop curricula, and determine requirements for enrollment and graduation (U.S. Department of Education 2010). Statewide, the regulation of education for youth is provided by the California Department of Education. The State Board of Education (SBE) is the governing and policy-making body of the California Department of Education. The SBE sets K-12 education policy in the areas of standards, instructional materials, assessment, and accountability (California State Board of Education 2010).

Locally, school districts are responsible for the management and development of elementary, middle, and high-school facilities. Throughout California there are 1,039 school districts.

2. Regulatory Setting

Key regulations and polices applicable to law enforcement, fire protection and emergency medical response services, and schools for the proposed ACC Program are summarized in Table 3.N-1.

Table 3.N-1. Applicable Laws and Regulations for Public Services

Regulation	Description
Federal	None applicable.
American with Disabilities Act	Guidelines to ensure that facilities are accessible to individuals with disabilities. Implements requirements for the design and construction of buildings.
State	
State Fire Responsibility Areas	Areas delineated by the State of California, Department of Forestry and Fire Protection (CAL FIRE) for which the State assumes primary financial responsibility for protecting natural resources from damages of fire. Local jurisdictions are required to adopt minimum recommended requirements for road design, road identification, emergency fire suppression and fuel breaks and greenbelts. All projects within or adjacent to a State Fire Responsibility Area must meet these requirements.
State School Funding	Education Code Section 17620 authorizes school districts to levy a fee, charge, dedication, or other requirement for any development project for the construction or reconstruction of school facilities.

O. Recreation

1. Existing Conditions

Recreational resources and facilities are provided and managed at federal, state, and local levels. The federal government manages a diverse array of recreational facilities and resources in California that include national parks and monuments, national forests and grasslands, wildlife refuges, wilderness areas, lakes and lands managed by different agencies in the federal government, wild and scenic rivers, and back country byways, national trials, and marine reserves and estuaries. The U.S. Fish and Wildlife Service (USFWS) manages the wildlife and fisheries resources and their habitats. Each federal agency's programs include recreation components.

California has over 275 State beaches and parks, recreation areas, wildlife areas, historic parks, and museums, and has authority over fishing and hunting activities, habitat restoration and protection in the State. General plans for State parks, recreation areas, and beaches are publicly available. The California Outdoor Recreation Plan and associated research provide policy guidance to all public agencies – federal, state, local, and special districts that oversee outdoor recreation on lands, facilities and services throughout California Agencies and departments that have involvement in recreational activities include Boating and Waterways, Fish and Game, Tahoe Regional Planning Association, various conservancies, and others (California State Parks 2008, p. 3).

Recreational lands and facilities are also managed by regional and local park and recreation agencies and open space districts. City and county General Plans contain recreation elements that provide framework for planning agencies to consider when projects are developed and implemented.

2. Regulatory Setting

The following provides a brief description of the Federal and State regulations that could be applicable to a new or renovated vehicle production facilities or fueling stations. Local regulations may also apply; however, because the specific siting of new is not known at this time it would be speculative to present a discussion of applicable local regulations.

Table 3.O-1. Applicable Laws and Regulations for Recreation	
Law or Regulation	**Description**
Federal	
Federal Land Policy and Management Act (FLPMA), 1976 – 43 CFR 1600	Establishes public land policy; guidelines for administration; and provides for the "multiple use" management, protection, development, and enhancement of public lands. "Multiple use" management, defined as "management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people" with recreation identified as one of the resource values (FLPMA 2001).
State	None applicable
Local	General plans for cities and counties contain designations for recreational areas. These are policy documents with planned land use maps and related information that are designed to give long-range guidance to those local officials making decisions affecting the growth and resources of their jurisdictions. Because of the number and variety of general plans and related local plans, they are not listed individually.

P. Transportation and Traffic

1. Existing Conditions

Existing roadway systems in the project area generally consist of highways, freeways, arterials, local streets, and intersections/ramps. The existing average annual daily traffic (AADT) volumes on the roadway segments that comprise these systems vary considerably (i.e., from hundreds to hundreds of thousands). The level of service (LOS), a scale used to determine the operating quality of a roadway segment or intersection based on volume-to-capacity ratio (V/C) or average delay, also vary from LOS A, the best and smoothest operating conditions, to LOS F, most congested operating conditions. Other roadway and traffic volume characteristics such as roadway length, number of lanes and facility type (e.g., two-lane freeway), right-of-way width and pavement width, terrain classification (e.g., flat), percent of heavy-duty truck traffic, and accident rates (e.g., number of accidents per million vehicle miles traveled) also vary substantially depending on the location. In addition to the roadway systems, circulation networks provide additional transportation opportunities and include mass transit, airports, and non-motorized travel (e.g., pedestrian and bicycle paths).

2. Regulatory Setting

Key regulations and polices applicable to utilities for the proposed ACC Program are summarized in Table 3.P-1. See Table 3.D-1 for a description of SB 375.

Table 3.P-1. Applicable Laws and Regulations for Transportation and Traffic

Regulation	Description
Federal	
40 CFR, Part 77 (Federal Aviation Administration)	Requires a determination of no hazard to air navigation for structures that will be more than 200 feet above ground level.
State	
California Vehicle Code (VC) Sections 353; 2500-2505; 31303-31309; 32000-32053; 32100-32109; 31600-31620; California Health and Safety Code Section 25160 et seq.	These regulate the highway transport of hazardous materials.
VC Sections 13369; 15275 and 15278	These address the licensing of drivers and the classification of licenses required for the operation of particular types of vehicles and also requires certificates permitting operation of vehicles transporting hazardous materials.
VC Sections 35100 et seq.; 35250 et seq.; 35400 et seq.	These specify limits for vehicle width, height, and length.
VC Section 35780	This requires permits for any load exceeding Caltrans weight, length, or width standards on public roadways.
California Streets and Highways Code Section 117, 660-672	This requires permits for any load exceeding Caltrans weight, length, or width standards on County roads.
California Streets and Highways Code Sections 117, 660-670, 1450, 1460 et seq., and 1480 et seq.	These regulate permits from Caltrans for any roadway encroachment from facilities that require construction, maintenance, or repairs on or across State highways and County roads.

Q. Utilities and Service Systems

1. Existing Conditions

a. Water Supply and Distribution

The principal water supply facilities in California are operated by the USBR and DWR. The USBR is a federal agency and it is the largest wholesaler of water in the U.S. and the second largest producer of hydroelectric power (USBR 2011a). In California, the Mid-Pacific Region of the USBR is responsible for the management of the Central Valley Project (CVP). The CVP serves farms, homes, and industry in California's Central Valley as well as the major urban centers in the San Francisco Bay Area. The CVP consists of 20 dams and reservoirs, 11 power plants, and 500 miles of major canals and reaches from the Cascade Mountains near Redding in the north to the Tehachapi Mountains near Bakersfield in the south. In addition to delivering water for municipal and industrial uses and the environment, the CVP produces electric power and provides flood protection, navigation, recreation, and water quality benefits (USBR 2011b).

DWR is a State agency that is responsible for managing and implementing the State Water Project (SWP). The SWP is a water storage and delivery system of reservoirs, aqueducts, power plants and pumping plants. Its main purpose is to store water and distribute it to 29 urban and agricultural water suppliers in Northern California, the San Francisco Bay Area, the San Joaquin Valley, the Central Coast, and Southern California (DWR 2010).

Local water districts, irrigation districts, special districts, and jurisdictions (e.g., cities and counties) manage and regulate the availability of water supplies and the treatment and delivery of water to individual projects. Depending on their location and the source of their supplies, these agencies may use groundwater, surface water through specific water entitlements, or surface water delivered through the CVP or SWP. In some remote areas not served by a water supply agency, individual developments may need to rely upon the underlying groundwater basin for their water supply. In these cases, the project would be required to secure a permit from the local land use authority and seek approval for development of the groundwater well(s).

b. Wastewater Collection and Treatment

The California State Water Resources Control Board (SWRCB) is the State agency responsible for the regulation of wastewater discharges to surface waters and groundwater via land discharge. The SWRCB and nine regional water quality control boards (RWQCB) are responsible for development and enforcement of water quality objectives and implementation plans that protect the beneficial uses of the federal and State waters (SWRCB 2010). The State water board also administers water rights in California. The RWQCB's are responsible for issuing permits or other discharge requirements to individual wastewater dischargers and for ensuring that they are meeting the requirements of the permit through monitoring and other controls.

Wastewater collection, treatment, and discharge service for developed and metropolitan areas is typically provided by local wastewater service districts or agencies that may or may not be operated by the local jurisdiction (e.g., city or county). These agencies are required to secure treatment and discharge permits for the operation of a wastewater facility from the RWQCB. Wastewater is typically collected from a specific development and conveyed through a series of large pipelines to the treatment facility where it is treated to permitted levels and discharged to surface waters or the land.

In areas that are remote or that are not served by an individual wastewater service provider, developments would be required to install an individual septic tank or other on-site wastewater treatment system. These facilities would need to be approved by the local land use authority and the RWQCB.

c. Electricity and Natural Gas

The California Public Utilities Commission (CPUC) regulates investor-owned electric and natural gas companies located within California. The CPUC's Energy Division develops and administers energy policy and programs and monitors compliance with the adopted regulations. One-third of California's electricity and natural gas is provided by one of three companies: Pacific Gas and Electric Company, Southern California Edison, San Diego Gas and Electric Company (CPUC 2010).

Locally, energy service is provided by a public or private utility. New development projects would need to coordinate with the local service provider to ensure adequate capacity is available to serve the development.

d. Solid Waste Collection and Disposal

Statewide, the California Department of Resources Recycling and Recovery (CAL Recycle), which is a department of the California Natural Resources Agency (CNRA), is responsible for the regulation of the disposal and recycling of all solid waste generated in California. Cal Recycle acts as an enforcement agency in the approval and regulation of solid waste disposal and recycling facilities. Local agencies can create local enforcement agencies (LEA) and, once approved by Cal Recycle, they can serve as the enforcement agency for landfills and recycling facilities with their jurisdictions (Cal Recycle 2011).

Local agencies or private companies own and operate landfill facilities and solid waste is typically hauled to these facilities by private or public haulers. Individual projects would need to coordinate with the local service provider and landfill to determine if adequate capacity exists to serve the project.

At this time, propulsion batteries are replaced at authorized original equipment manufacturer (OEM) service centers if needed. However, vehicle manufacturers differ in how they are addressing the need to properly handle or dispose of propulsion batteries after they reach the end of their useful life (e.g., recycling programs, switchable battery). Vehicle manufacturers have not provided specific information about how batteries would be handled after their "second life." A study at the National

Renewable Energy Laboratory concludes that if second uses for batteries are determined not to be economical then recycling them would be the next economically superior option (Neubauer and Pesaran 2011).

Federal and state agencies also regulate and/or research how automotive propulsion batteries should be handled at the end of their useful life. Regulations under the federal Resource Conservation and Recovery Act (RCRA) nickel-metal hydride batteries and lithium-ion batteries are classified as non-hazardous waste and are not required to be recycled. Per RCRA hazardous waste listings & criteria (40 CFR 261.4, Exclusions), fully spent consumer lithium batteries are neither toxic nor reactive and are considered non-hazardous (NEMA 2001).

California's hazardous waste management regulations classify all types of batteries, including nickel-metal hydride and lithium-ion batteries, as hazardous waste when discarded and must be managed accordingly. More specifically, facilities that treat, store, dispose and recycle batteries in California are also regulated under California's hazardous waste generator laws and regulations for Universal Waste (CCR, Title 22, Section 66261.9). These facilities are regulated and inspected by the California Department of Toxic Substances Control (DTSC), which is authorized by U.S. EPA to administer its own hazardous waste program for California. The local Certified Unified Program Agency (CUPA) is given authority to enforce hazardous waste management laws and regulations at the local level by the Secretary of Cal/EPA. Generators of universal wastes must recycle their waste by relinquishing it to the following: (1) a universal waste handler (e.g.; household hazardous waste facility, a 'Take-it-Back Partner' such as retailers or manufacturers); (2) a universal waste transporter; or (3) a destination facility (facility permitted by DTSC to treat, store, dispose or recycle).

2. Regulatory Setting

Key regulations and polices applicable to utilities for the proposed ACC Program are summarized in Table 3.Q-1.

Table 3.Q-1. Applicable Laws and Regulations for Public Services

Regulation	Description
Federal	None applicable.
State	
California Public Utilities Commission, Section 95-08-038	This section contains the rules for planning and construction of new transmission facilities, distribution facilities, and substations. The CPUC requires permits for the construction of certain power line facilities or substations if the voltages would exceed certain thresholds.

Table 3.Q-1. Applicable Laws and Regulations for Public Services

Regulation	Description
Section 21151.9 of the Public Resources Code/ Section 10910 et seq. of the Water Code	Required the preparation of a water supply assessment (WSA) for large developments. These assessments are prepared by public water agencies responsible for providing service and address whether there are adequate existing and projected future water supplies to serve the proposed project. All projects that meet the qualifications for preparing a WSA must identify the water supplies and quantities that would serve the project as well as project the total water demand for the service area (including the project's water demands) by source in 5-year increments over a 20-year period. This information must include data for a normal, single-dray, and multiple-dry years. The WSA is required to be approved by the water service agency before the project can be implemented.

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4.0 REGULATED COMMUNITY COMPLIANCE RESPONSES

For LEV III and ZEV, the regulated community would be automobile manufacturers. For CFO, the regulated community would be major refineries and gasoline importers, which would be required to establish the required minimum number of CFO outlets. For the ACC program as a whole, fuel producers (e.g., hydrogen), electricity generators, and mining would also be affected indirectly.

Compliance responses are activities undertaken by regulated communities to comply with regulations. Compliance activities would change in response to regulatory amendments included in the proposed Advanced Clean Cars (ACC) Program. This Environmental Analysis (EA) presents a programmatic evaluation that describes reasonably foreseeable environmental impacts resulting from the change in compliance responses by regulated communities. The analysis considers reasonable, potential compliance responses, but does not speculate as to all of the conceivable iterations of compliance responses that could occur within the passenger vehicle fleet or at the site- or project-specific level.

It is not possible to know with a reasonable level of certainty the specific actions that would be selected by regulated communities to comply with the regulatory changes under the proposed ACC Program. Individual vehicle manufacturers or major refiners and importers of gasoline could choose other compliance responses that result in different project impacts. For the purposes of this EA, the least expensive compliance responses are generally expected to be implemented by covered industries as a whole, although the responses of individual regulated communities within affected industries may differ depending on relative compliance costs and other factors.

The following compliance responses have been identified as reasonably foreseeable actions and provide the basis for a reasoned, good-faith assessment of potential, significant environmental impacts of the regulatory amendments under the proposed ACC Program. The compliance responses associated with each component of the proposed ACC Program are discussed separately below.

A. Low-Emission Vehicle and Greenhouse Gas Regulation (LEV III)

1. Fleet Mix

The proposed LEV III requirements, particularly the fleet average standards, would affect the mix of vehicle models and types that manufacturers would sell and lease in California. Table 4-1 summarizes projections by ARB staff about how a full-line manufacturer (i.e., a company that markets both passenger cars and light-duty trucks) could meet the LEV III fleet average emission standards for ozone precursors (e.g., NMOG and NO_X). It is important to note that Table 4-1 provides an example of how a manufacturer could comply with the ozone precursor standards, but LEV III also addresses CAPs and GHGs, as discussed below.

Table 4-1. Projected Sales Mix of Light-Duty Vehicles to Achieve Compliance with LEV III Emission Standards

Year	Passenger Cars										Fleet Average Standard for Mix of $NMOG+NO_X$ Emissions (g/mile)
	LEV 160	ULEV 125	ULEV 70	ULEV 50	SULEV 30	SULEV 20	PZEV	PHEV	BEV	FCV	
2015	5%	62%	8%	0%	0%	0%	21%	2%	1%	0%	0.100
2016	3%	50%	23%	0%	0%	0%	21%	2%	1%	0%	0.091
2017	3%	38%	35%	0%	0%	0%	21%	2%	1%	0%	0.084
2018	0%	25%	47%	0%	21%	0%	0%	6%	1%	0%	0.072
2019	0%	14%	55%	0%	21%	0%	0%	7%	3%	1%	0.064
2020	0%	2%	59%	0%	21%	5%	0%	8%	4%	1%	0.054
2021	0%	0%	31%	28%	21%	5%	0%	9%	5%	2%	0.046
2022	0%	0%	6%	45%	21%	10%	0%	10%	5%	2%	0.038
2023	0%	0%	5%	32%	33%	10%	0%	11%	6%	3%	0.035
2024	0%	0%	3%	15%	40%	20%	0%	13%	6%	3%	0.029
2025	0%	0%	0%	0%	55%	20%	0%	14%	6%	4%	0.025
Year	**Light-Duty Truck 1 (0-3,750 lb LVW)**										**Fleet Average Standard for Mix of $NMOG+NO_X$ Emissions (g/mile)**
	LEV 160	**ULEV 125**	**ULEV 70**	**ULEV 50**	**SULEV 30**	**SULEV 20**	**PZEV**	**PHEV**	**BEV**	**FCV**	
2015	3%	69%	7%	0%	0%	0%	21%	0%	0%	0%	0.102
2016	3%	52%	24%	0%	0%	0%	21%	0%	0%	0%	0.093
2017	0%	44%	35%	0%	0%	0%	21%	0%	0%	0%	0.086
2018	0%	32%	47%	0%	21%	0%	0%	0%	0%	0%	0.079
2019	0%	20%	59%	0%	21%	0%	0%	0%	0%	0%	0.072
2020	0%	6%	68%	0%	21%	5%	0%	0%	0%	0%	0.062
2021	0%	0%	55%	19%	21%	5%	0%	0%	0%	0%	0.055
2022	0%	0%	11%	58%	21%	10%	0%	0%	0%	0%	0.045
2023	0%	0%	0%	51%	39%	10%	0%	0%	0%	0%	0.039
2024	0%	0%	0%	33%	47%	20%	0%	0%	0%	0%	0.035
2025	0%	0%	0%	0%	80%	20%	0%	0%	0%	0%	0.028

Table 4-1. Projected Sales Mix of Light-Duty Vehicles to Achieve Compliance with LEV III Emission Standards

Year	Light-Duty Truck 2 (3,751 lb LVW – 8,500 lb GVWR)										Fleet Average Standard for Mix of NMOG+NO_X Emissions (g/mile)
	LEV	ULEV	ULEV 70	ULEV 50	SULEV 30	SULEV 20	PZEV	PHEV	BEV	FCV	
2015	5%	81%	14%	0%	0%	0%	0%	0%	0%	0%	0.119
2016	5%	76%	19%	0%	0%	0%	0%	0%	0%	0%	0.116
2017	5%	53%	42%	0%	0%	0%	0%	0%	0%	0%	0.104
2018	5%	53%	42%	0%	0%	0%	0%	0%	0%	0%	0.104
2019	5%	42%	53%	0%	0%	0%	0%	0%	0%	0%	0.098
2020	5%	36%	59%	0%	0%	0%	0%	0%	0%	0%	0.095
2021	4%	24%	72%	0%	0%	0%	0%	0%	0%	0%	0.087
2022	4%	24%	45%	27%	0%	0%	0%	0%	0%	0%	0.081
2023	4%	5%	45%	30%	16%	0%	0%	0%	0%	0%	0.064
2024	3%	0%	20%	50%	27%	0%	0%	0%	0%	0%	0.052
2025	2%	0%	0%	25%	72%	0%	0%	0%	0%	0%	0.038

Notes: These projections reflect a reasonably representative approach for compliance with the LEV III requirements. Other compliance scenarios that would achieve the fleet average emission standards of the LEV III amendments are conceivable. ARB's projections are specifically based on how vehicle manufacturers would be expected to respond to the amended standards for criteria air pollutants and precursors of LEV III and do not reflect the amendments to greenhouse gas (GHG) standards of LEV III. These projections do not account for any potential changes in consumer preference regarding the class of vehicles consumers choose to purchase. Consumer preferences can change according to a number of factors, including changes in fuel costs.
LEV = Low-Emission Vehicle; LEV160 = certified to 0.160 g/mi NMOG plus NOx ; ULEV125 = certified to 0.125 g/mi NMOG plus NOx; ULEV = Ultra-Low-Emission Vehicle; ULEV 70 = certified to 0.070 g/mi NMOG plus NOx; ULEV 50 = certified to 0.050 g/mi NMOG plus NOx; SULEV 30 = certified to 0.030 g/mi NMOG plus NOx; SULEV 20 = certified to 0.020 g/mi NMOG plus NOx; PZEV = Partial Zero Emission Vehicle; PHEV = Plug-in Hybrid Electric Vehicle; BEV = Battery Electric Vehicle; FCV = Fuel Cell Vehicle.
Source: ARB (available in the Staff Report, Section II.A.2)

As shown in Table 4-1, a greater proportion of the vehicle fleet would consist of vehicles from the more stringent emission performance classes (i.e., ULEV 50, SULEV 30, and SULEV 20) in order for manufacturers to comply with the increasingly stringent fleet-average emission standards proposed by the amendments. Thus, because compliance would be based on this proportion shift no changes in the amount of overall vehicle manufacturing or deliveries would be expected.

2. Technology Improvements

To meet the requirements for criteria air pollutant and precursor (CAP) emissions of the proposed ACC Program, manufacturers would be expected to reduce CAPs using a range of technologies. Other specific technology improvements could include load reductions and accessory improvements employed to reduce GHG emissions. Improvements in aerodynamics that reduce drag coefficients include installation of skirts, air dams, underbody covers, and application of more aerodynamic side view mirrors. In addition to the standard aerodynamic treatments, a second level of aerodynamic technologies could include active grille shutters, rear visors, and larger under body panels. Additional actions to reduce emissions may include installation of low drag brakes that reduce sliding friction of disc brake pads on rotors, and installation of front or secondary axle disconnects for four-wheel drive vehicles that reduce energy loss. Improvements to the powertrain (engines and transmissions) and vehicle improvements related to aerodynamics, low rolling resistance tires, auxiliary improvements, mass reduction, electric drive and hybrid systems are further discussed in the LEV III Staff Report, and in the following discussion.

a. Engine Improvements and Emission Control Systems

Manufacturers would be expected to continue to improve valve timing, cylinder deactivation, turbocharging, gasoline direct injection and other systems that would reduce GHG emissions. To reduce CAPs, manufacturers would be expected to improve current emission control system technologies across their light- and medium-duty vehicle fleet. Based on past compliance with previous versions of the LEV regulation (i.e., LEV I and LEV II), these improved emission control systems would be expected to include more efficient catalysts, secondary air injection, hydrocarbon adsorbers, and improved evaporative emission control systems.

Similarly, it is expected that the technologies necessary to meet the proposed LEV III evaporative emission standards would generally be the same as the technologies currently used to meet the existing optional zero evaporative standards. Because the types of technologies used currently would also be employed to meet the amended regulations, no substantial change in the manufacturing of emissions control equipment would be expected. These zero evaporative technologies consist of a hydrocarbon scrubber, air intake system element, and additional use of low/no permeation materials. The hydrocarbon scrubber and the air intake system element both generally consist of activated carbon, which acts to store fuel vapors. Steel would likely be used as no-permeation material, while various polymer materials, such as ethyl vinyl alcohol and fluorinated polymers, would be used as low-permeation materials. ARB staff expects that, for a limited number of vehicle models, a vapor blocking valve would be used to seal vapors in the fuel tank.

b. Improved Transmission Efficiency

In response to current and proposed regulations requiring reductions in GHG emissions from motor vehicles, manufacturers are incorporating improved transmissions on their vehicles. The transmission types involved include conventional automatic transmissions with up to 8 or 9 speeds; dual clutch automated manual transmissions that offer the efficiency of a manual transmission, but shift gears automatically; and continuously variable transmissions (CVTs) that can change seamlessly through an infinite number of effective gear ratios between maximum and minimum values (SAE 2011a). Transmission types installed in vehicles to comply with the proposed GHG emissions reductions would be similar to existing technology and equipment, so substantial changes in manufacturing requirements would not be expected; however, the volume manufactured could change, but would not be anticipated to result in a substantial increase in manufacturing capacity.

c. Improved Air Conditioning Systems

The predominant refrigerant currently used in new vehicles is hydrofluorocarbon-134a (HFC-134a), which has a relatively high GWP of 1,430 (U.S. EPA 2010a). Though the current Pavley regulations (which is part of the LEV II regulation) includes a credit incentive for using refrigerants with a GWP of 150 or less, an industry-wide replacement of HFC-134a with such low GWP refrigerants, most likely 2,3,3,3-tetrafluoropropene (commonly known as HFO-1234yf), is would not anticipated to occur until model year 2017 when availability of the new refrigerant increases and its costs decrease (U.S. EPA 2010a).

It is anticipated that auto manufacturers would work with suppliers of air conditioning (AC) systems to adapt to using HFO-1234yf. Such adaptations would likely include the addition of an internal heat exchanger to maintain AC efficiency. Some modifications at vehicle assembly plants would also be needed to accommodate the mild flammability of HFO-1234yf. By the time LEVIII would go into effect, manufacturers would be familiar with these changes from complying with low-GWP requirements established by the European Commission that start with model year 2011(U.S. EPA 2010a).

In addition, the AC service industry would be expected to purchase new machinery and tools for refrigerant recovery, recycling, and recharging and train and certify technicians on proper handling of new refrigerant (Cancel, 2011). Moreover, chemical manufacturers would need to develop new procedures and construct new facilities to produce the new refrigerant (Honeywell and DuPont, 2010). Again, these types of changes are currently in process to serve the European market, so a substantial increase in manufacturing capacity would not be expected. Additionally, in response to current and proposed regulations requiring reductions in GHG emissions from motor vehicles, manufacturers are incorporating improved AC efficiency technologies in their vehicles. Because the AC hardware installed in vehicles to comply with the proposed GHG emissions reductions would be similar to existing technology and equipment, no substantial changes in manufacturing requirements would be expected.

d. Lighter Materials

Vehicle manufacturers are increasingly seeking to reduce the weight of their vehicles, without compromising vehicle safety, to both reduce emissions and increase fuel efficiency. Typically, for every 10 percent reduction in vehicle weight a 6 to7 percent reduction in GHG emissions is achieved (Cheah 2007). These weight reductions are being achieved through the use of improved vehicle design and lightweight materials, such as high-strength steel, aluminum, magnesium, plastics and carbon composites (polycarbonate). These materials are already incorporated on vehicles today and would be expected to be increasingly used in future vehicle designs. However, such an increase would not be anticipated to result in a substantial increase in manufacturing capacity, mining, or transportation. Existing plants would be retooled for manufacturing these lighter-weight materials. It is expected that more weight reduction would be achieved in heavier vehicle models, as opposed to smaller models, which already achieve most of the weight reductions possible without compromising safety or performance. Thus, the weight reductions would not be expected to alter vehicle safety.

e. Low-Rolling Resistance Tires

One of the technologies under development to reduce vehicle emissions and increase fuel efficiency is the development of low-rolling resistance tires. Rolling resistance is primarily due to deformation of the tire sidewall, which generates heat representing lost energy. It is estimated that 5 to15 percent of light-duty fuel consumption is used to overcome rolling resistance in passenger cars (U.S. Department of Energy 2011). While considerable improvements have been made in reducing the rolling resistance of vehicle tires, tire manufacturers have indicated that further reductions in rolling resistance are possible, i.e., up to 50 percent. For most passenger vehicles, a 10 percent reduction in rolling resistance will have the practical effect of reducing emission by about 1 to 2 percent (TRB 2006). These reductions in rolling resistance would be expected through improved tire designs and materials, such as silicon oxide, a principal component of sand and glass. Low-rolling resistance tires are currently standard equipment on the Chevrolet Volt and Toyota Prius. ARB modeled all vehicles using low rolling resistance tires by 2025.

3. California Evaporative Emission Regulations

The proposed amendments include vehicles certification requirements from zero evaporative emission standards. Manufacturers would comply with these regulations through testing. The equipment needed for compliance would not be anticipated to differ substantially from that which is currently used.

4. Manufacturer Size Definition

Two proposed amendments would affect the size definitions of manufacturers. First, staff propose to decrease the intermediate volume manufacturer (IVM) (i.e., large volume manufacturer [LVM] threshold from 60,000 PCs, LDTs, and MDVs on average in California to 20,000 on average). Staff also propose that two manufacturers' sales be aggregated for determination of size if one manufacturer owns greater than 33.4 percent of another manufacturer, assuring a level playing field. All current IVMs, except Volvo, Subaru, Jaguar/Land Rover and Mitsubishi, would be expected to become LVMs in 2018, and meet the full ZEV requirements starting that year. This is definition change and would not be anticipated to result in any physical changes.

5. Amendments to the Environmental Performance Label

Manufacturer compliance with the Federal Fuel Economy and Environment Label would be deemed compliant with the California Environmental Performance Label. Thus, vehicles would have one single label that would display its Smog Score and Global Warming Score. This would save manufacturers from having to print two separate labels as well as from having to report two separate scores for both the state and federal labels. Reducing the number of labels is preferable to manufacturers because it reduces confusion by consumers who may not easily understand the difference between the two labels, particularly customers in other states who currently are seeing a California-based label on their cars. In response to this regulation, manufacturers would only present the federal label on the vehicles they market, reducing the resources needed to make, print on, and dispose of, a second label.

6. Amendments to the On-Board Diagnostic System Requirements

The proposed amendments to the OBD II regulation would consist of clarifications and relaxations, which include delays to the required start dates of a few OBD II monitoring requirements. Manufacturers would be expected to take advantage of the delays to improve their system strategies and develop robust monitors to meet the requirements.

7. Amendments to the Specifications for California Certification Fuel Regulation

The proposed E10 Certification Fuel changes apply only to on-road vehicles, excluding on-road motorcycles. The California certification exhaust test fuel specifications for the spark-ignition, off-road categories (small off-road engines, large spark-ignition engines, recreational marine spark-ignition engines, and off-highway recreational vehicles) would not change when a new E10-based certification test fuel is adopted under the LEVIII regulatory proposal.

B. Zero Emission Vehicle Regulation (ZEV)

1. Fleet Mix

The requirements of the ZEV regulation as proposed for amendment under the ACC Program are designed to allow vehicle manufacturers to comply with these requirements in a variety of ways. While the proposed amendments to the ZEV regulation would require manufacturers to earn a minimum proportion of the required ZEV credits with actual ZEVs (i.e., battery electric vehicles [BEVs] or hydrogen fuel cell vehicles [FCV]), credits can also be earned from Transitional Zero Emission Vehicles (TZEVs) (i.e., plug-in hybrid electric vehicles).

Compliance by manufacturers with the ZEV regulation as proposed for amendment would increase the number of ZEVs and TZEVs being sold and leased in California, as compared with the current regulation. Table 4-2 summarizes this projected increase. The ZEV regulation would include flexibilities that allow manufacturers to earn ZEV credits in any number of ways. ZEVs and TZEVs would earn different amounts of credits, based on the vehicle's zero emission range, and in some case, the vehicle's power. The proposed ZEV regulation would provide different flexibilities for large- and intermediate-volume vehicle manufacturers in meeting the requirements. Large-volume manufacturers include companies that sell or lease more than 20,000 vehicles per year in California and intermediate volume manufacturers are companies that sell more than 4,500 vehicles per year. Large volume manufacturer's account for approximately 97 percent of California's light-duty vehicle sales, must produce a minimum amount of credits from ZEVs, and are allowed to earn the rest of their requirement with credits from TZEVs. Intermediate volume manufacturers may fulfill their entire requirement with credits from TZEVs. However, any size manufacturer could, in theory, fulfill its entire requirement with ZEVs. Some manufacturers are more focused on fulfilling their ZEV requirements with BEV technologies, while others are more interested in developing FCVs. Because FCVs have a greater driving range than BEVs, FCVs earn more credit than BEVs. Also, the all-electric driving range of TZEVs varies from 10 to over 40 miles; the amount of credit each TZEV earns is linked to its all-electric range. Due to these uncertainties and historic banked credits from over compliance in the ZEV regulation from earlier years, ARB staff developed a "likely compliance scenario," summarized in Table 4-2, which takes into consideration past over-compliance with regulatory requirements, information from vehicle manufacturers, and projected market trends.

Table 4-2. Projected Numbers of Zero Emission Vehicle Types Sold or Leased in California by Type and by Year

ZEV Type	2018	2019	2020	2021	2022	2023	2024	2025
BEV	13,900	27,300	37,700	46,300	52,600	59,500	64,200	65,000
FCVs	2,900	6,200	10,600	15,400	21,600	27,800	35,200	43,600
TZEV	61,300	75,300	89,100	101,900	116,300	131,200	146,900	161,700
Total	78,100	108,800	137,400	163,600	190,500	218,500	246,300	270,700

Notes: ZEV = Zero Emission Vehicle (i.e., battery electric vehicles and fuel cell vehicles); TZEV = Transitional Zero Emission Vehicles (i.e., plug-in hybrid electric vehicles with an electric power range of 20 miles); BEV = Battery Electric Vehicle; FCV = Fuel Cell Vehicle (hydrogen).
Source: ARB's projections of a "likely compliance scenario" are based on past over-compliance with regulatory requirements, information from vehicle manufacturers, and projected market trends. More detailed are provided in the Staff Report.

2. Battery Production

The increase in BEVs and TZEVs (e.g. PHEVs) produced by manufacturers to meet requirements of the amended ZEV regulation would be accompanied by an increase in the production of propulsion batteries. Current BEV and TZEV battery technology involves use of nickel-metal or lithium-ion propulsion batteries.

Table 4-3 shows ARB's estimates of the amount of propulsion batteries that would be produced by vehicle manufacturers to meet the proposed requirements of the ZEV regulation. The projected quantities listed in Table 4-3 represent the amount of battery capacity, which is the amount of energy stored in a battery. Battery capacity is used to express the projected increase in propulsion batteries because the amount of battery capacity installed in each vehicle would vary according to its size and desired range.

Table 4-3. Projected Annual Increase in Battery Production (MW-hr)

Year	2018	2019	2020	2021	2022	2023	2024	2025
Capacity of Propulsion Batteries	108	541	838	1,172	1,459	1,755	2,008	2,182

Notes: MW-hr =megawatt hours = 1,000,000 watts
Source: Projections estimated by ARB 2011b

It is expected that the longevity of batteries would be sufficient to serve their function during the full operational life of the vehicle. For instance, the nickel-metal hydride battery included in the 2011 Toyota Prius (non-plug-in) is designed to last the life of the car or approximately 180,000 miles (Toyota Prius Battery 2011).

Because the number of BEVs and TZEVs produced would generally be offset by a corresponding decrease in production of internal combustion engine-based vehicles, a net increase in vehicle production facilities would not be anticipated. As the demand for propulsion batteries increases, however, new manufacturing facilities may need to be constructed and/or existing plants would be retooled to increase production. Some vehicle manufacturers would produce the batteries used in their cars while others would purchase the batteries from suppliers. Lithium-ion batteries require higher quality-control than nickel-metal batteries, often including clean-room production facilities, which may necessitate the building of new production facilities.

3. Lithium Demand

More vehicle manufacturers are considering the use of lithium-ion batteries in their BEV and TZEV models instead of nickel-metal hydride batteries (USGS 2011). Lithium is a favorable material, because it is the lightest of all metals and an excellent conductor of electricity (Gruber et al. 2011). Lithium-ion batteries are advantageous, because they have no memory effect, little discharge, and no scheduled cycling is required to prolong their useful life (Notter et al. 2010). Memory effect is an alleged effect observed in nickel cadmium rechargeable batteries that causes them to hold less charge. It describes one very specific situation in which certain NiCd batteries gradually lose their maximum energy capacity if they are repeatedly recharged after being only partially discharged. The battery appears to "remember" the smaller capacity. In addition, for production volumes greater than 300,000 units per year, lithium-ion batteries are projected to be less expensive to produce than nickel-metal hydride batteries (Snyder, Yang, and Miller 2009). A study performed at the University of Michigan's Center for Sustainable Systems concluded that the world supply of lithium is sufficient to support lithium demand, even with rapid and widespread adoption of electric vehicles (Gruber et al. 2011). USGS has identified the world supply of economically recoverable lithium to 33 million metric tons (USGS 2011) whereas the highest demand scenario evaluated by Gruber et al. (2011) would not exceed 20 million metric tons for the period 2010 to 2100.

Recycled lithium content has been historically insignificant but has increased steadily due to the growth in the consumption of lithium batteries (USGS 2011). One U.S.

company has recycled lithium metal and lithium-ion batteries since 1992 at its facility in British Columbia and in 2009, the U.S. Department of Energy awarded $9.5 million to a company to construct an advanced lithium battery recycling facility in Ohio (Toxco Inc. 2009; USGS 2011).

4. Battery Disposal, Recycling, and Exchange

At this time, PHEV and BEV propulsion batteries are replaced at authorized original equipment manufacturer (OEM) service centers if needed. However, vehicle manufacturers differ in how they are addressing the need to properly handle or dispose of propulsion batteries after they reach the end of their useful life in the PHEVs and BEVs they power. Toyota has a battery recycling program, in which dealerships will provide a $150 recycle fee to dismantlers that turn in used high-voltage Toyota batteries (Toyota Motor Corporation 2011a; Toyota Motor Corporation 2011b). Both General Motors and Nissan have made arrangements with power companies to develop new ways of using old batteries, including storage of solar or wind energy during peak generating times for later use (renewable power management), backup power management, and peak price arbitrage (St. John 2010; Recycling International 2011; Nissan Motor Co., Ltd. 2011). This approach acknowledges that a large amount of energy remains stored even in partially discharged batteries. Secondary uses for advanced batteries are also being investigated at a number of research institutions (NREL 2011; Neubauer and Pesaran 2011; Williams 2011). An electric taxi battery switchable battery project is underway in Japan and will be developed in San Francisco (Better Place 2010). However, no vehicle manufacturer has yet announced plans to produce a switchable battery electric vehicle. Moreover, vehicle manufacturers have not provided information about how batteries would be handled after their "second life." A study at the National Renewable Energy Laboratory concludes that if second uses for batteries are determined not to be economical then recycling them would be the next economically superior option (Neubauer and Pesaran 2011).

Federal and state agencies also regulate and/or research how automotive propulsion batteries should be handled at the end of their useful life. Regulations under the federal Resource Conservation and Recovery Act (RCRA) nickel-metal hydride batteries and lithium-ion batteries are classified as non-hazardous waste and are not required to be recycled. Per RCRA hazardous waste listings & criteria (40 CFR 261.4, Exclusions), fully spent consumer lithium batteries are neither toxic nor reactive and are considered non-hazardous (NEMA 2001). Lithium is not included on the list of metals that the Occupational Safety & Health Administration considers to be toxic (OSHA 2011), nor does it exhibit any one of the hazardous characteristics according to U.S. EPA's Toxicity Characteristics Leaching Procedure. While there is no lithium metal present in a fully spent lithium-ion battery, the larger lithium-ion battery cells used for automotive propulsion reach the end of their useful life before they are completely spent.

Nonetheless, U.S. EPA does recognize that lithium-ion batteries used for vehicle propulsion are a new and emerging technology and are being studied further. U.S. EPA formed the Lithium-ion Batteries and Nanotechnology Partnership in June 2009 to conduct a screening-level life cycle assessment of current and emerging lithium-ion batteries and battery components (e.g., battery anodes made from single-wall carbon nanotubes) used in TZEVs, ATZEVs, and BEVs (U.S. EPA 2010b). Members of the partnership include battery manufacturers, research institutions, battery recycling companies, the U.S. Department of Energy's Argonne National Laboratory, and the Environmental Defense Fund. The Partnership is examining the potential environmental impacts of lithium-ion batteries, including the extraction and acquisition of raw materials, materials processing, product manufacturing, produce use, and final disposal or disposition. The partnership will also determine whether lithium-ion battery systems present environmentally preferable options to existing systems such as the use of lead-acid batteries in internal combustion systems.

California's hazardous waste management regulations classify all types of batteries, including nickel-metal hydride and lithium-ion batteries, as hazardous waste when discarded and must be managed accordingly. More specifically, facilities that treat, store, dispose and recycle batteries in California are also regulated under California's hazardous waste generator laws and regulations for Universal Waste (CCR, Title 22, Section 66261.9). These facilities are regulated and inspected by the California Department of Toxic Substances Control (DTSC), which is authorized by U.S. EPA to administer its own hazardous waste program for California. The local Certified Unified Program Agency (CUPA) is given authority to enforce hazardous waste management laws and regulations at the local level by the Secretary of Cal/EPA. Generators of universal wastes must recycle their waste by relinquishing it to the following: (1) a universal waste handler (e.g.; household hazardous waste facility, a 'Take-it-Back Partner' such as retailers or manufacturers); (2) a universal waste transporter; or (3) a destination facility (facility permitted by DTSC to treat, store, dispose or recycle).

5. Plug Electric Vehicle Charging Infrastructure

Based on the data summarized in Table 4-2, there would be approximately 367,000 BEVs and 883,000 TZEVs operating in California in 2025. This growth in plug electric vehicles would be accompanied by increased demand for electric charging infrastructure. Virtually all plug electric vehicles require at least one readily available charging station at their "home" location and national travel survey data indicate that vehicles spend 66 percent of their time parked at this their "home" location (EPRI 2011). Thus, it is anticipated that plug electric vehicles, both BEVs and PHEVs, would primarily be charged in residential areas during hours between late afternoon and early morning. A survey conducted by EPRI and Southern California Edison about consumer's perceptions of plug-in hybrid electric vehicles found that 95 percent of respondents would prefer to charge their electric vehicle at home (EPRI and SCE 2010). Nonetheless, some vehicle charging at workplaces and public settings may occur if electric vehicle supply equipment is available. Approximately 1,300 public charging stations are currently being upgraded to the current plug standard and federal programs are funding the installation of close to 2,000 additional public charging stations in California. (California Plug-in Vehicle Collaborative, 2010)

6. Electricity Demand

The charging of BEVs and TZEVs has the potential for both positive and negative effects to the electric grid. The 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. National Personal Transportation Survey data indicate that the peak arrive time is 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 kW, 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).

7. Fuel Cell Production

The increase in FCVs produced by manufacturers to meet requirements of the amended ZEV regulation would be accompanied by an increase in the production of hydrogen fuel cells. As the demand for automotive fuel cells increases, new manufacturing facilities may need to be constructed and/or existing plants would be retooled to increase production. Some vehicle manufacturers would produce fuel cells in their own facilities cars while others would purchase the fuel cells from suppliers. However, because the number of FCVs produced would generally be offset by a corresponding decrease in production of internal combustion engine-based vehicles, a net increase in vehicle production facilities would not be anticipated.

8. Platinum Demand

Platinum is a vital component of proton exchange membrane fuel cells, which is the leading type of fuel cell that would be used in FCVs. The proton exchange membrane fuel cell's primary advantages include low operating temperature (approximately 80 degrees Celsius), high electric current densities, fast start capability, no corrosive fluid spillage hazard, low weight, small size, and potentially low-cost to manufacture (Spiegel 2004). Platinum serves as the catalyst that splits hydrogen into ions and electrical current (Bourzac 2008). Thus, increased production and sales of FCVs would be accompanied by an increase in demand for platinum and platinum-group metals. However, the leading demand sector for platinum-group metals is currently catalysts to decrease emissions of CAPs in both light- and heavy-duty vehicles (USGS 2011).

9. Fuel Cell Disposal, Recycling, and Exchange

Fuel cells for hybrid vehicles are manufactured once for each vehicle, and are designed to last for the lifetime of the vehicle, which is somewhere between 150,000 and 200,000 miles, or 15 to 20 years (HybridCars.com 2011). Replacement costs for spent fuel cells remains largely unknown because they are seldom replaced; however, there are some anecdotal reports of total battery replacements costing about $3,000 (HybridCars.com 2006a).

Eventually the batteries will no longer hold a significant charge and will need to be properly managed at the end of their life. Once the vehicle battery can no longer be used for its intended purpose, it becomes a waste. In California, all types of batteries are considered to be a hazardous waste and are managed under the Universal Waste Rule, unless determined they do not exhibit a characteristic of a hazardous waste. The Department of Toxic Substances Control's (DTSC) Universal Factsheet noted that, "Universal waste batteries include rechargeable nickel-cadmium batteries, silver button batteries, mercury batteries, small sealed lead acid batteries (burglar alarm and emergency light batteries), most alkaline batteries, carbon-zinc batteries, and any other batteries that exhibit a characteristic of a hazardous waste." DTSC had earlier noted on their website (since removed) that 'Per this definition, hybrid electric vehicle batteries may also be considered Universal Wastes -- check with the manufacturer of the vehicle for further information about the composition of such batteries' (DTSC 2010).

While battery toxicity may be a concern, today's hybrids use nickel–metal hydride (NiMH) batteries or Lithium-Ion batteries, which are not environmentally problematic, as are the rechargeable nickel cadmium or non-rechargeable metallic lithium batteries. Some manufacturers will recycle spent batteries reducing the need for disposal the potential for toxic hazards (HybridCars.com 2006b). Lithium-Ion cells contain no heavy metals, nor any toxic materials (TeslaMotors.com 2008). Unlike caustic lead acid car batteries, advanced Lithium-Ion batteries do not use harmful acids or metals, such as lead, to store electrical power. Lithium-Ion batteries use copper, cobalt, iron and nickel, and are considered safe for landfill disposal and incinerators (HybridCars.com 2009); however, it is currently illegal in most states to dispose of any Lithium-Ion batteries as municipal or household waste. Lithium is fairly valuable, as are the other materials involved, and there is economic incentive to reuse the components.

Manufacturers are currently working on battery recycling infrastructure, and are committed to supporting a responsible disposal and recycling infrastructure for spent batteries, and there are plans to construct America's first recycling facility for Lithium-Ion vehicle batteries via a grant from the U.S. Department of Energy. To encourage recycling, two automobile manufacturers place decals with a toll-free number on their hybrid battery packs. One offers a $200 incentive to ensure that every battery comes back to the company, and has a comprehensive battery recycling program in place and has been recycling nickel-metal hydride batteries since 1998. The other manufacturer collects the batteries and transfers them to a preferred recycler to follow their prescribed process: disassembling and sorting the materials; shredding the plastic material;

recovering and processing the metal; and neutralizing the alkaline material before sending it any waste material to a landfill (HybridCars.com 2006b).

Batteries that power hybrid vehicles will be recycled at recycling facilities, where they will be transformed into valuable scrap commodities like cobalt, copper, nickel and lithium carbonate, which can then be used to more efficiently produce another battery. At the battery recycling plants, the recycling process begins with manually sorting the batteries according to their chemistries (may also be done prior to arrival). NiCd, NiMH, Lithium-Ion and lead acid are often placed in designated boxes at the collection point. Then combustible materials, such as plastics and insulation, are removed using a gas-fired thermal oxidizer. Gases from the thermal oxidizer are sent to the plant's scrubber where they are neutralized to remove pollutants. The process leaves the clean, naked cells, which contain valuable metal content. The cells are then chopped into small pieces, which are heated until the metal liquefies. Non-metallic substances are burned off; leaving a black slag on top that is removed with a slag arm. The different alloys settle according to their weights and are skimmed off (Buchmann 2001).

There is one battery recycling facility in Lancaster, California that collects spent batteries and recycles them. A non-profit corporation was founded to promote the collection and recycling of rechargeable batteries in North America, and there are several facilities in the United States that recycle spent batteries. Europe and Asia are also active in recycling spent batteries and have developed technology to retrieve cobalt and other precious metals from spent Lithium Ion batteries. Lithium can be re-used repeatedly, reducing the concern of potential shortages in the future.

The Society of Automotive Engineers formed a Committee for Fuel Cell Standards that has published "Recommended Practice to Design for Recycling Proton Exchange Membrane (PEM) Fuel Cell Systems". This publication provides guidance about which advises manufacturers to consider environmental impacts and recommended practices when producing recyclable fuel cells for automotive use. More specifically, the report explains ways fuel cell design can account for the need to disassemble and recycle the product at the end of its useful life.

Carbon nanotubes could replace expensive platinum catalysts and help finally make fuel cells economical. The California Department of Toxics Substances Control is currently reviewing waste issues associated with nanotechnologies, including carbon nanotubes which are used in fuel cells (Kang 2010).

Used fuel cells are classified as ignitable hazardous waste under the federal Resource Conservation and Recovery Act.

The Society of Automotive Engineers formed a Committee for Fuel Cell Standards that has published "Recommended Practice to Design for Recycling Proton Exchange Membrane (PEM) Fuel Cell Systems". This publication advises manufacturers to consider environmental impacts and recommended practices when producing recyclable fuel cells for automotive use. More specifically, the report explains ways fuel cell design can account for the need to disassemble and recycle the product at the end of its useful life (SAE 2011b).

10. Hydrogen Fueling Infrastructure

The number of FCVs entering the vehicle fleet is particularly important, because it serves as the trigger that activates the CFO regulation, which is described below in Chapter II, Section C. Detail about the entry of FCVs into the statewide fleet, associated demand for hydrogen fueling stations, and the construction and operation of hydrogen fueling stations is included in the discussion of Clean Fuels Outlets in Section C below.

C. Clean Fuels Outlets

1. Triggering of the Clean Fuels Outlet Requirements

Under the Clean Fuels Outlet (CFO) regulation, requirements for new hydrogen fuel outlets would be activated when Department of Motor Vehicles records and automaker forecasts indicate that, in three years, the total number of FCVs in an air basin would meet or exceed the regional trigger level of 10,000 FCVs. It is more likely that the CFO regulation would initially be triggered by the air basin-wide trigger level of 10,000 FCVs rather than the statewide trigger level of 20,000 FCVs because of the spatial distribution of residential and vehicle population across the State.

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. Nonetheless, ARB staff developed a range of compliance scenarios based on confidential surveys of vehicle manufacturers. At one of the fastest rates, the statewide vehicle fleet could consist of up to 53,000 FCVs fleet during the 2015-2017 timeframe. At the slowest entry rate the statewide fleet would not include 20,000 FCVs until 2020 with the10,000 unit trigger level possibly being reached in an air basin in 2018. These two scenarios named fast entry (Upper Bound) and slow entry (Lower Bound) respectively, are discussed in greater detail below.

a. Fast-Entry of Fuel Cell Vehicles into the Vehicle Fleet

In early 2011, ARB, the California Energy Commission, and the California Fuel Cell Partnership conducted a confidential survey of vehicle manufacturers on FCV production and rollout plans, including vehicle numbers and deployment regions (CEC 2011, p. 56). Automakers were asked to assume that hydrogen fueling infrastructure would be in-place ahead of FCV rollouts. This assumption allowed each manufacturer to base its estimates on the status of its FCV technology development and its ability to achieve production numbers necessary to reach an economy of scale suitable for commercialization, including production facilities and supply chains. The results of this survey, which reflect a fast-entry of FCVs into the fleet, are summarized in Table 4-4.

Table 4-4. Projected Number of Fuel Cell Vehicles Entering the Vehicle Fleet by Year for the Upper Bound Scenario

Region	2011	2012	2013	2014	2015-2017
California Statewide	253	312	430	1,389	53,000
South Coast Air Basin	197	240	347	1,161	34,230

Notes: Projections of FCVs are based on a confidential survey of vehicle manufacturers conducted by the California Energy Commission and The California Fuel Cell Partnership and, thus, do not consider over-compliance with the proposed ZEV regulation by vehicle manufacturers.
The South Coast Air Basin consists of all of Orange County and the urban portions of Los Angeles, Riverside and San Bernardino counties and is under the jurisdiction of the South Coast Air Quality Management District.
Source: CEC 2011, p.56.

While the air basins where new FCVs would be sold or leased are not specified by the ZEV regulation, it is anticipated that most of the early FCVs would be sold or leased for operation in the South Coast Air Basin where several hydrogen stations are or will soon be operational. According to the FCV projections for the Upper Bound scenario, the regional trigger of 10,000 FCVs could be activated within the South Coast Air Basin as early as 2015, as shown in Table 4-5, with the statewide trigger of 20,000 FCVs activated shortly thereafter.

b. Slow-Entry of Fuel Cell Vehicles into the Vehicle Fleet (Lower Bound Scenario)

To develop a compliance scenario in which FCVs would enter the vehicle fleet at a slow pace, ARB assumed manufacturers would sell or lease a mix of BEVs, FCVs, and PHEVs to meet the proposed ZEV regulation requirement to have the statewide fleet be 16 percent ZEVs by 2025. This scenario may also be referred to as a Lower Bound compliance scenario. Table 4-5 shows the number and mix of BEVs and FCVs that could enter the statewide vehicle fleet under a minimum compliance scenario. This set of projections is based on the ZEV "likely compliance scenario" summarized on Table 4-2. Table 4-5 also shows how the cumulative number of FCV would grow over ime.

Table 4-5. Projected Number of Fuel Cell Vehicles Entering the Vehicle Fleet by Vehicle Type and Year for a Lower Bound Scenario

ZEV Type	2017	2018	2019	2020	2021	2022	2023	2024	2025
BEVs	—	14,000	27,000	38,000	46,000	53,000	60,000	64,000	65,000
FCVs	—	3,000	6,000	11,000	15,000	22,000	28,000	35,000	44,000
Combined	—	17,000	33,500	49,000	61,000	75,000	88,000	99,000	109,000
Cumulative FCVs	10,500	13,500	19,500	30,500	45,500	67,500	95,500	130,500	174,000

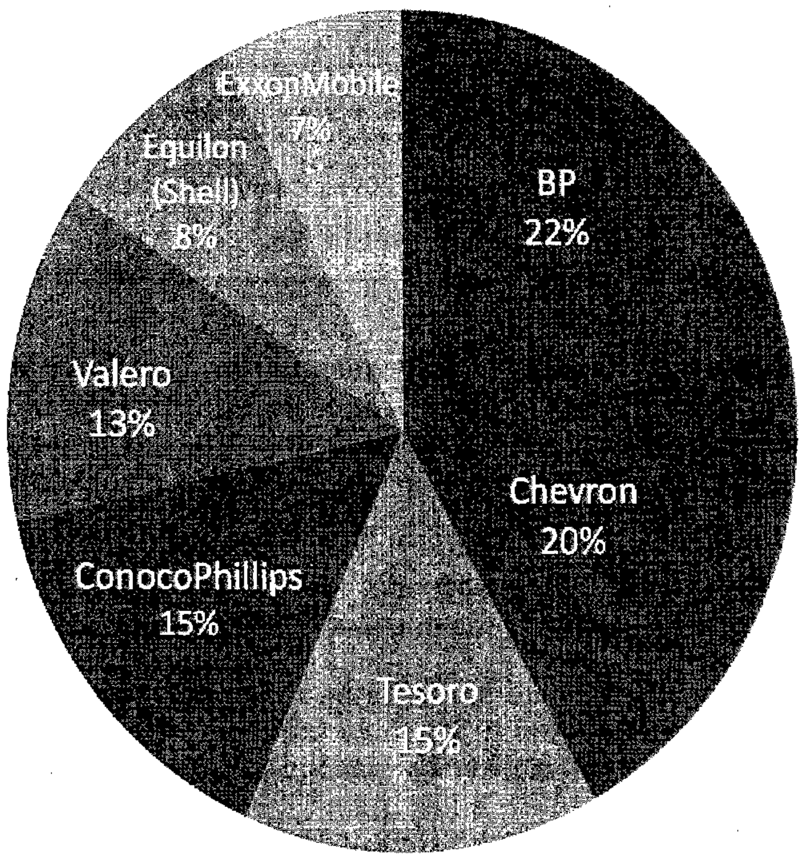
Notes: Cumulative totals do not reflect fleet turnover, which is the rate at which consumers purchase new vehicles to replace old ones.
ZEV = Zero Emission Vehicle; BEV = Battery Electric Vehicle; FCV = Fuel Cell Vehicle.
Source: ARB's projections of a "likely compliance scenario" are based on past over-compliance with regulatory requirements, information from vehicle manufacturers, and projected market trends. More detailed are provided in the Staff Report,

According to the projections for the Lower Bound scenario, the regional CFO trigger of 10,000 ZEVs would be activated in 2018 assuming 75 percent of the total FCVs are placed in one air basin (which will most likely be the South Coast air basin), and the statewide trigger of 20,000 ZEVs would be activated in 2020.

2. New Hydrogen Fueling Stations

The CFO regulation would be activated once the air basin-wide trigger level of 10,000 FCVs is expected to be met. ARB would then calculate the volume of hydrogen fuel the FCV fleet would demand, subtract the fuel availability at the time, and determine the additional number of hydrogen fuel stations needed to meet the projected demand. The requirement to build new stations would then be allocated to the major refiners and importers of gasoline based on their annual share of the gasoline market. Figure 4-1 illustrates each refiner/importer's share of the total gasoline produced or imported into California in 2010 and Table 4-6 summarizes how the required new stations could be divided among each refiner/importer once the trigger level of 10,000 FCVs is reached in an air basin.

Figure 4-1. Market Share of Major Refiners and Importers of Gasoline (2010)



Source: BOE 2010

Table 4-6. Projected Allocation of New Hydrogen Fuel Stations			
Projected Hydrogen Vehicle Fleet in a Single Air Basin (FCVs)			10,200
Hydrogen Fuel Market			
Demand, annual (kg/yr)			3,000,000
Pre-Existing Supply, annual (kg/yr)			1,700,000
Deficit, annual (kg/yr)			1,300,000
Deficit, average daily (kg/day)			3,560
Activated CFO Requirements and Market Share			
	2010 Market Share (%)	**Hydrogen Fuel (kg/day)**	**Stations**
Total	100%	3,560	9
BP	22%	783	2
Chevron	20%	712	2
Tesoro	15%	534	1
ConnocoPhillips	15%	534	1
Valero	13%	463	1
Equilon (Shell)	8%	284	1
ExxonMobil	7%	249	1

Notes: The information presented in this table represents a hypothetical scenario only. Values in the table reflect how the requirements to build new hydrogen fuel stations would be allocated based on total demand (using EMFAC VMT data and a fleet-average fuel economy of 67 mi/kg), pre-existing supply, and the market share of various refiners and importers of gasoline under the fast-entry scenario of FCVs entering the vehicle fleet in the South Coast Air Basin. The total number of new hydrogen fuel stations required would also vary according the proportion of new FCVs that are part of an organization's fleet and have their own privately operated fueling station.
FCV = Fuel Cell Vehicle; kg/yr = kilograms per year; kg/day = kilograms per day
Source: Sample calculations provided by ARB.

As shown in the example in Table 4-6, a minimum of nine new hydrogen stations would be required in the South Coast Air Basin when the trigger level of 10,000 FCVs is reached in the air basin. Based on the Upper Bound scenario presented in Table 4-6, this trigger level and associated allotment of new hydrogen fuel stations could occur as early as 2015.

Starting in 2016 in the Upper Bound Scenario, the number of vehicles statewide would exceed the 20,000 statewide trigger requiring the construction of 39 additional stations.

Under the Lower Bound compliance scenario the regional trigger would be reached in the South Coast Air Basin requiring five new hydrogen stations in 2018 and nine additional stations in 2019. By 2020, 26 new stations would be required statewide.

Once notified of their obligation, responsible parties would have approximately 2-1/2 years to meet fulfill their respective allocation requirements.

3. Locations of Hydrogen Fuel Outlets

When ARB assigns the allocations for new hydrogen fuel outlets, ARB would also inform refiners/importers of the general geographic areas where stations would be most useful to and valued by FCV drivers, but each refiner/importer would be responsible for selecting specific station locations.

While vehicle deployment projections are greatest in the South Coast Air Basin, significant vehicle deployments are also planned for the San Francisco Bay Area (California Fuel Cell Partnership 2009). However, once FCVs reach commercial viability and technology acceptance becomes widespread, the market would dictate where new FCVs are placed. As explained in Chapter II, Section C, it would be dependent upon manufacturers to identify new geographic market sectors and convey this information to ARB in their annual FCV projections.

It is anticipated 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.

4. Construction of Hydrogen Fueling Facilities

Building a new hydrogen fueling facility would typically take place at an existing retail gas station. The facilities and equipment required for hydrogen fueling could fit within the available square footage of larger gas station sites (i.e., within the same footprint of a carwash). Development of a new facility would include obtaining the standard design and building approvals and permits from the City, County and State authorities having jurisdiction. For the equipment area, construction would typically include minor trenching and filling for utilities and pouring concrete foundations for walls and equipment pads. Major equipment present at the station would include hydrogen storage tanks that hold either liquid or compressed gas, a hydrogen compression system, a refrigeration/cooling unit, safety monitors and sensors, and a system control panel. The hydrogen dispenser would typically be added to the end of an existing fueling island. However, in some cases, a gasoline dispenser may be removed and replaced with a hydrogen dispenser, or a separate stand-alone hydrogen dispensing island with or without a canopy may be added to the station. Although there is no standard station size, small volume hydrogen stations (100-250 kg/day dispensing capacity) today typically require approximately 700-800 square feet of surface area for equipment.

5. Hydrogen Station Operations

Like at a gasoline station, a FCV pulls up to a hydrogen dispenser that is designed and built to appear like a gasoline dispenser. The dispenser nozzle looks similar to a nozzle on a natural gas or propane dispenser. The nozzle locks on to the receptacle on the vehicle and, when the seal is tight, gaseous hydrogen fuel flows into the tank. Depending on the vehicle and tank size, a full fill, from empty can take from 3 to 5 minutes (California Fuel Cell Partnership 2011). Hydrogen fuel dispensers, depending on station design, can typically fuel four to eight vehicles per hour. Implementation of CFO would require that compliant stations satisfy the fueling protocol for light duty hydrogen powered vehicles specified in SAE TIR J2601 (SAE 2010).

Like gasoline stations, most hydrogen stations have their onsite fuel supply delivered by a tanker truck. Gaseous hydrogen is stored in banks of long narrow tanks secured to a truck trailer bed (referred to as a tube trailer), and liquid hydrogen is stored in large above-ground tanks. The liquid hydrogen vaporizes at ambient temperature to a gaseous state and is compressed before dispensing into the FCV. Hydrogen stored in gaseous state usually undergoes additional compression before dispensing. Hydrogen delivery frequency depends on the amount stored at each station, state of the hydrogen stored (gaseous or liquid) and demand for hydrogen at the station In the early years when there are relatively few FCVs, deliveries of hydrogen in a gaseous state would occur no more than once a week, and liquid deliveries would occur approximately once per month. Deliveries of gaseous hydrogen involve replacing an empty tube trailer with a full one, a process that takes less than one hour. Delivery of liquid hydrogen involves the transfer of liquid hydrogen from the tanker truck to the station's storage tank, a process that would typically require approximately 2 hours.

Some stations produce hydrogen onsite through electrolysis or steam methane reformation (SMR). An electrolyzer uses electrical power to separate water molecules into hydrogen and oxygen. A SMR generates steam, and uses it to separate the hydrogen from the natural gas molecule. The hydrogen is then purified, stored and then compressed for dispensing. Maintenance of the station consists of regular safety checking of hoses, nozzles and related equipment, calibration of sensors and dispensers, compressor repairs, valve/solenoid checks and normal lubrication.

6. Hydrogen Supply

Using the fast-rate scenario for FCVs entering the vehicle fleet, the total hydrogen demand when the 10,000 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 (when the regulation sunsets), it could represent 9.2 percent.

Using the more conservative slow-rate scenario for FCVs entering the vehicle fleet, the total statewide hydrogen demand in 2020 could represent 1 percent of the merchant hydrogen supply, and in 2028, it would represent 9 percent.

7. Hydrogen Production Plants

Recently, California has favored hydrogen fueling stations using delivered hydrogen with central production over stations that produce hydrogen on site (CEC 2011). As demand increases, however, on-site reformation may begin to compete on a cost basis with delivered hydrogen. 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. Hydrogen as a transportation fuel requires higher purity levels than hydrogen for industrial uses because fuel cells stack membranes are sensitive to impurities (CEC 2011). Plant modifications are also necessary so that purified hydrogen can be compressed and dispensed into delivery trailers. 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. Additional land may be required to install the equipment, which may or may not fit within the hydrogen plant's existing fence line. Any earthwork activities that could generate dust would have to be conducted in accordance with local ordinances regarding dust and earthwork. Emissions associated with the operation of the hydrogen purification and compression equipment would be subject to the authority of the local air pollution control district. Any release of combustible gases could be vented through the facility's existing flare system. Hazardous wastes, such as lubrication oil waste and catalyst waste associated with the purification equipment, would be generated in small quantities. Existing hydrogen production facilities would manage additional hazardous wastes associated with the new operations according to their existing hazardous waste permits.

It is important to note that, once the statewide demand for hydrogen reaches 3.5 million kilograms per year, the California standards for hydrogen production will be in place, which require that 33 percent of the hydrogen that is produced for transportation be made from eligible renewable resources (California Public Utilities 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 such as biogas or biomass. Recently, the world's first combined heat, hydrogen, and electric power system using biogas from the Orange County Sanitation District's wastewater treatment plant started in Fountain Valley, CA. This tri-generation system provides transportation-grade hydrogen to the public (approximately 25-50 fuel cell electric vehicle fill-ups per day), 250 kW of electric power to the wastewater treatment plant, and heat that is also used by the plant (HTAC 2011). ARB anticipates that as costs come down, more tri-generation plants could be constructed at wastewater treatment plants to meet increased demand for transportation-grade hydrogen made from eligible renewable resources. These tri-generation plants may require additional footprint beyond the plant's existing property line.

D. Consumer Response Effects

1. Fleet Turnover and Emissions

ARB's proposed ACC Program would increase new vehicle prices, starting with model year 2015. Regardless of an increase in price, it is likely that many of the technologies employed by manufacturers that lower GHG emissions and implemented to comply with the regulation (including the production of ZEVs) would result in vehicles with lower operating costs than comparable pre-regulation vehicles. Changes in vehicle prices and other attributes may affect consumer purchase decisions. For example, not all consumers would be willing to pay more for the vehicle that they might have otherwise purchased, and some consumers may purchase a used vehicle instead of a new vehicle that would be in accordance with their respective budgets. Others may wait until the following year, or respond in some other way. Still other consumers may be willing to pay the additional upfront cost for greater future reductions in operating cost, in which case the vehicle would be more attractive. Such decision changes, referred to as consumer response, can affect the California vehicle fleet mix and possibly emissions. Due to the concurrent tightening of criteria pollutant standards, even if there is a consumer response to potential price increases and changes in operating costs, the ACC program would continue to have a positive effect on tailpipe criteria pollutant emissions.

Consumer responses that result in increased traffic and vehicle miles travelled (VMT) have been factored into the emissions analysis, and are discussed in Chapter V of the LEV III Staff Report.

2. Impacts on Vehicle Sales, Fleet Size and Average Age

The impacts of the proposed regulation were assessed by forecasting a baseline future fleet mix that assumes that, absent the proposed amendments, vehicle prices and operating costs change only in response to the existing National Program requirements for model year 2012-2016. This baseline then is compared to a regulatory scenario that takes into account the estimated price and operating cost changes resulting from the proposed Advanced Clean Cars Program.

The LEV III Staff Report data reflect the differences in sales, fleet mix, and average age of the fleet between the baseline and regulation scenarios. Initially, there would be a negligible decrease in sales due to compliance with the criteria pollutant standards, while there is no concurrent reduction in operating costs resulting from these proposed amendments. However, once the GHG standards begin to phase in during model year 2017, the reduced operating costs of new vehicles makes them more attractive to consumers and total sales would be expected to increase. Sales continue to grow over the baseline until the standards have been fully phased-in model year 2025. After this point, new vehicles no longer offer any significant advantage in operating costs over used vehicles that become increasingly available on the market. Thus, the change in sales begins to decline, though these levels still represent a relative increase over baseline totals. As a result of these increased sales, the fleet continues to grow slowly with time, making the regulation scenario fleet generally larger in all years compared to the baseline fleet. These sales increases also contribute to decreasing the average age of the fleet, implying that households are not holding onto their older vehicles longer.

3. Vehicle Miles Travelled and Rebound

The rebound effect refers to an economic theory suggesting consumers would drive more if the vehicles they use are cheaper to operate. This is potentially relevant because many of the emissions control technologies that reduce GHG emissions also serve to lower vehicle operating costs. The proposed changes of the ACC program would also result in light-duty vehicles having lower operating costs on a cost-per-mile basis. Staff at ARB examined the extent to which VMT levels in California may increase due to the incremental reduction in operating costs associated with implementation of the proposed regulatory changes under the proposed ACC Program.

The incremental increase in VMT due to rebound effects of the proposed ACC Program was estimated by ARB staff using an econometric model developed by Hymel, Small, and Van Dender (2010). The model estimates the elasticity of VMT with respect to operating costs while considering other factors such as income and congestion. ARB staff then calculated projections (e.g., likely outcomes) of future rebound effect. Based on these projected response levels, the actual expected changes in VMT were calculated using the projected operating cost reductions that would result from the proposed ACC Program. (See the LEV III Staff Report for additional details on projection methodology.) Likewise, increases in VMT due to rebound would occur in the baseline as a result of both State and national vehicle emission standards that are already in place for model years 2012-2016. These changes in VMT are reflected and accounted for in the emission inventories and estimated emission reductions in Section V of the LEV III Staff Report. Staff assumed that the same VMT changes would apply to all vehicle technology types.

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5.0 IMPACT ANALYSIS AND MITIGATION

As discussed in Chapter 4, Regulated Community Compliance Responses, implementation of the proposed ACC Program could result in the construction and operation of new manufacturing plants that specialize in the production of propulsion batteries and fuel cells. New hydrogen fueling stations could also be constructed and operated along with modifications to existing hydrogen production plants. These would likely occur within existing footprints or in areas with consistent zoning. Thus, the impact discussion below focuses on these particular responses by the regulated community. All other regulated community compliance responses would not be anticipated to result in any physical changes and; thus, would result in no impacts.

A. Aesthetics

1. Scenic Vistas, Scenic Resources, Visual Character, Light and Glare

As discussed in Chapter 4, Regulated Community Compliance Responses, implementation of the proposed ACC Program could result in the construction and operation of new manufacturing plants that specialize in the production of propulsion batteries and fuel cells. New hydrogen fueling stations could also be constructed and operated along with modifications to existing hydrogen production plants. These would likely occur within existing footprints or in areas with consistent zoning.

However, there is uncertainty as to the exact locations of these new plants, stations, and modifications, especially in regards to new manufacturing plants for producing propulsion batteries and fuel cells and in relation to the location of viewers. Construction and operation of these, though likely to occur in areas with consistent zoning, could introduce or increase the presence of artificial elements (e.g., heavy-duty equipment, removal of existing vegetation, buildings) in areas with national, State, or county designated scenic vistas and/or scenic resources visible from State scenic highways. The visual impact of such development would depend on several variables, including size of facilities, viewing distance, angle of view, visual absorption capacities, and the structure placement in the landscape. In addition, operation may introduce substantial sources of nighttime lighting for safety and security purposes. As a result, this impact would be potentially significant.

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.

Mitigation Measure A.1.

The Regulatory Setting in Chapter 3 includes, but is not limited to, applicable laws and regulations that provide protection of aesthetic resources. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is under the purview of jurisdictions with local land use and/or permitting authority. New or modified facilities in California would qualify as a "project" under CEQA. The jurisdiction with primary permitting authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. Recognized practices routinely required to avoid and/or minimize impacts to aesthetic resources include:

- Proponents of new or modified facilities constructed as a compliance response to the ACC regulations would coordinate with local land use agencies to seek entitlements for development including the completion of all necessary environmental review requirements (e.g., CEQA). The local land use agency or governing body shall certify that the environmental document was prepared in compliance with applicable regulations and approve the project for development.

- Based on the results of the environmental review, proponents would implement all mitigation identified in the environmental document to reduce or substantially lessen the environmental impacts of the project.

- The project proponent would color and finish the surfaces of all project structures and buildings visible to the public to ensure that they: (1) minimize visual intrusion and contrast by blending with the landscape; (2) minimize glare; and (3) comply with local design policies and ordinances. The project proponent would submit a surface treatment plan to the lead agency for review and approval.

- To the extent feasible, the sites selected for use as construction staging and laydown areas would be areas that are already disturbed and/or are in locations of low visual sensitivity. Where possible, construction staging and laydown areas for equipment, personal vehicles, and material storage would be sited to take advantage of natural screening opportunities provided by existing topography and vegetation.

- All construction, operation, and maintenance areas would be kept clean and tidy, including the revegetating and regarding disturbed soil, and storage would be screened from view and/or are generally not visible to the general public.

- Siting projects and their associated elements next to prominent landscape features or in a setting for observation from national historic sites, national trails, and cultural resources would be avoided to the greatest extent.

- The project proponent would contact the lead agency to discuss the documentation required in the lighting mitigation plan, submit to the lead agency for review and approval a plan that describes the measures to be used and that demonstrates that the requirements of this condition will be satisfied, and notify the lead agency that the lighting has been completed and is ready for inspection.

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 that the 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 conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact regarding aesthetics resulting from the construction and operation of new plants, stations, and modifications may be significant and unavoidable.

B. Agriculture and Forestry Resources

1. Farmland, Zoning for Agricultural Use or Williamson Act Contract, Forest Land and Timberland

As discussed in Chapter 4, Regulated Community Compliance Responses, implementation of the proposed ACC Program could result in the construction and operation of new manufacturing plants that specialize in the production of propulsion batteries and fuel cells. New hydrogen fueling stations would also be constructed and operated along with modifications to existing hydrogen production plants.

There is uncertainty as to the exact locations of these new plants, stations, and modifications, especially in regards to new manufacturing plants for producing propulsion batteries and fuel cells; however, these would likely occur within existing facility footprints or in areas with consistent zoning. Thus, implementation of the proposed ACC Program would not be anticipated to result in the conversion of farmland, conflict with existing zoning for agricultural use or a Williamson Act contract, conflict with existing zoning for (or cause rezoning of) forest land or timberland, the loss of forest land (or conversion of forest land to non-forest use), or involve other changes resulting in conversion of farmland or forest land to non-agricultural use or non-forest use, respectively. As a result, this impact would be less than significant.

<u>**Mitigation**</u>
No mitigation is required.

C. Air Quality

1. Air Quality Plan, Air Quality Standards and Violations, Cumulative Criteria Pollutants, and Sensitive Receptors

a. Construction Impacts

As discussed in Chapter 4, Regulated Community Compliance Responses, implementation of the proposed ACC Program could result in the construction of new manufacturing plants that specialize in the production of propulsion batteries and fuel cells. New hydrogen fueling stations could also be constructed along with modifications to existing hydrogen production plants. Construction-related activities, if they occur, would be anticipated to result in an increase in CAPs and TACs (e.g., use of heavy-duty construction equipment). 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.

At this time, the specific location, type, and number of construction activities is not known and would be dependent upon a variety of factors that are not within the control of ARB. Nonetheless, the analysis provided herein provides a reasonable accounting of the types of environmental impacts that would occur with implementation of the proposed ACC Program as discussed below for short-term construction emissions. Further, subsequent environmental review would be conducted at such time that an individual project is proposed and land use entitlements are sought.

During the construction phase, CAPs and TACs could be generated from a variety of activities and emission sources. These emissions would be temporary and occur intermittently depending on the intensity of construction on a given day. Site grading and excavation activities would generate fugitive PM dust emissions, which is the primary pollutant of concern during construction. Fugitive PM dust emissions (including PM_{10} and $PM_{2.5}$) 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. Exhaust emissions from off-road construction equipment, material delivery trips, and construction worker-commute trips could also contribute to short-term increases in PM emissions, but to a lesser extent. Exhaust emissions from construction-related mobile sources also include ROG and NO_x emissions. These emission types and associated levels fluctuate greatly depending on the particular type, number, and duration of usage for the varying equipment.

The site preparation phase typically generates the most substantial emission levels because of the on-site equipment and ground-disturbing activities associated with grading, compacting, and excavation. Site preparation equipment and activities typically include backhoes, bulldozers, loaders, and excavation equipment (e.g., graders and scrapers). Although detailed construction specific information is not available at this time, based on the types of activities that could be conducted it would be expected that the primary sources of construction-related emissions include soil disturbance- and equipment-related activities (e.g., use of backhoes, bulldozers, excavators, and other related equipment). Based on typical emission rates and default parameters for above mentioned equipment and activities, construction activities could result in hundreds of pounds of daily NO_x and PM, which may exceed general mass emissions limits depending on the exact location of generation. Thus, implementation of the proposed ACC Program could generate levels that conflict with applicable air quality plans, violate or contribute substantially to an existing or projected violation, result in a cumulatively considerable net increase in non-attainment areas, or expose sensitive receptors to substantial pollutant concentrations. As a result, this short-term impact would be potentially significant.

This impact would 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.

b. Operational Impacts

Appendix T of the LEV III Staff Report provides a baseline for analysis for CAPs and GHGs, and the emissions impacts of the proposed rulemaking. This chapter began with a statistic that there are currently roughly 25 million cars operating in California, and that by 2035 more than 30 million cars will be operating in California. Prior to the establishment of ARB in 1968 photochemical smog pollution was a major health concern that caused major acute health impacts to Californians. Much of this smog was formed by automobile emissions. Over the next 40 years the ARB adopted the most stringent automobile emissions standards in the Country, including requiring use of the catalytic converter that revolutionized emissions control and dramatically reduced emissions from automobiles. Those regulations, in conjunction with regional programs to reduce emissions from refineries, power plants, and other stationary sources, led to a major improvement in air quality. In 1980, the South Coast Air Basin experienced widespread ozone levels which exceeded air quality standard for 179 days per year. In 2010 that number was reduced to 63 days per year, and those violations occurred in a much smaller portion of the Air Basin. During this same period, peak ozone concentrations in Southern California dropped more than 60percent - from 273 parts per billion (ppb) to 112 ppb. Similar air quality improvements were seen in many other regions of California.

Despite these major improvements air quality both the greater Los Angeles region and the San Joaquin Valley are classified by the U.S. EPA as "extreme" ozone non-attainment areas. This is the highest federal non-attainment classification, and these two areas of California are the only two areas of the nation granted this designation. Bringing these regions into attainment requires more significant emission controls than anywhere else in the United States.

In 2007, California adopted State Implementation Plans (SIPs) to chart the course to attainment of the 1997 federal 8-hour ozone standard. To achieve the 1997 ozone standard by the attainment date in 2023, NO_x emissions in the greater Los Angeles region must be reduced by two thirds, even after considering all of the regulations in place today, with the most significant share of needed emission reductions will come from long-term advanced clean air technologies. In the San Joaquin Valley, the SIP identified the need to reduce NOx emissions by 80 tons/day in 2023 through the use of long-term and advanced technology strategies. To put this in context, this is equivalent to eliminating the NOx emissions from all on-road vehicles operating in these regions.

Despite the dramatic emission reductions and air quality improvements achieved to date, most urban areas of California, including Southern California, the Bay Area, and the Central Valley continue to exceed the federal ozone standard . The ARB, the South Coast Air Quality Management District, and the San Joaquin Valley Air Pollution Control District are beginning to evaluate the emission reductions needed to attain the more health-protective ozone standard U.S. EPA established in 2008. In order to meet these challenges, air quality and land-use agencies in the South Coast and San Joaquin Valley must actively pursue a coordinated strategy that results in the widespread use of zero emission technologies on transportation networks designed to reduce smog forming emissions from single occupant vehicle use.

The proposed ACC Program would reduce emissions from conventional gasoline vehicles to incredibly low levels. Over a typical vehicle's 15 year lifetime ACC compliant cars would emit less than a pound of particulate matter, and less than 10 pounds of smog forming pollutants. The proposed regulation would also continue ARB's commitment to zero emission technologies, requiring roughly 6percent of vehicles sold in California to be true zero emission vehicles. Through that mandate, ZEV technologies will continue to improve and expand into wider applications, making them a viable option for many consumers in California. The proposed ACC regulation achieves maximum feasible emission reductions from automobiles and places the State on a continuing path to ultimately meet national ambient air quality standards.

In 2006 the legislature adopted Assembly Bill 32 which outlined California's major initiatives to reduce GHG emissions, and set an emissions reduction target of meeting 1990 emissions levels by 2020, which is a reduction of roughly 30percent. In 2005 then Governor Schwarzenegger established an emissions reduction target of achieving an 80 percent reduction in 1990 GHG emissions levels by 2050. In December 2008 the Board adopted ARB's Scoping Plan which outlined the initiatives that will be implemented to reach the 2020 GHG emissions target. The proposed ACC regulation is a major component of the Scoping Plan.

In addition to meeting ozone air quality standards, achieving an 80 percent reduction in GHG emissions by 2050 will also require widespread electrification of transportation networks in California. The proposed ACC regulation and associated ZEV mandate continues ARB's path towards meeting long-term GHG emissions goals.

Overall, implementation of the proposed ACC Program would result in an emissions benefit as compared to current regulations. Table 5-1, Table 5-2, and 5-3 provide the emission benefits for calendar years 2023, 2025, 2035, and 2040 for ROG, NO_x, and particulate matter ($PM_{2.5}$) respectively. Emission benefits are fully realized in the 2035-2040 timeframe when nearly all vehicles operating in the fleet are expected to be compliant with the proposed ACC Program. By 2035 ROG statewide emissions would be reduced by an additional 34 percent, NO_x emissions by an additional 37 percent, and $PM_{2.5}$ emissions by 10 percent.

Table 5-1. Statewide and Regional Emission Benefits of the Advanced Clean Car Program: Reactive Organic Gas (ROG)				
Statewide ROG (tons/day)				
Calendar Year	**Adjusted Baseline with Rebound**	**Proposed Regulation with Rebound**	**Benefits**	**Percent Reduction**
2023	189.6	182.9	6.6	3%
2025	175.5	164.4	11.1	6%
2035	141.1	93.6	47.4	34%

Table 5-2. Statewide Emissions Benefits of the Advanced Clean Car Program: Oxides of Nitrogen (NO_x)				
Statewide NOX (tons/day)				
Calendar Year	**Adjusted Baseline with Rebound**	**Proposed Regulation with Rebound**	**Benefits**	**Percent Reduction**
2023	201.3	185.6	15.7	8%
2025	183.6	161.2	22.4	12%
2035	136.8	86.4	50.4	37%

Table 5-3. Statewide and Regional Emissions Benefits of the Advanced Clean Car Program: Particulate Matter ($PM_{2.5}$)				
Statewide PM2.5 (tons/day)				
Calendar Year	**Adjusted Baseline with Rebound**	**Proposed Regulation with Rebound**	**Benefits**	**Percent Reduction**
2023	26.7	26.0	0.6	2%
2025	27.2	26.3	0.9	3%
2035	29.7	26.8	2.9	10%

In all calendar years between 2015 and 2030, all CAP emissions remain lower for the proposed ACC program than the baseline even when accounting for any possible increases due to changes in consumer purchasing patterns. The results without consumer response are analogous to the emissions benefits described in Section V-D of the LEV III Staff Report.[1] These curves (dashed lines, open markers) reflect the

[1] The CARBITS population reflects only twenty vintages of light-duty vehicles in any calendar year which represents a subset of the EMFAC population used for the emission reductions presented in Section V-D. The emissions estimates from the two models are therefore not necessarily expected to match exactly,

changes only from improvements in tailpipe emission rates and assume there are no changes in fleet composition, though do account for any emissions increases due to the rebound effect.

Changes in the fleet size and average age would also affect CAPs. ARB staff used the fleet composition generated by CARBITS in a modified emissions inventory tool to estimate the changes in CAP emissions shown in Figure 5-1. An additional change due to a different fleet mix yields the results with consumer response (solid line, closed markers). In this case, the distribution of vehicles not only includes a greater proportion of newer vehicles, but also more vehicles in total. Total emissions are a function of both the vehicle emission rates and the number of miles that vehicles are driven. While newer vehicles will have lower emission rates, separate from the expected increase in VMT due to the rebound effect resulting from the lower operating costs, vehicles also tend to be driven more intensively in their younger years. Thus, having a greater proportion of newer vehicles and a larger total fleet size would generate additional VMT as an artifact of the modeling methodology. As a result, consumer responses to new vehicle offerings could reduce some of the expected emission reductions of $PM_{2.5}$ (circles) as a result of an increase in VMT. However these same forces could further enhance emission reductions of ROG (triangles) and have essentially no effect on NO_x (squares). For all pollutants the proposed ACC Program would continue to produce net benefits when allowing for changes in fleet composition.

In the event that total fleetwide VMT is solely a function of the rebound effect, renormalizing VMT to account only for those effects but maintaining the changes in fleet composition would result in similar changes to the percent reductions without consumer response. Appendix S contains a detailed discussion on the relationship between fleet turnover, fuel price and emission reductions and indicates that although the magnitude of emission reductions could vary, the Program would result in an overall net emission reduction. (See Appendix T of the LEV III Staff Report for emission calculation methodologies and Appendix S of the LEV III Staff Report for more detailed emission results related to economic factors.)

Overall, staff believes that consumer response to new vehicle offerings would not negate any of the positive effects on criteria pollutant emissions that are expected to result from the proposed Advanced Clean Cars Program, including resultant upstream emission reductions (as discussed in Section V of the LEV III Staff Report).

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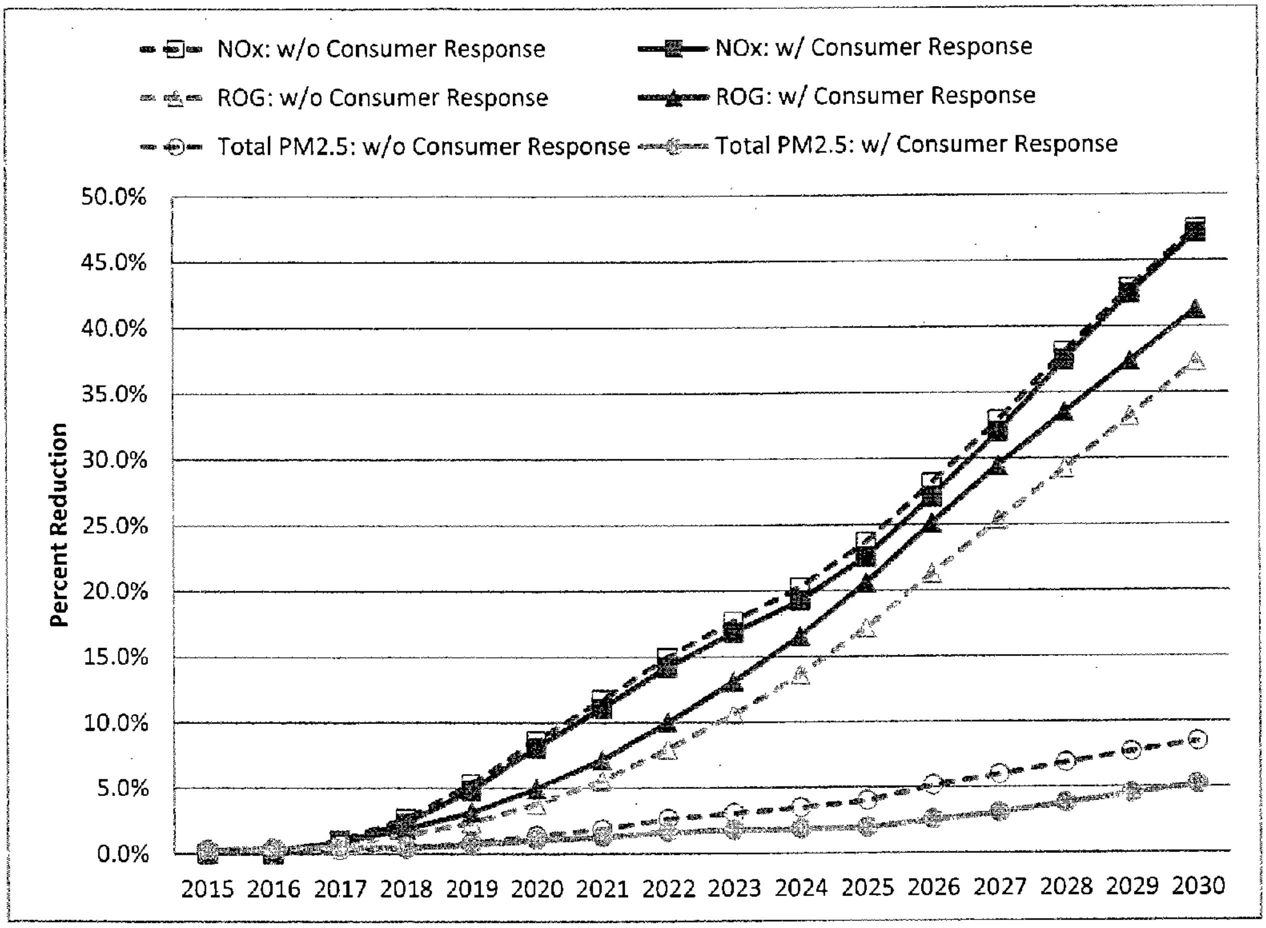
however the CARBITS subset covers an overwhelming majority of vehicles in the on-road fleet and their associated VMT.

Figure 5-1.
Advanced Clean Cars, Changes in ROG, NO_x, and $PM_{2.5}$ Emissions due to Consumer Response (percent)



Mitigation Measure C.1. (Construction)

The Regulatory Setting in Chapter 3 includes, but is not limited to, applicable laws and regulations that provide protection of air quality resources. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is under the purview of jurisdictions with local land use and/or permitting authority. New or modified facilities in California would qualify as a "project" under CEQA. The jurisdiction with primary permitting authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. Recognized practices routinely required to avoid and/or minimize impacts to air resources include:

- Proponents of new or modified facilities constructed as a compliance response to the ACC regulations would coordinate with local land use agencies to seek entitlements for development including the completion of all necessary environmental review requirements (e.g., CEQA). The local land use agency or governing body shall certify that the environmental document was prepared in compliance with applicable regulations and approve the project for development.

- Based on the results of the environmental review, proponents would implement all mitigation identified in the environmental document to reduce or substantially lessen the environmental impacts of the project.

- Specifically, apply for, secure, and comply with all appropriate air quality permits for project construction and operations from the local agencies with air quality jurisdiction and from other applicable agencies, if appropriate, prior to construction mobilization.

- Compliance with the CAA and the CCAA (e.g., NSR and BACT criteria if applicable).

- Comply with local plans, policies, ordinances, rules, and regulations regarding air quality-related emissions and associated exposure (e.g., construction-related fugitive PM dust regulations, indirect source review, and payment into offsite mitigation funds).

- For projects located in PM nonattainment areas, prepare and comply with a dust abatement plan that addresses emissions of fugitive dust during construction and operation of the project.

The proponents and local land use agencies can and should be the parties responsible for the project approval and implementation, its mitigation. ARB is not a land use agency and would not be responsible for ensuring that this mitigation is implemented. However, because of above mitigation are required by law, implementation would reduce this impact to a less-than-significant level.

2. Odors

There is uncertainty as to the exact locations of new manufacturing plants that specialize in the production of propulsion batteries and fuel cells, new hydrogen fueling stations, and modifications to existing hydrogen production plants. However, these would likely occur within existing footprints or in areas with consistent zoning and would not include activities or processes that are associated with major odor sources (e.g., landfills). Additionally, new people would not be located near existing odor sources because implementation of the proposed ACC Program would not include the development of sensitive uses (e.g., residences). Thus, implementation of the proposed ACC Program would not create objectionable odors affecting a substantial number of people. As a result, this impact would be less than significant.

Mitigation

No mitigation is required.

D. Greenhouse Gases

1. Greenhouse Gases; Plan, Policy, or Regulation

As mentioned above in the air quality discussion, 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. With respect to energy, it is also important to note that energy consumption associated with implementation of the proposed ACC Program would displace gasoline (a higher carbon transportation fuel) resulting in additional benefits.

Table 5-4. CO_2-Equivalent (CO_2e) Emission Benefits from Advanced Clean Car Regulations

Statewide CO_2e Emissions (Million Metric Tons / Year)

Calendar Year	**Adjusted Baseline with Rebound**	**Proposed Regulation with Rebound**	**Benefits**	**Percent Reduction**
2020	111.2	108.1	3.1	3%
2025	109.9	96.3	13.7	12%
2035	114.8	83.2	31.5	27%
2050	131.0	88.3	42.7	33%

Mitigation

No mitigation is required.

E. Biological Resources

1. Candidate, Sensitive, or Special Status Species; Riparian Habitat or Sensitive Natural Community; Wetlands; Movement, Local Policies and Ordinances; Plans

As discussed in Chapter 4, Regulated Community Compliance Responses, implementation of the proposed ACC Program could result in the construction and operation of new manufacturing plants that specialize in the production of propulsion batteries and fuel cells. New hydrogen fueling stations could also be constructed and operated along with modifications to existing hydrogen production plants. These would likely occur within existing footprints or in areas with consistent zoning.

However, there is uncertainty as to the exact locations of these new plants, stations, and modifications, especially in regards to new manufacturing plants for producing propulsion batteries and fuel cells and in relation to the location of biological resources. Construction of new plants could require disturbance of undeveloped area, such as clearing of vegetation, earth movement and grading, trenching for utility lines, erection of new buildings, and paving of parking lots, delivery areas, and roadways. These activities would have the potential to adversely affect biological resources (e.g., species, habitat) that may reside or be present in those areas. Because there are biological species that occur, or even thrive, in developed settings, resources could also be adversely affected by the installation of hydrogen fuel dispensing units at existing gasoline service stations and modifications to existing hydrogen production plants within existing footprints, or at other sites in areas with consistent zoning.

Long-term operation of new plants, stations, and modifications would often include the presence of humans; movement of automobiles, trucks and heavy equipment; and operation of stationary equipment. This environment would not be conducive to biological resources located on-site or nearby. The biological resources that could be affected by construction and operation associated with implementation of the proposed ACC Program, would depend on the specific location of each facility and its environmental setting. Harmful effects could include modifications to existing habitat; including removal, degradation, and fragmentation of riparian systems, wetlands, or other sensitive natural wildlife habitat and plan communities; interference with wildlife movement or wildlife nursery sites; loss of special-status species; and/or conflicts with the provisions of adopted habitat conservation plans, natural community conservation plans, or other conservation plans or policies to protect natural resources. Consequently, this impact would be potentially significant.

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.

Mitigation Measure E.1.

The Regulatory Setting in Chapter 3 includes, but is not limited to, applicable laws and regulations that provide protection of biological resources. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is under the purview of jurisdictions with local land use and/or permitting authority. New or modified facilities in California would qualify as a "project" under CEQA. The jurisdiction with primary permitting authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. Recognized practices that are routinely required to avoid and/or minimize impacts to biological resources include:

- Proponents of new or modified facilities constructed as a compliance response to the ACC regulations would coordinate with local land use agencies to seek entitlements for development including the completion of all necessary environmental review requirements (e.g., CEQA). The local land use agency or governing body would certify that the environmental document was prepared in compliance with applicable regulations and would approve the project for development.

- Based on the results of the environmental review, proponents would implement all mitigation identified in the environmental document to reduce or substantially lessen the environmental impacts of the project. The definition of actions required to mitigate potentially significant biological impacts may include the following; however, any mitigation specifically required for a new or modified facility would be determined by the local lead agency.

- Preparation of a biological inventory of site resources by a qualified biologist prior to ground disturbance or construction. If protected species or their habitats are present, comply with applicable federal and State endangered species acts and regulations. Ensure that important fish or wildlife movement corridors or nursery sites are not impeded by project activities.

- Preparation of a wetland survey of onsite resources. Establish setbacks and prohibit disturbance of riparian habitats, streams, intermittent and ephemeral drainages, and other wetlands. Wetland delineation is required by Section 3030(d) of the Clean Water Act and is administered by the U.S. Army Corps of Engineers.

- Prohibit construction activities during the rainy season with requirements for seasonal weatherization and implementation of erosion prevention practices.

- Prohibit construction activities in the vicinity of raptor nests during nesting season or establish protective buffers and provide monitoring as needed to ensure that project activity does not cause an active nest to fail.

- Preparation of site design and development plans that avoid or minimize disturbance of habitat and wildlife resources, and prevents stormwater discharge that could contribute to sedimentation and degradation of local waterways. Depending on disturbance size and location, a National Pollution Discharge Elimination System (NPDES) construction permit may be required from the California State Water Resources Control Board.

- Plant replacement trees and establish permanently protection suitable habitat at ratios considered acceptable to comply with "no net loss" requirements.

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 that the 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 conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact regarding biological resources resulting from the construction and operation of new plants, stations, and modifications may be significant and unavoidable.

F. Cultural Resources

1. Historic Resources, Archaeological Resources, Paleontological Resources, Unique Geologic Features, Human Remains

As discussed in Chapter 4, Regulated Community Compliance Responses, implementation of the proposed ACC Program could result in the construction and operation of new manufacturing plants that specialize in the production of propulsion batteries and fuel cells. New hydrogen fueling stations could also be constructed and operated along with modifications to existing hydrogen production plants. These would likely occur within existing footprints or in areas with consistent zoning.

However, there is uncertainty as to the exact locations of these new plants, stations, and modifications, especially in regards to new manufacturing plants for producing propulsion batteries and fuel cells and in relation to the location of cultural resources.

The long-term operation of new plants, stations, and modifications would not include any ground disturbance or demolition activities, which are the primary detriments to historical, archaeological, and paleontological resources. However, construction of new plants could require disturbance of undeveloped area, such as clearing of vegetation, earth movement and grading, trenching for utility lines, erection of new buildings, and paving of parking lots, delivery areas, and roadways. Demolition of existing structures may also occur before the construction of new buildings and structures. The cultural resources that could potentially be affected by ground disturbance activities could include, but are not limited to, prehistoric and historical archaeological sites, paleontological resources, historic buildings, structures, or archaeological sites associated with agriculture and mining, and heritage landscapes. Properties important to Native American communities and other ethnic groups, including tangible properties possessing intangible traditional cultural values, also may exist. Historic buildings and structures may also be adversely affected by demolition-related activities. Such resources may occur individually, in groupings of modest size, or in districts. Because culturally sensitive resources can also be located in developed settings, historic, archeological, and paleontological resources, and places important to Native American communities, could also be adversely affected by the installation of hydrogen fuel dispensing units at existing gasoline service stations and modifications to existing hydrogen production plants within existing footprints, or at other sites in areas with consistent zoning. As a result, this impact would be potentially significant.

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.

Mitigation Measure F.1.

The Regulatory Setting in Chapter 3 includes, but is not limited to, applicable laws and regulations that provide protection of cultural resources. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is under the purview of jurisdictions with local land use and/or permitting authority. New or modified facilities in California would qualify as a "project" under CEQA. The jurisdiction with primary permitting authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. Recognized practices that are routinely required to avoid and/or minimize impacts to cultural resources include:

- Proponents of new or modified facilities constructed as a compliance response to the ACC regulations would coordinate with local land use agencies to seek entitlements for development including the completion of all necessary environmental review requirements (e.g., CEQA). The local land use agency or governing body would certify that the environmental document was prepared in compliance with applicable regulations and would approve the project for development.

- Based on the results of the environmental review, proponents would implement all mitigation identified in the environmental document to reduce or substantially lessen the environmental impacts of the project. The definition of actions required to mitigate potentially significant cultural impacts may include the following; however, any mitigation specifically required for a new or modified facility would be determined by the local lead agency.

- Retain the services of cultural resources specialists with training and background that conforms to the U.S. Secretary of Interior's Professional Qualifications Standards, as published in Title 36, Code of Federal Regulations, part 61 (36 CFR Part 61).

- Seek guidance from the State and federal lead agencies, as appropriate, for coordination of Nation-to-Nation consultations with the Native American Tribes.

- Consult with lead agencies early in the planning process to identify the potential presence of cultural properties. The agencies will provide the project developers with specific instruction on policies for compliance with the various laws and regulations governing cultural resources management, including coordination with regulatory agencies and Native American Tribes.

- Define the area of potential effect (APE) for each project, which is the area within which project construction and operation may directly or indirectly cause alterations in the character or use of historic properties. The APE should include a reasonable construction buffer zone and laydown areas, access roads, and borrow areas, as well as a reasonable assessment of areas subject to effects from visual, auditory, or atmospheric impacts, or impacts from increased access.

- Retain the services of a paleontological resources specialist with training and background that conforms with the minimum qualifications for a vertebrate paleontologist as described in Measures for Assessment and Mitigation of Adverse Impacts to Non-Renewable Paleontologic Resources: Standard Procedures (Society of Vertebrate Paleontology 1995).

- Conduct initial scoping assessments to determine whether proposed construction activities would disturb formations that may contain important paleontological resources. Whenever possible potential impacts to paleontological resources should be avoided by moving the site of construction or removing or reducing the need for surface disturbance. The scoping assessment should be conducted by the qualified paleontological resources specialist in accordance with applicable agency requirements.

- The project proponent's qualified paleontological resources specialist would determine whether paleontological resources would likely be disturbed in a project area on the basis of the sedimentary context of the area and a records search for past paleontological finds in the area. The assessment may suggest areas of high known potential for containing resources. If the assessment is inconclusive a surface survey is recommended to determine the fossiliferous potential and extent of the pertinent sedimentary units within the project site. If the site contains areas of high potential for significant paleontological resources and avoidance is not possible, prepare a paleontological resources management and mitigation plan that addresses the following steps:

  - a preliminary survey (if not conducted earlier) and surface salvage prior to construction;
  - physical and administrative protective measures and protocols such as halting work, to be implemented in the event of fossil discoveries;
  - monitoring and salvage during excavation;
  - specimen preparation;
  - identification, cataloging, curation and storage; and
  - a final report of the findings and their significance.
  - Choose sites that avoid areas of special scientific value.

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 that the 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 conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact regarding cultural resources resulting from the construction and operation of new plants, stations, and modifications may be significant and unavoidable.

G. Geology and Soils

1. Risk of Loss, Injury, or Death; Unstable Geologic Unit or Soil; Expansive Soil

As discussed in Chapter 4, Regulated Community Compliance Responses, implementation of the proposed ACC Program could result in the construction and operation of new manufacturing plants that specialize in the production of propulsion batteries and fuel cells. New hydrogen fueling stations could also be constructed and operated along with modifications to existing hydrogen production plants.

New manufacturing plants and new hydrogen fueling stations could be located in a variety of relatively high-risk geologic and soil conditions that are considered to be potentially hazardous. For instance, the seismic conditions at the site of a new plant that may have high to extremely high seismic-related fault rupture and ground shaking potential associated with earthquake activity. New facilities could also be subject to seismic-related ground failure, including liquefaction and landslides.

New facilities could be located in a variety of geologic, soil, and slope conditions with varying amounts of vegetation that would be susceptible to soil erosion. Strong ground shaking could also trigger landslides in areas where the natural slope is naturally unstable or is over-steepened by the construction of access roads and structures.

New facilities could also be constructed in locations that would expose facilities and structures to expansive soil conditions. Expansive soils, those with high-plasticity clay content, can cause structural failure of the foundations and footings. The presence of expansive soils as defined in Table 18-1-B of the Uniform Building Code (1994) could create substantial risks to life or property. The potential for expansive soils is not well documented in all areas. Therefore, development of new manufacturing plants and new hydrogen fueling stations are potentially susceptible to the presence of expansive soils particularly in areas of fine-grained sediment accumulation typically associated with playas, valley bottoms, and local low-lying areas.

The specific design details, siting locations, seismic hazards, and geologic, slope, and soil conditions for a particular manufacturing plant or hydrogen fueling station are not known at this time and would be analyzed on a site-specific basis at the project level.

Therefore, for purposes of this analysis, development of these facilities could expose people and structures to relatively high levels of risk associated with strong seismic ground shaking, including liquefaction and landslides, and instability. These geologic, seismic, and soil-related conditions could result in damage to structures, related utility lines, and access roads, blocking access and posing safety hazards to people. As a result, this impact would be potentially significant.

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.

2. Substantial Soil Erosion or the Loss of Topsoil

New plants, stations, and modifications could be located in a variety of geologic, soil, and slope conditions with varying amounts of vegetation that would be susceptible to both soil erosion and loss of topsoil during construction. The level of susceptibility varies by location. However, the specific design details, siting locations, and soil erosion hazards for particular manufacturing plants and hydrogen fueling stations are not known at this time and would be analyzed on a site-specific basis at the project level. Therefore, for purposes of this analysis, the potential soil erosion hazard impacts would be considered potentially significant.

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.

3. Septic Tanks or Alternative Waste Water Disposal Systems

New manufacturing plants would not be anticipated to require the installation or use of septic tanks or alternative waste water disposal systems. Industrial land uses, manufacturing processes in particular, would require more advanced treatment systems that would likely be served by centralized wastewater treatment plants. New hydrogen fueling stations and modifications would not generate waste water and, thus, would not require new waste water treatment disposal systems. In addition, although there is uncertainty as to the exact locations of new plants, stations, and modifications, these would likely occur within existing footprints or in areas with consistent zoning. Consequently, if new hydrogen fueling stations or modification were to result in waste water generation, it could likely be served by an existing waste water treatment plant located in the surrounding urban areas. Therefore, the impacts related to adequately supporting septic tanks or alternative wastewater disposal systems would be less than significant.

<u>Mitigation Measure G.1 and G.2.</u>

The Regulatory Setting in Chapter 3 includes, but is not limited to, applicable laws and regulations that provide protection of geology and soils. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is under the purview of jurisdictions with local land use and/or permitting authority. New or modified facilities in California would qualify as a "project" under CEQA. The jurisdiction with primary permitting authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. Recognized practices that are routinely required to avoid and/or minimize impacts to geology and soils include:

- Proponents of new or modified facilities constructed as a compliance response to the ACC regulations would coordinate with local land use agencies to seek entitlements for development including the completion of all necessary environmental review requirements (e.g., CEQA). The local land use agency or governing body would certify that the environmental document was prepared in compliance with applicable regulations and would approve the project for development.

- Based on the results of the environmental review, proponents would implement all mitigation identified in the environmental document to reduce or substantially lessen the environmental impacts of the project. The definition of actions required to mitigate potentially significant geology and soil impacts may include the following; however, any mitigation specifically required for a new or modified facility would be determined by the local lead agency.

- Prior to the issuance of any development permits, proponents of new manufacturing plants and hydrogen fueling stations would prepare a geotechnical investigation/study, which would include an evaluation of the depth to the water table, liquefaction potential, physical properties of subsurface soils including shrink-swell potential (expansion), soil resistivity, slope stability, minerals resources and the presence of hazardous materials.

- Proponents of new manufacturing plants and hydrogen fueling stations would provide a complete site grading plan, and drainage, erosion, and sediment control plan with applications to applicable lead agencies. Proponents would avoid locating facilities on steep slopes, in alluvial fans and other areas prone to landslides or flash floods, or with gullies or washes, as much as possible.

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 that the 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 conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact to geology and soils resulting from the construction and operation of new plants, stations, and modifications may be significant and unavoidable.

H. Hazards and Hazardous Materials

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

As discussed in Chapter 4, Regulated Community Compliance Responses, implementation of the proposed ACC Program could result in the construction and operation of new manufacturing plants that specialize in the production of propulsion batteries and fuel cells. New hydrogen fueling stations could also be constructed and operated along with modifications to existing hydrogen production plants. These would likely occur within existing footprints or in areas with consistent zoning.

The long-term operation of new plants, stations, and modifications would result in the routine transport, use, and disposal of hazardous materials (i.e., propulsion batteries, fuel cells, and hydrogen). However, as discussed in Chapter 5, Regulated Community Compliance Responses, the transport, use, and disposal of hazardous materials would be required to comply with all applicable federal, State and local laws. In addition, although there is uncertainty as to the exact locations of these new plants, stations, and modifications, these would likely occur within existing footprints or in areas with consistent zoning where hazardous materials are currently in use. As a result, this impact would be less than significant.

2. Upset and Accident Conditions

Implementation of the proposed ACC Program would result in mass reductions in regards to the heavier vehicle classes. There are recent studies that analyze the relationship between vehicle weight, size (wheelbase, track width, and their product, footprint), and safety, for individual vehicle makes and models. Based on these studies, the principal difference between the heavier vehicles, especially truck-based LTVs, and the lighter vehicles, especially passenger cars, is that mass reduction has a different effect in collisions with another car or LTV. When two vehicles of unequal mass collide, the delta V is higher in the lighter vehicle, in the same proportion as the mass ratio. As a result, the fatality risk is also higher. Removing some mass from the heavy vehicle reduces delta V in the lighter vehicle, where fatality risk is high, resulting in a large benefit, offset by a small penalty because delta V increases in the heavy vehicle, where fatality risk is low – adding up to a net societal benefit. It is also important to note that once differences in vehicles, drivers and crash times/locations are accounted for, there is essentially no correlation between vehicle mass and US fatality risk per VMT (Wenzel 2011).

Also, with regards to battery fires and/or explosions, there are existing propulsion battery system safety documents that define evaluation methods and make recommendations for battery system performance. The SAE Standard defines a minimum set of acceptable safety criteria for a lithium-based rechargeable battery system to be considered for use in a vehicle propulsion application as an energy storage system connected to a high voltage power train. The purpose of the SAE Standard is to assure that a battery pack can safely be integrated into an electric or hybrid vehicle. Specifically, it is designed to assure that a single point fault will not result in fire, explosion, battery enclosure rupture or high voltage hazard.

However, construction activities would use heavy-duty equipment requiring periodic refueling and lubricating. Large pieces of construction equipment (e.g., backhoes, graders) are typically fueled and maintained at the construction site as they are not designed for use on public roadways. Thus, such maintenance uses a service vehicle that mobilizes to the location of the construction equipment. It is during the transfer of fuel that the potential for an accidental release is most likely. Although precautions would be taken to ensure that any spilled fuel is properly contained and disposed, and such spills are typically minor and localized to the immediate area of the fueling (or maintenance), the potential still remains for a significant release of hazardous materials into the environment. Consequently, the project could 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. Therefore, this impact would be potentially significant. 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.

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

As discussed above, although there is uncertainty as to the exact locations of these new plants, stations, and modifications, these would likely occur within existing footprints or in areas with consistent zoning where hazardous materials are currently in use. Thus, implementation of the proposed ACC Program would not be anticipated to result in locating new plants, stations, or modifications near schools, public (or public use) airports, private airstrips, or wildlands; or on sites included on a list of hazardous materials sites or impair implementation of or physically interfere with an adopted emergency response or evacuation plan. In addition, as noted above, the handling of hazards materials would be required to comply with all applicable federal, State and local laws. As a result, this impact would be less than significant.

Mitigation Measure H.2.

The Regulatory Setting in Chapter 3 includes, but is not limited to, applicable laws and regulations in regards to hazards. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is under the purview of jurisdictions with local land use and/or permitting authority. New or modified facilities in California would qualify as a "project" under CEQA. The jurisdiction with primary permitting authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. Recognized practices that are routinely required to avoid upset and accident-related impacts include:

- Proponents of new or modified facilities constructed as a compliance response to the ACC regulations would coordinate with local land use agencies to seek entitlements for development including the completion of all necessary environmental review requirements (e.g., CEQA). The local land use agency or governing body would certify that the environmental document was prepared in compliance with applicable regulations and would approve the project for development.

- Based on the results of the environmental review, proponents would implement all mitigation identified in the environmental document to reduce or substantially lessen the environmental impacts of the project. The definition of actions required to mitigate potentially significant upset and accident-related hazard impacts may include the following; however, any mitigation specifically required for a new or modified facility would be determined by the local lead agency.

- Handling of potentially hazardous materials/wastes should be performed under the direction of a licensed professional with the necessary experience and knowledge to oversee the proper identification, characterization, handling and disposal or recycling of the materials generated as a result of the project. As wastes are generated, they would be placed, at the direction of the licensed professional, in designated areas that offer secure, secondary containment and/or protection from stormwater runoff. Other forms of containment may include placing waste on plastic sheeting (and/or covering with same) or in steel bins or other suitable containers pending profiling and disposal or recycling.

- The temporary storage and handling of potentially hazardous materials/wastes should be in areas away from sensitive receptors such as schools or residential areas. These areas should be secured with chain-link fencing or similar barrier with controlled access to restrict casual contact from non-Project personnel. All project personnel that may come into contact with potentially hazardous materials/wastes will have the appropriate health and safety training commensurate with the anticipated level of exposure.

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 that the 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 conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact regarding upset and accident-related hazards resulting from the construction and operation of new plants, stations, and modifications may be significant and unavoidable.

I. Hydrology and Water Quality

1. Water Quality Standards or Waste Discharge Requirements; Groundwater Supplies or Groundwater Recharge; Runoff Water

As discussed in Chapter 4, Regulated Community Compliance Responses, implementation of the proposed ACC Program could result in the construction and operation of new manufacturing plants that specialize in the production of propulsion batteries and fuel cells. New hydrogen fueling stations could also be constructed and operated along with modifications to existing hydrogen production plants. These would likely occur within existing footprints or in areas with consistent zoning.

The long-term operation of new plants, stations, and modifications would be required to comply with applicable erosion, water quality standards, and waste discharge requirements (e.g., NPDES, SWPPP). With respect to depleting groundwater supplies, impairing quality, and runoff issues, new facilities would not be anticipated to result in substantial demands due to the nature of associated activities. As a result, this impact would be less than significant.

2. Drainage Patterns; Flood Hazards; Seiche, Tsunami, or Mudflow

As discussed in Chapter 4, Regulated Community Compliance Responses, implementation of the proposed ACC Program could result in the construction and operation of new manufacturing plants that specialize in the production of propulsion batteries and fuel cells. New hydrogen fueling stations would also be constructed and operated along with modifications to existing hydrogen production plants. These would likely occur within existing footprints or in areas with consistent zoning.

New plants, stations, and modifications could be located in a variety of conditions with regards to altering drainage patters, flooding, and inundation by seiche, tsunami, or mudflow. The level of susceptibility varies by location. However, the specific design details, siting locations, and associated hydrology and water quality issues are not known at this time and would be analyzed on a site-specific basis at the project level. Therefore, for purposes of this analysis, these potential hydrology and water quality-related impacts would be considered potentially significant.

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.

Mitigation Measure I.2.

The Regulatory Setting in Chapter 3 includes, but is not limited to, applicable laws and regulations in regards to hydrology and water quality. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is under the purview of jurisdictions with local land use and/or permitting authority. New or modified facilities in California would qualify as a "project" under CEQA. The jurisdiction with primary permitting authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. Recognized practices that are routinely required to avoid and/or mitigate hydrology and water quality-related impacts include:

- Proponents of new or modified facilities constructed as a compliance response to the ACC regulations would coordinate with local land use agencies to seek entitlements for development including the completion of all necessary environmental review requirements (e.g., CEQA). The local land use agency or governing body would certify that the environmental document was prepared in compliance with applicable regulations and would approve the project for development.

- Based on the results of the environmental review, proponents would implement all mitigation identified in the environmental document to reduce or substantially lessen the environmental impacts of the project. The definition of actions required to mitigate potentially significant hydrology and water quality impacts may include the following; however, any mitigation specifically required for a new or modified facility would be determined by the local lead agency.

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 that the 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 conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact regarding hydrology and water quality resulting from the construction and operation of new plants, stations, and modifications may be significant and unavoidable.

J. Land Use Planning

1. Divide an Established Community, Land Use Plan, Habitat Conservation Plan or Natural Conservation Plan

As discussed in Chapter 4, Regulated Community Compliance Responses, implementation of the proposed ACC Program could result in the construction and operation of new manufacturing plants that specialize in the production of propulsion batteries and fuel cells. New hydrogen fueling stations could also be constructed and operated along with modifications to existing hydrogen production plants. These would likely occur within existing footprints or in areas with consistent zoning. Thus, implementation of the proposed ACC Program would not be anticipated to divide an established community or conflict with a land use or conservation plan. This impact would be less than significant.

Mitigation

No mitigation is required.

K. Mineral Resources

1. Availability of a Known Mineral Resource or Recovery Site

As discussed in Chapter 4, Regulated Community Compliance Responses, implementation of the proposed ACC Program could result in the construction and operation of new manufacturing plants that specialize in the production of propulsion batteries and fuel cells. New hydrogen fueling stations could also be constructed and operated along with modifications to existing hydrogen production plants. These would likely occur within existing footprints or in areas with consistent zoning where original permitting and analyses considered these issues. In addition, implementation of the proposed ACC Program would not significantly deplete the supply of lithium or platinum and both are currently used in auto manufacturing processes. As a result, this impact would be less than significant.

Mitigation

No mitigation is required.

L. Noise

1. Noise Levels in Excess of Standards, Excessive Groundborne vibration or Groundborne Noise Levels, Substantial Increases in Ambient Noise Levels

Construction noise levels in the vicinity of new plants, stations, and modifications would fluctuate depending on the particular type, number, size, and duration of usage for the varying equipment. The effects of construction noise largely depend on the type of construction activities occurring on any given day, noise levels generated by those activities, distances to noise sensitive receptors, and the existing ambient noise environment in the receptor's vicinity. Construction generally occurs in several discrete stages, each phase requiring a specific complement of equipment with varying equipment type, quantity, and intensity. These variations in the operational characteristics of the equipment change the effect they have on the noise environment of the project site and in the surrounding community for the duration of the construction process.

To assess noise levels associated with the various equipment types and operations, construction equipment can be considered to operate in two modes, mobile and stationary. Mobile equipment sources move around a construction site performing tasks in a recurring manner (e.g., loaders, graders, dozers). Stationary equipment operates in a given location for an extended period of time to perform continuous or periodic operations. Operational characteristics of heavy construction equipment are additionally typified by short periods of full-power operation followed by extended periods of operation at lower power, idling, or powered-off conditions.

Additionally when construction-related noise levels are being evaluated, activities that occur during the more noise-sensitive evening and nighttime hours are of increased concern. Because exterior ambient noise levels typically decrease during the late evening and nighttime hours as traffic volumes and commercial activities decrease, construction activities performed during these more noise-sensitive periods of the day can result in increased annoyance and potential sleep disruption for occupants of nearby residential uses.

The site preparation phase typically generates the most substantial noise levels because of the on-site equipment associated with grading, compacting, and excavation, which uses the noisiest types of construction equipment. Site preparation equipment and activities include backhoes, bulldozers, loaders, and excavation equipment (e.g., graders and scrapers). Construction of large structural elements and mechanical systems could require the use of a crane for placement and assembly tasks, which may also generate noise levels. Although a detailed construction equipment list is not currently available, based on this project type it is expected that the primary sources of noise would include backhoes, bulldozers, and excavators. Noise emission levels from typical types of construction equipment can range from approximately 74 to 94 dBA at 50 feet.

Based on this information and accounting for typical usage factors of individual pieces of equipment and activity types, on-site construction could result in hourly average noise levels of 87 dBA L_{eq} at 50 feet and maximum noise levels of 90 dBA L_{max} at 50 feet from the simultaneous operation of heavy-duty equipment and blasting activities, if deemed necessary. Based on these and general attenuation rates, exterior noise levels at noise-sensitive receptors located within thousands of feet from project sites could exceed typical standards (e.g., 50/60 dBA L_{eq}/L_{max} during the daytime hours and 40/50 dBA L_{eq}/L_{max} during the nighttime hours).

Additionally, construction activities may result in varying degrees of temporary groundborne noise and vibration, depending on the specific construction equipment used and activities involved. Groundborne noise and vibration levels caused by various types of construction equipment and activities (e.g., bulldozers, blasting) range from 58-109 VdB and from 0.003 to 0.089 in/sec PPV at 25 feet. Similar to the above discussion, although a detailed construction equipment list is not currently available, based on this project type it is expected that the primary sources of groundborne vibration and noise would include bulldozers and trucks. According to FTA, levels associated with the use of a large bulldozer and trucks are 0.089 and 0.076 in/sec PPV (87 and 86 VdB) at 25 feet, respectively. With respect to the prevention of structural damage, construction-related activities would not exceed recommended levels (e.g., 0.2 in/sec PPV). However, based on FTA's recommended procedure for applying a propagation adjustment to these reference levels, bulldozing and truck activities could exceed recommended levels with respect to the prevention of human disturbance (e.g., 80 VdB) within 275 feet.

With respect to operational-related transportation activities, new plants, stations, and modifications would not be anticipated to result in a doubling of ADT volumes on affected roadway segments (e.g., the amount associated with a substantial traffic noise increase as discussed above). However, new plants, stations, and modifications, could introduce new on-site stationary noise sources (e.g., pumps, motors, compressors, fans, generators, and other equipment). Noise levels associated with these types of sources vary greatly, but would generally range from 70 dBA L_{eq} to 80 dBA L_{max} at 50 feet. Based on these and general attenuation rates, exterior noise levels at noise-sensitive receptors located within hundreds of feet from the location of the project sites could exceed typical standards (e.g., 50/60 dBA L_{eq}/L_{max} during the daytime hours and 40/50 dBA L_{eq}/L_{max} during the nighttime hours). Thus, implementation of the proposed ACC Program could result in the generation of short-term construction noise and long-term stationary noise levels in excess of applicable standards or that result in a substantial increase in ambient levels at nearby sensitive receptors, and exposure to excessive vibration levels. As a result, this impact would be potentially significant.

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.

2. People Residing or Working in the Area to Excessive Airport-Related Noise Levels

As discussed above, although there is uncertainty as to the exact locations of these new plants, stations, and modifications, these would likely occur within existing footprints or in areas with consistent zoning. Thus, implementation of the proposed ACC Program would not be anticipated to result in locating new plants, stations, or modifications near existing public (or public use) airports or private airstrips. In addition, implementation of the proposed ACC Program would not result in any housing placement or substantial increases in airport-activities. As a result, this impact would be less than significant.

Mitigation Measure L.1.

The Regulatory Setting in Chapter 3 includes, but is not limited to, applicable laws and regulations that pertain to noise. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is under the purview of jurisdictions with local land use and/or permitting authority. New or modified facilities in California would qualify as a "project" under CEQA. The jurisdiction with primary permitting authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. Recognized practices that are routinely required to avoid and/or minimize noise include:

- Proponents of new or modified facilities constructed as a compliance response to the ACC regulations would coordinate with local land use agencies to seek entitlements for development including the completion of all necessary environmental review requirements (e.g., CEQA). The local land use agency or governing body would certify that the environmental document was prepared in compliance with applicable regulations and would approve the project for development.

- Based on the results of the environmental review, proponents would implement all mitigation identified in the environmental document to reduce or substantially lessen the environmental impacts of the project. The definition of actions required to mitigate potentially significant noise impacts may include the following; however, any mitigation specifically required for a new or modified facility would be determined by the local lead agency.

- Ensure noise-generating construction activities (including truck deliveries, pile driving and blasting) are limited to the least noise-sensitive times of day (e.g., weekdays during the daytime hours) for projects near sensitive receptors.

- Consider use of noise barriers, such as berms, to limit ambient noise at property lines, especially where sensitive receptors may be present.

- Ensure all project equipment has sound-control devices no less effective than those provided on the original equipment.

- All construction equipment used would be adequately muffled and maintained.

- Consider use of battery powered forklifts and other facility vehicles.

- Ensure all stationary construction equipment (i.e., compressors and generators) is located as far as practicable from nearby sensitive receptors or shielded.

- Properly maintain mufflers, brakes and all loose items on construction and operational-related vehicles to minimize noise and ensure safe operations. Keep truck operations to the quietest operating speeds. Advise about downshifting and vehicle operations in sensitive communities to keep truck noise to a minimum.

- Use noise controls on standard construction equipment; shield impact tools.

- Consider use of flashing lights instead of audible back-up alarms on mobile equipment.

- Install mufflers on air coolers and exhaust stacks of all diesel and gas-driven engines.

- Equip all emergency pressure relief valves and steam blow-down lines with silencers to limit noise levels.
- Contain facilities within buildings or other types of effective noise enclosures.
- Employ engineering controls, including sound-insulated equipment and control rooms, to reduce the average noise level in normal work areas.

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 that the 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 conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact regarding noise resulting from the construction and operation of new plants, stations, and modifications may be significant and unavoidable.

M. Population and Housing

1. Population Growth, Displace Housing or People

As discussed in Chapter 4, Regulated Community Compliance Responses, implementation of the proposed ACC Program could result in the construction and operation of new manufacturing plants that specialize in the production of propulsion batteries and fuel cells. New hydrogen fueling stations could also be constructed and operated along with modifications to existing hydrogen production plants. Construction activities 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. Therefore, this impact would be less than significant.

Mitigation

No mitigation is required.

N. Public Services

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

As discussed in Chapter 4, Regulated Community Compliance Responses, implementation of the proposed ACC Program could result in the construction and operation of new manufacturing plants that specialize in the production of propulsion batteries and fuel cells. New hydrogen fueling stations could also be constructed and operated along with modifications to existing hydrogen production plants. Construction activities 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. Implementation of the proposed ACC Program would not require new additional housing or land use types that do not currently exist in the area; therefore, not affecting the provision of public services. As a result, this impact would be less than significant.

Mitigation

No mitigation is required.

O. Recreation

1. Regional Parks or Other Recreational Facilities

As discussed in Chapter 4, Regulated Community Compliance Responses, implementation of the proposed ACC Program could result in the construction and operation of new manufacturing plants that specialize in the production of propulsion batteries and fuel cells. New hydrogen fueling stations could also be constructed and operated along with modifications to existing hydrogen production plants. Construction activities 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. Thus, implementation of the proposed ACC Program would not be anticipated to increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration would occur. In addition, new (or expansion of) recreational-related facilities would not occur; therefore, not physically affecting the environment. As a result, this impact would be less than significant.

Mitigation

No mitigation is required.

P. Transportation/Traffic

1. Performance of Circulation System; Congestion Management Programs; Air Traffic Patterns; Hazards; Emergency Access, Policies, Plans and Programs

a. Construction Impacts

Although detailed information about specific construction activities is not currently available, new plants, stations and modifications would be anticipated to result in short-term construction traffic (primarily motorized) from worker commute- and material delivery-related trips. The amount of construction activity would fluctuate depending on the particular type, number, and duration of usage for the varying equipment, and the phase of construction. These variations would affect the amount of project-generated traffic for both worker commute trips and material deliveries. Depending on the amount of trip generation and the location of new facilities, implementation could conflict with applicable programs, plans, ordinances, or policies (e.g., performance standards, congestion management); and/or result in hazardous design features and emergency access issues from road closures, detours, and obstruction of emergency vehicle movement, especially due to project-generated heavy-duty truck trips. As a result, this impact would be potentially significant.

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.

b. Operational Impacts

With respect to operational-related activities, 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. In addition, as discussed in Chapter 4, Regulated Community Compliance Responses, deliveries associated with long-term operational activities (e.g., hydrogen deliveries) would not be anticipated to result in a substantial number of new trips (or associated VMT). Thus, implementation of the proposed ACC Program would not be anticipated to result in substantial traffic volumes on local roadways and; therefore, would not generate long-term operational traffic that conflicts with applicable programs, plans, ordinances, or policies; result in a change in air traffic patterns; substantially increase hazards due to design features; or result in inadequate emergency access. As a result, this impact would be less than significant.

Mitigation Measure P.1. (Construction)

The Regulatory Setting in Chapter 3 includes, but is not limited to, applicable laws and regulations in regards to transportation. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is under the purview of jurisdictions with local land use and/or permitting authority. New or modified facilities in California would qualify as a "project" under CEQA. The jurisdiction with primary permitting authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. Recognized practices that are routinely required to avoid and/or minimize construction traffic impacts include:

- Proponents of new or modified facilities constructed as a compliance response to the ACC regulations would coordinate with local land use agencies to seek entitlements for development including the completion of all necessary environmental review requirements (e.g., CEQA). The local land use agency or governing body would certify that the environmental document was prepared in compliance with applicable regulations and would approve the project for development.

- Based on the results of the environmental review, proponents would implement all mitigation identified in the environmental document to reduce or substantially lessen the environmental impacts of the project. The definition of actions required to mitigate potentially significant traffic impacts may include the following; however, any mitigation specifically required for a new or modified facility would be determined by the local lead agency.

- Minimize the number and length of access, internal, service and maintenance roads and use existing roads when feasible.

- Provide for safe ingress and egress to/from the proposed project site. Identify road design requirements for any proposed roads, and related road improvements.

- If new roads are necessary prepare a road siting plan and consult standards contained in federal, State, or local requirements. The plans should include design and construction protocols to ensure roads will meet the appropriate standards and be no larger than necessary to accommodate their intended functions (e.g., traffic volume and weight of vehicles). Access roads should be located to avoid or minimize impacts to washes and stream crossings, follow natural contours and minimize side-hill cuts. Roads internal to a project site should be designed to minimize ground disturbance. Excessive grades on roads, road embankments, ditches, and drainages should be avoided, especially in areas with erodible soils.

- Prepare a Construction Traffic Control Plan and a Traffic Management Plan.

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 that the 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 conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact regarding traffic resulting from the construction of new plants, stations, and modifications may be significant and unavoidable.

Q. Utilities and Service Systems

1. Water Supply, Wastewater Treatment, and Storm Water, and Solid Waste Infrastructure

As discussed in Chapter 4, Regulated Community Compliance Responses, implementation of the proposed ACC Program could result in the construction and operation of new manufacturing plants that specialize in the production of propulsion batteries and fuel cells. New hydrogen fueling stations could also be constructed and operated along with modifications to existing hydrogen production plants.

As discussed in Chapter 4, Regulated Community Compliance Responses, new hydrogen fueling stations would likely be located in urban areas consistent with local zoning. These locations would likely be served by utility and service systems that are already in place at the time the stations are built. Such systems would include water supply service providers, centralized wastewater treatment systems, storm water drainage infrastructure, and solid waste service providers and related infrastructure. Additionally, the demand for these utilities and services from hydrogen fueling stations would be minimal and not be unlike the demand from existing gasoline service stations. For these reasons, demand for these utilities and services would not be expected to exceed the capacity of the local providers or necessitate an increase in service capacities and associated infrastructure and, therefore, would not result associated environmental impacts.

New manufacturing plants, however, could generate substantial increases in the demand for water supply, wastewater treatment, storm water drainage, and solid waste services in their local areas. These new facilities, no matter their size and location would be required to seek local land use approvals prior to their development. Part of the land use entitlement process for facilities proposed in California requires that each of these projects undergo environmental review consistent with the requirements of CEQA and the State CEQA Guidelines. It is assumed that facilities proposed in other states would be subject to comparable federal, state, and/or local environmental review requirements (e.g., CEQA) and that the environmental review process would assess whether adequate utilities and services (i.e., wastewater services, water supply services, solid waste facilities) would be available and whether the project would result in the need to expand or construct new facilities to serve the project. Through the environmental review process, utility and service demands would be calculated, agencies would provide input on available service capacity and the potential need for service-related infrastructure including expansions to waste water treatment plants, new water supply entitlements and infrastructure, storm water infrastructure, and solid waste handling capacity [e.g., landfills]). Resulting environmental impacts would also be determined through this process.

At this time, the specific location, type, and number of new manufacturing plants developed is not known and would be dependent upon a variety of market factors that are not within the control of ARB including: economic costs, product demands, environmental constraints, and other market constraints. Thus, the specific impacts from new manufacturing plants on utility and service systems cannot be identified with any certainty, and individual plants could potentially result in significant environmental impacts for which it is unknown whether mitigation would be available to reduce the impacts to a less-than-significant level. Thus, for purposes of this analysis, this impact is considered potentially significant.

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.

Mitigation Measure Q.1.

The Regulatory Setting in Chapter 3 includes, but is not limited to, applicable laws and regulations that related to utilities and service systems. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is under the purview of jurisdictions with local land use and/or permitting authority. New or modified facilities in California would qualify as a "project" under CEQA. The jurisdiction with primary permitting authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. Recognized practices that are routinely required to avoid and/or minimize utility and service-related impacts include:

- Proponents of new or modified facilities constructed as a compliance response to the ACC regulations would coordinate with local land use agencies to seek entitlements for development including the completion of all necessary environmental review requirements (e.g., CEQA). The local land use agency or governing body would certify that the environmental document was prepared in compliance with applicable regulations and would approve the project for development.

- Based on the results of the environmental review, proponents would implement all mitigation identified in the environmental document to reduce or substantially lessen the environmental impacts of the project. The definition of actions required to mitigate potentially significant utility or service-related impacts may include the following; however, any mitigation specifically required for a new or modified facility would be determined by the local lead agency.

— Comply with local plans and policies regarding the provision of water supply, wastewater treatment, and storm water drainage utilities, and solid waste services.

— Where an on-site wastewater system is proposed, submit a permit application to the appropriate local jurisdiction and include the application with applications to appropriate lead agencies.

— Where appropriate, prepare a Water Supply Assessment (WSA) consistent with the requirements of Section 21151.9 of the Public Resources Code/ Section 10910 et seq. of the Water Code. The WSA would be approved by the local water agency/purveyor prior construction of the project.

— Comply with local plans and policies regarding the provision of wastewater treatment services.

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 that the 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 conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact to utilities and service systems resulting from the construction and operation of new plants and modifications to existing plants may be significant and unavoidable.

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6.0 CUMULATIVE AND GROWTH-INDUCING IMPACTS

Cumulative impacts are impacts on the environment that result from the incremental impacts of a proposed project when added to other past, present, and reasonably foreseeable future actions (CEQA Guidelines, CCR, Title 14, Section 15355[b]). Such impacts can result from individually minor, but collectively significant actions taking place over time. CEQA Guidelines, CCR, Title 14, Section 15130 states that the discussion of cumulative impacts need not provide as much detail as the discussion of effects attributable to the project alone.

Recognizing the programmatic nature of the EA, cumulative impacts for resource topics are disclosed in general qualitative terms as they pertain to reasonably foreseeable compliance responses. The State CEQA Guidelines require that cumulative impacts be addressed when the cumulative impacts are expected to be significant and when the project's incremental contribution to the effect is cumulatively considerable (CEQA Guidelines, CCR, Title 14, Section 15130[a]). Where a lead agency is examining a project with an incremental effect that is not "cumulatively considerable," a lead agency need not consider that effect significant, but must briefly describe its basis for concluding that the incremental effect is not cumulatively considerable. EIRs must consider "other projects creating related impacts." (CEQA Guidelines, CCR, Title 14, Section 15130[a][1]). CEQA Guidelines, CCR, Title 14, Section 15355(b) requires an analysis of "other closely related past, present, and reasonably foreseeable probable future projects". ARB is, accordingly, considering in the cumulative impacts analysis of other projects that, like the proposed ACC Program, are designed to *reduce* annual emissions of CAPs and GHGs, and not simply every project that emits CAPs or GHGs. This approach is "guided by the standards of practicality and reasonableness" (CEQA Guidelines, CCR, Title 14, 15130[b]) and serves the purposes of the cumulative impacts analysis, which is to provide "a context for considering whether the incremental effects of the project at issue are considerable" when judged "against the backdrop of the environmental effects of other projects." (CBE v. Cal. Res. Agency [2002] 103 Cal.App.4th 98, 119).

The level of detail in this section has been guided by what is practical and reasonable, and contains the following elements:

- An analysis of related future projects or planned regulatory programs that would affect resources in the project area similar to those affected by the proposed project;
- A summary of the expected environmental effects to be produced by those reasonably foreseeable future projects with specific reference to additional information stating where that information is available; and
- A reasonable analysis of the cumulative impacts of the relevant projects. An environmental document must examine reasonable feasible options for mitigating or avoiding the project's contribution to any significant cumulative effects.

Due to the statewide reach of the proposed ACC Program and the longer-term future horizon for the reduction achievements, the impact analysis is inherently cumulative in nature, rather than site or project specific. As a result the character of impact conclusions in the resource-oriented sections of Chapter 5 are cumulative, considering the potential effects of the full range of reasonably foreseeable methods of compliance, along with expected background growth in California, as appropriate.

This section evaluates the cumulative and growth-inducing impacts associated with implementation of the proposed ACC Program and the potential contribution of the program to those impacts. The impact assessment discusses each resource topic evaluated in this EA.

A. Aesthetics

There is uncertainty as to the exact locations of new plants, stations, and modifications, especially in regards to new manufacturing plants for producing propulsion batteries and fuel cells and in relation to the location of viewers. Construction and operation of these, though likely to occur in areas with consistent zoning, could introduce or increase the presence of artificial elements (e.g., heavy-duty equipment, removal of existing vegetation, buildings) in areas with national, state, or county designated scenic vistas and/or scenic resources visible from State scenic highways. The visual impact of such development would depend on several variables, including size of facilities, viewing distance, angle of view, visual absorption capacities, and the structure placement in the landscape. Operation may introduce substantial sources of nighttime lighting for safety and security purposes. Implementation of Mitigation Measure A.1. would not reduce these impacts to a less-than-significant level. Thus, the proposed ACC Program could result in a considerable contribution to a cumulative aesthetics-related impact.

B. Agriculture and Forestry Resources

Implementation of the proposed ACC Program could result in the construction and operation of new manufacturing plants that specialize in the production of propulsion batteries and fuel cells. New hydrogen fueling stations would also be constructed and operated along with modifications to existing hydrogen production plants. There is uncertainty as to the exact locations of these new plants, stations, and modifications, especially in regards to new manufacturing plants for producing propulsion batteries and fuel cells; however, these would likely occur within existing facility footprints or in areas with consistent zoning. Thus, implementation of the proposed ACC Program would not be anticipated to result in the conversion of farmland, conflict with existing zoning for agricultural use or a Williamson Act contract, conflict with existing zoning for (or cause rezoning of) forest land or timberland, the loss of forest land (or conversion of forest land to non-forest use), or involve other changes resulting in conversion of farmland or forest land to non-agricultural use or non-forest use, respectively. Thus, the proposed ACC Program would not result in a considerable contribution to a cumulative agriculture-related impact.

C. Air Quality

A majority of California is designated as a nonattainment area for ozone and PM_{10}, and to a lesser degree for $PM_{2.5}$, and areas with high levels of TACs. As described in above in Chapter 5, future projects associated with implementation of proposed ACC Program and other cumulative development projects 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 and through this process, air quality levels and associated exposure of sensitive receptors would be calculated and resulting impacts would be determined. With respect to long-term operational emissions, implementation of the proposed ACC Program would result in a beneficial impact.

However, depending on the specific location, type, and number, construction activities could generate short-term emissions that conflict with applicable air quality plans, or violate or contribute substantially to an existing or projected violation. Additionally, implementation could also result in the exposure of sensitive receptors to substantial pollutant concentrations. Implementation of Mitigation Measure C.1. (Construction) would reduce these impacts to a less-than-significant level. Thus, all potentially significant air quality impacts associated with the implementation of the proposed ACC Program would be reduced to a less-than-significant level with mitigation and would not result in a considerable contribution to a cumulative air quality impact.

D. Greenhouse Gases

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. Thus, the proposed ACC Program would not result in a considerable contribution to a cumulative GHG-related impact.

E. Biological Resources

There is uncertainty as to the exact locations of these new plants, stations, and modifications, especially in regards to new manufacturing plants for producing propulsion batteries and fuel cells and in relation to the location of biological resources. Construction of new plants could require disturbance of undeveloped area, such as clearing of vegetation, earth movement and grading, trenching for utility lines, erection of new buildings, and paving of parking lots, delivery areas, and roadways. These activities would have the potential to adversely affect biological resources (e.g., species, habitat) that may reside or be present in those areas. Because there are biological species that occur, or even thrive, in developed settings, resources could also be adversely affected by the installation of hydrogen fuel dispensing units at existing gasoline service stations and modifications to existing hydrogen production plants within existing footprints, or at other sites in areas with consistent zoning. Long-term operation of new plants, stations, and modifications would often include the presence of humans; movement of automobiles, trucks and heavy equipment; and operation of stationary equipment. This environment would not be conducive to biological resources located on-site or nearby.

The biological resources that could be affected by construction and operation associated with implementation of the proposed ACC Program, would depend on the specific location of each facility and its environmental setting. Harmful effects could include modifications to existing habitat; including removal, degradation, and fragmentation of riparian systems, wetlands, or other sensitive natural wildlife habitat and plan communities; interference with wildlife movement or wildlife nursery sites; loss of special-status species; and/or conflicts with the provisions of adopted habitat conservation plans, natural community conservation plans, or other conservation plans or policies to protect natural resources. Implementation of Mitigation Measure E.1. would not reduce these impacts to a less-than-significant level. Thus, the proposed ACC Program could result in a considerable contribution to a cumulative biology-related impact.

F. Cultural Resources

There is uncertainty as to the exact locations of these new plants, stations, and modifications, especially in regards to new manufacturing plants for producing propulsion batteries and fuel cells and in relation to the location of cultural resources. The long-term operation of new plants, stations, and modifications would not include any ground disturbance or demolition activities, which are the primary detriments to historical, archaeological, and paleontological resources. However, construction of new plants could require disturbance of undeveloped area, such as clearing of vegetation, earth movement and grading, trenching for utility lines, erection of new buildings, and paving of parking lots, delivery areas, and roadways. Demolition of existing structures may also occur before the construction of new buildings and structures. The cultural resources that could potentially be affected by ground disturbance activities could include, but are not limited to, prehistoric and historical archaeological sites, paleontological resources, historic buildings, structures, or archaeological sites associated with agriculture and mining, and heritage landscapes. Properties important to Native American communities and other ethnic groups, including tangible properties possessing intangible traditional cultural values, also may exist. Historic buildings and structures may also be adversely affected by demolition-related activities. Such resources may occur individually, in groupings of modest size, or in districts. Because culturally sensitive resources can also be located in developed settings, historic, archeological, and paleontological resources, and places important to Native American communities, could also be adversely affected by the installation of hydrogen fuel dispensing units at existing gasoline service stations and modifications to existing hydrogen production plants within existing footprints, or at other sites in areas with consistent zoning. Implementation of Mitigation Measure F.1. would not reduce these impacts to a less-than-significant level. Thus, the proposed ACC Program could result in a considerable contribution to a cumulative cultural resource-related impact.

G. Geology and Soils

As discussed in Chapter 5, new manufacturing plants would not be anticipated to require the installation or use of septic tanks or alternative waste water disposal systems, but rather likely be served by centralized wastewater treatment plants. New hydrogen fueling stations and modifications would not generate waste water and, thus, would not require new waste water treatment disposal systems. However, new manufacturing plants and new hydrogen fueling stations could be located in a variety of relatively high-risk geologic and soil conditions that are considered to be potentially hazardous. New facilities could be located in a variety of geologic, soil, and slope conditions with varying amounts of vegetation that would be susceptible to soil erosion and the loss of topsoil during construction. New facilities could also be constructed in locations that would expose facilities and structures to expansive soil conditions. Development of these facilities could expose people and structures to relatively high levels of risk associated with strong seismic ground shaking, including liquefaction and landslides, and instability; or result in substantial soil erosion or the loss of topsoil. These geologic, seismic, and soil-related conditions could result in damage to structures, related utility lines, and access roads, blocking access and posing safety hazards to people. Implementation of Mitigation Measure G.1. and G.2. would not reduce these impacts to a less-than-significant level. Thus, the proposed ACC Program could result in a considerable contribution to a cumulative geology and soils-related impact.

H. Hazards and Hazardous Materials

As discussed in Chapter 5, the long-term operation of new plants, stations, and modifications would result in the routine transport, use, and disposal of hazardous materials (i.e., propulsion batteries, fuel cells, and hydrogen); however, such would be required to comply with all applicable federal, State and local laws. Implementation of the proposed ACC Program would not be anticipated to result in locating new plants, stations, or modifications near schools, public (or public use) airports, private airstrips, or wildlands; or on sites included on a list of hazardous materials sites or impair implementation of or physically interfere with an adopted emergency response or evacuation plan. In addition, as noted above, the handling of hazards materials would be required to comply with all applicable federal, State and local laws; and, although there is uncertainty as to the exact locations of these new plants, stations, and modifications, these would likely occur within existing footprints or in areas with consistent zoning where hazardous materials are currently in use. Implementation of the proposed ACC Program would result in mass reductions in regards to the heavier vehicle classes. When two vehicles of unequal mass collide, the delta V is higher in the lighter vehicle, in the same proportion as the mass ratio. As a result, the fatality risk is also higher. Removing some mass from the heavy vehicle reduces delta V in the lighter vehicle, where fatality risk is high, resulting in a large benefit, offset by a small penalty because delta V increases in the heavy vehicle, where fatality risk is low – adding up to a net societal benefit. It is also important to note that once differences in vehicles, drivers and crash times/locations are accounted for, there is essentially no correlation between vehicle mass and US fatality risk per VMT (Wenzel 2011). Also, with regards to battery fires and/or explosions, there are existing propulsion battery system safety documents that define evaluation methods and make recommendations for battery system performance. However, the project could 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 primarily related to construction activities as discussed in Chapter 5. Implementation of Mitigation Measure H.2. would not reduce these impacts to a less-than-significant level. Thus, the proposed ACC Program could result in a considerable contribution to a cumulative hazards-related impact.

I. Hydrology and Water Quality

The long-term operation of new plants, stations, and modifications would be required to comply with applicable erosion, water quality standards, and waste discharge requirements (e.g., NPDES, SWPPP). With respect to depleting groundwater supplies, impairing quality, and runoff issues, new facilities would not be anticipated to result in substantial demands due to the nature of associated activities. However, new plants, stations, and modifications could be located in a variety of conditions with regards to altering drainage patters, flooding, and inundation by seiche, tsunami, or mudflow. Implementation of Mitigation Measure I.2. would not reduce these impacts to a less-than-significant level. Thus, the proposed ACC Program could result in a considerable contribution to a cumulative hydrology and water quality-related impact.

J. Land Use Planning

New hydrogen fueling stations would also be constructed and operated along with modifications to existing hydrogen production plants. These would likely occur within existing footprints or in areas with consistent zoning. Thus, implementation of the proposed ACC Program would not be anticipated to divide an established community or conflict with a land use or conservation plan. Thus, the proposed ACC Program would not result in a considerable contribution to a cumulative land use planning-related impact.

K. Mineral Resources

New hydrogen fueling stations would also be constructed and operated along with modifications to existing hydrogen production plants. These would likely occur within existing footprints or in areas with consistent zoning where original permitting and analyses considered these issues. In addition, as discussed in Chapter 4, Regulated Community Compliance Responses, implementation of the proposed ACC Program would not significantly deplete the supply of lithium or platinum and both are currently used in auto manufacturing processes. Thus, the proposed ACC Program would not result in a considerable contribution to a cumulative mineral resources-related impact.

L. Noise

As discussed above, although there is uncertainty as to the exact locations of these new plants, stations, and modifications, these would likely occur within existing footprints or in areas with consistent zoning. Thus, implementation of the proposed ACC Program would not be anticipated to result in locating new plants, stations, or modifications near existing public (or public use) airports or private airstrips. In addition, implementation of the proposed ACC Program would not result in any housing placement or substantial increases in airport-activities. With respect to operational-related transportation activities, new plants, stations, and modifications would not be anticipated to result in a doubling of ADT volumes on affected roadway segments (e.g., the amount associated with a substantial traffic noise increase as discussed above). However, the construction and operation of new plants, stations, and modifications, could introduce new on-site construction- and stationary- source noise (e.g., heavy-duty construction equipment, pumps, motors, compressors, fans, generators, and other equipment) levels in excess of applicable standards or that result in a substantial increase in ambient levels at nearby sensitive receptors, and exposure to excessive vibration levels. Implementation of Mitigation Measure L.1. would not reduce these impacts to a less-than-significant level. Thus, the proposed ACC Program could result in a considerable contribution to a cumulative noise-related impact.

M. Population and Housing

Construction activities 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. Thus, the proposed ACC Program would not result in a considerable contribution to a cumulative population and housing-related impact.

N. Public Services

Construction activities 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. Implementation of the proposed ACC Program would not require new additional housing or land use types that do not currently exist in the area; therefore, not affecting the provision of public services. Thus, the proposed ACC Program would not result in a considerable contribution to a cumulative population and public services-related impact.

O. Recreation

As discussed above, it would be anticipated that the need for a substantial amount of construction worker migration would not occur and that a substantial amount of new personnel would not be needed to operate the facilities. Thus, implementation of the proposed ACC Program would not be anticipated to increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration would occur. In addition, new (or expansion of) recreational-related facilities would not occur; therefore, not physically affecting the environment. Thus, the proposed ACC Program would not result in a considerable contribution to a cumulative recreation-related impact.

P. Transportation/Traffic

With respect to operational-related activities, 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. In addition, deliveries associated with long-term operational activities (e.g., hydrogen deliveries) would not be anticipated to result in a substantial number of new trips (or associated VMT). However, depending on the amount of trip generation associated with construction activities and the location of new facilities, implementation could conflict with applicable programs, plans, ordinances, or policies (e.g., performance standards, congestion management); and/or result in hazardous design features and emergency access issues from road closures, detours, and obstruction of emergency vehicle movement, especially due to project-generated heavy-duty truck trips. Implementation of Mitigation Measure P.1. would not reduce these impacts to a less-than-significant level. Thus, the proposed ACC Program could result in a considerable contribution to a cumulative transportation/traffic-related impact.

Q. Utilities and Service Systems

New hydrogen fueling stations would likely be located in urban areas consistent with local zoning. These locations would likely be served by utility and service systems that are already in place at the time the stations are built and the demand would be minimal and not be unlike the demand from existing gasoline service stations. Thus, such would not be expected to exceed the capacity of the local providers or necessitate an increase in service capacities and associated infrastructure. However, new manufacturing plants could generate substantial increases in the demand for water supply, wastewater treatment, storm water drainage, and solid waste services in their local areas. Implementation of Mitigation Measure Q.1. would not reduce these impacts to a less-than-significant level. Thus, the proposed ACC Program could result in a considerable contribution to a cumulative utilities and service systems-related impact.

R. Growth-Inducing Impacts

The proposed ACC Program would not directly result in any growth in population or housing. Implementation would support job formation in the affected industries (e.g., manufacturing associated with batteries, advanced clean cars, and material and technology improvements). The job formation would support improved employment in the State, which may indirectly encourage population growth. Any growth would occur over the long-term period of the ACC Program's regulations, which could be accommodated within the normal planning process in California communities, including environmental review. California is renowned for its environmentally progressive laws and regulations, and the proposed ACC Program would contribute to California's effort to improve public health, contribute towards healthy lifestyles and improved quality of life.

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7.0 ALTERNATIVES ANALYSIS

Under ARB's CEQA certified regulatory program, an environmental analysis shall address "feasible alternatives to the proposed action [that] would substantially reduce any significant adverse impact identified" (CCR, Title 17, Section 60005[b]). Additionally, any ARB action or proposal for which significant adverse environmental impacts have been identified shall not be approved or adopted as proposed, if there are "feasible alternatives available [that] would substantially reduce such adverse impact" (CCR, Title 17, Section 60006). CEQA Guidelines, CCR, Title 14, Section 15126.6(a) also indicates the need for an evaluation of "a range of reasonable alternatives to the project, or the location of the project, [that] would feasibly attain most of the basic project objectives but would avoid or substantially lessen any of the significant effects, and evaluate the comparative merits of the alternatives."

The purpose of the alternatives analysis is to determine whether or not a variation of the proposed project would reduce or eliminate significant project impacts, within the framework of achieving the basic project objectives. The proposed ACC Program could be designed differently, which provides opportunities to define alternatives for the EA analysis. Options for the emission requirements under the LEV regulation, vehicle requirements under the ZEV regulation, and provisions of the CFO regulation are discussed below. No alternatives are discussed for the EPL, on-board diagnostics, or certification fuel components of the LEV regulation, because the proposed amendments to those parts by this regulatory package would not result in any significant impacts to the environment.

A. No Project Alternative

1. Description of the No Project Alternative

CEQA requires a specific alternative of "No Project" to be evaluated. Under the No Project Alternative, amendments would not occur to the existing LEV (including EPL), ZEV, and CFO regulations. Thus, the emission requirements for CAPs in place for model year 2010, the final year of implementation of the existing LEV II regulation, would remain in effect for subsequent model years. The existing requirements of the ZEV regulation would continue without the additional requirement that manufacturers earn a minimum proportion of the required credits by selling AT PZEVs, TZEVs, and PZEVs. The EPL regulation would continue to be required on new cars. In addition, the Pavley regulations would also continue at 2016 model year standard levels.

2. Consistency with Project Objectives

The No Project Alternative would fail to achieve the project objectives listed in Chapter 1, Section C, because enhancements to programs for CAP and GHG reductions necessary to achieve air quality standards and GHG requirements and targets would not occur.

Under the No Project Alternative, ARB would continue to implement other existing programs and regulations intended to reduce emissions of CAPs and GHGs in California, but without the proposed ACC Program. Vehicle emissions of CAPs and GHGs would continue to decrease as the vehicle fleet turns over under the existing LEV and ZEV regulations. This is because, typically, almost all of the State's fleet of light- and medium-duty vehicles turns over in an approximately 15-year cycle. Thus, because 2010 is the last model year addressed by the existing LEV regulation, the vehicle fleet would continue to become incrementally cleaner and more efficient until approximately 2025. After that complete turnover cycle, the emissions efficiency of the vehicle fleet would not improve with subsequent fleet turnover, because new vehicles would no longer be cleaner than the older vehicles they replace. The No Project Alternative would not fulfill the requirement of HSC Section 43018(a), which requires ARB to reduce vehicle emissions of CAPs to the maximum extent feasible. Further, the No Project Alternative would not help attain the California and national ambient air quality standards and it would fail to ensure all Californians live, work, and play in a healthful environment free from harmful exposure to air pollution.

The No Project Alternative would also fail to fulfill either the AB 1493 mandate to achieve maximum feasible GHG reductions or the AB 32 mandate to reduce GHG emissions to 1990 levels by 2020. ARB has identified that an additional reduction of 3.8 MMT CO_2e would be needed from light- and medium-duty vehicles to achieve the goals of AB 32, which would be in addition to compliance with the existing LEV and ZEV regulations (ARB 2011b). ARB would attempt to develop and implement other regulations or programs to achieve a reduction a minimum of 3.8 MMT CO_2e; however, it is too speculative at this time to determine whether this reduction could be achieved or when a new regulation would be able to go into effect. Therefore, it is reasonable to conclude that this reduction would not likely be achieved by 2020 with a new regulation or program and California would not achieve the AB 32 mandate.

In addition, implementation of the No Project Alternative would prevent ARB from coordinating with the national Tier 3 standards for CAP emissions that are currently being developed by U.S. EPA, as well as efforts by U.S. EPA and NHTSA to develop GHG standards for light-duty vehicles. For instance, the credit formula that applies to GHG standards for air conditioning systems under the existing Pavley regulation would not align with U.S. EPA's methodology for model years 2017 – 2025. Such inconsistencies between the State and federal requirements would likely result in compliance difficulty and confusion for manufacturers. In addition, Board approval of a "No Project" Alternative would threaten California's nation-leading role in forcing new motor vehicle technology, making it more likely that U.S. EPA and NHTSA could finalize weaker standards than they have proposed, and consequently, would prevent California from achieving needed emission reductions.

Without regulatory requirements, development and use of ZEVs would not increase fast enough to meet ARB's air quality standards and GHG reduction targets. It is unlikely that vehicle manufacturers would increase production of BEVs or hydrogen FCVs above existing levels in response to market demand alone. Economies of scale in production costs would not be realized unless manufacturers commit to producing larger volumes of these alternative vehicles. Consumers would be expected to hesitate to purchase BEVs and FCVs because of doubts about sufficient availability of charging and fueling stations. Left unchanged, the existing CFO regulation would not require the installation of hydrogen fueling infrastructure until the projected number of vehicles reaches 20,000 FCVs. Once activated, the existing regulation only requires a few oil companies and convenience store and supermarket chains to build the stations, leaving several large oil companies that own smaller numbers of gasoline stations (or no stations) out of the requirement in the early years. Also, with a 20,000 vehicle trigger, hydrogen fueling infrastructure would not be sufficient to support the FCV market before the trigger is reached, making it unlikely that the cumulative total of FCVs in the State would ever reach 20,000 vehicles. Thus, it is uncertain whether any entities would build new hydrogen fueling facilities if vehicle manufacturers do not increase production of hydrogen FCVs. Similarly, it is unlikely that vehicle manufacturers would commit to increasing production of FCVs without having a high level of confidence that the fueling infrastructure would be in place to support the FCVs.

In addition, the EPL would not be changed to be consistent with the federal Fuel Economy and Environment label. Cars sold and leased in California would be required to have both the California EPL and the federal Fuel Economy and Environment label, which would supply different sets of information to consumers and could result in buyer confusion.

In summary, the No Project Alternative would neither meet the objectives of the project, nor create an environmentally advantageous outcome.

3. Environmental Impacts

There would be no new environmental impacts under the No Project Alternative, because compliance responses by vehicle manufacturers and refiners and importers of gasoline would be the same as under the existing regulatory environment.

Because the emission standards under the LEV regulation and the proportion of ZEVs would not change and because the vehicle manufacturing industry has already met these requirements for its 2010 and 2011 vehicle models with existing production facilities, it is anticipated that the No Project Alternative would not result in the development of new manufacturing plants that specialize in the production of propulsion batteries or fuel cells, or the modification or expansion of existing production facilities. The proportion of ZEVs and ZEV credit-qualifying vehicles in the statewide vehicle fleet would likely not increase and, therefore, new hydrogen fueling stations would not be developed under the existing CFO regulation. Thus, no environmental impacts related to new or expanded facilities would occur under the No Project Alternative.

Beneficial impacts resulting from the proposed ACC Program would not occur under the No Project Alternative. This would include reduction of CAPs and GHG beyond what is required under existing regulations and reduction in dependence on conventional petroleum fuels. In addition to failing to meet project objectives, this would put the No

Project Alternative at a substantial environmental disadvantage, compared to the proposed ACC Program.

B. More Stringent Emissions Standards in the Low-Emission-Vehicle and Zero Emission Vehicle Regulations

1. Description of the Alternative

This alternative is referred to as the More Stringent Alternative. It would amend the existing LEV regulation to have more stringent emission standards for light- and medium-duty vehicles for both CAPs and GHGs than the proposed amendments to the ACC Program. More specifically, the standards under this alternative would be more stringent for each model year than those in the proposed ACC Program. While the overall strictness of the standards would increase annually with this alternative, many attributes would be similar to the proposed ACC Program. This includes replacement of separate standards for NMOG and NO_x with a combined standard that would be based on the sum of these two pollutants. A more robust Federal Test Procedure for measuring emissions would still be required and the "durability basis" would still be extended to 150,000 miles to ensure the effectiveness of a vehicle's emissions control systems over the operational life of the vehicle. Also, the California Supplemental Federal Test Procedure (SFTP) would still be extended to more medium-duty vehicles the SFTP (known as SFTP II) and would include standards for exhaust emissions of particulate matter. In addition, evaporative emission standards would still be extended to more vehicle types and to vehicles fueled by gasoline that contains higher percentages of ethanol or other biofuels.

This alternative would amend the ZEV regulation to require manufacturers to earn more ZEV credits than would be required under the proposed ACC Program for model years 2015 to 2025. Amendments to the CFO regulation would be the same as under the proposed project.

2. Consistency with Project Objectives

Because manufacturers would have less time, compared to the proposed ACC Program, to develop more cost-effective innovations that could achieve the more stringent emission standards under this alternative, the production costs of building vehicles that meet these standards would likely be higher and would be passed on to the consumer at the point of sale. Manufacturers have indicated that a more stringent set of standards within this timeframe would be prohibitively expensive, because time is needed to design the necessary innovations and establish production lines. The incremental increase in cost borne by consumers would be greater than under the proposed ACC Program and could result in slower turnover of the statewide fleet. Thus, the emissions reductions realized by requiring lower-emission vehicles would be offset to some degree by the slowdown in vehicle turnover. While overall emissions reductions from the statewide fleet would still be achieved, due to potential fleet turnover delays it is not certain that this alternative would reduce vehicle CAP emissions to the maximum extent feasible, as required by HSC Section 43018(a). The emissions reduction that would occur would nonetheless help air basins throughout California attain the California and national ambient air quality standards.

For these same reasons, it is also not certain that this alternative would achieve a reduction of 3.8 MMT CO_2e by 2020 that has been identified by ARB in the adopted Scoping Plan as the reduction needed from an ACC Program (ARB 2011b). Thus, California's ability to achieve additional reductions in furtherance of AB 1493 and to attain the GHG reduction goal of AB 32 could be affected, particularly if ARB cannot develop other programs or regulations to reduce GHG emissions in time.

This alternative would achieve the objective to establish a uniform set of vehicle emission standards in California, and would ensure that some emission reductions would occur. In addition, the statewide fleet of light- and medium-duty vehicles would become more fuel efficient and, thus, help the State become less dependent on petroleum as an energy source. However, the degree of this effect is unknown in light of the expected delay in the vehicle fleet turnover, as discussed above.

More specifically, as described Appendix T (LEV III Mobile Source Emissions Inventory Technical Support Document), ARB staff analyzed an alternative scenario that would have accelerated fleet average emission standards by three years to 2022. To reflect the accelerated regulatory scenario, staff assessed the population fraction by technology group and vehicle class that would be sold in each calendar year, by emissions process (e.g., exhaust and evaporative emissions). Tables 2-27 through 2-30 of Appendix T provide, for the accelerated CAPs regulatory scenario, population splits by technology group for each regulated vehicle class. From this analysis, ARB found that an acceleration of three years would provide very small additional emission benefits relative to the proposed ACC program scenario, as shown in Figures 7-1 through 7-4 below.

The proposed ACC Program includes new future-year GHG emission standards that reduce emissions as cleaner vehicles penetrate into the fleet. Because the standards are a fleet mix by calendar year, fleets have the option to comply with them in different ways, and the penetration of ZEV vehicles is one of many ways in which the standards could be met. As a result, ARB staff modeled GHG benefits of the combined program and did not evaluate the tailpipe emission benefits of ZEV apart from the other components of the proposed ACC Program.

As part of this analysis, ARB staff evaluated a more aggressive option, which is consistent with this alternative. Under this more aggressive scenario, emissions would be reduced by 3 percent per year between 2016 and 2025. Using the proposed phase-in schedule for the regulation, ARB staff estimated the percent reduction in CO_2 emission rates by model year for those vehicles subject to the proposed ACC Program. Table 2-35 of Appendix T shows the more stringent alternative GHG standard for new vehicles in California. Figure 7-1 through 7-3 show the proposed ACC Program scenario along with the more stringent alternative (i.e., dashed line).

Figure 7-1. ROG Emissions: Baseline, Proposed, and Accelerated Scenarios

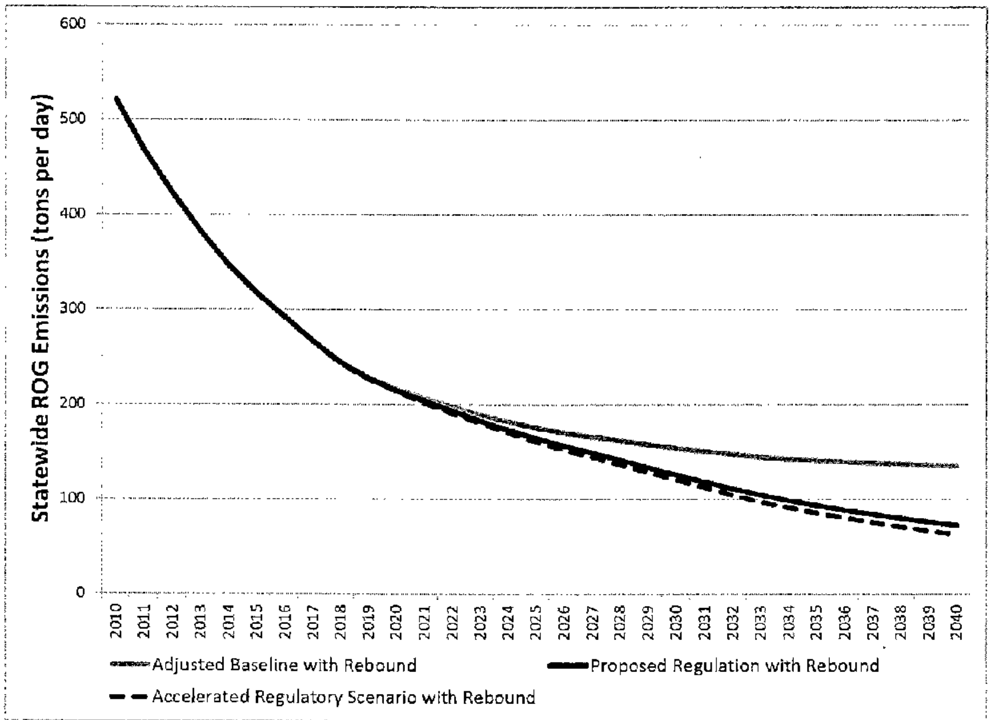


Figure 7-2. NO_x Emissions: Baseline, Proposed, and Accelerated Scenarios

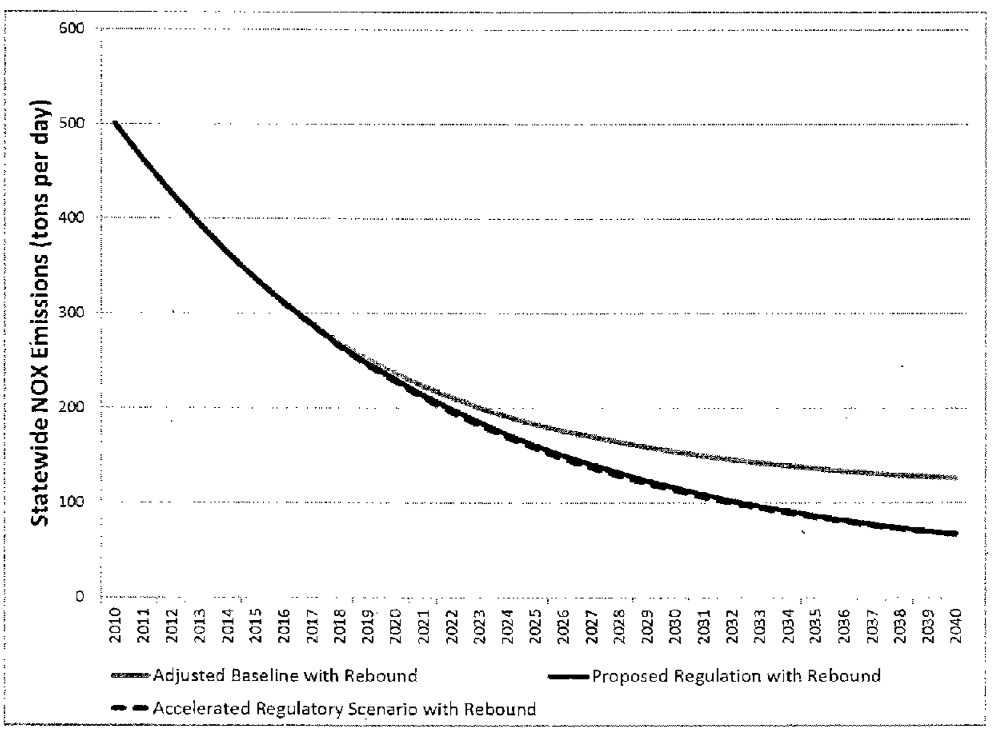


Figure 7-3. CO Emissions: Baseline, Proposed, and Accelerated Scenarios

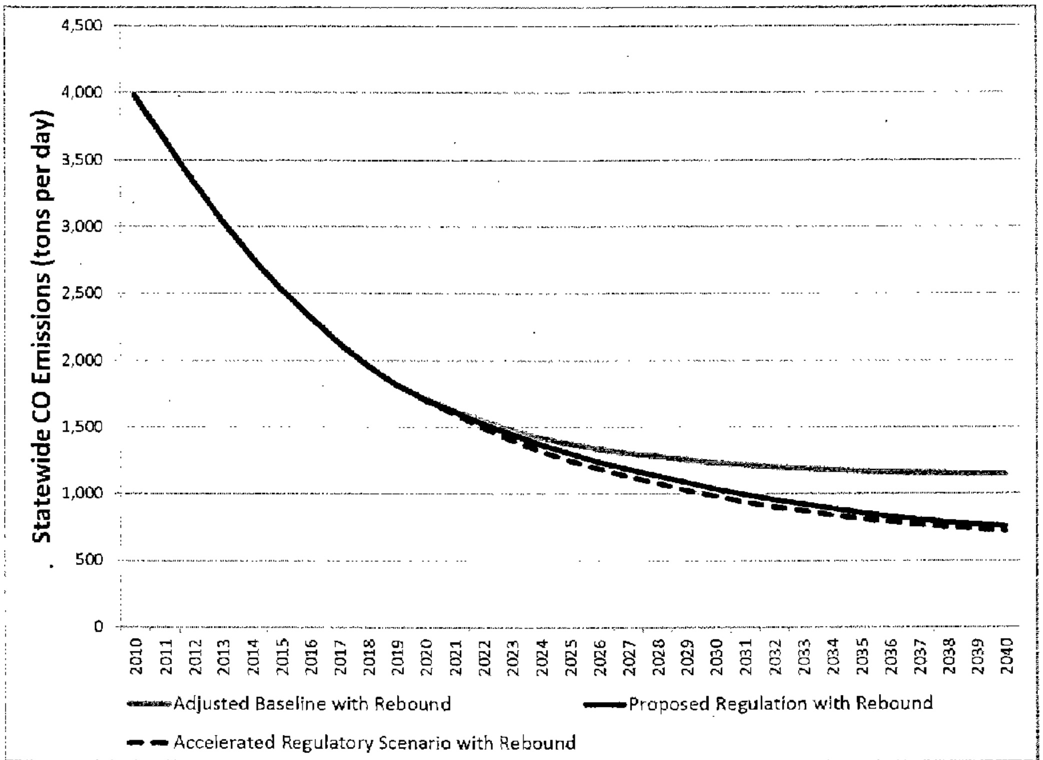
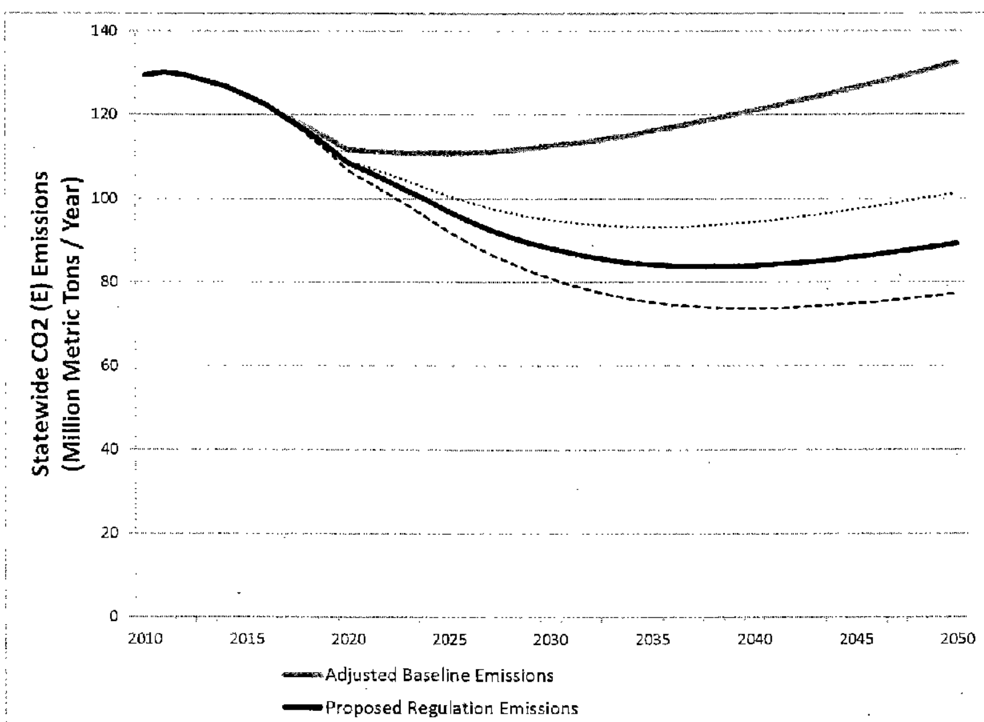


Figure 7-4. Statewide CO_2e Emissions Proposed vs Alternative Greenhouse Gas Regulatory Scenarios (with Rebound)



3. Environmental Impacts

The types of impacts under the More Stringent Alternative would be the same as the proposed amendments to the ACC Program, including potentially significant adverse impacts related to aesthetics, biological resources, cultural resources, geology and soils, hazards and hazardous materials, noise, transportation/traffic, and utilities and service systems. However, because many of the adverse environmental effects would be associated with the development of new or modified manufacturing plants and/or new hydrogen fueling stations, these impacts from compliance responses under the More Stringent Alternative may occur slower as discussed above, but could be greater after complete implementation, than under the proposed ACC Program. This is because the More Stringent Alternative would result in greater penetration of ZEVs and ZEV credit-qualifying vehicles into the statewide vehicle fleet and manufacturers may produce and sell more BEVs and hydrogen FCVs, which earn the highest credit value, to achieve the more requirements of a more stringent ZEV regulation. The More Stringent Alternative could result in more or larger manufacturing plants being constructed, or more intense modifications or expansions to existing plants, and an associated increase in the potential or intensity of those significant adverse impacts identified for the proposed ACC Program in Chapter 6, Impact Analysis and Mitigation. The increase in hydrogen FCVs in the vehicle fleet would then trigger requirements for major refiners and importers of gasoline to build hydrogen fueling stations (i.e., a trigger of 10,000 vehicles within an air basin and 20,000 vehicles statewide). Moreover, the types of environmental impacts associated with the production, distribution, and sale of hydrogen would be the same as for the proposed project with the exception that more hydrogen production and distribution activity and hydrogen fuel outlets would occur. Assuming the trigger level for building required hydrogen fueling stations would occur earlier in time, the impact associated with construction and operation of these stations may be experienced earlier as well.

Beneficial air quality, GHG, and energy effects would be anticipated to be greater overall, but could occur at a slower pace.

C. Less Stringent Emissions Standards in the Low-Emission-Vehicle and Zero Emission Vehicle Regulations

1. Description of the Alternative

This alternative is referred to as the Less Stringent Alternative. It would amend the existing LEV regulation to include less stringent emission standards for light- and medium-duty vehicles for both CAPs and GHGs. More specifically, the standards under this alternative would be less stringent for each model year than those in the proposed ACC Program. This alternative would also amend the ZEV regulation to require manufacturers to earn fewer ZEV credits than would be required under the proposed amendments to the ACC Program. Under this alternative the set of emission standards and ZEV credit requirements that would be phased in for model years 2015 – 2025 would also be less stringent than the proposed ACC Program.

Some attributes of this alternative would be similar to the proposed project, including the replacement of separate standards for NMOG and NO_x with a combined standard that that is based on the sum of these two pollutants. A more robust Federal Test Procedure for measuring emissions would also be required and the "durability basis" would be extended to 150,000 miles to ensure the effectiveness of a vehicle's emissions control systems over the operational life of the vehicle. Also, the SFTP would be extended to medium-duty vehicles the SFTP (known as SFTP II) and would include standards for exhaust emissions of particulate matter. Evaporative emission standards would be extended to more vehicle types and vehicles fueled by gasoline that contains higher percentages of ethanol or other biofuels. Amendments to the CFO regulation would be the same as under the proposed ACC Program.

2. Consistency with Project Objectives

Emissions generated by the statewide fleet of light- and medium-duty vehicles would decrease because the LEV standards under this alternative would be more stringent than the existing LEV regulation standards and the ZEV requirements would be increased from the current ZEV regulation. However, the emissions reduction achieved under this alternative would not be as great as the reductions that would be achieved under the proposed ACC Program. Also, the emissions reduction would not be the maximum feasible reduction that is mandated by HSC Section 43018(a). Thus, this alternative would limit the ability of various air districts throughout the State to attain the State and national ambient air quality standards in their respective air basins.

Similarly, the statewide fleet of light- and medium-duty vehicles would become more GHG-efficient, which would help the State attain its GHG reduction goals; however, the extent of the reduction would be less than the 3.8 MMT CO_2e by 2020 that is identified by ARB as the reduction needed from a ACC Program as identified in ARB's adopted Scoping Plan (ARB 2011b). Thus, this could prevent California from achieving the GHG reduction goal of AB 32, particularly if ARB cannot develop other programs or regulations to reduce GHG emissions. In addition, this alternative would not meet the maximum feasible emission reductions in furtherance of AB 1493.

In addition, the statewide fleet of light- and medium-duty vehicles would become more fuel efficient and, thus, help the State become less dependent on petroleum as an energy source, but not to the extent that it would under the proposed ACC Program.

This alternative would achieve the objective to establish a set of vehicle emissions standards in California and would ensure that some emission reductions would occur.

As described above, the proposed ACC Program includes new future year GHG emission standards that reduce emissions as cleaner vehicles penetrate into the fleet. Because the standards are a fleet mix by calendar year, fleets have the option to comply with them in different way, and the penetration of ZEV vehicles is one of many ways in which the standards could be met. As a result, ARB staff modeled GHG benefits of the combined program and did not evaluate the tailpipe emission benefits of ZEV apart from the other components of the proposed ACC Program.

As part of this analysis, ARB staff evaluated a less aggressive option, which is consistent with this alternative. Under this less aggressive scenario, emissions would not be reduced by 3 percent per year between 2016 and 2025. Using the proposed phase-in schedule for the regulation, ARB staff estimated the percent reduction in CO_2 emission rates by model year for those vehicles subject to the proposed ACC Program. Table 2-34 of Appendix T shows the Less Stringent Alternative GHG standard for new vehicles in California.

3. Environmental Impacts

The types of impacts under the Less Stringent Alternative would be the same as the proposed amendments to the ACC Program, including potentially significant adverse impacts related to aesthetics, biological resources, cultural resources, geology and soils, hazards and hazardous materials, noise, transportation/traffic, and utilities and service systems. However, because many of the adverse environmental affects would be associated with the development of new or modified manufacturing plants and/or new hydrogen fueling stations, the degree of these impacts from these compliance responses under the Less Stringent Alternative may be less, or occur later in time, than under the proposed ACC Program. This is largely because the Less Stringent Alternative would result in slower penetration of ZEVs and ZEV credit-qualifying vehicles into the statewide vehicle fleet and associated production by manufacturers. Nonetheless, this could result in the construction of new manufacturing plants, or modifications or expansions to existing plants, and the same associated impacts identified for the proposed ACC Program in Chapter 5, Impact Analysis and Mitigation. The penetration of hydrogen FCVs in the vehicle fleet would trigger requirements for major refiners and importers of gasoline to build hydrogen fueling stations (i.e., a trigger of 10,000 vehicles within an air basin and 20,000 vehicles statewide). Moreover, the types of environmental impacts associated with the production, distribution, and sale of hydrogen would be the same as for the proposed project with the exception that less hydrogen production and distribution activity would occur and fewer hydrogen fuel outlets would be constructed. Assuming the trigger level for building required hydrogen fueling stations would occur later in time, the impact associated with construction and operation of these stations may be experienced later as well.

Beneficial air quality, GHG, and energy effects would be anticipated to be less than those that would occur with implementation of the proposed ACC program.

D. A Clean Fuels Outlet Regulation Based on a Memorandum of Agreement with Major Refiners and Importers of Gasoline

1. Description of the Alternative

This alternative is referred to as the Memorandum of Agreement (MOA) Alternative. Under the alternative, the obligations of the CFO regulation would be based on an MOA between ARB, major refiners and importers of gasoline, gasoline station owners, hydrogen fuel providers, vehicle manufacturers, and other government entities rather than a codified regulation. The MOA would describe a multilateral agreement among these parties that outlines the criteria that determine the timing and responsibility of constructing new hydrogen fueling stations at various locations in California. Vehicle manufacturers would commit to providing sales forecasts about the number and locations of hydrogen FCVs they anticipate selling or leasing in the State. The MOA would have the binding power of a contract and be legally enforceable.

All other changes to the LEV and ZEV regulations and the EPL would be the same as the proposed ACC Program.

2. Consistency with Project Objectives

Under the MOA Alternative, it is assumed that the requirements for major refiners and importers of gasoline to establish new hydrogen fueling stations outlined in the MOA would be set by agreement, but not more strictly bound by regulation, increasing the potential for varying levels of commitment. This is typically true of MOAs for multiple reasons including that each party to the agreement may interject its own unique stipulations. It is not clear whether a party to the MOA would face penalties if it failed to fulfill the MOA. This could ultimately result in fewer hydrogen fueling stations being constructed in California under an agreement than if the CFO requirements were codified in regulation. Thus, there may not be a sufficient availability of hydrogen fuel for hydrogen fuel vehicles produced and sold by automobile manufacturers to fulfill the requirements of the ZEV regulation. This could ultimately affect California's ability to achieve the maximum emissions reduction possible from motor vehicles as required by HSC Section 43018(a) and to help local air basins attain the California and national ambient air quality standards. It could also hinder California's ability to achieve a reduction of 3.8 MMT CO_2e by 2020 that ARB identified as the reduction needed from an ACC Program to support the adopted Scoping Plan and achieve AB 32 goals (ARB 2011b), and to further AB 1493 reductions. It is too speculative to determine whether ARB would be able to develop and implement other programs or regulations that would achieve this reduction in time Limited availability of hydrogen fuels stations would also adversely affect the objective of reducing California's dependence on petroleum because a sufficient number and variety of fuel options would not be available to consumers.

3. Environmental Impacts

The types of impacts under the MOA Alternative would be the same as the proposed amendments to the ACC Program, including potentially significant adverse impacts related to aesthetics, biological resources, cultural resources, geology and soils, hazards and hazardous materials, noise, transportation/traffic, and utilities and service systems. However, because many of the adverse environmental affects would be associated with the development of new or modified manufacturing plants and/or new hydrogen fueling stations, the degree of these impacts from these compliance responses under the MOA Alternative may be similar to or less than the proposed ACC Program, depending on the degree of commitment to the agreement. Nonetheless, this could result in the construction of new manufacturing plants, or modifications or expansions to existing plants, and the same associated impacts identified for the proposed ACC Program in Chapter 5, Impact Analysis and Mitigation. The penetration of hydrogen FCVs in the vehicle fleet would then trigger requirements for major refiners and importers of gasoline to build hydrogen fueling stations (i.e., a trigger of 10,000 vehicles within an air basin and 20,000 vehicles statewide). Moreover, the types of environmental impacts associated with the production, distribution, and sale of hydrogen would be the same as for the proposed project with the exception that less hydrogen production and distribution activity would occur and fewer hydrogen fuel outlets would be constructed. Assuming the trigger level for building required hydrogen fueling stations would occur later in time, the impact associated with construction and operation of these stations may be experienced later as well.

Beneficial air quality, GHG, and energy effects would be anticipated to be similar to those that would occur with implementation of the proposed ACC program.

E. Alternatives Considered but Rejected as Infeasible

1. Feebate Regulation

A feebate regulation 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 has sponsored research on the potential benefits of a feebate regulation for new vehicles and eliminated it as an option for a number of reasons (ITS 2011). First, given the aggressive performance standards proposed for new vehicles, the additional emission reductions achieved from increased sales of low-emitting vehicles that could result from a feebate regulation would likely be minimal, because the sale of low-emitting vehicles would be partially offset by the sale of high-emitting vehicles. Manufacturers already need to install all available, cost-effective emission-reducing technology, as well as adopt their own internal pricing strategies to comply with the existing LEV standards. A feebate regulation would replace this internal pricing strategy and would only induce substantial, additional emissions reductions if fees and rebates were very high, leading to greater economic impacts on consumers.

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 regulation 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.

2. Targeting High-Emitting Vehicles in the Existing Fleet

ARB considered a regulation that would specifically target high-emitting vehicles in the existing vehicle fleet and would require that they install add-on emission controls to control CAPs. However, this type of regulation would not be cost-effective and would be difficult to enforce. In addition, there is a range of technological difficulties associated with after-market equipment and aftermarket technologies generally are not as cost effective at reducing emissions as emission control systems integrated in a vehicle design without compromising driving performance, ease of use, and/or safety. This approach would not fulfill the requirement of HSC, Section 43018(a), which requires ARB to reduce vehicle emissions of CAPs to the maximally extent feasible.

3. Battery Electric Vehicles or Hydrogen Fuel Cell Vehicles Only

ARB considered requiring all light- and medium-duty vehicles to be BEVs or hydrogen FCVs. Market studies by manufacturers have shown that the market for BEVs and hydrogen FCVs is limited to approximately 30 percent of the light- and medium-duty vehicle fleet.

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8.0 MANDATORY FINDINGS OF SIGNIFICANCE

Consistent with the requirements of CEQA Guidelines, CCR, Title 14, Section 15065 and Appendix G, Environmental Checklist, Section 18, this EA addresses the mandatory findings of significance for a project.

A. Mandatory Findings of Significance

1. **Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat for a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?**

Under CCR, Title 14, Section 15065(a) of the CEQA Guidelines, a finding of significance is required if a project "has the potential to substantially degrade the quality of the environment." In practice, this is the same standard as a significant effect on the environment, which is defined in CCR, Title 14, Section 15382 of the CEQA Guidelines as "a substantial or potentially substantial adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance." As with all of the environmental effects and issue areas, the precise nature and magnitude of impacts would 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-specific level. All of these issues would be addressed through project-specific environmental reviews that would be conducted by local land use agencies or other regulatory bodies at such time the projects are proposed for implementation. ARB would not be the agency responsible for conducting the project-specific environmental review because it is not the agency with authority for making land use decisions.

This EA, in its entirety, addresses and discloses potential environmental effects associated with construction and operation of the proposed ACC Program, including direct, indirect, and cumulative impacts in the following resource areas:

- Aesthetics
- Agriculture and Forestry Resources
- Air Quality
- Greenhouse Gas Emissions

- Biological Resources
- Cultural Resources
- Geology and Soils
- Hazards and Hazardous Materials
- Hydrology and Water Quality
- Land Use and Planning
- Mineral Resources
- Noise
- Population and Housing
- Public Services
- Recreation
- Transportation/Traffic
- Utilities and Service Systems

As described in Chapter 5, this EA discloses potential environmental impacts, the level of significance prior to mitigation, mitigation measures, and the level of significance after the incorporation of mitigation measures.

a. Impacts on Species

Under CCR, Title 14, Section 15065(a)(1) of the CEQA Guidelines, a lead agency shall find that a project may have a significant effect on the environment where there is substantial evidence that the project has the potential to (1) substantially reduce the habitat of a fish or wildlife species; (2) cause a fish or wildlife population to drop below self-sustaining levels; or (3) substantially reduce the number or restrict the range of an endangered, rare, or threatened species. Chapter 5, "Biological Resources," of this EA addresses impacts related to the reduction of the fish or wildlife habitat, the reduction of fish or wildlife populations, and the reduction or restriction of the range of special-status species.

b. Impacts on Historical Resources

CCR, Title 14, Section 15065(a)(1) of the CEQA Guidelines states that a lead agency shall find that a project may have a significant effect on the environment where there is substantial evidence that the project has the potential to eliminate important examples of a major period of California history or prehistory. CCR, Title 14, Section 15065(a)(1) amplifies Public Resources Code (PRC) Section 21001(c) requiring that major periods of California history are preserved for future generations. It also reflects the provisions of PRC Section 21084.1 requiring a finding of significance for substantial adverse changes to historical resources. CCR, Title 14, Section 15064.5 of the CEQA Guidelines establishes standards for determining the significance of impacts to historical resources and archaeological sites that are a historical resource. Chapter 5, "Cultural Resources," of this EA addresses impacts related to California history and prehistory, historic resources, archaeological resources, and paleontological resources.

In addition, as with all of the environmental effects and issue areas, the precise nature and magnitude of impacts would depend on the types of projects authorized, 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-specific level.

2. Does the project have impacts that are individually limited, but cumulatively considerable?

As required by CCR, Title 14, Section 15065 of the CEQA Guidelines, a lead agency shall find that a project may have a significant effect on the environment where there is substantial evidence that the project has potential environmental effects that are individually limited, but cumulatively considerable. As defined in CCR, Title 14, Section 15065(a)(3) of the CEQA Guidelines, cumulatively considerable means "that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects." Cumulative impacts are addressed for each of the environmental topics listed above and are provided in Chapter 6, "Cumulative and Growth-Inducing Impacts," of this EA.

3. Does the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?

Consistent with CCR, Title 14, Section 15065(a)(4) of the CEQA Guidelines, a lead agency shall find that a project may have a significant effect on the environment where there is substantial evidence that the project has the potential to cause substantial adverse effects on human beings, either directly or indirectly. Under this standard, a change to the physical environment that might otherwise be minor must be treated as significant if people would be significant affected. This factor relates to adverse changes to the environment of human beings generally, and not to effects on particular individuals. While changes to the environment that could indirectly affect human beings would be represented by all of the designated CEQA issue areas, those that could directly affect human beings include air quality, geology and soils, hazards and hazardous materials, hydrology and water quality, noise, population and housing, public services, transportation/traffic, and utilities, which are addressed in Chapter 5 of this EA.

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10.0 LIST OF FIGURES

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11.0 LIST OF TABLES

12.0 ACRONYMS AND ABBREVIATIONS

AADT	average annual daily traffic
AB	Assembly Bill
AC	air conditioning
ACC	Advanced Clean Cars
ACEC	Area of Critical Environmental Concern
ACHP	Advisory Council on Historic Preservation
AFV	alternatively fueled vehicle
AICUZ	Department of Defense Air Installations Compatible Use Zones
ALUC	Airport Land Use Commission
APS	Alternative Planning Strategy
ARB or Board	California Air Recourses Board
AST	Above Ground Tanks
BC	black carbon
BEV	battery electric vehicle
BMPs	best management practices
CAA	Clean Air Act
CAFE	Corporate Average Fuel Economy
CAL FIRE	California, Department of Forestry and Fire Protection
CAL Recycle	California Department of Resources Recycling and Recovery
CalARP	California Accidental Release Prevention
CalEPA	California Environmental Protection Agency
Caltrans	California Department of Transportation
CAP	criteria air pollutant and precursor

CBSC	California Building Standards Code
CCAR	California Climate Action Registry
CCAT	California Climate Action Team
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
Census	U.S. Census Bureau
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFO	Clean Fuels Outlets
CGS	California Geological Survey
CH_4	methane
CHP	California Highway Patrol
CN	California Natural Resources Agency
CNEL	Community Noise Equivalent Level
CNPS	California Native Plant Society
CNRA	California Natural Resources Agency
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CPUC	California Public Utilities Code
CUPA	Certified Unified Program Agency
CVP	Central Valley Project
CVTs	continuously variable transmissions

CWA	Clean Water Act
dB	decibel
dBA	A-Weighted Decibel
Delta	Sacramento-San Joaquin Delta
DFG	Department of Fish and Game
DoE	Department of Environment
DOF	State of California, Department of Finance
DOGGR	California Division of Oil, Gas, and Geothermal Resources
DOJ	California Department of Justice
DTSC	California Department of Toxic Substances Control
DWR	California Department of Water Resources
E10	10 percent by volume ethanol
E10 fuel	fuel that contains 10 percent ethanol
EA	Environmental Analysis
EDCs	endocrine disrupting compounds
EDD	California Employment Development Department
EIS	environmental impact statement
EISA	Energy Independence and Security Act
EPCA	Energy Policy and Conservation Act
EPCRA	Emergency Planning and Community Right-to-Know Act
EPL	California Environmental Performance Label
FAA	Federal Aviation Administration
FCVs	fuel cell vehicles
FEMA	Federal Emergency Management Agency

FHA	Federal Highway Administration
FHMR	Federal Hazardous Materials Regulations
FHWA	Federal Highway Administration
FLPMA	Federal Land and Policy Management Act
FRA	Federal Rail Administration
FSOR	Final Statement of Reasons
FTA	Federal Transit Administration
g/mi	grams per mile
gCO_2/mile	grams of CO_2 per mile
GHGs	greenhouse gas
GWP	global warming potential
HAPs	hazardous air pollutants
HC	hydrocarbons
HC	particulate matter, and evaporative emissions of hydrocarbons
HFCs	hydrofluorocarbons
HFCV	hydrogen fuel cell vehicles
HSC	Health and Safety Code
HTAC	Hydrogen and Fuel Cell Technical Advisory Committee of the U.S. Department of Energy
HUD	U.S. Department of Housing and Urban Development
HV	High-Voltage
in/sec	inches per second
IPCC	Intergovernmental Panel on Climate Change
ITS	Institute of Transportation Studies

IVM	intermediate volume manufacturer
kg/day	kilograms per day
kg/yr	kilograms per year
LCFS	Low Carbon Fuel Standard
L_{dn}	Day-Night Noise Level
LDTs	light-duty trucks
LEA	local enforcement agencies
LEPCs	local emergency planning committees
L_{eq}	Equivalent Noise Level
LEV II	LEV regulation
LEV III	Low-Emission Vehicle and Greenhouse Gas Regulation
L_{max}	Maximum Noise Level
L_{min}	Minimum Noise Level
LOS	level of service
LVM	large volume manufacturer
MACT and BACT	maximum or best available control technology for toxics
MDPVs	medium-duty passenger vehicles
MDV	medium-duty vehicles
mg/L	milligrams per liter
MMT	Million Metric Tons
$MMTCO_2e$	million metric tons of carbon dioxide equivalent
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MPOs	Metropolitan Planning Organizations

MRZs	Mineral Resource Zones
MS4 Permit	General Permit for Municipal Separate Storm Sewer Systems Permit
MTBE	methyl tertiary butyl ether
mya	million years ago
N_2O	nitrous oxide
NAGPRA	Native American Graves Protection and Repatriation Act of 1990
NEMA	Association of Electrical and Medical Imaging Equipment Manufacturers
NESHAP	national emissions standards for HAPs
NF_3	nitrogen trifluoride
NHPA	National Historic Preservation Act
NHTSA	National Highway Traffic Safety Administration
NiMH	nickel–metal hydride
NMHC	non-methane hydrocarbon
NMOG	non-methane organic gas
NO_X	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NREL	National Renewable Energy Laboratory
NRHP	National Register of Historic Places
OAQPS	Office of Air Quality Planning and Standards
OEM	original equipment manufacturer
ORVR	onboard refueling vapor recovery
OSHA	U.S. Department of Labor Occupational Safety and Health Administration

PA	Programmatic Agreements
PCBs	polychlorinated biphenyl compounds
PCs	passenger cars
PEM	Proton Exchange Membrane
PFCs	perfluorocarbons
PGM	platinum-group metal
PHEVs	plug-in hybrid electric vehicles
PIER	Public Interest Energy Research
PM	particulate matter
polycarbonate	plastics and carbon composites
ppb	parts per billion
PPV	peak particle velocity
PRC	Public Resources Code
PUC	California Public Utilities Commission
PZEV	Partial Zero Emission Vehicle
RCRA	Resource Conservation and Recovery Act
RFS	Renewable Fuels Standard
RMP	Risk Management Plan
RMS	root-mean-square
RNHA	Regional Housing Needs Allocation
ROG	reactive organic gas
ROWs	right-of-ways
RTP	Regional Transportation Plan
RWQCB	regional water quality control board

SAE	Society of Automotive Engineers
SARA	Superfund Amendments and Reauthorization Act
SBE	State Board of Education
SCR	selective catalytic reduction
SCS	Sustainable Communities Strategy
SDC	Seismic Design Criteria
SDWA	Safe Drinking Water Act
SERCs/TERCs	state/tribe emergency response commissions
SF_6	sulfur hexafluoride
SFTP	California Supplemental Federal Test Procedure
SHPO	State Historic Preservation Officer
SIC	Standard Industrial Classification
SIPs	State Implementation Plans
SMARA	Surface Mining and Reclamation Act
SMR	steam methane reformation
SULEVs	Super-Ultra-Low-Emission Vehicles
SUVs	sport utility vehicles
SWAMP	Surface Water Ambient Monitoring Program
SWP	State Water Project
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	California State Water Resources Control Board
TACs	toxic air contaminants
TDS	Total dissolved solids
TMDL	Total Maximum Daily Load

TPY	tons per year
TSCA	Toxic Substances Control Act
TZEV	Transitional Zero Emission Vehicles
U.S. BR	U.S. Bureau of Reclamation
U.S. EPA	U.S. Environmental Protection Agency
ULEVs	Ultra-Low-Emission Vehicles
UNEP	United Nations Environment Programme
USACE	U.S. Army Corps of Engineers
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
UST	Underground Tanks
V/C	volume-to-capacity ratio
VC	California Vehicle Code
VdB	vibration decibels
VMT	vehicle miles travelled
WDRs	waste discharge requirements
WMO	World Meteorological Organization
WSA	water supply assessment
ZEV	Zero Emission Vehicle

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ATTACHMENT 1. ENVIRONMENTAL CHECKLIST

Refer to Chapter 5.0, Impact Analysis and Mitigation, for a full discussion of the environmental issues.

A. Aesthetics

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact/No Impact	Beneficial Impact
Aesthetics. Would the project:				
a) Have a substantial adverse effect on a scenic vista?	☒	☐	☐	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a State scenic highway?	☒	☐	☐	☐
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☒	☐	☐	☐
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☒	☐	☐	☐

B. Agriculture and Forest Resources

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact/No Impact	Beneficial Impact
Agriculture and Forest Resources.				
In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997, as updated) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the State's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board.				
Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☒	☐
b) Conflict with existing zoning for agricultural use or a Williamson Act contract?	☐	☐	☒	☐
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220[g]), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104[g])?	☐	☐	☒	☐
d) Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☒	☐
e) Involve other changes in the existing environment, which, due to their location or nature, could result in conversion of Farmland to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☒	☐

C. Air Quality

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact/No Impact	Beneficial Impact
Air Quality.				
Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied on to make the following determinations.				
Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?				
Construction Impacts	☐	☒	☐	☐
Operational Impacts	☐	☐	☐	☒
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?				
Construction Impacts	☐	☒	☐	☐
Operational Impacts	☐	☐	☐	☒
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or State ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?				
Construction Impacts	☐	☒	☐	☐
Operational Impacts	☐	☐	☐	☒
d) Expose sensitive receptors to substantial pollutant concentrations?				
Construction Impacts	☐	☒	☐	☐
Operational Impacts	☐	☐	☐	☒
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☒	☐

D. Greenhouse Gas Emissions

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact/No Impact	Beneficial Impact
Greenhouse Gas Emissions. Would the project:				
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☐	☒
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☐	☒

E. Biological Resources

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact/No Impact	Beneficial Impact
Biological Resources. Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or the U.S. Fish and Wildlife Service?	☒	☐	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by the California Department of Fish and Game or the U.S. Fish and Wildlife Service?	☒	☐	☐	☐
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☒	☐	☐	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☒	☐	☐	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☒	☐	☐	☐
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or State habitat conservation plan?	☒	☐	☐	☐

F. Cultural Resources

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact/No Impact	Beneficial Impact
Cultural Resources. Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in Section 15064.5?	☒	☐	☐	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5?	☒	☐	☐	☐
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☒	☐	☐	☐
d) Disturb any human remains, including those interred outside of formal cemeteries?	☒	☐	☐	☐

G. Geology and Soils

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact/No Impact	Beneficial Impact
Geology and Soils. Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? (Refer to California Geological Survey Special Publication 42.)	☒	☐	☐	☐
ii) Strong seismic ground shaking?	☒	☐	☐	☐
iii) Seismic-related ground failure, including liquefaction?	☒	☐	☐	☐
iv) Landslides?	☒	☐	☐	☐
b) Result in substantial soil erosion or the loss of topsoil?	☒	☐	☐	☐
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	☒	☐	☐	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994, as updated), creating substantial risks to life or property?	☒	☐	☐	☐
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☒	☐

H. Hazards and Hazardous Materials

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact/No Impact	Beneficial Impact
Hazards and Hazardous Materials. Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☒	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and/or accident conditions involving the release of hazardous materials into the environment?	☒	☐	☐	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☒	☐
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☒	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☒	☐
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☒	☐
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☒	☐
h) Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☒	☐

I. Hydrology and Water Quality

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact/No Impact	Beneficial Impact
Hydrology and Water Quality. Would the project:				
a) Violate any water quality standards or waste discharge requirements?	☐	☐	☒	☐
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☒	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial on- or off-site erosion or siltation?	☒	☐	☐	☐
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in on- or off-site flooding?	☒	☐	☐	☐
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☒	☐
f) Otherwise substantially degrade water quality?	☐	☐	☒	☐
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☒	☐	☐	☐
h) Place within a 100-year flood hazard area structures that would impede or redirect flood flows?	☒	☐	☐	☐
i) Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam?	☒	☐	☐	☐
j) Result in inundation by seiche, tsunami, or mudflow?	☒	☐	☐	☐

J. Land Use and Planning

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact/No Impact	Beneficial Impact
Land Use and Planning. Would the project:				
a) Physically divide an established community?	☐	☐	☒	☐
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to, a general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☒	☐
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☒	☐

K. Mineral Resources

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact/No Impact	Beneficial Impact
Mineral Resources. Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the State?	☐	☐	☒	☐
b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?	☐	☐	☒	☐

L. Noise

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact/No Impact	Beneficial Impact
Noise. Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or in other applicable local, State, or federal standards?	☒	☐	☐	☐
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☒	☐	☐	☐
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☒	☐	☐	☐
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☒	☐	☐	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☒	☐
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☒	☐

M. Population and Housing

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact/No Impact	Beneficial Impact
Population and Housing. Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☒	☐
b) Displace substantial numbers of existing homes, necessitating the construction of replacement housing elsewhere?	☐	☐	☒	☐
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☒	☐

N. Public Services

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact/No Impact	Beneficial Impact
Public Services. Would the project:				
a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, or the need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:				
Fire protection?	☐	☐	☒	☐
Police protection?	☐	☐	☒	☐
Schools?	☐	☐	☒	☐
Parks?	☐	☐	☒	☐
Other public facilities?	☐	☐	☒	☐

O. Recreation

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact/No Impact	Beneficial Impact
Recreation. Would the project:				
a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☒	☐
b) Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?	☐	☐	☒	☐

P. Transportation/Traffic

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact/No Impact	Beneficial Impact
Transportation/Traffic. Would the project:				
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?				
Construction Impacts	☒	☐	☐	☐
Operational Impacts	☐	☐	☒	☐
b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?				
Construction Impacts	☒	☐	☐	☐
Operational Impacts	☐	☐	☒	☐
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?				
Construction Impacts	☒	☐	☐	☐
Operational Impacts	☐	☐	☒	☐
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?				
Construction Impacts	☒	☐	☐	☐
Operational Impacts	☐	☐	☒	☐
e) Result in inadequate emergency access?				
Construction Impacts	☒	☐	☐	☐
Operational Impacts	☐	☐	☒	☐
f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?				
Construction Impacts	☒	☐	☐	☐
Operational Impacts	☐	☐	☒	☐

Q. Utilities and Service Systems

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact/No Impact	Beneficial Impact
Utilities and Service Systems. Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☒	☐	☐	☐
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☒	☐	☐	☐
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☒	☐	☐	☐
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☒	☐	☐	☐
e) Result in a determination by the wastewater treatment provider that serves or may serve the project that it has adequate capacity to serve the project's projected demand, in addition to the provider's existing commitments?	☒	☐	☐	☐
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☒	☐	☐	☐
g) Comply with federal, State, and local statutes and regulations related to solid waste?	☒	☐	☐	☐

R. Mandatory Findings of Significance

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact/No Impact	Beneficial Impact
Mandatory Findings of Significance.				
a) Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of an endangered, rare, or threatened species, or eliminate important examples of the major periods of California history or prehistory?	☒	☐	☐	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	☒	☐	☐	☐
c) Does the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?	☒	☐	☐	☐

Authority: Public Resources Code Sections 21083, 21083.5.
Reference: Government Code Sections 65088.4.
Public Resources Code Sections 21080, 21083.5, 21095; *Eureka Citizens for Responsible Govt. v. City of Eureka* (2007) 147 Cal.App.4th 357; *Protect the Historic Amador Waterways v. Amador Water Agency* (2004) 116 Cal.App.4th at 1109; *San Franciscans Upholding the Downtown Plan v. City and County of San Francisco* (2002) 102 Cal.App.4th 656.

Appendix C

ECONOMIC ANALYSIS INPUTS

APPENDIX C
Economic Analysis Inputs

The following appendix provides additional information on the assumptions used in the staff's economic analysis, found in the Zero Emission Vehicle (ZEV) Initial Statement of Reasons (ISOR). Additional information is provided regarding electricity and hydrogen fuel prices, electric charging equipment costs, purchase incentives, and gasoline fuel tax revenue losses.

Impact to Manufacturers - Infrastructure Inputs

Electricity Rates

Assumed electricity rates for battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV) were used for determining consumer payback periods in Table 5.4, Section 5.4. A number of factors will have impacts on future electricity rates, some of which are vehicle owner specific depending on how and when they charge. These factors include increased power production costs due to the state's 33-percent Renewable Portfolio Standard (RPS) by 2020, time-of-use (TOU) rates that offer low super-off-peak rates coupled with high on-peak rates, increased local distribution costs as more electric vehicles charge from the grid, and infrequent fast charging at a premium price. Table C.1 below summarizes various electric rate programs and projections for reference purposes.

Table C.1: Sample electric rate programs or projections (2009$) (California except where noted)

	$/kWh
Average residential retail rate in California (2010)	0.127
Projected residential retail rate under 33% RPS (2020)[1]	0.17
AEO 2010-2035 reference electric rate	0.10
Ave. transportation electric rate (CEC IEPR 2011 fuel prices)	0.126
Experimental EV TOU for SDG&E (super off-peak /off-peak /on-peak)[2]	0.08/0.18/0.29

kWh: kilowatt hour
AEO: Annual Energy Outlook
CEC IEPR: California Energy Commission Integrated Energy Policy Report
SDG&E: San Diego Gas and Electric

For this analysis, a fixed electric rate of $0.15/kWh was assumed for 2017 and beyond. This simplified scenario value is a balance between potential rate increases from carbon and renewables policies, but also expected off-peak charging with lower TOU rates. Estimating a more accurate average electric rate for BEV and PHEV drivers is not realistic, given the number of uncertainties that could have large effects on the price. Future driver charging trends will be important to study, which will affect average electric rates depending on the time of day charging occurs, and whether it is a residential or public charge location. Additionally, the future use of sub (or separate) meters for

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[1] E3, 2010. Energy & Environmental Economics (E3), prepared for CPUC, October 2010. "Greenhouse Gas Modeling of California's Electricity Sector to 2020: Updated results of the GHG Calculator."
[2] CPUC, 2010. California Public Utilities Commission. June 24, 2010. Resolution E-4334.

residential dedicated charging circuits will have a large impact on the price. In California household, electricity rates increase with electricity use. The addition of an electric car to the household electricity load will push the usage into the highest tiers, raising the rates to the maximum level. So, if a separate meter and account is allowed, the car can be disassociated with the house and the household is not penalized for including the car in the household load.

Electric Vehicle Service Equipment (EVSE) Equipment

The purchase and installation of residential electric vehicle chargers, commonly referred to as electric vehicle service equipment (EVSE), was included in the incremental vehicle prices for BEVs and PHEVs (Table 5.1, ZEV ISOR).[3,4] However, the following tables provide details of these assumptions. Table C.2 below provides details of the residential EVSE level assumed for the varying technology types. Generally, advanced vehicles with smaller battery packs (e.g. PHEV with 20 miles electric range) can be accommodated with Level 1 (L1) home charging, whereas BEVs will need to more heavily rely on home Level 2 (L2) charging.

Table C.2: Charging type by vehicle technology and class

	PHEV20	**PHEV40**	**BEV75**	**BEV100**	**BEV150**
Subcompact	100% L1	25% L1, 75% L2	100% L2	100% L2	100% L2
Compact	100% L1	10% L1, 90% L2	100% L2	100% L2	100% L2
Midsize	100% L1	100% L2	100% L2	100% L2	100% L2
Small truck	100% L1	100% L2	100% L2	100% L2	100% L2

Table C.3 below shows the cost assumptions used in this analysis, drawn from the joint analysis with the Environmental Protection Agency (EPA) and National Highway Traffic Safety Administration (NHTSA). The costs below account for charging technology cost reductions over time, fixed labor rates for electrical contractors, and a varying level of home installations depending on how large the battery pack is in the vehicle. Level 1 residential chargers were assumed to be $30 in 2025, and Level 2 chargers were assumed to be $202 in 2025.

[3] DOE, 2011a. United States Department of Energy. Fact Sheet. 2011. "*Electric Vehicle Charging Equipment Permitting*"
[4] DOE, 2011b. United States Department of Energy Clean Cities. Fact Sheet. April 2011. "*Plug-in Electric Vehicle Fact Sheet*"

Table C.3: Residential EVSE Cost Assumptions, 2009$

Cost type	Technology	Vehicle Class	2020	2025
Direct manufacturing cost (DMC)	PHEV20 charger	All	38	30
	PHEV40 charger	Subcompact	199	159
		Compact	231	185
		Midsize, small truck	252	202
	BEV charger	All	252	202
Indirect costs (IC)	PHEV20 charger	All	18	10
	PHEV40 charger	Subcompact	92	55
		Compact	107	64
		Midsize, small truck	117	70
	BEV charger	All	117	70
Total costs	PHEV20 charger	All	55	41
	PHEV40 charger	Subcompact	291	214
		Compact	338	249
		Midsize, small truck	369	272
	BEV charger	All	369	272
Labor	All	All	1009	1009

Although electric sub-meters are not required for homeowners to charge a BEV or a PHEV, and costs for such were not considered in this analysis, they will be necessary for homeowners to take advantage of electric vehicle-specific TOU electric rates in the future. Additionally, future vehicles may have this sub-meter capability built into the vehicle's computer and communication with electric utilities. With today's homeowner costs for sub-meters, the cost break-even period could be substantial as the electric vehicle specific TOU rate may not be much lower than the whole house TOU rate.

Hydrogen Pricing

Assumed hydrogen prices for fuel cell vehicles (FCV) were used for determining consumer payback periods in Table 5.6, Section 5.3.1. It is difficult to project the price of hydrogen for transportation, particularly in the next few years when a network of distribution stations is first being formed. Academic and federal national laboratory analysis largely focuses on relatively large stations operating at high throughput utilization. A supporting factor that will contain costs for early networks, however, is that hydrogen production will predominantly come from existing centralized industrial facilities. In order to perform the economic analyses for the Low Emission Vehicle (LEV), the ZEV, and the Clean Fuels Outlet (CFO) regulations, staff assumed a linear decreasing price scenario as shown in Table C.4. For further details on how staff estimated the hydrogen fuel price, refer to the CFO ISOR, Section 5 and Appendix E.

Table C.4. Delivered Hydrogen Price Scenario by Year - (2009 $)

Year	2018	2019	2020	2021	2022	2023	2024	2025
Price, $/kg	$13	$12	$11	$10	$9	$8	$7	$6

Although the information in Table C.4 was developed for the economic analyses, it is by no means intended to serve as a pricing schedule for retail hydrogen.

In addition to electricity and hydrogen fuel prices, detailed estimates of future gasoline prices were assumed. Table C.5 below shows a sample of gasoline prices used to calculate the impact to the consumer.

Table C.5. Select Retail Gasoline Fuel Prices (2009 dollars per gallon)*

Year	Price
2011	$3.68
2015	$4.06
2020	$4.06
2025	$4.02
2030	$4.17

Average of high and low cases, converted from 2010 dollars using Consumer Price Index adjustment factor.

*CEC, 2011. California Energy Commission. Draft Staff Report, August 2011. "Transportation Energy Forecasts and Analyses for the 2011 Integrated Energy Policy Report" http://www.energy.ca.gov/2011publications/CEC-600-2011-007/CEC-600-2011-007-SD.pdf

Details of these values, and their information sources, can be found in the LEV III ISOR Section VII-B.

Impacts to Individuals – Incentive Considerations

As referred to in Section 5.3, Potential Impacts to Individuals, vehicle and equipment purchase incentives can have a positive impact on consumers' purchase decisions for advanced vehicles and fuels. Although this incentive information was not directly included in the staff analysis, as incentives are expected to have expired soon after 2015, it is provided here as background information.

Many advanced vehicles have temporary government incentives designed to help increase demand and use. Table C.6 shows the most relevant federal and state incentives that exist for purchasing electric vehicles. There are a number of additional incentives at the state and local level, primarily for charging equipment subsidies, but are too numerous to list here. The California Energy Commission's Assembly Bill 118 program funds are partly used for residential vehicle charging equipment, and the South Coast and Bay Area Air Quality Management Districts have substantial regional funds available.

Table C.6: Current Incentive Programs at the Federal and State Level

Incentive Program	Description	Yrs Effective
Federal vehicle tax credit, PEVs	$7,500 for BEVs; $4,500 - $7500 for PHEVs; Max 200,000 vehicles per manufacturer	2009 -
Federal vehicle tax credit, FCVs	$4,000 for FCVs	2009 - 2014
California vehicle rebate	$2,500 for ZEVs (BEV or FCV); $2,000 for PHEV	2010 - 2015

A list of all the incentive programs, with cross-references by technology and/or fuel type, can be found at www.DriveClean.ca.gov. By 2015, the majority of existing incentives will not be available. Net consumer calculations shown here did not assume any incentives in the 2020 through 2025 period.

Impacts to Local and State Agencies – Fuel Tax Revenue Considerations

As noted in Section 5.6, gasoline tax revenues will be impacted by vehicle fleets that become more efficient and transition to non-gasoline or diesel fuels. Gasoline tax revenue has not been rising with increased transportation infrastructure costs, and as a result, revenue generation is no longer keeping pace with expenditures. The primary reason is the existing tax rates have not changed for many years and are not indexed to inflation. However, a secondary reason is the vehicle fleet is becoming more efficient. The new national fleet standard will compound this challenge. A third issue with the current tax structure, though minor in scale, is that hydrogen and transportation electricity are not taxed for these transportation infrastructure costs.

Although this challenge is not a result of the LEV III and ZEV regulations, the scale of the problem is large enough to warrant highlighting in this analysis. Table C.7 below shows the fuel tax losses over the years of the LEV III regulation (2017-2025) given today's taxation structure (Federal and California).

Table C.7: Lost fuel tax revenue from entire LEV III fleet displacing gasoline usage in California (2017-2025, 2009$)[1, 2]

Gasoline displaced (million gallons)	5,960
Total tax revenue loss ($ millions)	**$ 3,980**

1. Gasoline taxation includes three components:
   - $0.184 /gallon federal fuel tax
   - $0.357 /gallon state excise tax
   - Variable state sales tax. This includes $0.055 prepaid sales tax/gallon + 2.25% sales tax on the retail (untaxed) price of fuel.
2. References:
   i. API, 2011. American Petroleum Institute, as published on CaliforniaGasPrices.com. Webpage. "USA Tax Map" May 2011 http://www.californiagasprices.com/USA_Tax_Map.aspx. Accessed November 7, 2011.
   ii. BOE, 2011. State of California Board of Equalization. Website. Fuel Tax Swap Frequently Asked Questions (FAQ) http://www.boe.ca.gov/sutax/gasswapfaq.htm#1 Accessed November 7, 2011.

This loss in fuel tax revenue directly affects budgets for transportation infrastructure and system improvements, including road improvements, subsidies for mass transit, and non-vehicle modes (bicycle routes, etc). The estimates in Table C.7 assume all federal fuel taxes collected from California fuel sales ultimately return to California through the state dispersements. Historically, California has not received its proportional share (less than 100% returned).

REFERENCES
Appendix C

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