

State of California
Air Resources Board

Public Hearing to Consider Proposed Amendments to the Small Off-Road Engine Regulations: Transition to Zero Emissions

Staff Report: Initial Statement of Reasons

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Acronyms

ABT – Averaging, Banking, and Trading

AGZA – American Green Zone Alliance

ANSI – American National Standards Institute

ARB – California Air Resources Board

ASTM – ASTM International

BAAQMD – Bay Area Air Quality Management District

Board – California Air Resources Board

CARB – California Air Resources Board

CCR – California Code of Regulations

CEQA – California Environmental Quality Act

CFR – Code of Federal Regulations

CH₄ – Methane

CIPM MRA – Mutual Recognition Arrangement of the *Comité International des Poids et Mesures*

CNG – Compressed natural gas

CO – Carbon monoxide

CO₂ – Carbon dioxide

CO₂e – Carbon dioxide equivalents

CORE – Clean Off-Road Equipment Voucher Incentive Project

COVID-19 – Coronavirus Disease 2019

CP – Certification Procedure

CSUF – California State University, Fullerton

CSUF SSRC – California State University, Fullerton Social Science Research Center

CVS – Constant volume sampling system

DEF – Diesel exhaust fluid

DF – Deterioration factor

DOF – California Department of Finance

EA – Environmental Analysis

EFELD – Evaporative Family Emission Limit Differential

EIR – Environmental Impact Report

EMA – Truck and Engine Manufacturers Association

EMEL – Evaporative Model Emission Limit

EO – Executive Order

ER – Emergency Room

EVR – Enhanced vapor recovery

FEL – Family Emission Level

FID – Flame ionization detector

FTIR – Fourier transform infrared

GDF – Gasoline dispensing facility

GHG – Greenhouse gas

GPA – Gas Processors Association

H₂O – Water

HC – Hydrocarbons

HSC – Health and Safety Code

IPCC – Intergovernmental Panel on Climate Change

ISO – International Organization of Standardization

ISOR – Initial Statement of Reasons (this Staff Report)

IWG – Interagency Working Group

LNG – Liquefied natural gas

LPG – Liquefied petroleum gas

LSI – Large spark-ignition

MECA – Manufacturers of Emission Controls Association

MSS – CARB’s 2020 Mobile Source Strategy

MY – Model Year

NAAQS – National Ambient Air Quality Standards

NASEM – National Academies of Science, Engineering, and Medicine

NEMA – National Electrical Manufacturers Association

NGS – National Geodetic Survey

NIST – National Institute of Standards and Technology

NMHC – Nonmethane hydrocarbon

NMHCE – Nonmethane hydrocarbon equivalent

NMNEHC – Nonmethane-nonethane hydrocarbon

NO_x – Oxides of nitrogen

OAL – Office of Administrative Law

OMB – Office of Management and Budget

OPEI – Outdoor Power Equipment Institute

OSHA – Occupational Safety and Health Administration

PEMS – Portable emission measurement system

PFC – Portable fuel container

PM – Particulate matter

PM_{2.5} – Particulate matter with diameter of 2.5 micrometers or less

PM₁₀ – Particulate matter with diameter of 10 micrometers or less

PRC – Public Resource Code

PSPS – Public Safety Power Shutoffs

REMI – Regional Economic Models, Inc.

RSQE – University of Michigan’s Research Seminar in Quantitative Economics

ROG – Reactive organic gases

SAE – SAE International

SAM – State Administrative Manual

SBAPCD – Santa Barbara Air Pollution Control District

SC-CO₂ – Social cost of carbon

SCAQMD – South Coast Air Quality Management District

SHED – Sealed housing for evaporative determination

SI – *Système International d’Unités*

SIP – State Implementation Plan

SJVAPCD – San Joaquin Valley Air Pollution Control District

SORE – Small off-road engines

SRIA – Standardized Regulatory Impact Analysis or Standardized Regulatory Impact Assessment

TAC – Toxic Air Contaminant

THC – Total hydrocarbons

THCE – Total hydrocarbon equivalent

TP – Test Procedure

tpd – Tons per day

TSD – Technical Support Document

U.S. EPA – United States Environmental Protection Agency

USB – Universal Serial Bus

UV – Ultraviolet

ZEE – Zero-emission equipment

Units of Measure

° – degrees

% – percent

cc – cubic centimeters

g – grams

hp – horsepower

kgal – thousand gallons

kW – kilowatt

kWh – thousand Watt hours

lbs – pounds

m – meters

m³ – cubic meters

μm – micrometers

μg – micrograms

MMT – million metric tons

ppb – parts per billion

tpd – tons per day

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Executive Summary

In this rulemaking, the California Air Resources Board (CARB or Board) staff is proposing amendments to the Small Off-Road Engine (SORE) Exhaust and Evaporative Emission Regulations and Test Procedures (collectively, Proposed Amendments).

The Proposed Amendments would accelerate the transition of SORE equipment to zero-emission equipment (ZEE). SORE equipment and ZEE are collectively referred to as small off-road equipment. Deployment of ZEE is key to meeting the expected emission reductions in the Revised Proposed 2016 State Strategy for the State Implementation Plan (2016 State SIP Strategy) and the goals of Governor Newsom's Executive Order (EO) N-79-20, issued September 23, 2020. The Proposed Amendments would update emission standards for new SORE (engines or equipment produced for sale or lease for use or operation in California) and would not affect equipment already in use.

This Executive Summary and the Staff Report comprise the Initial Statement of Reasons (ISOR) for this proposed rulemaking, required by the California Administrative Procedure Act. Appendices A-G contain the Proposed Amendments:

- Appendix A: Proposed Amendments to the Small Off-Road Engine Exhaust Emission Regulations, California Code of Regulations, Title 13, Division 3, Chapter 9. Off-Road Vehicles and Engines Pollution Control Devices, Article 1. Small Off-Road Engines
- Appendix B: Proposed Amendments to the Small Off-Road Engine Evaporative Emission Regulations, California Code of Regulations, Title 13, Division 3, Chapter 15. Additional Off-Road Vehicles and Engines Pollution Control Requirements, Article 1. Evaporative Emission Requirements for Off-Road Equipment
- Appendix C: Proposed Amendments to Small Off -Road Engine Evaporative Emissions Test Procedure, TP-901, Test Procedure for Determining Permeation Emissions from Small Off-Road Engine Fuel Tanks
- Appendix D: Proposed Amendments to Small Off-Road Engine Evaporative Emissions Test Procedure, TP-902, Test Procedure for Determining Evaporative Emissions from Small Off-Road Engines
- Appendix E: Proposed Amendments to Small Off-Road Engine Evaporative Emission Control System Certification Procedure, CP-902, Certification Procedure for Evaporative Emission Control Systems on Small Off-Road Engines

- Appendix F: Proposed Amendments to the California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1054)
- Appendix G: Proposed Amendments to the California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1065)

The proposed changes in Appendices A-G are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions from the existing regulatory text.

A. Authority to Regulate SORE

Section 209(e) of the federal Clean Air Act uniquely grants the State of California the authority to adopt and enforce emission standards and other requirements relating to the control of emissions from new nonroad engines or vehicles within the state, which includes SORE. California is, effectively, allowed an exemption from federal Clean Air Act provisions that otherwise prevent states from setting their own emission standards for these nonroad mobile sources. The exemption recognizes California's long standing air pollution challenges and pioneering work to reduce mobile source emissions. Under section 209, subsection (e)(1) of the federal Clean Air Act, "New engines which are used in construction equipment or vehicles or used in farm equipment or vehicles and which are smaller than 175 horsepower" are preempt from CARB's emission standards and only subject to emission standards from the U.S. Environmental Protection Agency (U.S. EPA).

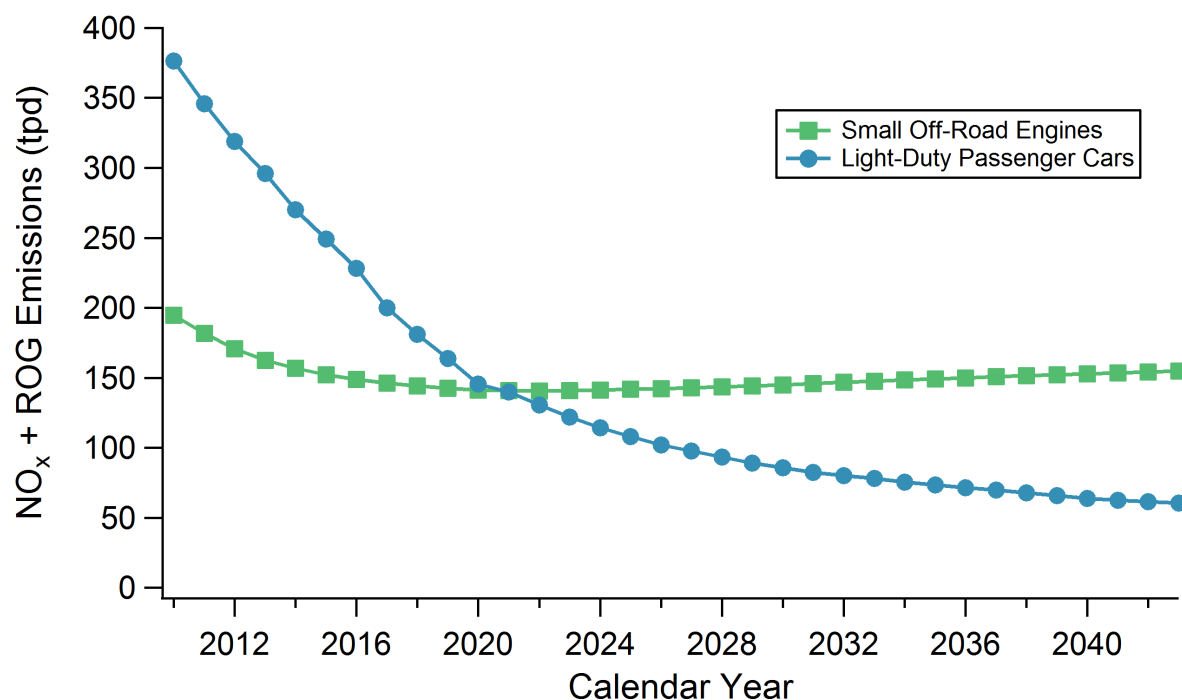
B. Purpose of Proposed Amendments

Statewide, more than 28 million Californians live in areas that exceed the national ambient air quality standards (NAAQS) for ozone and PM_{2.5} (particulate matter with diameter of 2.5 micrometers or smaller) (CARB, 2021a2). Mobile sources powered by fossil fuels are the largest sources of emissions that contribute to formation of these pollutants. Under California Health and Safety Code (HSC) section 43013, CARB must adopt emission standards for off-road engines "for the control of air contaminants and sources of air pollution which [CARB] has found to be necessary, cost effective, and technologically feasible, to carry out the purposes of [its statutory authority under the HSC]" The Proposed Amendments are necessary to meet CARB's obligation under HSC section 43018 to "endeavor to achieve the maximum degree of emission reduction possible from vehicular and other mobile sources in order to accomplish the attainment of the state standards at the earliest practicable date." Replacing sales of internal combustion engines in both on-road and off-road applications with zero-emission technology is necessary to attain ambient air quality standards and protect the health and welfare of all California residents.

SORE are spark-ignition engines rated at or below 19 kilowatts (25.5 horsepower). These engines are used in a variety of small off-road equipment types, including, but not limited to, lawn mowers, leaf blowers, chainsaws, pressure washers, air compressors, and portable generators. Equipment powered by SORE are referred to

as SORE equipment. SORE equipment emit both oxides of nitrogen (NO and NO₂, denoted NO_x) and reactive organic gases (ROG), which contribute to particulate matter (PM) and ozone formation. In California, SORE emit more NO_x and ROG than light-duty passenger cars, both in summer and annually. As shown in Figure ES-1, without further action, SORE will emit 1.8 times the amount of summertime NO_x and ROG that California light-duty passenger cars emit in 2031 (CARB, 2020).

Figure ES-1. Summer average NO_x + ROG emissions from small off-road engines and light-duty passenger cars in California without further regulation.



The 2016 State SIP Strategy includes a measure estimated to reduce statewide NO_x and ROG emissions from SORE by 4 and 36 tons per day (tpd), respectively, in 2031. The Proposed Amendments would exceed these expected emission reductions to help California attain PM_{2.5} and ozone NAAQS. The Proposed Amendments are also part of a portfolio of “Strategies, in coordination with other State agencies, U.S. Environmental Protection Agency and local air districts, to achieve 100 percent zero-emission from off-road vehicles and equipment operations in the State by 2035,” as directed in EO N-79-20, issued September 23, 2020.

C. Summary of Proposed Amendments

The Proposed Amendments would set SORE emission standards to zero in two phases. First, for model year (MY) 2024 and all subsequent model years, exhaust emission standards would be set to zero (0.00 grams per kilowatt-hour or g·kWh⁻¹), except for carbon monoxide (CO). Evaporative emission standards would also be set to zero (0.00 grams per test or g·test⁻¹). The evaporative emission standards would include “hot soak” emissions (representing emissions that occur when placing a hot engine in storage after use on a hot summer day) to better evaluate emissions from

real-world use of SORE equipment. These emission standards of zero would apply for engines used in all equipment types produced for sale or lease for operation in California, except generators. Generator emission standards would be more stringent than the existing emission standards starting in MY 2024, but would not be zero. The second phase would be implemented starting in MY 2028, when the emission standards for generators would be zero.

The Proposed Amendments would also amend existing emission reduction credit programs to improve consistency and add flexibility for manufacturers. The exhaust emission regulations include an emission reduction credit averaging, banking, and trading (ABT) program, where manufacturers can generate credits with engines that emit below the emission standards and use them to produce engines that emit above the emission standards. This averaging of emissions gives manufacturers the flexibility to certify those higher-emitting engines. Exhaust emission reduction credits may be banked for up to five years, to be used later, or may be traded with other manufacturers. The existing evaporative emission reduction credit program only includes averaging and banking. In the Proposed Amendments, trading would be added to the evaporative credit program. New zero-emission generator credit programs would be added to the ABT programs, which would allow manufacturers to earn emission reduction credits for zero-emission generators.

Other Proposed Amendments to the regulations include sunsetting the voluntary "Blue Sky Series" engine requirements and repealing the variance provisions in the evaporative emission regulations. The Blue Sky Standards were developed to allow manufacturers to receive recognition for certifying to lower emission standards, but CARB has no record of any manufacturer taking advantage of the program for engines. Additionally, the Proposed Amendments to the evaporative emission test procedures would add further instructions for a fuel tank pressure test, a new fuel cap and tether test, a tilt test to check for fuel leaks, and instructions for accelerated preconditioning of engines. The Proposed Amendments to TP-901 would ensure fuel tank testing configurations were closer to those of production fuel tanks by requiring the hole for a fuel line and grommet system to be present in the fuel tanks and requiring fuel tanks to be tested with the same production fuel cap throughout testing. Evaporative emission control system certification procedure CP-902 would be used for all engines, including those with displacement less than 80 cc, which currently use a different certification procedure.

Most of the Proposed Amendments to the exhaust emission test procedures are intended to align them with updates to the federal test procedures that have been adopted since CARB adopted its test procedures. The Proposed Amendments also include California-specific changes necessary to maintain the stringency of California emission standards, provide consistency with other California SORE regulations, prevent redundant effort and confusion for testers, or provide additional flexibility. For example, the requirements for exhaust emission compliance testing would be changed from testing "a reasonable number of engines" to "one or more engines." Procedure text that provides examples based on equipment or fuel types that are not relevant to

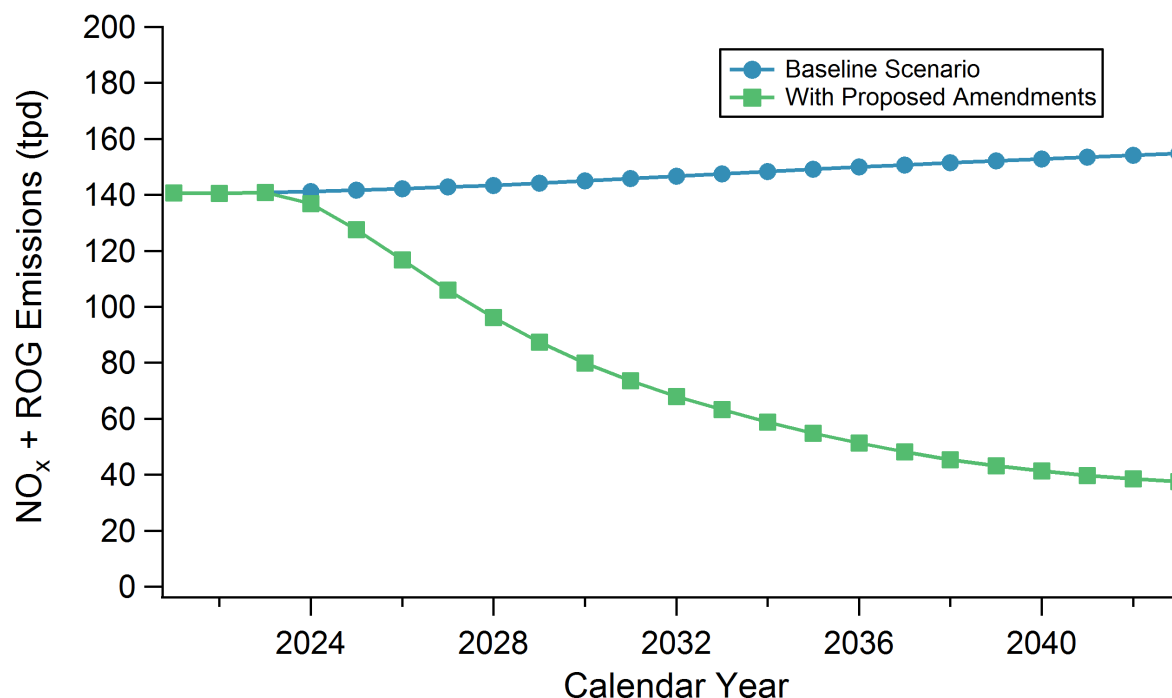
SORE, such as locomotives and compression-ignition engines, would be removed to prevent confusion. References to National Institute of Standards and Technology (NIST)-traceable standards would be changed to *Système International d'Unités* (SI)-traceable standards to allow flexibility for manufacturers around the world to use other recognized international standards while still maintaining the consistency necessary to ensure test data accuracy, precision, and comparability to the emission standards.

D. Air Quality and Public Health Benefits

CARB's 2020 Mobile Source Strategy states that "As research continues to show harmful effects from air pollution at increasingly lower levels, achieving the State's complementary goals, targets and standards will provide much-needed public health protection for the millions of Californians that still breathe unhealthy air and will reduce exposure in the State's most highly-impacted and disadvantaged communities." An important strategy to reduce emissions and provide much-needed public health protection for Californians is electrification of SORE. The small off-road equipment market is well prepared for electrification. The Proposed Amendments would support the goals of the 2016 State SIP Strategy and would reduce emissions of pollutants with multiple known adverse health effects and which are associated with existing California ambient air quality standards. These pollutants include NO_x, which contributes to formation of tropospheric ozone, and PM_{2.5}, which may deposit deep inside the lungs. Long-term exposure to PM_{2.5} has been causally linked to premature death, particularly in people who have chronic heart or lung diseases, and reduced lung function in children. The Proposed Amendments would also reduce greenhouse gas (GHG) emissions and petroleum use.

Under the Proposed Amendments, significant reductions in both NO_x and ROG emissions would begin in calendar year 2025, years before emission standards of zero would be implemented for generators. In 2031, the expected summer average emission reductions would be 7.9 tpd of NO_x and 64.5 tpd of ROG (Figure ES-2). These represent 43 percent and 51 percent reductions of NO_x and ROG, respectively, compared to the emissions under the Baseline Scenario. For the purposes of this rulemaking, the Baseline Scenario is defined as the scenario where existing regulations continue and where no further regulatory action is taken on SORE in the future. The Proposed Amendments would result in total emission reductions of approximately 59,307 tons of NO_x and 423,240 tons of ROG, averaged across the year from 2023 through 2043, compared to the Baseline Scenario. Such emission reductions would decrease the amount of adverse health impacts in California. Through 2043, premature deaths due to cardiopulmonary causes would be expected to decrease by 892; emergency room (ER) visits for asthma would be expected to decrease by 438; and acute respiratory and cardiovascular hospitalizations would be expected to decrease by 169 and 142, respectively.

Figure ES-2. Summer average NO_x + ROG emissions under the Baseline Scenario and the Proposed Amendments.



The Proposed Amendments would decrease the use of fossil fuels in California, which would decrease carbon dioxide and other GHG emissions. The benefit of the GHG emission reductions can be estimated using the Social Cost of Carbon, which calculates benefits between \$339 million and \$1.43 billion through 2043, depending on the discount rate.

E. Economic Impacts

Staff conducted economic analyses, including a Standardized Regulatory Impact Analysis, for the Proposed Amendments. This included the determination of costs to users of small off-road equipment from initial purchase through the useful lifetime of the equipment. Upfront purchase costs could be higher or lower for ZEE than for equivalent SORE equipment, depending on the equipment type. In contrast, operating costs for ZEE are typically lower than for SORE equipment, due to savings on gasoline purchases and reduced maintenance costs.

Overall, the Proposed Amendments would have a net direct cost of \$4.08 billion accrued over the modeled regulatory horizon of 2023 through 2043. Residential users are expected to experience a net direct cost accrued through 2043 of \$2.79 billion, while professional users (nonlandscaping businesses, landscapers and government entities) are expected to experience an accrued net direct cost of \$1.29 billion. When health benefits are considered, the Proposed Amendments are estimated to have a net benefit of \$4.27 billion accrued through 2043. Overall, the Proposed Amendments would have a benefit-cost ratio of 1.30, meaning the monetized benefits are greater

than the costs. Table ES-1 summarizes the results of the economic analyses for the Proposed Amendments.

Table ES-1. Results of the economic analyses for the Proposed Amendments over the regulatory horizon of 2023 through 2043 (billions 2019\$).

| Total costs | Health benefits | Cost-savings (benefit) | Tax & fee revenue | Total benefit | Net benefit | Benefit-cost ratio |
|--------------------|------------------------|-------------------------------|------------------------------|----------------------|--------------------|---------------------------|
| \$14.41 | \$8.82 | \$10.33 | -\$0.47 | \$18.68 | \$4.27 | 1.30 |

F. Technological Feasibility

ZEE are primarily electric, either battery-powered or corded. ZEE are available for most small off-road equipment categories, including lawn and garden equipment and utility equipment, for both residential and professional use. The level of performance, number of brands, and number of equipment options have increased greatly and continue to do so today. Today, there are at least 35 brands of zero-emission lawn mowers available (CARB, 2021d and 2021e), with several brands directed at professional users. Battery and electric motor technology has advanced rapidly in recent years, while costs have declined. It is projected that from 2010 to 2030, the price of a battery holding a kilowatt-hour of energy will decrease by over 90 percent (Martin, 2019). New technologies, such as brushless electric motors, have led to a significant increase in the efficiency of equipment.

ZEE available today have many of the same characteristics as their SORE equipment counterparts. Self-propelled lawn mowers with the same cutting width and adjustable deck heights as many SORE lawn mowers are available as ZEE. Riding mowers with the same cutting width and speed range as many SORE riding mowers are also available as ZEE. The wide availability of ZEE equivalents for SORE equipment suggests that replacing SORE equipment with ZEE is feasible.

Approximately 52 percent of small off-road equipment in use in California are currently ZEE. However, among the current population of small off-road equipment, the fraction that is ZEE varies substantially by equipment type. Approximately 99 percent of pumps are ZEE, and 5 percent of riding mowers are ZEE. The fraction of small off-road equipment that is ZEE also varies by user type, from 55 percent for residential users to 6 percent for professional landscapers (North American Industry Code System 541320 and 561730) (CSUF SSRC, 2019).

While adoption rates for ZEE among professional landscapers are lower than for residential users, there is substantial evidence that all new small off-road equipment can be zero-emission. Using ZEE is technologically feasible and can offer significant cost-savings to professional users. There are at least 12 brands of zero-emission lawn and garden equipment designed for professional users available for sale.

The Proposed Amendments would allow more time for generators to meet emission standards of zero. While zero-emission generators are available to meet users'

demand, there is still a need to allow manufacturers adequate time to continue to innovate and grow to meet the future demands of the zero-emission generator market. As a result, the Proposed Amendments include exhaust and evaporative emission standards for generators for MYs 2024 through 2027 that are more stringent and comprehensive than the current emission standards, but are not zero. These proposed emission standards would enable emission reductions to be achieved while allowing more time for manufacturers to develop additional options for zero-emission generators. The proposed MY 2024-2027 emission standards are approximately 40 to 90 percent lower than current emission standards for generators. Engines currently certified for sale or lease for use or operation in California exhibit emissions below the proposed MY 2024-2027 emission standards. These engines demonstrate the feasibility of the proposed emission standards.

The occurrence of public safety power shutoffs in recent years has increased the dependence on generators for power backup. It is important to note that the SORE regulations do not apply to stationary generators, which are not moved for equipment operation or storage. These stationary generators are frequently powered by natural gas or propane and usually installed on a concrete pad. To the extent that Californians rely on generators subject to CARB's SORE regulations, the time between the Board adoption of the Proposed Amendments and the effective date of the emission standards of zero for generators will provide adequate time for manufacturers to assess power outages in California, better understand consumer needs during those outages, and develop zero-emission generators to better meet those needs by 2028.

G. Environmental Analysis

The Proposed Amendments are substantively similar to a regulatory concept measure previously included within CARB's 2016 State SIP Strategy. In its approval of the 2016 State SIP Strategy, CARB certified an environmental analysis (EA), entitled Final Environmental Analysis for the Revised Proposed 2016 State Strategy for the State Implementation Plan (Final EA), that evaluated the impacts associated with the 2016 State SIP Strategy's SORE regulatory measures. CARB identified mitigation for those impacts, evaluated overarching alternatives to the 2016 State SIP Strategy and adopted a statement of overriding circumstances for impacts deemed significant and unavoidable. While the Proposed Amendments fill in more detail with respect to specifying the more stringent emission standards and eventual emission standards of zero, the additional detail does not change the potential compliance responses identified in the Final EA and associated impacts and mitigation measures from potential compliance-response development projects. Rather, the only change triggered by the Proposed Amendments that warrants an addendum to the Final EA is the need to add the Proposed Amendments' detail to the project description of the 2016 State SIP Strategy's SORE measures. Therefore, since the Final EA adequately evaluated impacts, mitigation and alternatives associated with the 2016 State SIP Strategy SORE measures and the Proposed Amendments are substantively similar to the 2016 State SIP Strategy SORE measures, the Proposed Amendments do not trigger the need to prepare a subsequent environmental analysis.

H. Environmental Justice

The Proposed Amendments would reduce statewide emissions of NO_x and ROG from SORE by about half in 2031, compared to the Baseline Scenario. Reducing NO_x and ROG emissions is an integral part of California reaching its goal of attaining and maintaining national and California ambient air quality standards for ozone, which are protective of the health and welfare of all California residents. Consequently, all communities, including disadvantaged low-income communities and communities of color, would benefit from the Proposed Amendments. Enhanced emission benefits in underserved communities are not expected. However, the Proposed Amendments would help improve the overall health of these communities through fewer instances of premature mortality, fewer hospital and ER visits, and fewer lost days of work. These health benefits would result from reduced tropospheric ozone and PM production as NO_x and ROG emissions decrease.

Users of SORE equipment are exposed to CO, PM_{2.5}, and toxic air contaminants (TACs) when operating equipment. Replacing these equipment with ZEE would result in decreased exposure to these air contaminants for equipment users. The Proposed Amendments are consistent with CARB's environmental justice policy of reducing exposure to air pollutants and reducing adverse health impacts from TACs in all California communities.

Sole-proprietorships and other small business landscapers may be significantly affected by the direct economic impacts of the Proposed Amendments. Small business landscapers make up more than 99 percent of landscaping businesses in California. The higher upfront costs of ZEE and the batteries needed to power ZEE for a full work day may be a significant expense for many landscaping businesses. Purchasing all new ZEE in addition to the batteries may be burdensome. However, landscapers using ZEE may realize net cost-savings within the first few years of purchase due to decreased fuel and maintenance costs, despite larger upfront costs. Furthermore, over time, additional savings are expected from decreased maintenance and repair costs because the businesses would no longer have the costs of routine engine maintenance and repairs. Staff expects that a landscaping business would not need to purchase a full suite of ZEE at once, thereby avoiding a significant one-time cost to transition to ZEE. Rather, landscaping businesses would gradually purchase ZEE to replace SORE equipment as it breaks or for other business reasons, such as upgrading equipment.

I. Regulatory Alternatives Evaluated

In addition to the Proposed Amendments, which is the preferred alternative, CARB staff evaluated several regulatory alternatives. First, staff evaluated an alternative that would set emission standards for all SORE to zero for MY 2024. This alternative would have a \$2.49 billion direct cost and a marginal increase in emission reductions for NO_x and ROG compared to the Proposed Amendments. Staff rejected this alternative on technological feasibility grounds due to the market for zero-emission generators not being ready to fully meet potential demand.

Second, staff evaluated an alternative that would set more stringent emission standards for all SORE for MYs 2024 through 2025 and would set emission standards to zero for MY 2026 and subsequent model years. This alternative would cost \$1.81 billion more than the Proposed Amendments and have marginally lower emission reductions than the Proposed Amendments. Staff rejected this alternative due to its higher costs and failure to maximize the use of ZEE that is technologically feasible starting in MY 2024.

Finally, staff evaluated a Small Business Alternative. This alternative would delay implementation of any new emission standards until MY 2028. This alternative would cost \$419 million more and would have 28 percent lower emission reductions than the Proposed Amendments. Staff rejected this alternative due to its failure to meet the expected emissions reductions for SORE in the 2016 State SIP Strategy.

J. Regulatory Development Process and Outreach Efforts

Staff held public workshops and had other meetings with interested persons during the development of the Proposed Amendments. Stakeholders' comments during and after these informal pre-rulemaking discussions and in response to a separate solicitation of alternatives, provided staff with useful information that staff considered during development of the Proposed Amendments, and in selecting alternatives for consideration.

A survey to determine the small off-road equipment population in California was conducted by California State University Fullerton Social Science Research Center beginning in 2017. Throughout development of the survey, meetings of the SORE Working Group were held to get feedback on the survey questions. The SORE Working Group consists of interested stakeholders, including manufacturers, trade associations, government agencies, individuals, and environmental organizations. At each stage of the survey, all parties were invited to give feedback on the questions asked, and the survey questionnaires were improved as a result.

Staff held three pre-rulemaking public workshops to discuss the development of the Proposed Amendments, in September 2019, June 2020, and March 2021. Staff presented regulatory concepts, and discussed potential amendments at these workshops. The workshops were attended by industry representatives, environmental organizations, and interested citizens. In addition to these public workshops, staff held numerous meetings with equipment and engine manufacturers, industry trade associations, environmental organizations, and interested residents.

Staff also conducted outreach to inform stakeholders about the potential regulations. CARB staff has attended four conventions held for landscapers in California. These conventions have provided opportunities for staff to inform professional landscapers about potential regulatory changes and about ZEE capabilities and availability. CARB staff has presented information about zero-emission landscaping equipment and the potential regulatory amendments at five meetings attended by landscapers and members of local governmental committees in California.

Since 2018, CARB staff has operated a demonstration project called the ZEE Roadshow, where several brands of zero-emission lawn and garden equipment designed for professional use are loaned to landscaping crews throughout the state. This provides them with an opportunity to use ZEE without purchasing it. The response has been overwhelmingly positive, with nearly all crews finding at least one ZEE type that they preferred over SORE equipment. Landscaping crews receiving the ZEE Roadshow have included theme parks, colleges and universities, school districts, and municipal organizations.

K. Justification for Regulations Different from Federal Regulations

The differences between the proposed California requirements and existing federal requirements are intended to reduce NO_x and ROG emissions and replace SORE equipment with ZEE as soon as feasible. This would alleviate the health and environmental burden of SORE emissions, allow California to meet its 2016 State SIP Strategy commitments, and help ensure that SORE equipment sold and used in California comply with the exhaust and evaporative emission standards over their useful life. These regulations are justified by their benefit to human health and the environment.

State and federal law also authorize these differences. CARB may regulate emissions from off-road engines under the authority granted to it by the California Legislature in the HSC, and under the provisions of the federal Clean Air Act that direct U.S. EPA to authorize California to adopt and enforce emission standards and other requirements relating to the control of emissions from off-road engines upon meeting the criteria for authorization established in the federal Clean Air Act.

L. Staff Recommendation

California Air Resources Board staff recommends that the Board adopt the Proposed Amendments to the California Code of Regulations and to the documents incorporated by reference as provided in Appendices A through G.

I. Introduction and Background

A. Overview

The California Air Resources Board (CARB or Board) is responsible for protecting the public from the harmful effects of air pollution through the development of programs that reduce the emissions of specific pollutants and their precursors. Several areas within California exceed national ambient air quality standards (NAAQS) set by United States Environmental Protection Agency (U.S. EPA) for both fine particulate matter (PM) with diameter of 2.5 micrometers or smaller (PM_{2.5}) and ozone. Currently, 19 areas within California, including the South Coast, San Francisco Bay Area, and Sacramento County air basins, are nonattainment areas for NAAQS for ozone. U.S. EPA set a NAAQS of 70 parts per billion (ppb) for ozone in 2015. Most areas of California that exceed the 70 ppb standard also exceed the older 75 ppb standard set in 2008. The Revised Proposed 2016 State Strategy for the State Implementation Plan (2016 State SIP Strategy) sets expected emission reduction for attainment of the 75 ppb standard by 2031 for all air basins in California. Attainment demonstrations have not yet been submitted for the 70 ppb standard in the South Coast Air Basin or other extreme and severe nonattainment areas, but the deadlines are expected to be no later than 2037.

Oxides of nitrogen (NO and NO₂, collectively denoted as NO_x) also contribute to the formation of PM_{2.5}. PM_{2.5} has direct negative health impacts. There are four areas in California in nonattainment of the annual average NAAQS for PM_{2.5}, including the South Coast Air Basin and the San Joaquin Valley Air Basin, according to the 2016 State SIP Strategy. Those areas exceed an annual average of 12.0 micrograms per cubic meter (µg/m³), averaged over three years. San Joaquin Valley and South Coast Air Basin nonattainment areas have attainment dates of 2025 to meet the annual average NAAQS. New attainment dates are expected soon for the other regions.

The South Coast Air Quality Management District (SCAQMD) and the San Joaquin Valley Air Pollution Control District (SJVAPCD) are also required to meet the 24-hour 35 µg/m³ NAAQS for PM_{2.5} in 2024. SCAQMD has released a draft plan showing that the South Coast Air Basin attained the 24-hour standard in 2020 and will maintain this standard going forward.

Meeting these public health goals requires phasing out the use of internal combustion engines in both on-road and off-road applications and adopting zero-emission technology. CARB's 2020 Mobile Source Strategy (MSS) states that "As research continues to show harmful effects from air pollution at increasingly lower levels, achieving the State's complementary goals, targets and standards will provide much-needed public health protection for the millions of Californians that still breathe unhealthy air and will reduce exposure in the State's most highly-impacted and disadvantaged communities." (CARB, 2021a2). An important strategy to reduce harmful effects from air pollution emissions is electrification, i.e., converting all fossil fuel-burning equipment to electric powered equipment. Furthermore, the 2016 State SIP Strategy identifies the need for substantial

emission reductions from small off-road engines (SORE) and other mobile sources and increased penetration of zero-emission technology. These emission reductions are needed to attain ambient air quality standards and protect the health and welfare of all California residents. In addition, California Health and Safety Code (HSC) § 43018 requires CARB to “endeavor to achieve the maximum degree of emission reduction possible from vehicular and other mobile sources in order to accomplish the attainment of the state standards at the earliest practicable date.” Finally, Governor Newsom’s Executive Order (EO) N-79-20, issued September 23, 2020, (EO N-79-20) orders CARB to develop and propose, “Strategies, in coordination with other State agencies, the U.S. EPA, and local air districts, to achieve 100 percent zero-emission from off-road vehicles and equipment operation in the State by 2035.” (California Executive Order No. N-79-20, 2020). This Staff Report: Initial Statement of Reasons (Staff Report) provides the basis for CARB staff’s proposal to amend regulations for SORE (collectively, Proposed Amendments) to reduce SORE emissions and accelerate the adoption of zero-emission equipment (ZEE).

SORE are spark-ignition engines rated at or below 19 kilowatts (25.5 horsepower), that are not used to propel a licensed on-road motor vehicle, an off-road motorcycle, an all-terrain vehicle, a marine vessel, a snowmobile, a model airplane, a model car, or a model boat. SORE are predominantly used in lawn and garden equipment such as lawn mowers, string trimmers, and leaf blowers, as well as in other small off-road equipment such as portable generators, pressure washers, and air compressors. The vast majority of SORE are fueled by gasoline, but some are powered by compressed natural gas (CNG), propane, liquefied petroleum gas (LPG), or liquefied natural gas (LNG). Small off-road equipment that are powered by SORE are known as SORE equipment. The use and storage of SORE equipment leads to significant emissions of air pollutants, including reactive organic gases (ROG) and NO_x. These air pollutants contribute to particulate matter (PM) and ground-level ozone formation (elements of smog) in California.

Existing CARB and U.S. EPA emission standards for SORE have led to substantial emission reductions. Since 2000, emissions of pollutants that contribute to ozone and PM_{2.5} formation from SORE have decreased by 50 percent. Even so, in California, SORE emit more NO_x and ROG than light-duty passenger cars, both in summer and annually. Without additional regulation, SORE will emit 1.8 times the amount of summertime NO_x and ROG that California light-duty passenger vehicles emit in 2031 (CARB, 2020 and 2021b).

Operating a typical professional lawn mower for one hour emits as much ozone-forming pollution as driving a new light-duty passenger car about 300 miles –approximately the distance from Los Angeles to Las Vegas, more than 4 hours of drive time. Operating a typical professional backpack leaf blower for one hour emits ozone-forming pollution comparable to driving the same light-duty passenger car about 1,100 miles – approximately the distance from Los Angeles to Denver, more than 15 hours of drive time. These comparisons are based on the lawn mower, the leaf blower, and the light-duty passenger car having emissions equal to their respective emission standards.

It is necessary to update the SORE regulations to meet the expected emission reductions put forth in the 2016 State SIP Strategy and the goals in EO N-79-20, one of which is to “transition to 100 percent zero-emission off-road vehicles and equipment by 2035 where feasible.” (California Executive Order No. N-79-20, 2020). A transition to ZEE is not expected to occur without the Proposed Amendments. Without further regulation, the SORE equipment population is projected to be higher in 2043 than it is in 2021 (CARB, 2020).

ZEE produce no direct exhaust nor evaporative emissions of any criteria pollutant or precursor pollutant and help protect public health, attain NAAQS, reduce petroleum use, and meet sustainability objectives. ZEE include manual equipment, corded electric small off-road equipment (i.e., equipment that is powered through an electrical cord and is plugged into an electrical outlet), and battery-powered electric small off-road equipment. Manual equipment, such as reel mowers, brooms, rakes and scythes have been available since before SORE equipment was first produced. Electric small off-road equipment have been available for decades. Technological improvements have resulted in the performance of currently available ZEE being comparable to the performance of SORE equipment. This Staff Report focuses on small off-road equipment other than manual equipment when discussing ZEE.

The Proposed Amendments would accelerate the transition to ZEE by setting evaporative and exhaust emission standards to zero for new SORE (engines or equipment produced for sale or lease for use or operation in California), except engines used exclusively in generators, for model year (MY) 2024 and subsequent model years. Implementing emission standards of zero [0.00 grams of hydrocarbons (HC) + NO_x per kilowatt-hour, or g·kWh⁻¹, for exhaust emissions and 0.00 grams per test for evaporative emissions] does not necessarily mean that all new sales of small off-road equipment would be ZEE. Banked emission reduction credits could be used to offset emissions from SORE for up to five model years after the credits were generated. Also, engines or equipment emitting below 0.005 g·kWh⁻¹ or g·test⁻¹ could be certified to meet emission standards of zero. However, staff believes that it is unlikely that engines or equipment meeting emission standards of zero will be manufactured. It is more likely that manufacturers will use emission reduction credits in the near-term to offset emissions from SORE while the credits are available.

Currently, most ZEE is either battery-powered or corded electric equipment, but fuel cells could also be used in place of engines subject to the SORE regulations. Under the Proposed Amendments, new generators would be subject to more stringent emission standards for MYs 2024 through 2027, and a zero-emission standard for MY 2028 and subsequent model years. Any remaining emission reduction credits may be used to allow for continued production of SORE for sale or lease for use or operation in California. The Proposed Amendments would also amend existing credit programs and make other changes to the SORE regulations to improve consistency and increase compliance flexibility for manufacturers, while reaching lower emission levels and maintaining enforceability.

The remainder of this chapter describes CARB's legal authority to regulate SORE emissions, provides an overview of the SORE regulations and their history, summarizes the Proposed Amendments, and provides background information about the expected emission reductions from the 2016 State SIP Strategy and the MSS that necessitate replacement of all SORE equipment by ZEE (CARB, 2017b and 2021a2). This chapter also provides a synopsis of the current ZEE market and potential challenges for ZEE deployment. The remainder of this Staff Report provides the rationale for the Proposed Amendments, summarizes the regulatory development process, and describes the potential environmental and economic benefits and impacts of the Proposed Amendments and alternatives that staff considered.

B. Legal Authority and Responsibilities

1. State Law

Under California HSC sections 39500 and 39602, CARB is the air pollution control agency responsible for controlling emissions from motor vehicles "for all purposes set forth in federal law." Under HSC section 39602.5, CARB is required to "adopt rules and regulations pursuant to Section 43013 that ... will achieve ambient air quality standards required by the federal Clean Air Act ... in all areas of the state by the applicable attainment date, and to maintain these standards thereafter." Specifically named among CARB's general duties and powers (HSC §§ 39600-39619.8) are the responsibilities to prepare California's State Implementation Plan (SIP) and to coordinate all local air quality management district activities necessary to comply with the federal Clean Air Act. Furthermore, HSC section 43013 requires CARB to "adopt and implement motor vehicle emission standards, in-use performance standards, and motor vehicle fuel specifications for the control of air contaminants and sources of air pollution which the state board has found to be necessary, cost effective, and technologically feasible, to carry out the purposes" of its enabling statutory authority. Adoption and implementation of emission standards carries out many purposes provided in CARB's enabling statutory authority, including the following purpose: "The control and elimination of ... air pollutants [are] of prime importance for the protection and preservation of the public health and well-being, and for the prevention of irritation to the senses, interference with visibility, and damage to vegetation and property." (HSC section 43000, subd. (b).) HSC section 43018 requires that CARB endeavor to achieve the maximum degree of technologically feasible, cost effective reductions of emissions from all mobile source categories under its jurisdiction, including off-road mobile sources such as SORE, to accomplish the attainment of ambient air quality standards at the earliest practicable date. Under its statutory authority, CARB may adopt test and certification procedures to ensure compliance with CARB's emission standards (HSC sections 43101, 43102, and 43104).

To comply with HSC provisions noted above, the Board adopted, and has since amended, the exhaust and evaporative regulations for SORE found in California Code of Regulations (CCR), Title 13, sections 2400 through 2409 and 2750 through 2774, and test and certification procedures incorporated by reference therein. The regulations contain the performance standards and specifications—including SORE exhaust and evaporative

emission standards—that must be met by equipment manufacturers to obtain CARB certification in the form of an Executive Order of Certification. The test procedures verify compliance with performance standards and specifications, and the certification procedures detail requirements for evaporative emission control system certification. These regulations and certification and test procedures help CARB verify that engines sold in California are certified and labeled to meet all applicable requirements.

The federal Clean Air Act, section 209(e)(1) preempts certain SORE from CARB regulation of emission standards, which are new engines used in construction equipment or vehicles or used in farm equipment or vehicles and which are smaller than 175 horsepower. Approximately 11 percent of small off-road equipment in California are construction equipment or vehicles or farm equipment or vehicles which use engines smaller than 175 horsepower.

2. Federal Law

Section 209(e) of the federal Clean Air Act uniquely grants the State of California the authority to adopt and enforce rules to control emissions from nonroad engine or vehicular sources within the state, including SORE (with the exception of new engines which are used in construction equipment or vehicles or used in farm equipment or vehicles and which are smaller than 175 horsepower, as discussed in section I.A.1. of this Staff Report). California is allowed an exemption from federal Clean Air Act provisions that otherwise prevent states from setting their own emission standards for mobile source emissions. The exemption recognizes California's long standing air pollution challenges and pioneering efforts to reduce mobile source emissions.

C. Regulatory History

Emissions from SORE occur both when the engine is running (exhaust and evaporative emissions) and when it is not running (evaporative emissions). Exhaust emissions contain both NO_x and ROG, while evaporative emissions contain ROG. CARB adopted the first SORE regulations in 1990 when setting the first exhaust emission standards. The exhaust emission regulations include emission standards for HC^a, NO_x, carbon monoxide (CO), and PM. The exhaust emission standards were implemented in two tiers between MYs 1995 and 2002. Further exhaust emission standards and the first CARB evaporative emission standards for SORE were adopted in 2003. Evaporative emissions occur both when the engine is operating and when it is not. The most recent SORE exhaust emission standards were implemented between MYs 2000 and 2008. The evaporative emission standards were implemented between MYs 2006 and 2013.

^a Hydrocarbons are chemical compounds consisting of carbon and hydrogen only; many hydrocarbons are ROG. Emissions of all organic compounds are measured to verify compliance with the emission standards for hydrocarbons for gasoline-fueled engines.

The most recent amendments to the evaporative emission regulations were adopted in 2016, following validation studies that found low rates of compliance with existing emission standards. A major purpose of these amendments was to increase compliance rates and facilitate compliance testing and enforcement actions. The amendments included the following: the requirement for one engine instead of five to be tested for an initial compliance determination; the option for the Executive Officer to purchase equipment for compliance testing; and the requirement for bonds to be posted by manufacturers without sufficient U.S. assets to cover potential enforcement penalties. The 2016 amendments did not change the emission standards except to include fuel line permeation emission standards for engines with displacement^b less than or equal to 80 cubic centimeters (cc). These fuel line permeation emission standards were similar to those included in U.S. EPA regulations and implemented between MYs 2012 and 2016. Tables I-1, I-2, and I-3 provide the current SORE exhaust and evaporative emission standards, respectively. CARB staff continues to perform compliance testing to hold manufacturers accountable for achieving the certified emission levels and ensure Californians realize the air quality benefits of the current regulations.

Both exhaust and evaporative emission regulations include emission reduction credit programs, which allow manufacturers to produce engines that emit at levels higher than the emission standards if they offset those with engines that emit at levels lower than the emission standards. The exhaust emission reduction credit program allows for credit generation for ZEE. The credit programs are reviewed in more detail in Chapter II.

Table I-1. Current SORE exhaust emission standards.

| Displacement category | HC + NO_x (g·kWh⁻¹)^c | CO (g·kWh⁻¹) | Particulate matter (g·kWh⁻¹) |
|------------------------------|---|------------------------------------|--|
| < 50 cc | 50 | 536 | 2.0 |
| 50-80 cc, inclusive | 72 | 536 | 2.0 |
| > 80 cc - < 225 cc | 10.0 | 549 | NA |
| 225-825 cc, inclusive | 8.0 | 549 | NA |
| > 825 cc | 8.0 | 549 | NA |

^b Displacement is the total swept volume of all the cylinders in an engine, usually expressed in cubic centimeters or liters, and is an expression of an engine's size.

^c g·kWh⁻¹: grams (g) of emissions per kilowatt-hour (kWh). A kilowatt-hour is a unit of energy equal to one kilowatt of power sustained for one hour.

Table I-2. Current SORE diurnal emission standards.

| Displacement category | Current diurnal emission standard (g organic material hydrocarbon equivalent·day⁻¹) |
|---|---|
| ≤ 80 cc | N/A |
| > 80 cc - < 225 cc except walk-behind mowers | $0.95 + 0.056 \times \text{nominal capacity (liters)}$ |
| > 80 cc - < 225 cc walk-behind mowers | 1.0 |
| ≥ 225 cc | $1.20 + 0.056 \times \text{nominal capacity (liters)}$ |

Table I-3. Current permeation emission standards for SORE with displacement less than or equal to 80 cc.

| Displacement category | Fuel line permeation emissions^d (g ROG·m⁻²·day⁻¹) | Fuel tank permeation emissions (g ROG·m⁻²·day⁻¹) |
|------------------------------|---|---|
| ≤ 80 cc | 15 or 225 | 2.0 |

All SORE with displacement greater than 80 cc must meet the evaporative emission standards noted in Table I-2 in compliance testing, but manufacturers may use evaporative emission control system components that meet design standards for certification. The design standards include fuel tank and fuel lines permeation emission standards. These permeation emission standards set a maximum amount of ROG that can penetrate through the walls of fuel lines or fuel tanks and evaporate on outside surfaces. The design standard for carbon canisters sets a minimum working capacity that is proportional to the nominal capacity of an engine's fuel tank. Carbon canisters control fuel tank venting emissions to reduce their release to the atmosphere. SORE with displacement less than or equal to 80 cc must meet permeation emission standards for fuel tanks and fuel lines.

D. Criteria Air Pollutants and Air Quality Commitments

The federal Clean Air Act requires the U.S. EPA to set NAAQS for six of the most common air pollutants, which are collectively known as "criteria air pollutants" or simply "criteria pollutants." Criteria pollutants include ground-level ozone, PM, CO, lead, sulfur dioxide, and nitrogen dioxide (NO₂). Emissions of NO_x and ROG from SORE contribute to three of these—ozone, PM, and NO₂—either directly (NO₂ and PM) or indirectly (NO₂, ozone and PM) and all have negative health effects. The next subsections of this chapter cover the following topics: Subsection I.D.1 provides a brief review of the negative health effects associated with criteria air pollutants; subsection I.D.2 gives an overview of expected

^d The fuel line permeation emission standard of 225 g ROG·m⁻²·day⁻¹ applies to fuel lines used in chainsaws; fuel lines in other equipment must meet a 15 g ROG·m⁻²·day⁻¹ fuel line permeation emission standard.

emission reductions in the 2016 State SIP Strategy and the MSS; and subsection I.D.3 discusses EO N-79-20 and how the Proposed Amendments will help reach the goals stated therein. These goals and commitments prompted and guided the development of the Proposed Amendments to the SORE regulations. Section D of Chapter IV provides a more in-depth review of the negative health effects associated with the pollutants.

1. Negative Health Effects

NO_x is a set of highly reactive gases, NO₂ and NO, which are emitted from internal combustion engines. The majority of NO_x emissions from internal combustion engines are NO, but NO₂ is rapidly formed in the presence of ozone. Breathing air with a high concentration of NO₂ can irritate airways in the human respiratory system. Such exposures over short periods can aggravate respiratory diseases, particularly asthma, leading to respiratory symptoms (such as coughing, wheezing or difficulty breathing), hospital admissions and emergency room (ER) visits. Longer exposures to elevated concentrations of NO_x may contribute to the development of asthma and potentially increase susceptibility to respiratory infections. People with asthma, as well as children and the elderly, are generally at greater risk. NO_x reacts with other chemicals in the air to form both ozone and PM_{2.5} (World Health Organization, Europe, 2006).

Both ozone and PM, especially PM_{2.5}, are harmful when inhaled (Xing et al., 2016). Ozone can trigger a variety of health problems including chest pain, coughing, throat irritation, and airway inflammation. It can also reduce lung function and harm lung tissue. Ozone can worsen bronchitis, emphysema, and asthma, leading to increased medical complications (The Royal Society, 2008). Similarly, studies have linked daily exposure to PM_{2.5} with hospitalization for heart- and lung-related causes. Exposure to PM_{2.5} also increases the number of ER visits and exacerbates asthma and other respiratory diseases, such as chronic obstructive pulmonary disease. It can also increase the severity of respiratory symptoms and the frequency of asthma medication use. Exposure to ozone and PM_{2.5} was estimated to contribute to between 16,000 and 40,400 premature deaths in California in 2012 (Wang et al., 2019).

ROG include all organic gas compounds emitted to the atmosphere except certain less reactive compounds, such as methane and ethane. ROG contributes to the formation of tropospheric ozone through reaction with NO_x in the presence of sunlight (The Royal Society, 2008). Additionally, some components of ROG can have direct health effects, in particular, those that are toxic air contaminants (TAC). According to HSC section 39655, TACs are “air pollutants which may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health.”

2. State Implementation Plan

All geographic areas in California that are designated nonattainment areas for one or more NAAQS are required by the federal Clean Air Act to submit a SIP. Under federal Clean Air Act section 110, SIPs provide for the “implementation, maintenance, and

enforcement” of NAAQS. Areas with more significant air quality challenges are required to include strategies to attain the relevant NAAQS. Substantial progress has been achieved in reducing NO_x and ROG emissions in California through implementation of CARB’s existing mobile source programs, and it is expected that these programs will continue to provide further reductions through 2031, contributing significantly to meeting ambient air quality standards. As a result of SORE regulations and increasing adoption of ZEE by users, emissions of NO_x and ROG from SORE have decreased by 50 percent since 2000.

However, the most recent ozone NAAQS are more stringent than the previous ozone NAAQS and warrant more extensive emissions control strategies. Although California has significantly reduced ambient ozone concentrations, the challenges posed by the more stringent NAAQS prompted the reclassification of the San Joaquin Valley and South Coast nonattainment designations. Both regions are now classified as “extreme nonattainment” with regard to the 8-hour ozone standard. For example, to meet the 75 ppb NAAQS for ozone by 2031, the South Coast Air Basin will require an approximate 80 percent reduction in ambient NO_x from current levels. Statewide, about 12 million Californians live in communities that still exceed the federal ozone and PM_{2.5} standards. Federal Clean Air Act § 182(e)(5) provides that extreme nonattainment areas may rely on the development of new technologies or improvement of existing technologies, in addition to other enforceable commitments. The 2016 State SIP Strategy states that achieving this reduction will require comprehensive efforts to address emissions from both stationary and mobile sources including SORE through ongoing implementation of already adopted measures, as well as new actions.

In 2007, CARB adopted SIPs for the federal 1997 80 parts per billion (ppb) 8-hour ozone NAAQS (CARB, 2007b). The 2007 SIPs included a comprehensive State Strategy (2007 State SIP Strategy) and local attainment plans. These plans were designed to attain the 1997 80 ppb 8-hour ozone NAAQS, as well as the 1997 65 micrograms per cubic meter (µg/m³) 24-hour and 15 µg/m³ annual PM_{2.5} NAAQS. The 2007 State SIP Strategy called for a combination of technically feasible and cost-effective control strategies. In 2009 and 2011, CARB adopted revisions to the 2007 State SIP Strategy, updating the assumptions and control strategy to demonstrate attainment (CARB, 2009 and 2011a).

The 2007 State SIP Strategy includes the following measure for reduction of emissions from SORE: Reduce exhaust emission from SORE by tightening emission limits as a long-term concept (CARB, 2007a).

In 2017, CARB adopted the 2016 State SIP Strategy (CARB, 2017b). The 2016 State SIP Strategy included control measures to achieve the reductions necessary from mobile sources, fuels, and consumer products to meet the 1997 80 ppb 8-hour ozone, 2008 75 ppb 8-hour ozone, and 2012 12 µg/m³ PM_{2.5} NAAQS. The 2016 State SIP Strategy proposed a suite of regulatory and incentive programs, which, in combination with local actions, were designed to achieve emission reductions to meet the NAAQS. The 2016 State SIP Strategy includes a new measure for SORE with the goal to reduce SORE

emissions and increase the penetration of zero-emission technology. The 2016 State SIP Strategy includes the following actions and expected emission reductions for SORE:

Reduce exhaust and evaporative emissions from SORE through enhanced enforcement of the current emission standards, adoption of more stringent exhaust and evaporative emission standards, and increased use of ZEE.

Develop additional strategies for transitioning to zero-emission technologies, including an initial focus on incentives for use of ZEE.

Propose regulations to reduce SORE emissions by 2031 by the following amounts:

- Statewide: Reduce NO_x emissions by 4 tons per day (tpd), ROG emissions by 36 tpd, and PM_{2.5} by < 0.1 tpd.
- South Coast Air Basin: Reduce NO_x emissions by 2 tpd and ROG emissions by 16 tpd.
- San Joaquin Valley Air Basin: Reduce NO_x emissions by 0.3 tpd.

In November 2016, CARB staff proposed to the Board and the Board approved for adoption amendments to the evaporative emission requirements for SORE with provisions for enhanced enforcement of the evaporative emission standards. Staff also began conducting more frequent compliance testing in Fall 2016. CARB staff has pursued several strategies to encourage the adoption of zero-emission technologies as detailed in subsection E of this chapter. The Proposed Amendments described in Chapters II and XI are designed to achieve the expected emission reductions for SORE.

The 2016 State SIP Strategy also includes a measure for “Further Deployment of Cleaner Technologies: Off-Road Equipment” specific to the South Coast Air Basin. This measure would achieve an estimated 18 tpd of NO_x emission reductions and 20 tpd of ROG emission reductions by 2031 but does not specify the source of the reductions. The measure calls on CARB and the local air district to identify and develop mechanisms to incentivize deployment of near-zero and zero-emission technologies, and to expand and enhance existing incentive and other innovative funding programs for off-road equipment to increase the emphasis on and support for ZEE and provide near-source risk reduction for operators of the equipment. The Proposed Amendments described in Chapters II and XI include changes to expand existing emission reduction credit programs to further incentivize and accelerate the production of ZEE.

Amendments to regulations for SORE are necessary. In the absence of tighter emission standards for SORE, emissions of the ozone precursors NO_x and ROG are expected to increase as California’s population continues to grow. Maximum emissions reductions must be achieved from SORE in order to avoid this increase in emissions and instead reduce SORE emissions to achieve 2016 State SIP Strategy commitments necessary to attain the ozone NAAQS and protect public health and welfare.

3. Executive Order N-79-20

In September 2020, Governor Gavin Newsom issued Executive Order N-79-20, which sets a goal to “transition to 100 percent zero-emission off-road vehicles and equipment by 2035 where feasible.” EO N-79-20 specifically directs CARB, to the extent consistent with State and federal law, to develop and propose strategies, in coordination with other state agencies, U.S. EPA and local air districts, to achieve 100 percent zero-emission from off-road vehicles and equipment operations in the State by 2035. The EO further states that in implementing the strategies, CARB “shall act consistently with technological feasibility and cost-effectiveness.” (California Executive Order No. N-79-20, 2020).

The Proposed Amendments are an important part of meeting the 2035 zero-emission goal for off-road vehicles and equipment operations. Setting SORE exhaust and evaporative emission standards to zero for new engines (engines produced for sale or lease for use or operation in California) for MY 2024 and subsequent model years for all equipment except generators, and for MY 2028 and subsequent model years for generators, will result in a significant change in the in-use fleet of SORE equipment to ZEE by 2035. As described in the next section and following chapters, development of the Proposed Amendments took into account the typical useful lifetime of current SORE equipment and technological feasibility and cost-effectiveness of current and anticipated zero-emission options.

E. Technological Feasibility

1. Current ZEE Availability and Usage Rates

ZEE have been available for many equipment types for decades. The level of performance, number of brands, and number of equipment options have increased greatly and continue to do so today. Battery and electric motor technology has advanced rapidly in recent years, while costs have declined. Advances in battery technology have allowed for the price of batteries to fall precipitously. It is projected that from 2010 to 2030, the price of a battery holding a kilowatt-hour of energy will decrease by over 90 percent (Martin, 2019). The increase in use of brushless electric motors has led to a significant increase in the efficiency of equipment using that technology. These developments have led to a significant increase in ZEE product development over the last several years.

ZEE on the market today have a broad range of both capability and price. For residential-grade equipment, there are currently at least 35 different manufacturers of ZEE (CARB, 2021c). For lawn mowers, one of the most abundant types of small off-road equipment, there are at least 28 brands of ZEE available, with many brands offering multiple models. The number of manufacturers has risen steadily over the past 15 years, and is likely to continue rising as the market for ZEE matures. Residential users can purchase quality ZEE at most home improvement retailers and hardware stores.

For professional-grade equipment, there are at least twelve different manufacturers of ZEE (CARB, 2021c) with at least nine brands of ZEE lawnmowers. Many of these manufacturers are those who currently make SORE equipment trusted by professional users. This

equipment can be purchased directly from the manufacturer or through certified dealers located around the state, similar to purchasing gasoline-powered equipment.

Generators are another common type of small off-road equipment. Zero-emission generators are available to meet users' demand, and their price depends largely on the cost of energy storage. The expected decrease in the cost of energy storage will both decrease the average cost of a zero-emission generator and increase energy storage. Some small off-road equipment is specialized and used in emergency response. These include chainsaws, pumps, and cutoff saws. While zero-emission chainsaws, pumps, and cutoff saws are available, new engines used in chainsaws with displacement 45 cc and above, pumps with displacement 40 cc and above, and cutoff saws are preempt under section 209(e)(1) of the federal Clean Air Act, and therefore, not subject to the SORE regulations. Chainsaws designed for use by firefighters typically use engines with displacement 45 cc or above (Stihl USA, 2021f), and fire pumps typically use engines with displacement 40 cc or above (CET, 2021). Section 2403(f) of the exhaust emission regulations provides that "fire and police departments, and other entities that specialize in emergency response may purchase emergency equipment powered by a non-California certified engine only when such equipment with a California-certified engine is not available." This provision allows a fire or police department, or other entity that specializes in emergency response, to submit a request to the Executive Officer for approval to purchase emergency equipment powered by a non-California certified engine, if no equipment powered by California certified engines and consistent with the entity's application requirements is available. CARB has not received any request from a fire or police department, or other entity that specializes in emergency response to purchase emergency equipment powered by a non-California certified engine. The Proposed Amendments would not impact this existing provision.

To better understand the small off-road equipment population in California, CARB contracted with the Social Science Research Center (SSRC) at California State University, Fullerton (CSUF) to conduct an intensive survey between 2017 and 2019 of households, nonlandscaping businesses, and landscapers on their ownership and use of small off-road equipment, and other related topics (CSUF survey) (CSUF SSRC, 2019). Staff developed the survey questions in close collaboration with SSRC, industry and other interested stakeholders through a series of working group meetings. The main goal of the survey was to calculate a more accurate inventory of small off-road equipment in California for emissions modeling. The survey reached over 1,100 households, 1,300 businesses and 600 landscaping businesses throughout the state. Topics included ownership, use rates, knowledge of ZEE, and maintenance practices. The final report estimates the total small off-road equipment population and the populations of several equipment types.

According to the CSUF survey, almost half of households own at least one piece of lawn and garden equipment. Nearly 40 percent of households own another piece of small off-road equipment such as an air compressor, generator, or pressure washer. The residential sector makes up the majority of the small off-road equipment population in California, with a total population of about 26.4 million pieces of equipment (CSUF SSRC, 2019). Of the

26.4 million pieces of residential small off-road equipment in California, about 15.5 million are ZEE. This represents a current ZEE ownership rate of 59 percent for residential small off-road equipment in California. Residential users use their equipment less frequently than professional users, and thus replace equipment less frequently. The CSUF survey showed that the median age of equipment is six years for a residential lawnmower and five years for a trimmer/edger. Only 7 percent of households stated that they intended to buy any additional pieces of small off-road equipment or replacements for their current small off-road equipment in the next year.

The professional sector makes up a relatively small portion of the SORE equipment population in the state. Per the CSUF survey, the total professional SORE equipment population is about 2.87 million, which is about 10 percent of the total population in California. Although professional equipment make up only a small fraction of all SORE, professional equipment are used far more frequently than residential equipment and produce the majority of SORE emissions in California. Of the 2.87 million pieces of professional small off-road equipment, only about 960,000, or 33 percent, are ZEE. Eight percent of small off-road equipment used by landscaping businesses are ZEE.

2. Comparison of ZEE and SORE Equipment

For the most common types of SORE equipment, there are ZEE equivalents available in the market with similar or better performance characteristics and lifetime. For the purpose of comparing performance characteristics and lifetime, staff evaluated some of the most popular types of small off-road equipment available in the market for both residential and professional use. This comparison is not comprehensive and does not demonstrate that SORE equipment and ZEE have identical performance.

For both residential and professional equipment analyses, staff evaluated SORE equipment and their ZEE equivalents. The nine most common types of small off-road equipment were evaluated. For residential equipment, these make up 98 percent of in-use residential SORE equipment that would be impacted by the Proposed Amendments is considered in the analysis (CARB, 2020). For professional equipment, the nine equipment types evaluated by CARB make up 91 percent of the professional SORE equipment that would be impacted by the Proposed Amendments is considered by this analysis (CARB, 2020).

a. Performance Characteristics

i. Residential Equipment

Staff analyzed the performance of residential SORE equipment and ZEE that are similar in functionality, as shown in Table I-4. The analysis focused on bestselling SORE equipment models for each equipment type, using data from major home improvement retailers regarding median price and popularity. The ZEE was selected for similar characteristics to the SORE equipment. Staff reviewed characteristics of each piece of equipment to determine what work it could accomplish. For instance, with the lawn mower, cutting width, self-propulsion, and cutting height adjustment were considered. The SORE and

zero-emission mowers both have 21-inch cutting widths, and have six cutting height positions. These characteristics determine how quickly a lawn mower is able to cut grass. The zero-emission lawn mower is self-propelled, while the SORE lawn mower is not, so the zero-emission lawn mower would be easier to operate for most users. With similar characteristics, the lawn mowers are equally capable of cutting a lawn in similar time.

Staff compared leaf blowers that can move similar amounts of leaves based on air flows stated in equipment specifications. The SORE equipment considered moves air at 453 cubic feet per minute, while the ZEE ranges from 250 to 500 cubic feet per minute. The blowing force of the SORE blower is 15.8 Newtons. The zero-emission leaf blower has a blowing force of 21 Newtons. The chainsaws compared have the same bar length, allowing them to cut similar sized objects. The pressure washers both create streams with 3,000 pounds per square inch of pressure and have interchangeable nozzles. The zero-emission pressure washer has a maximum flowrate of 1.3 gallons per minute (gpm), while the SORE pressure washer has a maximum flowrate of 2.3 gpm. The SORE riding mower has a 48 inch cutting deck. While 48 inch residential-grade electric riding mowers are less common, both 38 inch and 54 inch versions are available. Both the SORE and electric riding mowers are mulching capable with side discharge. The SORE riding mower has a top drive speed of 5.5 miles per hour (mph), while the zero-emission riding mower has a top drive speed of 7 mph. The SORE snow blower has an 18 inch clearing swath, while the electric has a 20 inch clearing swath. Both have adjustable chutes to change the direction of snow throw. The SORE string trimmer has a cutting swath of 18 inches and bump feed. The battery-electric string trimmer has a cutting swath range of 14 to 16 inches and also has bump feed. While the cutting swath of the electric string trimmer is slightly smaller than its SORE counterpart, it allows for a wider range of string diameters and has an adjustable cutting depth. Both trimmers have attachments that can be changed for other tool capabilities.

Generators are different from other SORE, in that their function is to generate electricity. Because of this, zero-emission generators often do not contain an electric motor.^e Instead, zero-emission generators often convert chemical energy to electrical energy without the use of an electric motor. Characteristics that establish functionality of a SORE or zero-emission generator include the types and number of receptacles available on the generator and the power rating. Most SORE and zero-emission generators are equipped with 120-volt power output, but both are available with 240-volt output as well. The SORE and zero-emission generators cited in Table I-4 both have 120-volt output. The runtime of a zero-emission generator that does not have solar or wind attachments is determined by the energy storage and the load on the generator. Therefore, if a longer runtime is required under the same load, a larger energy storage zero-emission generator must be

^e In this context, an electric motor is a rotating machine that transforms electrical energy into mechanical energy.

purchased. Zero-emission generators can also be purchased with solar or wind generation equipment, which can add to the available power and runtime.

The SORE equipment and ZEE evaluated may have different runtimes, but the runtime of the ZEE can always be extended through the use of additional batteries. Additional batteries can increase the cost of the equipment to complete the job. However, if the equipment is used enough to necessitate extra batteries, it is more likely that users will make back the additional investment through decreased maintenance and fuel costs.

Table I-4. Residential SORE equipment and ZEE used in performance analysis.

| Type of equipment | Make and model of SORE equipment | SORE equipment citation | Make and model of ZEE | ZEE citation |
|----------------------------|----------------------------------|-------------------------|-----------------------|---------------------|
| Chainsaw | Ryobi RY 3716 | (Home Depot, 2020l) | DEWALT DCCS670T1 | (Home Depot, 2020d) |
| Portable Generator | Briggs & Stratton #030744 | (Home Depot, 2020b) | Goal Zero Yeti 1500 | (Goal Zero, 2020b) |
| Lawn Mower | Troy-Bilt TB170 XP Space Saver | (Home Depot, 2020c) | Ego LM2102SP | (Home Depot, 2020f) |
| Leaf Blower/Vacuum | Echo PB-2520 | (Home Depot, 2020e) | Ego LB6500 | (Lowes, 2021a) |
| Pressure Washer | Ryobi RY803001 | (Home Depot, 2020m) | Sun Joe SPX4600 | (Home Depot, 2020n) |
| Pump < 2 hp | GPT Co. XG10 | (Lowes, 2021b) | RYOBI P750-P163 | (Home Depot, 2020k) |
| Riding Mower | John Deere BG21077 | (Home Depot, 2020h) | RYOBI- RY48140 | (Home Depot, 2021a) |
| Snow Blower | Briggs & Stratton #1697099 | (Home Depot, 2020a) | Greenworks SN200 | (Home Depot, 2020g) |
| Trimmer/Edger/Brush Cutter | Toro 51978 | (Home Depot, 2020o) | Milwaukee 2825-21ST | (Home Depot, 2021b) |

ii. Professional equipment

For each professional equipment type, SORE equipment and ZEE that are similar in functionality were selected for performance analysis, as shown in Table I-5. Staff reviewed characteristics of each piece of equipment to determine what work it could accomplish. For instance, with the riding mower, deck size, speed range, and discharge system were evaluated. Both riding mowers have a 60-inch deck size, a 10 mile-per-hour top speed,

side discharge decks, and twin lever control for steering. With these similar characteristics, the riding mowers are expected to be able to accomplish the same jobs.

The SORE and zero-emission chainsaws compared in the performance analysis both have 18-inch bar lengths. The manufacturer's description of the zero-emission chainsaw claims it "Provides expected power and torque of a 50cc gas engine." (Greenworks, 2021b). Chainsaws using engines with displacement 45 cc or greater are preempt and would not be impacted by the Proposed Amendments. The walk-behind lawn mowers compared are both self-propelled and have 21-inch cutting decks. Both mowers are capable of mulching or bagging the grass cuttings. The SORE lawn mower has drive speeds between 2.1 and 4.0 mph, while the ZEE lawn mower has drive speed between 1.1 and 3.3 mph. The SORE leaf blower has a maximum air velocity of 232 miles per hour, while the ZEE leaf blower has a maximum of 188 miles per hour. The blowing force of the zero-emission leaf blower is 21 Newtons, while the blowing force of the SORE leaf blower is 30 Newtons. The trimmers compared have similar cutting widths, with the SORE trimmer at 46 centimeters and the zero-emission trimmer at 40 cm. The SORE snow blower has a 28-inch clearing width and can throw the snow up to 45 feet. The zero-emission snow blower has a 21 inch clearing width and can throw snow up to 40 feet. For the pressure washers, both are cold water units. Both units have a maximum pressure of 4,000 psi and maximum flow rate of 3.5 gallons per minute. Both the SORE and zero-emission pressure washers can operate over a variety of nozzle angles.

The SORE generator cited in Table I-5 has both 120-volt and 240-volt output. The zero-emission generator has 120-volt, universal serial bus (USB) A, USB-C, USB-C power delivery, 6 mm port, 12-volt car port, and a 12-volt high power port. The runtime of a zero-emission generator that does not have solar or wind attachments is determined by the energy storage and the load. Therefore, if a longer runtime is required, a larger energy storage zero-emission generator must be purchased. Zero-emission generators can be purchased with solar or wind generation equipment, which can add to the available power and runtime. The Goal Zero 3000X is compatible with solar attachments, which can be purchased separately. More information on zero-emission generators is in section I.E.3.b, below.

Runtime for ZEE is determined by the battery capacity and the load. For most professional equipment, including all the handheld equipment, extra batteries can be purchased at any time. Some riding mowers, including the Gravely Pro-Turn EV (Gravely, 2021), have batteries that can be exchanged.

Table I-5. Professional SORE equipment and ZEE used in performance analysis.

| Type of equipment | Make and model of SORE equipment | SORE equipment citation | Make and model of ZEE | ZEE citation |
|---------------------------------|----------------------------------|-------------------------------------|---|---|
| Chainsaw | Stihl MS-211 | (Stihl USA, 2020b) | Greenworks Commercial GS 181 | (Greenworks, 2021b) |
| Generator Set | Honda EU7000iS | (Honda, 2020a) | Goal Zero 3000X | (Goal Zero, 2020a) |
| Lawn Mower | Honda HRC216HXA | (Honda, 2020b) | Greenworks GMS210 | (Greenworks, 2021c) |
| Leaf Blower/ Vacuum | Husqvarna 967 14 43-01 | (Leaf Blowers Direct, 2020) | Stihl BGA 200 | (Stihl USA, 2021b) |
| Pressure Washer | Simpson SW4035HADM | (Pressure Washers Direct, 2020) | Pressure Pro EE3540A-AS + Goal Zero 3000X | (Pressure Washers Direct, 2021; Goal Zero, 2020a) |
| Pump < 2 hp | Honda GX-25 | (Northern Tool and Equipment, 2020) | Milwaukee 2771-21 | (Home Depot, 2020i) |
| Riding Mower | John Deere Z920M | (John Deere, 2020) | Mean Green CXR-60 | (Eco Equipment Supply, 2020) |
| Snow Blower | Toro Power Max HD 928 | (Toro, 2020) | Toro 39902 | (Snow Blowers Direct, 2020) |
| Trimmer/Edger/ Brush Cutters | Husqvarna 525LST | (Husqvarna, 2020a) | Husqvarna 536 LiLx | (Husqvarna, 2020b) |

iii. Operational differences between SORE equipment and ZEE

While ZEE can perform the same jobs as SORE equipment, there are differences in operator experience with the two types of equipment. Overall, the zero-emission versions of specific equipment types have been designed to mimic the user experience of the SORE equipment, but there are differences in preparing equipment for use.

With ZEE, particularly for regular users, the timing of battery charging needs to be considered. For most professional users, it is assumed they will purchase sufficient batteries for a typical day of use and will recharge the batteries overnight when not operating equipment. Users would need sufficient electrical service and outlets to run battery chargers overnight. Daily runtime can be extended without the purchase of extra batteries if recharging is possible.

When operating SORE equipment, users must make regular trips to the gas station. The user must fill a portable fuel container (PFC) with gasoline and then pour the gasoline into the equipment fuel tank. For any two-stroke equipment,^f the fuel must be mixed with oil in a specific (generally 50:1) ratio before adding fuel to the equipment. This adds time to preparing equipment for use. These operations present numerous opportunities for fuel spillage, another source of excess ROG emissions from SORE.

Starting the equipment can also be very different for SORE equipment and ZEE. All ZEE is push-button start. Sometimes ZEE is purposefully made with starting sequences that requires pressing certain buttons in a certain order to avoid accidental power up (e.g., U.S. Consumer Safety Product Commission, 2021). SORE equipment is sometimes available with push-button start for a premium. Other SORE equipment has recoil start where the user must use a pull cord to physically start the engine.

iv. Equipment lifetimes

When a manufacturer certifies SORE for sale or lease for use or operation in California, it is required to choose an emissions durability period, which is the period that represents an engine's useful life. Currently, emissions durability periods for SORE in California range from 50 to 1000 hours. The wide range in durability periods can come from various points of failure including piston ring failure, crank bearing failure, gasket degradation, and various carburetor issues. Since there are so many moving parts inside an internal combustion engine, the opportunity for failure is high.

ZEE, in contrast, often utilize electric motors. In general, these electric motors are either brushed or brushless direct current motors, with the brushless motors being the newest and most preferred option. Electric motors do not have many moving parts. In general, this leads to significantly longer lifespans of the motors, with brushed electric motors operating between 1,000 and 3,000 hours depending on the material composition of the brushes (Perzan, 2021; Janjua, 2017). Based on market reports, staff expects the majority of new ZEE purchased to be battery-powered (Farnsworth Group, 2021). The majority of battery-powered equipment utilizes brushless motors due to the increased efficiency and lifespan of the motors. Brushless motors can operate for tens of thousands of hours,

^f The complete combustion cycle of a two-stroke engine requires one up and one down movement of the piston within the cylinder during one crankshaft revolution. The complete combustion cycle of a four-stroke engine requires two up and two down movements of the piston within the cylinder during two crankshaft revolutions. A complete combustion cycle is the complete process of gasoline and air being drawn into the cylinder, compressing the mixture, igniting it, and expelling the exhaust. Two-stroke engines have fewer moving parts than four-stroke engines and often have a higher power-to-weight ratio. Two-stroke engines require pre-mixing of fuel and oil, often referred to as premix, because they rely on the oil in the fuel-oil mixture to lubricate critical engine parts. Four-stroke engines do not require premix because the critical engine parts are either directly or splash lubricated. Two-stroke engines often have higher emissions than four-stroke engines of comparable power output due to the oil being burned in the engine as well as the presence of oil droplets in the exhaust. Consequently, particulate matter exhaust emission standards specified in § 2403 apply to two-stroke engines but not four-stroke engines.

depending on the quality of the bearings that are used in the motor (Perzan, 2021; Janjua, 2017). Overall, electric motors provide a service life that is significantly longer than internal combustion engines.

ZEE generally have a longer limited warranty period than SORE equipment. For instance, Stihl offers limited warranties of three years for residential use and two years for professional use on all of their battery equipment. For the gasoline-powered equipment, residential limited warranties range from one to two years. For professional gasoline-powered equipment, limited warranties range from three months to two years (Stihl USA, 2021a). While the equipment evaluated for performance characteristics were not chosen for their limited warranty period, in almost all cases the limited warranty period for the electric equipment is at least as long as the limited warranty period for the SORE equipment, as shown in Tables I-6 and I-7, below. These units are representative of the general trend that ZEE has longer warranty periods than SORE equipment. The trimmers in Tables I-6 and I-7 show shorter warranties for the zero-emission version than the SORE version. There are ZEE trimmers with longer warranties, including all Stihl battery-powered trimmers, which have the three-year warranty noted above, and all trimmers under the SCAQMD commercial lawn and garden equipment exchange program, which have a two-year warranty (Shen, Walter, Personal Communication, August 11, 2021). The zero-emission pressure washer has a shorter motor warranty than the engine warranty on the SORE pressure washer; both have five-year warranties on the pump.

Exhaust and evaporative emission control system warranty periods are two years for SORE equipment, regardless of the limited warranty period. ZEE used to generate emission reduction credits must have a minimum warranty period of two years for the equipment, including batteries and battery chargers, as applicable.

These limited warranty periods suggest that ZEE generally have a longer lifetime than SORE equipment. Using ZEE can help users save money on equipment purchases over time, by extending the period before they purchase replacement equipment.

Table I-6. Residential SORE equipment and ZEE limited warranty periods.

| Type of equipment | Make and model of SORE equipment | SORE warranty period (years) | SORE equipment citation | Make and model of ZEE | ZEE warranty period (years) | ZEE citation |
|-----------------------------|----------------------------------|------------------------------|-------------------------|-----------------------|-----------------------------|---------------------|
| Chainsaw | Ryobi RY 3716 | 3 | (Home Depot, 2020l) | DEWALT DCCS670T1 | 3 | (Home Depot, 2020d) |
| Generator Set | Briggs & Stratton #030744 | 2 | (Home Depot, 2020b) | Goal Zero Yeti 1500 | 2 | (Goal Zero, 2020b) |
| Lawn Mower | Troy-Bilt TB170 XP Space Saver | 3 | (Home Depot, 2020c) | Ego LM2102SP | 5 | (Home Depot, 2020f) |
| Leaf Blower/ Vacuum | Echo PB-2520 | 5 | (Home Depot, 2020e) | Ego LB6500 | 5 | (Lowe's, 2021a) |
| Pressure Washer | Ryobi RY803001 | 3 | (Home Depot, 2020m) | Sun Joe SPX4600 | 2 | (Home Depot, 2020n) |
| Pump < 2 hp | GPT Co. XG10 | 1 | (Lowe's, 2021b) | RYOBI P750-P163 | 3 | (Home Depot, 2020k) |
| Riding Mower | John Deere BG21077 | 2 | (Home Depot, 2020h) | RYOBI- RY48140 | 3 | (Home Depot, 2021a) |
| Snow Blower | Briggs & Stratton #1697099 | 3 | (Home Depot, 2020a) | Greenworks SN200 | 3 | (Home Depot, 2020g) |
| Trimmer/ Edger/Brush Cutter | Toro 51978 | 4 | (Home Depot, 2020o) | Milwaukee 2825-21ST | 3 | (Home Depot, 2021b) |

Table I-7. Professional SORE equipment and ZEE limited warranty periods.

| Type of equipment | Make and model of SORE equipment | SORE warranty period (years) | SORE equipment citation | Make and model of ZEE | ZEE warranty period (years) | ZEE citation |
|----------------------------|----------------------------------|------------------------------|-------------------------------------|------------------------------|-----------------------------|---------------------------------|
| Chainsaw | Stihl MS-211 | 0.25 | (Stihl USA, 2020b) | Greenworks Commercial GS 181 | 2 | (Greenworks, 2021b) |
| Generator Set | Honda EU7000iS | 3 | (Honda, 2020a) | Goal Zero 3000X | 2 | (Goal Zero, 2020a) |
| Lawn Mower | Honda HRC216HXA | 1 | (Honda, 2020b) | Greenworks GMS210 | 2 | (Greenworks, 2021c) |
| Leaf Blower/Vacuum | Husqvarna 967 14 43-01 | 0.25 | (Leaf Blowers Direct, 2020) | Stihl BGA 100 | 2 | (Stihl USA, 2020a) |
| Pressure Washer | Simpson SW4035HADM | 3 | (Pressure Washers Direct, 2020) | Pressure Pro EE3540A-AS | 1 | (Pressure Washers Direct, 2021) |
| Pump < 2 hp | Honda GX-25 | 1 | (Northern Tool and Equipment, 2020) | Milwaukee 2771-21 | 5 | (Home Depot, 2020i) |
| Riding Mower | John Deere Z920M | 3 | (John Deere, 2020) | Mean Green CXR-60 | 2 | (Eco Equipment Supply, 2020) |
| Snow Blower | Toro Power Max HD 928 | 45 days | (Toro, 2020) | Toro 39902 | 2 | (Snow Blowers Direct, 2020) |
| Trimmer/Edger/Brush Cutter | Husqvarna 525LST | 2 | (Husqvarna, 2020a) | Husqvarna 536 LiLx | 1 | (Husqvarna, 2020b) |

3. Potential Challenges for ZEE Deployment

Manufacturers currently produce zero-emission landscaping equipment for residential and professional users. However, as described in this section, some professional and residential users are reluctant to purchase ZEE. These users may not choose to purchase ZEE as long as new SORE equipment are available in California. In addition, there is still a need for innovation and growth in the zero-emission generator market. Allowing certification of only zero-emission generators beginning with MY 2024 could have unintended negative impacts on backup power supply in some regions of California. A regulation that accelerates the adoption of ZEE, while allowing more time and incentives for generators to meet the zero-emission standard, can be the driving force that helps users embrace the new technology and provides the emission reductions that are expected under the 2016 State SIP Strategy.

a. Consumer Behavior

Some users continue to purchase SORE equipment rather than ZEE. Studies by The Farnsworth Group indicate that ZEE accounted for more of the small off-road equipment purchased by residential users and landscapers in 2020 than in previous years (Farnsworth Group, 2021a and 2021b). Twenty-seven percent of surveyed landscapers' purchases were ZEE in 2020, versus 21 percent in 2018. Three major factors cited for consumer behavior as it pertains to small off-road equipment purchase decision are the upfront cost, run-time, and user habit (CSUF SSRC, 2019).

Residential survey respondents who noted that they had no plans to purchase new equipment in the next year were asked what factors would be important in a hypothetical purchase in deciding between gasoline-powered equipment and ZEE. Cost was the top response, followed closely by power and time to refuel/recharge. These results suggest that many individuals base their purchase decisions on old information. Currently, residential SORE equipment and ZEE have similar prices. In many cases, ZEE cost less to purchase. Section VII.A.2 and section C.1.c.i of Appendix I of this Staff Report discuss residential and professional SORE equipment and ZEE pricing. ZEE manufacturers market their equipment as having performance that is comparable to or better than SORE in many cases.

The CSUF survey asked participating landscapers what qualities of the equipment were most important to them, to better understand landscapers' rate of adoption of ZEE. Performance, run-time, and cost were the top three responses. The average purchase price of professional ZEE, including sufficient batteries for an eight-hour workday, is higher than for SORE equipment. As an example, the purchase price of a professional ZEE leaf blower with batteries is nearly twice as much as its gasoline counterpart. Upfront cost is a significant barrier to transforming the population of lawn and garden equipment in the professional market to ZEE, even though ZEE often have a lower total cost of ownership over the equipment lifetime. Decreasing battery prices may result in lower prices for ZEE (Martin 2019), as discussed further in section I.E.3.b. ZEE do not have many of the inconveniences of gasoline-powered equipment, listed in I.E.2.a.iii. ZEE are quieter and require little maintenance. Charging costs less than

purchasing gasoline (Mahoney, 2021). Section C.1.d.i of Appendix I includes a discussion of fuel and electricity costs.

Professional landscapers and residential users with large properties require ZEE with a longer run time or must purchase additional batteries to complete their typical work day. Some of these users who currently use SORE equipment may purchase diesel or large spark-ignition (LSI) engine equipment rather than SORE or ZEE equipment when replacing their SORE equipment. However, this is not a likely pathway as diesel equipment are much more expensive than similar SORE equipment and do not offer the full operational cost-savings that ZEE offer. For example, the price of a Generac XD5000E, which is a popular diesel generator, is \$4,230.42 (Generac, 2021).⁹ This is much higher than the price of the residential SORE generator in Table I-4, \$861.49 (Home Depot, 2020b). The price of the residential zero-emission generator in Table I-4 is \$2,169.95 (Goal Zero, 2020b), which is lower than the price of the Generac XD5000E diesel generator. The price of this diesel generator is approximately 4 times the price of the residential SORE generator and 2 times the price of the zero-emission generator. This cost difference would be significant for most consumers. Reported production of small off-road diesel engines rated at or below 19 kW for California is approximately one tenth of the production of SORE for California. Manufacturers of diesel generators would need to significantly increase production volumes in order to meet demand from customers who would otherwise purchase SORE generators. CARB staff plans to propose amendments to the current emission standards for off-road diesel engines around 2024 and may at the same time include provisions encouraging or requiring ZEE for some diesel applications.

For riding lawn mowers, both diesel and LSI options are available. LSI versions of riding mowers are generally less expensive than diesel. A user who wants to purchase a riding mower but does not want to purchase ZEE is more likely to purchase an LSI engine riding mower as it is less expensive than a diesel engine riding mower. A popular LSI riding mower is the Cub Cadet PRO Z 972 L KW, which has a price of \$12,899 (Holmes Rentals and Sales, 2021). This price is higher than the price of the commercial SORE riding mower in Table I-5 at \$10,449. The price increase associated with purchasing an LSI engine riding mower instead of a SORE riding mower is smaller than for a zero-emission riding mower, but an LSI engine riding mower does not offer the operational savings a zero-emission mower would offer. It is important to note that per EO N-79-20 (California Executive Order No. N-79-20, 2020), CARB staff will be looking for ways to encourage or require the maximum use of zero-emission equipment where feasible, including in categories where manufacturers currently sell LSI versions.

While purchasing additional batteries would add to the upfront cost, a professional user could still experience operational cost-savings. Many manufacturers sell equipment bundles that include multiple batteries and a quick charger that can charge

⁹ Prices in this paragraph include sales tax.

one battery about as quickly as a user can discharge another battery. Residential-grade ZEE generally come with a battery that can last long enough for the average user to conduct the job at hand (Mahoney, 2021; Yardcare.com, 2020).

b. More Time Needed for Generators to Meet Zero-Emission Standards

Generators are fundamentally different from other SORE equipment because their purpose is to generate electricity. Because their function is to provide electrical power rather than perform mechanical work (as lawn and garden equipment does), zero-emission generators often convert chemical energy to electrical energy without the use of an electric motor. Most zero-emission generators are essentially battery banks with a built-in power inverter. Some models have the ability to accept solar panels for charging. Hydrogen fuel cell powered generators have also been introduced in the market and could become more prevalent. For purposes of this report, we refer to all of these SORE alternatives as zero-emission generators.

In 2020, generators accounted for 14 percent of the total population of SORE equipment, and 19 percent of all NO_x and ROG emissions from SORE (CARB, 2020). Residential users own 89 percent of SORE generators and, on average, use them more than other small off-road equipment. Per the CSUF survey, only 14 percent of residential generators and 11 percent of generators owned by nonlandscaping businesses are currently zero-emission generators, much lower than most other equipment types. Zero-emission generators will need to make up a much larger market share to achieve substantial emission reductions from generators. Regulatory amendments are needed to accelerate the deployment of zero-emission generators in California.

Zero-emission generators can serve the needs of users. The Goal Zero Yeti 6000X is one of the highest energy storage portable zero-emission generators that is widely available. It has 6,071 watt-hours of energy storage and can run a full-size refrigerator for 110 hours or a circular saw for 4 hours. Solar panels can extend the runtime (Goal Zero, 2021d). Some zero-emission generators have greater energy storage and more capability. The Onyx Rhino has 7,600 watt-hours of energy storage and is equipped with both 120-volt and 240-volt 50 or 60 hertz output. The Onyx Rhino can run a refrigerator for 3 to 4 days, charge a laptop over 100 times, or charge a 20-volt power drill over 150 times (Onyx, 2021).

For users who require even more power, such as contractors, mobile power units are available. For example, FreeWire Tech currently produces a mobile power unit, the Mobi Gen, which has 80 kilowatt-hours of energy storage, and a rated power output of 11 kilowatts (FreeWire Tech, 2021). Zero-emission generators of this size have higher prices than SORE generators; however, incentive programs such as the Clean Off-Road Equipment Voucher Incentive Project (CORE) exist to help mitigate the cost of these generators (California CORE, 2021). Additionally, new vehicle models such as the Ford F-150 Lightning pickup truck allow use of electricity from batteries powering the vehicles to power other equipment. The F-150 Lightning has 90 kilowatt-hours of energy storage, which can be used to provide backup power to a home. The F-150

Lightning can also use the 90 kilowatt-hour battery to deliver up to 9,600 watts of 120-volt power to items plugged directly into the vehicle (Ford Motor Company, Inc., 2021).

Even so, for the reasons described in the following paragraphs, CARB staff recommends allowing more time and implementing a new credit program for manufacturers to innovate and develop new products to meet the future demands of the zero-emission generator market. Manufacturers will need to overcome several challenges to increase the share of zero-emission generators:

- Limited options are currently available, and they often have higher costs. As shown in Appendix I, a popular SORE generator, the Briggs & Stratton #030744, costs \$861.49 (Home Depot, 2020b). A zero-emission generator with similar characteristics, the Goal Zero Yeti 1500, costs \$2,169.95 (Goal Zero, 2020b). The \$1,308.46 price differential would be difficult to recoup without significantly increased use. Section C.1.d of Appendix I includes a discussion of operating costs. As the cost of batteries decreases (Martin 2019), the price of zero-emission generators is also expected to decrease.
- Current supply might not meet future demand. While the existing zero-emission generators can adequately power essential equipment and appliances in residences, manufacturers of zero-emission generators may not be positioned to meet the market demand that could occur if fewer SORE generators were produced starting in MY 2024. Population modelling with SORE2020 suggests demand for generators is relatively constant, year over year. Requiring MY 2024 generators to meet emission standards of zero could increase the price of available zero-emission generators due to demand. A price increase would create added costs for residential users and professional users. Users may not recoup such additional costs through operating cost-savings with zero-emission generators. The break-even point for typical residents purchasing a zero-emission generator instead of SORE at current prices is 9 years. If the price of ZEE increased, that time would be extended. Sections C.2, C.3, and C.5 of Appendix I include break-even time calculations. Thus, the market is not ready to replace the remaining SORE generators with zero-emission generators by MY 2024.
- Options for non-grid recharging of zero-emission generators are costly. Batteries can be charged on the grid, if available, or through local solar or wind power generation. Solar panels and wind turbines can have significant cost. For instance, Goal Zero sells kits with zero-emission generators and solar panels. A low cost version with a Goal Zero Yeti 200X power station and Nomad 20 solar panel costs \$449.90 (Goal Zero, 2021b). The Goal Zero Yeti 200X power station by itself costs \$299.95 (Goal Zero, 2021c). The Goal Zero Yeti with the greatest energy storage is the 6000X, which costs \$4,999.95 (Goal Zero, 2021d), while with 4 Nomad 200 Solar Kits, the cost is \$7,350.52 (Goal Zero, 2021b). Fuel cell generators can be run for as long as there is fuel present, much like a SORE generator. The cost of a fuel cell can be significant (Patel, 2020). Fuel cells

usually use a methanol reformer to produce hydrogen. Methanol in California is currently available for \$3.85 per gallon (Altergy 2021, personal communication, May 24, 2021), which is similar to the price of gasoline.

- The zero-emission generator market needs more time to mature to better meet demand for backup power supply. In some regions of the state, public safety power shutoffs (PSPS) occur during periods of increased fire danger. Electric utilities have announced efforts to reduce the number and duration of PSPS events. These include increasing utilization of microgrids and transmission line switches that allow for very localized PSPS (Pacific Gas & Electric, 2020). PSPS were less frequent and had a shorter duration on average in 2020 than in 2019 (California Public Utilities Commission, 2021). CARB staff recommends implementing emission standards of zero for generators starting in MY 2028 to allow more time for the zero-emission generator market to mature.

The price of zero-emission generators per unit of energy storage will likely decrease over time as the cost of batteries decreases. Projections suggest that, from 2010 to 2030, the price of a battery holding a kilowatt-hour of energy will decrease by over 90 percent (Martin, 2019). CARB staff expects that generator manufacturers will be able to offer zero-emission generators at a price and capability comparable to existing SORE generators by MY 2028 and that, as the market matures, the overall supply of zero-emission generators will increase to meet the demand. CARB staff further anticipates the proposed zero-emission generator credit program will accelerate the production of more, and a greater variety of, zero-emission generators.

F. Additional Strategies for Transition to ZEE

CARB staff has pursued several strategies to support increased adoption of zero-emission technologies. One such strategy was running ZEE demonstration projects with state agencies. The landscaping crew at Capital Park in Sacramento, several California Department of Transportation crews, and the landscapers at California State University Sacramento were all able to try a full suite of ZEE from several manufacturers. These demonstration projects were run in conjunction with the manufacturers, who supplied the equipment.

Staff also met with personnel from the Department of General Services through these demonstration projects, and provided input for updates to the State Administrative Manual (SAM). Recommended updates, which included adding sweeping and raking as preferred methods for exterior maintenance, were incorporated in the SAM in November 2018 (California Department of General Services, 2019). The updated SAM requires that when sweeping or raking are not possible, electric equipment must be used, unless there are compelling circumstances and prior authorization is received from facilities management. The updates to the SAM also require state departments to replace their gasoline-powered equipment with zero-emission strategies, as replacement schedules allow.

Since 2018, staff has conducted a program to reach more landscaping groups with information about ZEE and an opportunity to try the equipment. The ZEE Roadshow is a demonstration project, with a trailer filled with eight brands of ZEE for professional users. The Roadshow has visited California landscaping crews at locations including cities, school districts, colleges, theme parks, and zoos. Further discussion of the ZEE Roadshow can be found in section X.E.

Several programs provide incentive funding for professional and residential users to purchase ZEE. These programs are an important complement to the Proposed Amendments. CARB manages a broad portfolio of incentives that collectively help achieve CARB's emission reduction goals, including greenhouse gas (GHG) reductions. This includes programs such as the Carl Moyer Memorial Air Quality Standards Attainment Program (Carl Moyer Program) and Community Air Protection Incentives Program. The Carl Moyer Program provides funding opportunities for early and extra cost-effective emission reductions that can be credited towards California's SIP commitments. The Community Air Protection Incentives Program includes funding to support early actions for emission reductions in communities most heavily impacted by disproportionate levels of air pollution. Finally, the Clean Mobility in Schools Pilot Project included funding for zero-emission landscaping equipment. Three schools were awarded funding and one has already purchased ZEE.

Several air districts, including SCAQMD and SJVAPCD, have existing incentive programs for landscapers. These programs allow landscapers to trade in their existing SORE equipment and obtain a substantial rebate or discount on their purchase of ZEE (SCAQMD, 2021; SJVAPCD, 2021). Both the Bay Area Air Quality Management District (BAAQMD) and Santa Barbara Air Pollution Control District (SBAPCD) also offered incentive programs for professional landscapers. Due to the overwhelming response to these programs, they have exhausted all available funding (BAAQMD, 2021; SBAPCD, 2021). Many districts offer incentives on residential equipment, as well.

II. The Problem That the Proposal Is Intended to Address

This chapter provides a description of the problems that the Proposed Amendments to the SORE exhaust and evaporative regulations and the certification and test procedures are intended to address, along with descriptions of how the Proposed Amendments would resolve the problems. Chapter XI provides detailed descriptions of the underlying purpose and rationale for each specific proposed amendment. Appendices A through G provide the full text of the Proposed Amendments.

A. Current SORE Regulations Will Not Achieve Required Emission Reductions

1. The Problem

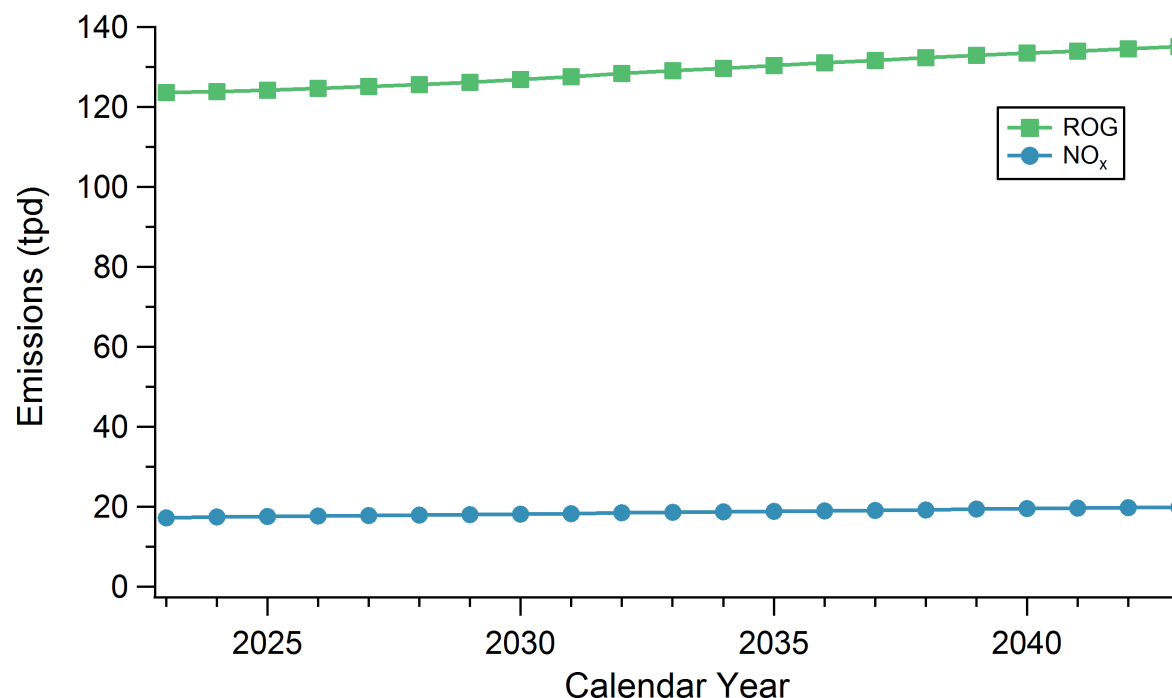
HSC, section 39602.5(a) provides that CARB must "adopt rules and regulations pursuant to Section 43013 that ... will achieve ambient air quality standards required by the federal Clean Air Act ... in all areas of the state by the applicable attainment

date, and to maintain these standards thereafter. Under HSC, section 39602.5(b), the state board shall adopt these measures if they are necessary, technologically feasible, and cost effective, consistent with Section 43013.” CARB must also “adopt and enforce rules and regulations that anticipate the development of new technologies or the improvement of existing technologies” if they are necessary to carry out CARB’s duties to achieve attainment of ambient air quality standards (HSC, section 39602.5(b)). Substantial progress has been achieved in reducing NO_x and ROG emissions through implementation of CARB’s existing mobile source programs. Many of these programs will continue to provide further reductions through 2031, contributing significantly to meeting ambient air quality standards. However, about 12 million Californians live in communities that still exceed the ozone and PM_{2.5} NAAQS (CARB, 2017b). Substantial challenges still remain in meeting the ozone standards in two areas of the state with the worst air quality issues: the South Coast Air Basin and the San Joaquin Valley Air Basin. Mobile sources and the fossil fuels that power them are the largest contributors to the formation of ozone and PM_{2.5} in California. Consequently, as described in Chapter I, the 2016 State SIP Strategy calls for substantial emission reductions from both stationary and mobile sources, including SORE. SORE use leads to significant emissions of NO_x and ROG, which contribute to PM and ozone formation. The 2016 State SIP Strategy contains expected statewide emission reductions for SORE of 4 tpd of NO_x and 36 tpd of ROG, by 2031 (CARB, 2017b). Expected emission reductions in 2031 from SORE included in the 2016 State SIP Strategy in 1) the South Coast Air Basin are 2 tpd of NO_x and 16 tpd of ROG, and 2) in the San Joaquin Valley Air Basin are 0.3 tpd of NO_x (CARB, 2017b).

Current SORE regulations will not achieve emission reductions expected under the 2016 State SIP Strategy. As described in greater detail in section III.A.3, the population of ZEE in California has increased in recent years. The increase is expected to continue as the total population of small off-road equipment grows (CARB, 2020). Even so, the growth in ZEE sales will be insufficient to maximize the reduction of SORE emissions without further regulation (CARB, 2020). SORE emissions are still expected to increase in the 2020s as California’s population continues to grow. As shown in Figure II-1, during summer months (May through October), NO_x emissions from SORE in 2021 are 17.0 tpd and are expected to increase 8 percent to 18.3 tpd by 2031. ROG emissions from SORE are currently 123.8 tpd and expected to increase 3 percent to 127.5 tpd by 2031 (CARB, 2020).

The 2016 State SIP Strategy calls for more stringent emission standards and additional regulatory incentives to accelerate the replacement of SORE equipment with ZEE. More stringent emission standards and additional regulatory incentives would prevent SORE emissions from increasing and facilitate emission reductions necessary to attain ambient air quality standards by 2031 and protect the health and welfare of all California residents. Replacing new sales of SORE equipment with ZEE as quickly as feasible will help California maximize emission reductions from SORE and meet its obligations under the 2016 State SIP Strategy. Amendments to the SORE regulations are necessary to accomplish these actions.

Figure II-1. Summer average NO_x and ROG emissions under current SORE regulations.



Exhaust emission standards for SORE have not been changed since MYs 2000 to 2008, depending on displacement category, despite improvements in available emission control technologies. In fact, among engines currently available for sale in California, there are many engine families certified below the current emission standards. Manufacturers use emission credits generated by engine families that are certified to levels below the current emission standards to offset emissions from engine families that are certified to levels above the current standard.

There are two paths to engine certification for evaporative emissions – design and performance. Manufacturers using design certification must use evaporative emission control system components that meet design standards. For performance certification, manufacturers must test emissions from the complete engine (with the evaporative emission control system installed). The majority of evaporative families use design certification. Among those evaporative families using performance certification, there are several families that emit well below the current emission standards, demonstrating that overall lower emissions from SORE are possible.

Engines with displacement less than or equal to 80 cc comply by using fuel tanks and fuel lines that meet the emission standards listed in Table I-3. There is no performance certification option for engines in this displacement category.

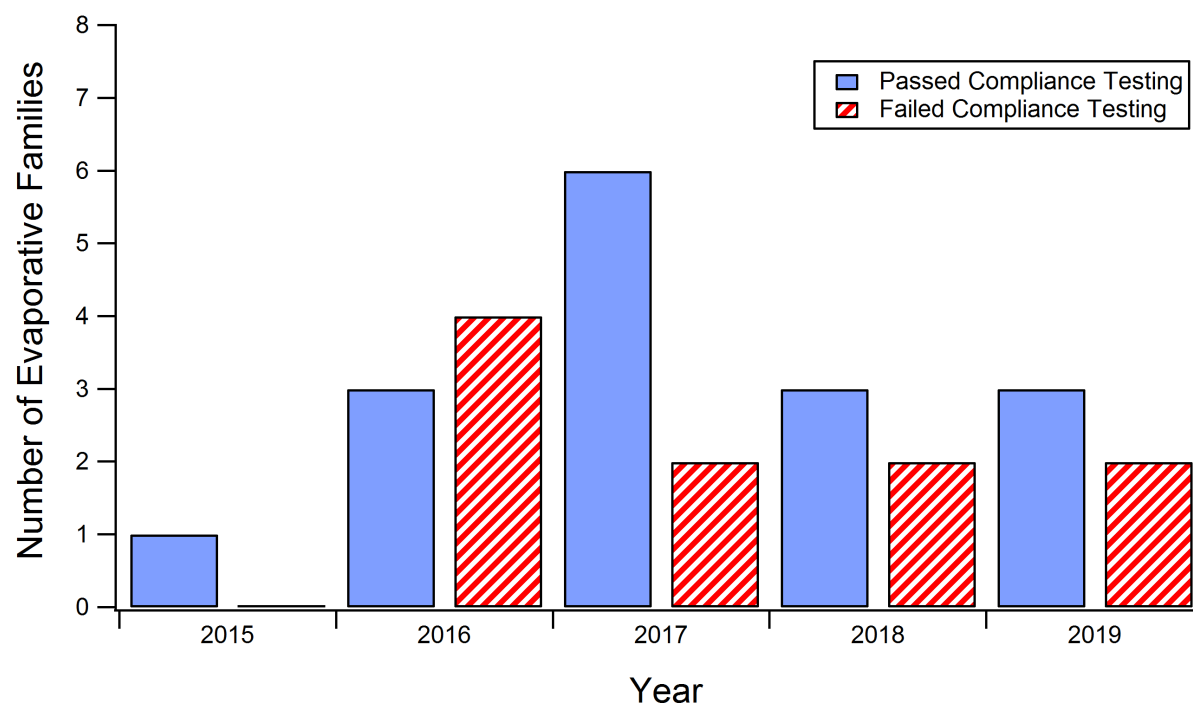
Beginning with MY 2024, the Proposed Amendments would require all SORE to use performance certification. Evaporative emission standards for MYs 2024 through 2027 for engines used in generators would be more stringent than the current emission standards. Evaporative emission standards for all other SORE would be zero. To

ensure that engines meet the more stringent emission standards for generators, performance certification is necessary. Manufacturers would also need to use performance certification to determine the amount of credits needed to offset emissions from SORE categories for which emission standards are zero.

Current compliance testing of evaporative families shows low rates of compliance (CARB, 2021f; Figure II-2). Of the 31 evaporative families tested by CARB between MYs 2015 and 2019, 12 have failed. This 39 percent failure rate results in much higher ROG emissions from SORE and highlights the need to adopt zero-emission technologies as quickly as possible. Prior to MY 2020, only SORE that were performance certified were required to meet a diurnal emission standard in compliance testing. This means engines are failing compliance testing, despite being tested under the same conditions as certification testing conditions. This suggests poor quality control of SORE evaporative emission control systems.

Generators, in particular, present a unique issue for emission reductions. The function of generators is to produce electricity when grid electricity is not available, so zero-emission generators must have significant battery capacity or be able to generate electricity through use of solar energy, wind energy, or a fuel cell. However, reducing emissions from generators is vital. In 2020, generators were the single largest NO_x and ROG emission source in the SORE category, accounting for 19.3 percent of the total of NO_x and ROG emissions from SORE (CARB, 2020). Therefore, the Proposed Amendments include more stringent emission standards for engines used exclusively in generators for MY 2024 and subsequent model years.

Figure II-2. Evaporative emission compliance testing results for MYs 2015-2019.



2. The Solution

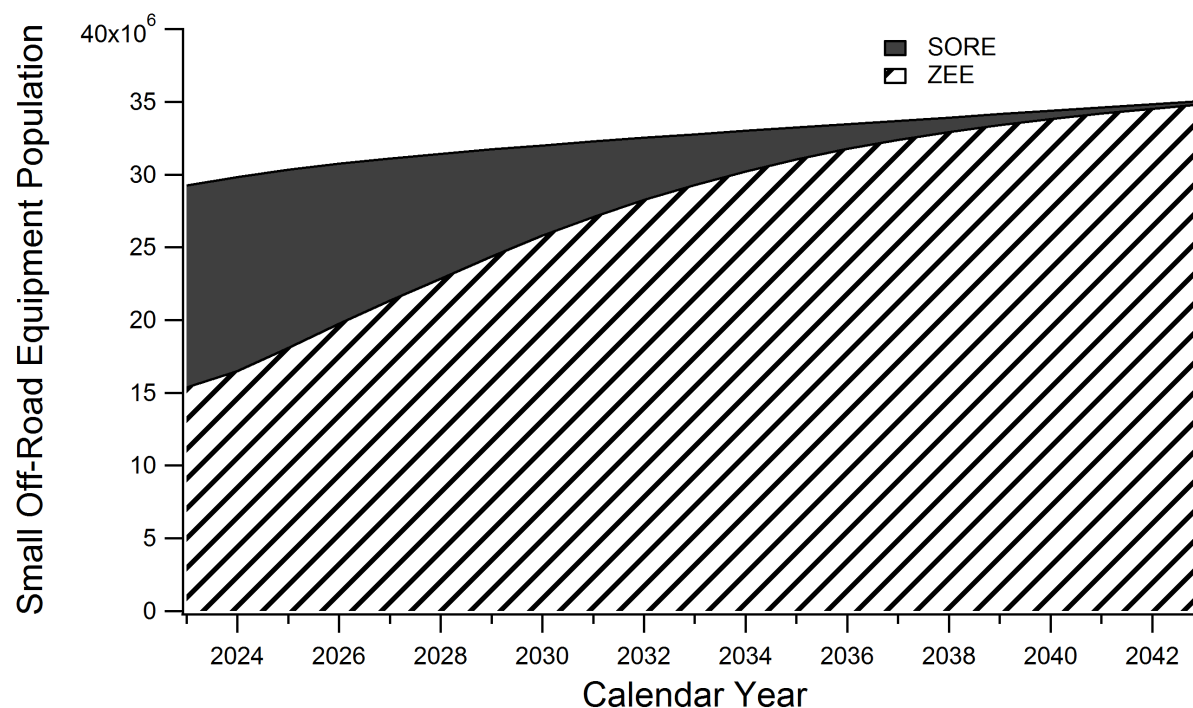
To address these problems, CARB staff proposes regulatory amendments to the SORE regulations to accelerate the replacement of new SORE equipment produced for sale or lease for use or operation in California with ZEE. This will be achieved by setting SORE emission standards to zero and by refining and expanding existing emission reduction credit programs for manufacturers to further incentivize ZEE. Currently, most ZEE are either battery-powered or corded electric equipment. In addition to charging battery storage using grid electricity, fuel cells and solar or wind generation could be used directly to power electric equipment in place of engines subject to the SORE regulations.

a. Amend Emission Standards

The Proposed Amendments, as summarized in Chapter XI and provided in full in Appendices A through G, include two phases for tightening the emission standards. First, for MY 2024, HC and NO_x exhaust emission standards and evaporative emission standards would be zero for engines used in all new small off-road equipment types produced for sale or lease for use or operation in California except generators. Generator emission standards would be more stringent starting with MY 2024 but would not be zero. The second phase would be implemented starting with MY 2028, when the emission standards for new generators manufactured for sale or lease for use or operation in California would be zero.

These emission standards would maximize emission reductions as statutorily required of CARB, help meet the expected emission reductions for SORE in the 2016 State SIP Strategy and move close to the zero-emission goals for small off-road equipment identified in EO N-79-20, noted in section I.A of this Staff Report. Under the Proposed Amendments scenario, it is projected that 93.4 percent of equipment subject to the SORE regulations would be ZEE in 2035 (CARB, 2020). Figure II-3 shows the modeled growth of ZEE as a portion of small-off road equipment under the Proposed Amendments. Some equipment is kept in use for many years, so replacing the remaining SORE equipment with ZEE would take many additional years. However, 99.4 percent of equipment subject to the SORE regulations would be ZEE in 2043.

Figure II-3. Modeled small off-road equipment population statewide under the Proposed Amendments.



The Proposed Amendments would allow more time for generators to meet emission standards of zero for two reasons. First, one of the main uses of generators is backup power supply. In some regions of the state, PSPS have become an occasional occurrence due to periods of high wind and low humidity events that increase fire risk. It is not the intention of the Proposed Amendments to reduce options for backup power supply in these regions, so a delay in the time for generators to be zero-emissions is reasonable. Second, as described in section I.E.3.b, there is still a need for innovation and growth in the zero-emission generator market. The fraction of all generators currently in use that are ZEE is significantly lower than that for lawn and garden equipment, such as lawnmowers and trimmers.

Professional users' generator use varies by industry. Professional-grade zero-emission generator options are currently limited and have a higher cost than their SORE counterparts. Reducing emission standards for generators in two phases and over a longer period than other small off-road equipment allows time for the market to mature. A proposed zero-emission generator credit program provides manufacturer flexibility and send a market signal to encourage growth in the zero-emission generator market.

Under the Proposed Amendments, beginning with MY 2024, the evaporative emission standards would cover a greater portion of an engine's evaporative emissions. This would ensure MY 2024 and subsequent model year SORE equipment meet the emission standards. Currently, the evaporative emission standards only apply to the 24-hour diurnal cycle, while under the Proposed Amendments they would also apply to the hot soak period. The evaporative test procedure includes running the

equipment for fifteen minutes to heat the engine. Then the hot soak period occurs, which involves holding the equipment at 95 degrees for one hour. Section XI.B has further description of the hot soak and diurnal test procedures. Manufacturers are already required to measure and report hot soak emissions when performing a test on a complete engine, so including hot soak emissions would not add any testing burden or cost. This change would reduce the potential for higher-than-expected hot soak emissions to reduce the actual benefits of the emission standards.

The Proposed Amendments include hot soak plus diurnal evaporative emission standards for generators for MYs 2024 through 2027 that are approximately 50 percent lower than current diurnal emission standards. Currently-certified engines meet these emission standards, including the hot soak. Several evaporative families in each displacement category meet the proposed emission standards. These evaporative families include engines used in all major SORE equipment types, including generators. The hot soak plus diurnal emission standards would apply to engines with displacement less than or equal to 80 cc, which are currently required to meet permeation emission standards for fuel tanks and fuel lines. The 0.50-gram organic material hydrocarbon equivalent per test emission standard for engines with displacement less than or equal to 80 cc was developed through testing conducted at CARB, which found engines for sale in California already exhibit hot soak plus diurnal emissions below this level. The permeation emission standards currently in effect for engines with displacement less than or equal to 80 cc would be phased out for engines produced after MY 2023.

Tables II-1 and II-2 compare current and proposed emission standards for exhaust and evaporative emissions, respectively. The proposed HC + NO_x exhaust emission standard for the displacement category of greater than 825 cc would align with the current exhaust emission standard for LSI engines, i.e., those rated greater than 19 kilowatts (kW) and with displacement greater than 825 cc.

New emission standards for all SORE would apply beginning with MY 2024 to provide sufficient lead time to permit the development of the necessary technology giving appropriate consideration to the cost of compliance within that time period, as required by Section 209 of the Clean Air Act. This will provide at least two years for manufacturers to meet the emission standards, including preparing the necessary compliance demonstrations, which is sufficient where the technology to meet the emission standards is used in equipment already in the market. Implementing the proposed emission standards beginning in two years will result in significant emission reductions and progress in meeting the goals of EO N-79-20 without imposing an undue burden or cost for compliance. Considering the requirements, implementing the emission standards earlier than two years does not provide adequate consideration for the costs.

The Proposed Amendments would also sunset the voluntary “Blue Sky Standards” for engines produced after MY 2023. The Blue Sky Standards were developed to allow manufacturers to receive recognition for certifying to lower emission standards, but

CARB has no record of any manufacturer taking advantage of the program for engines.

Table II-1. Current SORE exhaust emission standards and exhaust emission standards under the Proposed Amendments.

| Displacement category | Current HC + NO_x emission standard (g·kWh⁻¹) | Proposed HC + NO_x emission standard^h for MY 2024-2027 generators (g·kWh⁻¹) | Proposed HC + NO_x emission standard for all other SORE for MYs 2024 and later (g·kWh⁻¹) |
|------------------------------|---|--|--|
| < 50 cc | 50 | 6.0 | 0.00 |
| 50-80 cc, inclusive | 72 | 6.0 | 0.00 |
| > 80 cc - < 225 cc | 10.0 | 6.0 | 0.00 |
| 225-825 cc, inclusive | 8.0 | 3.0 | 0.00 |
| > 825 cc | 8.0 | 0.80 | 0.00 |

^h For MY 2028 and subsequent model years, the proposed exhaust emission standards for generators are 0.00 g·kWh⁻¹ for HC + NO_x.

Table II-2. Current SORE evaporative emission standards and evaporative emission standards under the Proposed Amendments.

| Displacement category | Current diurnal emission standard (g·day⁻¹) | Proposed hot soak plus diurnal emission standardⁱ for MY 2024-2027 generators (g·test⁻¹) | Proposed hot soak plus diurnal emission standard for all other SORE for MYs 2024 and later (g·test⁻¹) |
|--|---|---|---|
| ≤ 80 cc | N/A | 0.50 | 0.00 |
| > 80 cc - < 225 cc except walk-behind mowers | 0.95 + 0.056 × nominal capacity (liters) | 0.60 | 0.00 |
| > 80 cc - < 225 cc walk-behind mowers | 1.0 | N/A | 0.00 |
| ≥ 225 cc | 1.20 + 0.056 × nominal capacity (liters) | 0.70 | 0.00 |

The Proposed Amendments include revisions to the following SORE regulations:

- Amend CCR §§ 2400, 2401, 2402, 2403, 2404, 2405, 2405.1, 2405.2, 2405.3, 2406, 2407, 2408, 2408.1, 2750, 2752, 2753, 2754, 2754.1, 2754.2, 2755, 2756, 2757, 2758, 2759, 2761, 2762, 2763, 2764, 2765, 2766, 2767, 2767.1, and 2771
- Adopt CCR §§ 2408.2 and 2754.3
- Repeal CCR § 2768

To provide consistency with the proposed changes to the emission standards, the Proposed Amendments also include revisions to the test and certification procedures included in the above SORE regulations and in the following procedures incorporated by reference:

- CARB. Small Off-Road Engine Evaporative Emissions Test Procedure, TP-901, Test Procedure for Determining Permeation Emissions from Small Off-Road Engine Fuel Tanks. Adopted July 26, 2004, and last amended [insert amendment date].

ⁱ For MY 2028 and subsequent model years, the proposed evaporative emission standards for generators are 0.00 g·test⁻¹.

- CARB. Small Off-Road Engine Evaporative Emissions Test Procedure, TP-902, Test Procedure for Determining Evaporative Emissions from Small Off-Road Engines. Adopted July 26, 2004, and last amended [insert amendment date].
- CARB. Small Off-Road Engine Evaporative Emission Control System Certification Procedure, CP-902, Certification Procedure for Evaporative Emission Control Systems on Small Off-Road Engines. Adopted July 26, 2004, and last amended [insert amendment date].
- CARB. California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1054). Adopted October 25, 2012, and last amended [insert amendment date].
- CARB. California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1065). Adopted October 25, 2012, and last amended [insert amendment date].

The above listed documents are also being amended by this proposed regulatory action; thus, the “insert amendment date” would be the date that the regulation is adopted by CARB.

The Proposed Amendments incorporate by reference the following documents that were not previously incorporated:

- American National Standards Institute, Inc. (ANSI)/National Electrical Manufacturers Association (NEMA). 2016. ANSI/NEMA WD 6-2016, Wiring Devices - Dimensional Specifications. ANSI Approval Date: February 11, 2016.
- American National Standards Institute, Inc. (ANSI)/Outdoor Power Equipment Institute (OPEI). 2018. ANSI/OPEI B71.10-2018, American National Standard for Off-Road Ground-Supported Outdoor Power Equipment – Gasoline Fuel Systems – Performance Specifications and Test Procedures. Published November 12, 2018.
- ASTM International (ASTM). 1995. D2986 – 95a, Standard Practice for Evaluation of Air Assay Media by the Monodisperse DOP (Diethyl Phthalate) Smoke Test. Approved September 10, 1995.
- ASTM. 2009. F1471 – 09, Standard Test Method for Air Cleaning Performance of a High-Efficiency Particulate Air Filter System. Approved March 1, 2009.
- ASTM. 2010. D5291 – 10, Standard Test Methods for Instrumental Determination of Carbon, Hydrogen, and Nitrogen in Petroleum Products and Lubricants. Approved May 1, 2010.
- ASTM. 2010. D5599 – 00 (Reapproved 2010), Standard Test Method for Determination of Oxygenates in Gasoline by Gas Chromatography and Oxygen Selective Flame Ionization Detection. Approved October 1, 2010.

- ASTM. 2012. D4629 – 12, Standard Test Method for Trace Nitrogen in Liquid Petroleum Hydrocarbons by Syringe/Inlet Oxidative Combustion and Chemiluminescence Detection. Approved April 15, 2012.
- ASTM. 2012. D5762 – 12, Standard Test Method for Nitrogen in Petroleum and Petroleum Products by Boat-Inlet Chemiluminescence. Approved April 15, 2012.
- ASTM. 2012. D6348 – 12^{ε1}, Standard Test Method for Determination of Gaseous Compounds by Extractive Direct Interface Fourier Transform Infrared (FTIR) Spectroscopy. Approved February 1, 2012.
- ASTM. 2020. D1835 – 20, Standard Specification for Liquefied Petroleum (LP) Gases. Approved May 1, 2020.
- CARB. 2012. California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles. Amended December 6, 2012.
- CARB. 2018. California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles. Amended December 19, 2018.
- GPA Midstream Association. 2017. GPA Midstream Standard 2140-17, Liquefied Petroleum Gas Specifications and Test Methods. Adopted as Recommended Procedures 1931, revised 2017.
- International Organization for Standardization (ISO). 2020. ISO 8178-1, Reciprocating internal combustion engines — Exhaust emission measurement — Part 1: Test-bed measurement systems of gaseous and particulate emissions. Reference number ISO 8178-1:2020(E). Published June 2020.
- National Institute of Standards and Technology (NIST). 1994. NIST Technical Note 1297, 1994 Edition, Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results. September 1994.
- NIST. 2008. Special Publication 811, 2008 Edition, Guide for the Use of the International System of Units (SI). March 2008.
- SAE International (SAE). 2011. Surface Vehicle Recommended Practice SAE J1151, Methane Measurement Using Gas Chromatography. Stabilized September 2011.
- SAE. 2011. Surface Vehicle Standard SAE J1527, Marine Fuel Hoses. Revised February 2011.
- SAE. 2012. Surface Vehicle Standard SAE J30, Fuel and Oil Hoses. Revised February 2012.

- SAE. 2013. Surface Vehicle Recommended Practice SAE J2996, Small Diameter Fuel Line Permeation Test Procedure. Issued January 2013.
- SAE. 2017. Surface Vehicle Recommended Practice SAE J1930, Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms - Equivalent to ISO/TR 15031-2. Revised March 2017.
- SAE. 2019. Surface Vehicle Recommended Practice SAE J1737, Test Procedure to Determine the Hydrocarbon Losses from Fuel Tubes, Hoses, Fittings, and Fuel Line Assemblies by Recirculation. Revised August 2019.
- Title 40, Code of Federal Regulations, Part 63, Appendix A—Test Methods, Test Method 320—Measurement of Vapor Phase Organic and Inorganic Emissions by Extractive Fourier Transform Infrared (FTIR) Spectroscopy. Last amended December 2, 2020.
- Title 40, Code of Federal Regulations, Part 86—Control of Emissions from New and In-Use Highway Vehicles and Engines, section 86.132-96(j). Last amended June 29, 2021.
- Title 40, Code of Federal Regulations, Part 1051—Control of Emissions from Recreational Engines and Vehicles, section 1051.505. Last amended June 29, 2021.
- Title 40, Code of Federal Regulations, Part 1068—General Compliance Provisions for Highway, Stationary, and Nonroad Programs, sections 1068.103(f) and 1068.215. Last amended June 29, 2021.
- Title 40, Code of Federal Regulations, Part 1090—Regulation of Fuels, Fuel Additives, and Regulated Blendstocks. Last amended December 4, 2020.

These documents are necessary to ensure that all SORE test procedures are following the most current version of procedures and guidance on engines.

b. Emission Reduction Credit Programs

Under the Proposed Amendments, manufacturers may continue to use emission reduction credits through the averaging, banking, and trading (ABT) programs. The ABT programs allow manufacturers to earn credits when they certify SORE that emit at levels lower than the current emission standards. These credits may be 1) used to offset emissions from SORE that emit at higher levels (referred to as averaging); 2) banked for future years; or 3) traded with other manufacturers. Credits expire after five years if they have not been used. Staff expects that, overall, generator engines would use more credits than they earn after MY 2023. The sales- and power-weighted average HC + NO_x emission rates for MY 2018 generators exceed the proposed MY 2024 emission standards. No credits could be earned once emission standards of zero are implemented for generator engines. Therefore, only remaining banked credits could be used for MY 2028 and subsequent model year engines. This would result in a replacement of SORE equipment with ZEE as it reaches the end of its useful life over time. The transition to ZEE would reduce NO_x and ROG emissions and improve California's air quality, consistent with the 2016 State SIP Strategy.

The Proposed Amendments would lower the maximum family emission levels (FEL) for engines. An FEL is defined as an emission level that is declared by the manufacturer to serve for the ABT program and in lieu of an emission standard for certification. Establishing more stringent maximum FELs is necessary to accelerate exhaust emission reductions in order to achieve the necessary SORE emission reductions by 2031 as expected under the 2016 State SIP Strategy. The lower maximum FELs would be equivalent to the current HC + NO_x exhaust emission standards, shown in Table II-1. These lowered maximum FELs for HC + NO_x would ensure that no MY 2024 or subsequent model year engines are introduced for sale or lease for use or operation in California with excessive exhaust emissions, while still allowing manufacturers flexibility to use the credits they have generated to sell engines with emissions above the proposed, more stringent emission standards. This would ensure the highest-emitting engines, which have the greatest impact on air quality and expose operators to the greatest amounts of pollutants, are replaced with ZEE the earliest.

These lower maximum FELs would also maintain maximum flexibility for manufacturers to shift their focus to ZEE. By setting the maximum FELs to the current emission standards, manufacturers could continue using credits they have banked or earn in future years on engines already in production today, without having to develop new technology.

The Proposed Amendments would also allow alternative fuel-powered SORE equipment to qualify for evaporative emission credits. This includes engines powered with CNG, propane, LPG, or LNG. These engines are not subject to the evaporative regulations, but if manufacturers wish to earn emissions credits, they may follow the test procedure to do so. This will allow more flexibility in production and give credits to manufacturers of low-emitting engines.

Currently, the emission reduction credit program for evaporative emissions only has provisions for averaging and banking. The Proposed Amendments would add trading to the program to align with the exhaust emission regulations. This would allow more flexibility in the program. Manufacturers who earn credits could trade them to other manufacturers, encouraging production of the lowest-emitting engines possible.

To send another market signal to manufacturers to increase development and production of zero-emission generators, the Proposed Amendments also include a new, generator-specific emission reduction credit program. This voluntary program would allow manufacturers to offset emissions from generators with emission levels above the proposed emission standards by using credits earned from certifying zero-emission generators. All SORE, including generator engines, may be included in engine families participating in the certification averaging, banking and trading program described in § 2408. Zero-emission generators, however, are not among the equipment types included in the ZEE credits averaging, banking and trading program described in § 2408.1. The program in § 2408.1 prioritized lawn and garden equipment because professional landscapers use such equipment extensively. The emission inventory calculated with SORE2020 indicates that generators produce the highest statewide emissions of any small off-road equipment type. In 2020, generators

accounted for approximately 14 percent of the total population of SORE equipment, and 19 percent of all NO_x and ROG emissions from SORE (CARB, 2020). The function of generators is to provide electrical power rather than perform mechanical work (as lawn and garden equipment does), so zero-emission generators often do not contain an electric motor. Instead, zero-emission generators often convert chemical energy to electrical energy without the use of an electric motor. This makes incorporation of zero-emission generators into the same ZEE credits averaging, banking, and trading provisions as lawn and garden equipment less straightforward.

The Proposed Amendments add a new and separate program for zero-emission generators for simplicity. The program is tiered, granting more emission reduction credits for zero-emission generators with greater energy storage and power delivery than for those with less energy storage and power delivery. This tier system would enable the greatest credit benefits to manufacturers who develop zero-emission generators in the least developed sector of the market (i.e., zero-emission generators with the greatest energy storage and highest power output). The zero-emission generator credits would be subject to similar provisions to those in the existing emission reduction credit programs, including a five-year limit on banking credits.

In summary, the Proposed Amendments would expand the current emission reduction credit programs to increase flexibility for manufacturers. These amendments are intended to lessen the initial cost impacts for manufacturers (and those purchasing equipment) that could result when SORE equipment is replaced with ZEE. The credit programs spread out the cost impact over a longer time. Throughout the economic analysis described in Chapter VII and Appendix I of this Staff Report, credit use has been modeled such that all banked credits are used before they expire.

The Proposed Amendments include revisions to the emission reduction credit programs in following SORE regulations: CCR §§ 2408, 2408.1, 2408.2, 2754.1, and 2754.3.

B. Exhaust Emissions Durability Periods for SORE Do Not Represent Actual Lifetimes

1. The Problem

The exhaust emissions durability period is the period that represents the engine's useful life. Under California Part 1054.107, useful life is described as the period during which engines are required to comply with all applicable emission standards. The current regulations allow applicants for certification to select a durability period for their engines from a range of choices that generally reflect "moderate," "intermediate," or "extended" use. Actual use times, as found in the CSUF survey (CSUF SSRC, 2019), are often much longer than the emissions durability periods defined in the current regulations. The 75th percentile age of in-use residential generators is 15 years (CSUF SSRC, 2019). SORE2020 includes an average residential activity rate for a generator of 62 hours per year (CARB, 2020). A generator used at the average residential activity level would be used for 930 hours in 15 years. SORE2020 includes an average professional activity rate for a generator of 146 hours

per year (CARB, 2020). The 75th percentile age of a generator owned by a nonlandscaping business is 15 years (CSUF SSRC, 2019). A generator used at the average professional activity level would be used for 2,190 hours in 15 years.

In addition to actual use time, many manufacturers advertise use of their products for longer than the durability period. Honda's GX120, GX160, and GX200 engines are each certified to an emissions durability period of 500 hours. However, the maintenance schedule in the owner's manual indicates the cyclone-type air filter should be changed for the first time after 600 hours of engine operation (Honda, 2020c). Westerbeke's 9.9E, J3 and J4 generators are each certified to an emissions durability period of 250 hours, but their website says, "It is not uncommon to hear that generator sets and engines have run up to 10,000 hours with no major repairs." (Westerbeke, 2016). This discrepancy means some SORE may be emitting at levels above the emission standards for a large portion of their use time.

SORE equipment besides generators would also be subject to longer durability periods when using credits to certify. Currently, lawn mowers may certify at durability periods ranging from 125 to 500 hours. However, the 75th percentile age for a residential lawn mower is 15 years (CSUF SSRC, 2019). Average residential use time for lawn mowers is 19 hours per year (CARB, 2020). A residential lawnmower used at the average rate would be used 285 hours in 15 years. Landscapers, on average, use lawn mowers for 240 hours per year (CARB, 2020), and the 75th percentile age is 3 years (CSUF SSRC, 2019). A lawn mower owned by a landscaper used at the average rate would be used for 720 hours in 3 years.

The SORE2020 emissions inventory model used to quantify emission reductions due to the Proposed Amendments assumes emissions deteriorate (i.e., increase) to a level equal to the proposed emission standards at the end of the emissions durability period and then remain at that emission level until the equipment is no longer used. Section III.A.3 includes additional discussion of the use of SORE2020 to quantify emission reductions due to the Proposed Amendments.

The actual use times of equipment today are significantly longer than many of the durability periods specified in the SORE regulations, which can result in excess emissions. If engines are kept by users for longer than the durability period, California may not realize the emission reductions estimated under the Proposed Amendments. Therefore, based on this better understanding of a generator's actual operating hours during its useful life, current regulations need to be updated to more accurately reflect the current lifetime use period of generators.

2. The Solution

The Proposed Amendments would change the emissions durability periods to more accurately reflect the actual lifetime of SORE equipment. This would prevent manufacturers from certifying to unrealistically short emissions durability periods and only meeting the emission standards for a small portion of the equipment's lifetime. Table II-3 and II-4 describe the current and proposed exhaust emissions durability

periods for SORE. The proposed durability period for all SORE with displacement less than or equal to 80 cc other than generator engines is 300 hours. The proposed durability period for generator engines with displacement less than or equal to 80 cc is 500 hours. The proposed durability period for engines with displacement greater than 80 cc and less than 225 cc is 500 hours. The proposed durability period for engines with displacement greater than or equal to 225 cc is 1,000 hours. The durability periods in the Proposed Amendments are the longest of the current durability periods for each displacement category for engines other than generator engines with displacement less than or equal to 80 cc. Generators are not handheld equipment and do not have the same limitations of space and weight as handheld equipment. Among generators that use engines with displacement less than or equal to 80 cc, most have 80 cc engines. The design of many 80 cc engines is closer to that of an engine with displacement greater than 80 cc than it is to that of engines used in handheld equipment. The example in this section illustrates that a residential generator with an engine with displacement less than or equal to 80 cc used at the average residential activity level may be used well in excess of its current 50- to 300-hour durability period. A 500-hour durability period assures more residential generators using engines with displacement less than 225 cc will meet the emission standard for their lifetime. For all displacement categories except greater than 825 cc, there are currently engines certified below the proposed emission standards at the longest current durability periods. The proposed emission standards and emissions durability period for engines with displacement greater than 825 cc are aligned with the current emission standard and emissions durability period for similar LSI engines, i.e., those rated greater than 19 kW and with displacement greater than 825 cc. Therefore, these durability periods are technologically feasible for SORE.

The Proposed Amendments include revisions to the durability periods as listed in CCR § 2403.

Table II-3. Current SORE emissions durability periods and emissions durability periods for generator engines under the Proposed Amendments.

| Displacement category | Current emissions durability period^j (hours) | Proposed emissions durability period for MYs 2024 and later (hours) |
|------------------------------|--|--|
| < 50 cc | 50/125/300 | 500 |
| 50-80 cc, inclusive | 50/125/300 | 500 |
| > 80 cc - < 225 cc | 125/250/500 | 500 |
| 225-825 cc, inclusive | 125/250/500/1,000 | 1,000 |
| > 825 cc | 125/250/500/1,000 | 1,000 |

Table II-4. Current SORE emissions durability periods and emissions durability periods for SORE other than generator engines under the Proposed Amendments.

| Displacement category | Current emissions durability period^j (hours) | Proposed emissions durability period for MYs 2024 and later (hours) |
|------------------------------|--|--|
| < 50 cc | 50/125/300 | 300 |
| 50-80 cc, inclusive | 50/125/300 | 300 |
| > 80 cc - < 225 cc | 125/250/500 | 500 |
| 225-825 cc, inclusive | 125/250/500/1,000 | 1,000 |
| > 825 cc | 125/250/500/1,000 | 1,000 |

C. Trading of Evaporative Emission Credits Is Not Permitted, Restricting Manufacturer Flexibility

1. The Problem

Under the current regulations, manufacturers may not trade evaporative emission credits. A manufacturer may only average and bank credits for its own future use. This limits manufacturer flexibility. This lack of flexibility could be particularly challenging for manufacturers under the Proposed Amendments when emission standards would be zero and credit use would be the only compliance path for SORE equipment with

^j Manufacturers choose the emissions durability period which matches the expected useful life of an engine family. These categories are generally taken to reflect "moderate," "intermediate," and "extended" use.

nonzero emissions. This may result in unbalanced portfolios between exhaust and evaporative credits for manufacturers because credit trading is allowed under the SORE exhaust emission regulations. Manufacturers who possess banked exhaust emission reduction credits and no evaporative emission reduction credits could be unable to offset the evaporative emissions of their engines without the ability to trade evaporative emission credits with other manufacturers. It is necessary to amend the evaporative emission credit provisions to increase flexibility for manufacturers to facilitate compliance with the proposed emission standards and increase cost-effectiveness of the Proposed Amendments.

2. The Solution

Trading provisions have been added to the evaporative emission regulations under the Proposed Amendments. These provisions would allow manufacturers to trade evaporative emission credits with one another, if desired. The proposed evaporative emission credit trading provisions are similar to the existing trading provisions in the exhaust emission credit regulations. Manufacturers could use credits to offset emissions from their own evaporative families or they could trade earned credits to other manufacturers to generate revenue. An increase in certification of ZEE would increase its availability to users in California, further developing the market and accelerating the adoption of ZEE in place of SORE equipment.

The Proposed Amendments include revisions to credit provisions to incorporate trading in the following sections of the SORE regulations: CCR §§ 2754.1, 2754.3

D. Fuel Caps and Tethers Can Cause Fuel to Spill

1. The Problem

The evaporative emission regulations require fuel caps for fuel tanks used on engines with displacement greater than 80 cc to be secured to the fuel tank, equipment or engine with a tether. This prevents fuel caps from falling and becoming damaged or dirty. It also prevents them from being lost. Some fuel caps are equipped with internal tethers, i.e., with tethers that are attached to a location inside the fuel tanks. Other fuel caps incorporate fuel gauges that extend into the fuel in the fuel tank or otherwise come into contact with liquid fuel inside the fuel tank. During evaporative emissions compliance testing and other observations of engines, CARB staff has observed fuel spilling or dripping from several pieces of equipment when the fuel caps were removed. Based on these observations, CARB staff concludes that there is greater likelihood that these tethers and fuel caps may cause users of SORE equipment to spill or drip fuel when removing a cap from the fuel tank, thereby creating excess emissions neither captured in current test procedures nor reflected in CARB's emissions inventory. Therefore, it is necessary to amend the test procedures to ensure that fuel caps and tethers are designed to prevent fuel spillage. It is also necessary for certification applicants to include information in their applications to show that their engines meet relevant emission standards.

2. The Solution

The Proposed Amendments add a provision to the SORE regulations to require that fuel caps and their tethers must not cause fuel to spill when fuel caps are removed. This will reduce emissions when fuel caps are removed to check the fill level and during refueling. This provision is not expected to impact equipment costs, overall. Some manufacturers may move the tether holding the fuel cap from inside the gas tank to the outside. For some engines, this may reduce the cost of the tether, as the material has less exposure to gasoline. For other engines, it may increase the costs, as they may have to weld a tab onto the fuel tank to attach the tether. Any cost or cost-savings is expected to be negligible.

The Proposed Amendments include revisions to the fuel cap and tether requirements and test procedures included in the following section of the SORE regulations and documents incorporated by reference:

CCR § 2756

Small Off-Road Engine Evaporative Emissions Test Procedure, TP-901, Test Procedure for Determining Permeation Emissions from Small Off-Road Engine Fuel Tanks

Small Off-Road Engine Evaporative Emissions Test Procedure, TP-902, Test Procedure for Determining Evaporative Emissions from Small Off-Road Engines

E. The Variance Provisions Cause Inequitable Results, Leading to Potential Unmitigated Excess Emissions

1. The Problem

Under the current evaporative emission regulations, a manufacturer that cannot meet the requirements set forth in §§ 2754 through 2757, due to extraordinary reasons beyond the manufacturer's reasonable control, may apply in writing for a variance. The provision requires that a manufacturer mitigate the noncompliance to the maximum extent feasible. Two manufacturers have been granted variances. Excess emissions mitigation can be accomplished by certain methods including, but not limited to, relinquishing the relevant amount of evaporative emission credits or by setting a higher evaporative model emission limit to offset the excess emissions under the variance. While the variance procedure may provide a relief valve for some manufacturers that could not meet certain requirements due to extraordinary reasons beyond the manufacturers' reasonable control, it provides no relief for those manufacturers who may have had some reasonable control over their ability to meet certain requirements but still could not meet those requirements. In essence, the variance procedures create inequitable results, rewarding some manufacturers who qualify for the process while leaving others who may need relief but do not meet the threshold criteria. In turn, manufacturers that do not qualify for the variance process may choose to try to certify their engines even though they may not meet all the requirements for certification, which could result in unmitigated excess emissions. When the emission standards are zero, no further credits may be earned. Under the

variances currently in force, estimated statewide excess emissions have been offset by relinquishing evaporative emission credits or by setting a higher evaporative model emission limit. If there were insufficient credits, excess emissions may not be completely offset. This could result in higher than expected emissions and the reductions expected under the Proposed Amendments would not be met.

2. The Solution

The variance provision of the evaporative regulations is repealed under the Proposed Amendments. This would no longer allow a manufacturer that cannot meet the requirements set forth in §§ 2754 through 2757, due to extraordinary reasons beyond the manufacturer's reasonable control, to apply in writing for a variance. This would ensure equity for all manufacturers, because all manufacturers would be required to meet the requirements of the regulations. The addition of evaporative emission credit trading would also alleviate the need for variances, which would enable all manufacturers to certify their engines in a manner consistent with the SORE evaporative emission standards; manufacturers who could not meet the emission standards could acquire credits to offset emissions above the emission standards.

The Proposed Amendments include repealing the variance provision in the following section of the SORE regulations: CCR § 2768.

F. Tilting Equipment for Cleaning and Maintenance Can Result in Excess Emissions

1. The Problem

Currently, as discussed in section II.A.1, a large portion of SORE that has been compliance tested for evaporative emissions has failed. Updates to the evaporative emission test procedures are needed to increase compliance rates. CARB staff has observed two significant opportunities for excess evaporative emissions resulting from normal equipment maintenance, neither of which is quantified using existing test procedures.

Fuel can spill when equipment is tilted for cleaning, maintenance, transport or storage. Figure II-4 shows a hydraulic jack which can be used to tilt a riding mower for cleaning and maintenance. Other equipment, such as walk-behind mowers and pressure washers, are easily tilted by the user. Mi-T-M, a manufacturer of pressure washers and other small off-road equipment, provides instructions to enable a user to start an engine after it has been tipped (Mi-T-M, 2021). Those instructions discuss the possibility of engine oil getting into the cylinder, preventing the engine from starting, or contaminating the air filter. The presence of oil on the air filter could affect the amount of air going into the engine, potentially resulting in excess emissions. It is also possible when equipment is tilted that liquid fuel can contact the carbon canister, which must be prevented. The carbon canister captures evaporative emissions from the fuel tank when the equipment is stored. Once liquid fuel has contacted the carbon canister, it can be spoiled and no longer work as intended. This can result in excess evaporative emissions during equipment storage, and therefore, expected emission reductions will not be realized. CARB staff has noted that tilting equipment, including

equipment that has two wheels and must be tilted for transport, may contribute to its failure to meet emission standards in testing (CARB, 2016b).

Figure II-4. A hydraulic jack being used to clean under a riding lawn mower.



(Photo from Costco, 2021)

2. The Solution

Under the Proposed Amendments, TP-902 would include a tilt test before evaporative emission testing. The tilt test consists of tipping a piece of equipment 90 degrees in three directions, without tilting toward the carburetor, and will account for any emissions that come from fuel leaks when equipment is turned on its side for cleaning, maintenance, transportation or storage. The tilt test is not expected to have a significant impact on costs to manufacturers as it adds only a few minutes of staff time to a multi-month testing period. Also, the current regulations include requirements that are expected to ensure evaporative emission control systems would not be negatively affected by momentary tilting of the engine. An example is the requirement in § 2754 of the evaporative emission regulations to install carbon canisters in a way that prevents exposing the carbon to water or liquid fuel.

The Proposed Amendments include revisions to incorporate the tilt test in the following test procedure incorporated by reference:

CARB. Small Off-Road Engine Evaporative Emissions Test Procedure, TP-902, Test Procedure for Determining Evaporative Emissions from Small Off-Road Engines

G. Manufacturers May Not Determine Fuel Tank Pressure Limits Accurately

1. The Problem

The evaporative emission test procedures, TP-901 and TP-902, include pressure tests for fuel tanks. The test procedures also require manufacturers to determine a fuel tank system's design pressure and vacuum limits under normal operating and storage conditions, considering the influence of any associated pressure/vacuum relief components. Currently, there is no specified procedure for determining these fuel tank pressure limits. The test procedures do not require a pressure test if the fuel tanks have no features that would cause positive or negative pressure to accumulate during normal operation or storage. The method for determining the pressure limits is left to the manufacturer.

If tanks actually operate or are stored at pressures outside the window of the pressure test conducted, fuel tanks may weaken under real-world use. The weakening can result in excess evaporative emissions from the fuel tanks due to thinning or cracks that can occur.

2. The Solution

A procedure for determining pressure limits of tanks has been added to the evaporative test procedures as part of the Proposed Amendments. This test ensures that manufacturers determine pressure limits of their tanks uniformly. It further ensures that pressure tests are cycled through the actual higher and lower pressures that tanks may achieve when operating or stored during actual use by a consumer.

Encompassing the full range of pressures experienced by the fuel tank is vital for the integrity of the evaporative emission test. If the tank is cycled through a smaller pressure range than actually experienced by the tank under normal operating conditions, or no pressure test is performed, it may not properly stress the tank and reveal weaknesses that contribute to excess emissions.

The Proposed Amendments include revisions to specify the pressure testing in the following test procedures incorporated by reference:

CARB. Small Off-Road Engine Evaporative Emissions Test Procedure, TP-901, Test Procedure for Determining Permeation Emissions from Small Off-Road Engine Fuel Tanks

CARB. Small Off-Road Engine Evaporative Emissions Test Procedure, TP-902, Test Procedure for Determining Evaporative Emissions from Small Off-Road Engines

H. Manufacturers Wish to Accelerate Preconditioning

1. The Problem

Manufacturers frequently request approval for accelerated preconditioning of fuel tanks or evaporative emission control systems when planning to conduct evaporative emission testing. Preconditioning is the process of exposing evaporative emission control systems or their components to liquid fuel or fuel vapors to a point of

maximum permeation to ensure the evaporative emissions measured in a test represent the emissions that would occur in real-world use. For example, evaporative emissions from a new engine that has not previously contained fuel would be expected to be lower if they were measured the first day fuel were introduced to the fuel tank than after the fuel tank had contained fuel for a longer period of time. Under the current test procedure, manufacturers are required to precondition evaporative emission control systems or components for 140 days or provide data documenting that emissions will not increase with further preconditioning for units preconditioned less than 140 days. The data that must be provided are not specified in the test procedures. Manufacturers frequently request a reduction in that time. If manufacturers wish to shorten the preconditioning time, it is vital that all evaporative emission control system components have already reached maximum permeation to ensure that the evaporative emission testing represents real-world emissions. If the fuel contact time is insufficient, the test may not capture actual evaporative emissions from the equipment representative of real-world operations.

2. The Solution

The evaporative test procedures have been modified to add specifications for data documenting that evaporative emissions will not increase with further preconditioning to clarify requirements for accelerated preconditioning. The specifications would ensure that all manufacturers know the requirements for accelerated preconditioning and that they are applied consistently to all manufacturers to maintain a level playing field.

The Proposed Amendments include revisions to the preconditioning requirements in the following test procedures incorporated by reference:

CARB. Small Off-Road Engine Evaporative Emissions Test Procedure, TP-901, Test Procedure for Determining Permeation Emissions from Small Off-Road Engine Fuel Tanks.

CARB. Small Off-Road Engine Evaporative Emissions Test Procedure, TP-902, Test Procedure for Determining Evaporative Emissions from Small Off-Road Engines.

I. CARB Test Procedures Have Become Inconsistent with U.S. EPA Test Procedures

1. The Problem

U.S. EPA test procedures for exhaust emissions have been updated since CARB test procedures were last updated. Those updates have created inconsistencies between U.S. EPA and CARB test procedures that are unnecessary and add to regulatory complexity for manufacturers. Under the CARB test procedures, measurement instrumentation is more limited than allowed by U.S. EPA. The U.S. EPA procedures specify engine preconditioning requirements for various types of engines, while no such specificity exists under CARB procedures. U.S. EPA procedures include new procedures for determining the mass of nonmethane hydrocarbons from the measurement of total HC, which is absent in the CARB procedures.

2. The Solution

The CARB exhaust test procedures have been updated to harmonize with U.S. EPA test procedures throughout. Changes to U.S. EPA test procedures have not been incorporated if they are less stringent than the CARB's requirements. This harmonization simplifies testing for manufacturers and allows for easier comparison of the test procedures. With the test procedures more closely aligned, manufacturers may do less testing overall and have less confusion between the U.S. EPA and CARB test procedures. Some of these changes include allowing more types of instrumentation for measurement of HC emissions.

The Proposed Amendments include revisions to the following test procedures incorporated by reference:

CARB. California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1054).

CARB. Proposed Amendments to California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1065).

J. Compliance Testing of Exhaust Emissions from Engines is Overly Burdensome

1. The Problem

Under the current regulations, CARB is required to test up to 30 engines to determine compliance of an engine family with exhaust emission regulations. This is overly burdensome and makes it extremely difficult for CARB to conduct compliance testing. Without compliance testing, CARB cannot verify that engines are actually meeting the emission standards set forth in the regulations. If engines are not complying with the emission standards, excess emissions will occur.

2. The Solution

Under the Proposed Amendments, the current exhaust emission compliance testing requirement to test "a reasonable number" of engines has been changed to "one or more." This will allow CARB to perform compliance testing of exhaust emissions without the onerous burden of testing up to 30 engines from an engine family before making a determination whether the family meets the emission standards. The requirement that engines be tested in "groups of five" has been deleted. This will allow for broader exhaust emission compliance testing of SORE.

The Proposed Amendments include revisions to the compliance testing procedures included in the following sections of the SORE regulations and documents incorporated by reference:

- CCR § 2407.
- CARB. California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1054).

- CARB. Proposed Amendments to California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1065).

K. Other Changes to the Regulations and Procedures

Other administrative changes have been made to the regulations and certification and test procedures to provide clarity for manufacturers. These are detailed in Chapter XI of this document.

III. Air Quality

The SORE regulations have been successful at reducing emissions over the last 25 years. The Proposed Amendments would continue to improve the SORE regulations to achieve additional emission reductions and accelerate the adoption of ZEE to help California attain and maintain ambient air quality standards. The Proposed Amendments are designed to maximize emission reductions and achieve the expected emission reductions in the 2016 State SIP Strategy specified for SORE and would reduce emissions of pollutants that have multiple known adverse health effects. Emissions of NO_x and ROG from SORE contribute to formation of three criteria air pollutants—ozone, PM and NO₂—either directly (NO₂ and PM) or indirectly (NO₂, ozone, and PM). As described in Chapters I and IV, all of these criteria air pollutants have adverse health effects. The Proposed Amendments would also reduce GHG emissions and petroleum use. The Proposed Amendments are part of a portfolio of “Strategies, in coordination with other State agencies, U.S. Environmental Protection Agency and local air districts, to achieve 100 percent zero-emission from off-road vehicles and equipment operations in the State by 2035,” which EO N-79-20 (California Executive Order No. N-79-20, 2020) orders CARB to develop and propose.

As described in Chapters II and XI, the Proposed Amendments would increase the adoption of ZEE for small off-road equipment regulated by the State at the earliest practicable date. This chapter describes the methodology by which the emission benefits were estimated and a summary of results as they relate to the 2016 State SIP Strategy.

A. SORE Emission Inventory and Modeling Methodology

To quantify emission reductions due to the Proposed Amendments, staff developed an updated version of the SORE emissions inventory model, SORE2020. This updated version of the model uses the data collected as part of the CSUF survey as well as various emissions testing and reporting data to calculate SORE emissions. This section describes in detail the small off-road equipment emission inventory as well as the SORE2020 model.

1. SORE2020 Model Description

The updated, stand-alone SORE2020 model reflects the California economy recovering from the 2008 economic recession and incorporates emission results from

CARB's recent in-house testing as well as CARB's most recent certification data and the CSUF survey (CSUF SSRC, 2019). Data collected through this survey provide the most up-to-date information regarding the population and activity of small off-road equipment in California. SORE2020 incorporates the latest information for the base year population, population growth, equipment usage, spatial allocation, and emission factors, along with an intuitive, graphical user interface.

Staff presented the draft version of the SORE2020 model along with details on its methodologies and data inputs at a public workshop in April 2020 and released the final version of the model in September 2020. The final version of the model incorporates comments from industry and stakeholders received since the April 2020 workshop.

Compared to the previous emissions inventory model, OFFROAD2007, which only contained equipment used in the residential and business sectors, the SORE2020 Model also includes a third sector, landscapers. The population of equipment in the landscaping business sector is relatively low compared to the population of equipment owned by residents. However, the activity is significantly higher than it is for equipment designated for residential use.

The SORE2020 model is designed to be user-friendly and allows flexibility in selecting categories with specified inputs, such as population, activity, or emission factors, to accommodate custom outputs or to run different scenarios. Compared to the previous model, ROG emission estimates from SORE2020 are higher than those from OFFROAD2007, and range from 23 percent higher in calendar year 2020, to 4 percent higher in 2050. Similarly, NO_x emission estimates from SORE2020 are also higher than OFFROAD2007, and range from 15 percent higher in calendar year 2020, to 10 percent higher in 2050.

The total equipment population in the light commercial equipment category was updated in SORE2020, which resulted in a three-fold increase in emissions even though annual equipment usage in the final SORE2020 model for light commercial equipment is lower than in OFFROAD2007. The increase in the population of the light commercial equipment category was one of the main drivers of increased total emissions in SORE2020 compared to OFFROAD2007.

Emissions estimates for each type of SORE equipment in tons per day were calculated through 2050 by multiplying the emission factor by activity data and total population of the equipment. SORE2020 can output daily emissions estimates for total hydrocarbons (THC), total organic gases, ROG, CO, carbon dioxide (CO₂), NO_x, PM, particulate matter with diameter of 10 micrometers or less (PM₁₀), PM_{2.5}, and oxides of sulfur. The model was refined through outreach and workshops with the general public and industry stakeholders. Further details on the model methodology can be found in the SORE2020 Technical Report (CARB, 2020).

Finally, SORE2020 includes ZEE to estimate the impact of the increasing trend toward electrification in the lawn and garden equipment and light commercial equipment categories. ZEE were not included in prior SORE emission inventories.

2. Baseline Small Off-Road Equipment Inventory

Conditions under the current SORE regulations are referred to as the “Baseline Scenario” in this emissions analysis. The Baseline Scenario assumes that no further regulations would be adopted over the regulatory horizon of 2023 through 2043. The equipment population inventory used in the Baseline Scenario was developed with the data obtained from the CSUF survey (CSUF SSRC, 2019), engine production line testing sales data from SORE manufacturers’ reports provided to CARB, and evaporative emissions production volume reporting data, also submitted to CARB from SORE manufacturers.

The SORE population inventory separates the total amount of small off-road equipment in the state into several categories. First, the equipment are separated by type of owner. There are three categories: residents, businesses, and landscapers. Residents are individuals in the state that own residential-grade small off-road equipment for their private use. Businesses are defined as those that own small off-road equipment to maintain their own property or conduct work, excluding landscapers. Finally, landscapers include all businesses under North American Industry Classification System codes 541320 (Landscape and Architectural Services) and 561730 (Landscaping Services). The share of small off-road equipment belonging to residents, businesses, and landscapers is based on the CSUF survey. The population is also categorized by power type, whether SORE equipment or ZEE. Finally, the population is categorized by equipment type.

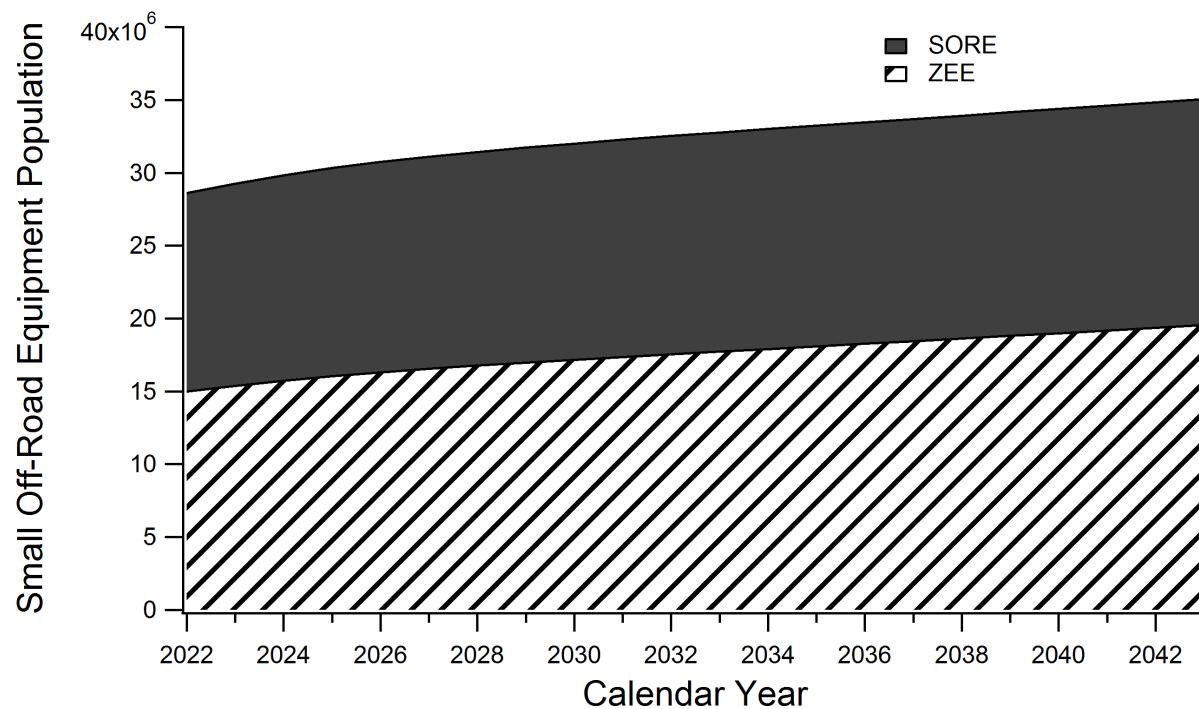
From the base year population, staff modeled the statewide small off-road equipment population into future years. Growth is expected in both ZEE and SORE equipment populations. The modeling utilized household growth projections in California along with historical shipment data for gasoline-powered equipment. The small off-road equipment population in the past has tracked well with household growth, so that was used as a proxy for future years (CARB, 2020). Staff developed a survival curve for each category of equipment to calculate the population of a given MY over time. This curve is based on the age distribution of equipment from CSUF survey data. Figure III-1 shows the modeled total population of small off-road equipment starting in the economic base year of 2022 and during the regulatory horizon of 2023 through 2043. In 2035, under the Baseline Scenario, only 54 percent of all small off-road equipment subject to the SORE regulations would be ZEE.

Median age for each equipment type was determined from the results of the CSUF survey. Table III-1 shows the median age for each equipment type by owner.

Table III-1. Median equipment age from the CSUF survey.

| Type of Equipment | Resident-Owned Median Age (Years) | Business-Owned Median Age (Years) | Landscaper-Owned Median Age (Years) |
|----------------------------|-----------------------------------|-----------------------------------|-------------------------------------|
| Chainsaw | 5 | 3 | 2 |
| Lawn Mower | 6 | 5 | 3 |
| Leaf Blower | 5 | 3 | 2 |
| Riding Mower | 8 | - | 5 |
| Trimmer/Edger/Brush Cutter | 5 | 3 | 2 |
| Generator | 7 | 5 | 4 |
| Pressure Washer | 5 | 3 | 3 |
| Pump | 6 | 8 | 3 |

Figure III-1. Modeled small off-road equipment population statewide under the Baseline Scenario.



The population inventory does not reflect recent economic changes associated with the Coronavirus Disease 2019 (COVID-19) pandemic (Bohn et al., 2020). Indeed, the Outdoor Power Equipment Institute (OPEI) reported record growth in sales across the industry in 2020 despite the economic conditions (OPEI, 2020). Generator sales in response to potential PSPS in California have not yet been fully reflected in the small

off-road equipment inventory, where we would expect an increase in generator emissions due to increased generator purchases and use during PSPS.

3. SORE2020 Emissions Model Applied to Regulatory Scenario

Estimated emissions under the Proposed Amendments are compared to emissions under the current SORE regulations each year for the regulatory horizon of 2023 through 2043 to calculate the annual emission reduction benefit under the Proposed Amendments. The 2023 through 2043 regulatory horizon was selected due to the length of time it will take to have over 99 percent of the small off-road equipment population be ZEE based on emissions modeling.

The SORE2020 model run for the Proposed Amendments also included the expected effect of current ABT credit banks. The most recent complete credit bank data set available at the time of calculation was from the end of MY 2018. As of the end of MY 2018, manufacturers collectively held 2.0 billion grams of exhaust emission credits and 138 thousand grams of evaporative emission credits.^k Based on CARB's historical records of the SORE credit banks, the emission credit banks for both evaporative and exhaust emissions have remained relatively constant over the last several years. It is assumed that this credit bank would remain relatively stable until the first of the new emission standards included in the Proposed Amendments would go into effect in MY 2024.

Staff assumed that all available credits would be used by manufacturers for generators, and that the credits would be used equally throughout the four-year period when generators would be subject to more stringent emission standards (MYs 2024 through 2027). The exhaust and evaporative credit banks were treated separately and assumed to be completely exhausted by the end of MY 2027. Staff expects that, overall, generator engines would use more credits than they earn after MY 2023. The sales- and power-weighted average HC + NO_x emission rates for MY 2018 generators exceed the proposed MY 2024 emission standards. No credits can be earned once emission standards of zero become effective for a model year. Therefore, only remaining banked credits could be used for MY 2028 and subsequent model years. Current emission levels were calculated from sales-weighted averages of certification data and validation studies conducted by CARB and industry (CARB, 2016c and 2021)^l. Staff calculated that, using a sales-weighted average, manufacturers could use credits to certify MYs 2024 through 2027 generators with emission rates higher than the newly-implemented emission standards, as shown in Tables III-2 and III-3. These emission levels were used when calculating overall emissions

^k The credit banks are based on manufacturer reported sales data, which are confidential business information. They are subject to validation by CARB staff.

^l CARB's sales-weighted averages and validation studies also relied on manufacturers' confidential reported sales data for their CARB-certified engines. CARB staff aggregated the sales data across all SORE manufacturers to generate the sales-weighted averages. An unredacted, confidential version and a redacted version of the CBI will be included in the rulemaking file.

reductions with SORE2020. Scenarios where manufacturers use their banked credits on different types of equipment would not lead to significant differences in overall emissions, as shown in the sensitivity analysis in section IV.A.1.

Table III-2. Exhaust emission standards and modeled emission levels for MY 2024-2027 generators assuming complete use of banked credits under the Proposed Amendments.

| Displacement category | HC + NO_x emission standard (g·kWh⁻¹) | HC + NO_x emission level with credit use (g·kWh⁻¹) |
|------------------------------|---|--|
| < 50 cc | 6.0 | 10.4 |
| 50-80 cc, inclusive | 6.0 | 8.5 |
| > 80 cc - < 225 cc | 6.0 | 6.7 |
| 225-825 cc, inclusive | 3.0 | 3.8 |
| > 825 cc | 0.80 | 0.80 ^m |

Table III-3. Evaporative emission standards and modeled emission levels for MY 2024-2027 generators assuming complete use of banked credits under the Proposed Amendments.

| Displacement category | Hot soak plus diurnal emission standard (g·test⁻¹) | Hot soak plus diurnal emission level with credit use (g·test⁻¹) |
|------------------------------|--|---|
| ≤ 80 cc | 0.50 | 0.68 |
| > 80 cc - < 225 cc | 0.60 | 0.65 |
| ≥ 225 cc | 0.70 | 0.85 |

In order to calculate emission reductions of the Proposed Amendments, SORE2020 emission factors for nonpreempt engines were adjusted to reflect the proposed emission standards and durability periods. Adjusted zero-hour emission factors for SORE (i.e., emission factors for engines at the beginning of their useful life) were calculated by applying ratios of the proposed emission standards to current emission standards. Adjusted exhaust emission deterioration factors were calculated by using the proposed durability period hours and adjusted zero-hour emission factors. The zero-hour emission factors were set and emissions were assumed to deteriorate to levels equivalent to the proposed emission standards in the time of the durability period. The increased adoption of ZEE was incorporated by setting emission factors to

^m No credit use was assumed as large spark-ignition engines in this displacement category have been subject to an equivalent emission standard since MY 2015.

zero for MY 2024 and subsequent model years for all new SORE equipment except generators and for MY 2028 and subsequent model years for generators. There was no change in total equipment population or the amount of new equipment in any year, which means the equipment turnover rate was unchanged. This assumes that ZEE has the same lifetime as SORE equipment. This assumption has no effect on emissions (because any ZEE at the end of their lifetime would be replaced with ZEE), but is the most economically conservative assumption. As explained in section I.E.2 of this report, the useful lifetime of ZEE is expected to be as long as the useful lifetime of SORE equipment, and may be longer.

B. Emission Reductions in Support of the 2016 State SIP Strategy

The SORE2020 model output includes two sets of emission reduction data. The first set is reductions based solely on the summer months each year. The second set is reductions averaged across all 12 months. These data sets serve different purposes. The summer emission reductions specifically provide a comparison to the expected emission reductions in the 2016 State SIP Strategy. Evaporative emissions peak in the warmest months. Tropospheric ozone, formed from photochemical, temperature-sensitive reactions between NO_x and ROG, reaches its highest concentrations in the summer, as well. Since the 2016 State SIP Strategy aims to reduce ozone concentrations, it is important to understand what any regulatory changes could achieve in those summer months. The annual average–emission reduction data set allows for further analysis as it relates to health effects caused by exposure to PM_{2.5}. In this Staff Report, both sets of SORE2020 data will be discussed as they are relevant. Summer average emission reductions will be specified as such.

Table III-4 identifies the modeled summer average NO_x and ROG emission benefits of the Proposed Amendments. Staff calculated emission benefits based on the difference in modeled emissions between the Baseline Scenario and Proposed Amendments scenario each year for the regulatory horizon of 2023 through 2043. Figures III-2 and III-3 graphically show modeled summer average emissions of NO_x and ROG, respectively, for the Baseline Scenario and Proposed Amendments scenario. In the Baseline Scenario, NO_x and ROG emissions would increase year over year due to an increase in population of SORE equipment. In 2031, the summer statewide emissions under the Baseline Scenario are expected to be approximately 18.3 tpd of NO_x and 127.5 tpd of ROG. In 2043, the summer statewide emission reductions are expected to be approximately 19.9 tpd of NO_x and 135.0 tpd of ROG.

The 2016 State SIP Strategy contains expected emission reductions from SORE of 36 tpd for ROG, and 4 tpd of NO_x, in 2031 (CARB, 2017b). The total contribution of NO_x and ROG from SORE in summer in California is approximately 141 tons per day in 2021. This is approximately equal to the NO_x and ROG emissions from light-duty passenger cars, according to the most recent inventories, SORE2020 and EMFAC2021 (CARB, 2020 and 2021b). Significant reductions in both NO_x and ROG emissions would begin in calendar year 2025 under the Proposed Amendments, after emission standards are zero for most SORE equipment and significantly more stringent for generators. For emissions modelling, it was assumed that once emission standards of

zero went into effect, all new equipment purchased would have zero emissions. Lifetimes of equipment were assumed to be the same as in the Baseline Scenario to be most conservative. Section II.B.1 includes a more detailed description of equipment lifetimes. Emission benefits would continue to increase as more SORE equipment reached the end of their life and were replaced with ZEE. In 2031, the summer statewide emission reductions are expected to be approximately 7.9 tpd of NO_x and 64.5 tpd of ROG. These represent 43 and 51 percent reductions of NO_x and ROG, respectively, compared to the Baseline Scenario and exceed the expected emission reductions from SORE in the 2016 State SIP Strategy. By 2043, summertime statewide NO_x and ROG emissions from SORE equipment would not reach zero but would be approximately 6.4 tpd and 31 tpd, respectively. The remaining emissions would be produced by engines that are used in federally-regulated construction and farm equipment or vehicles under 175 horsepower that are included in the SORE2020 model but are preempt and not subject to the SORE regulations.

Table III-4. Summer average emission reductions under the Proposed Amendments.

| Calendar year | ROG emission reductions (tpd) | NO_x emission reductions (tpd) |
|----------------------|--------------------------------------|---|
| 2023 | 0.0 | 0.0 |
| 2024 | 3.9 | 0.5 |
| 2025 | 12.7 | 1.4 |
| 2026 | 23.0 | 2.5 |
| 2027 | 33.2 | 3.6 |
| 2028 | 42.5 | 4.7 |
| 2029 | 50.8 | 5.8 |
| 2030 | 58.2 | 6.9 |
| 2031 | 64.5 | 7.9 |
| 2032 | 70.0 | 8.7 |
| 2033 | 74.8 | 9.5 |
| 2034 | 79.3 | 10.2 |
| 2035 | 83.5 | 10.8 |
| 2036 | 87.3 | 11.4 |
| 2037 | 90.8 | 11.8 |
| 2038 | 93.8 | 12.2 |
| 2039 | 96.5 | 12.6 |
| 2040 | 98.7 | 12.8 |
| 2041 | 100.7 | 13.1 |
| 2042 | 102.4 | 13.3 |
| 2043 | 103.9 | 13.5 |
| Average | 65.3 | 8.3 |

Figure III-2. Summer average NO_x emissions under the Proposed Amendments and the Baseline Scenario.

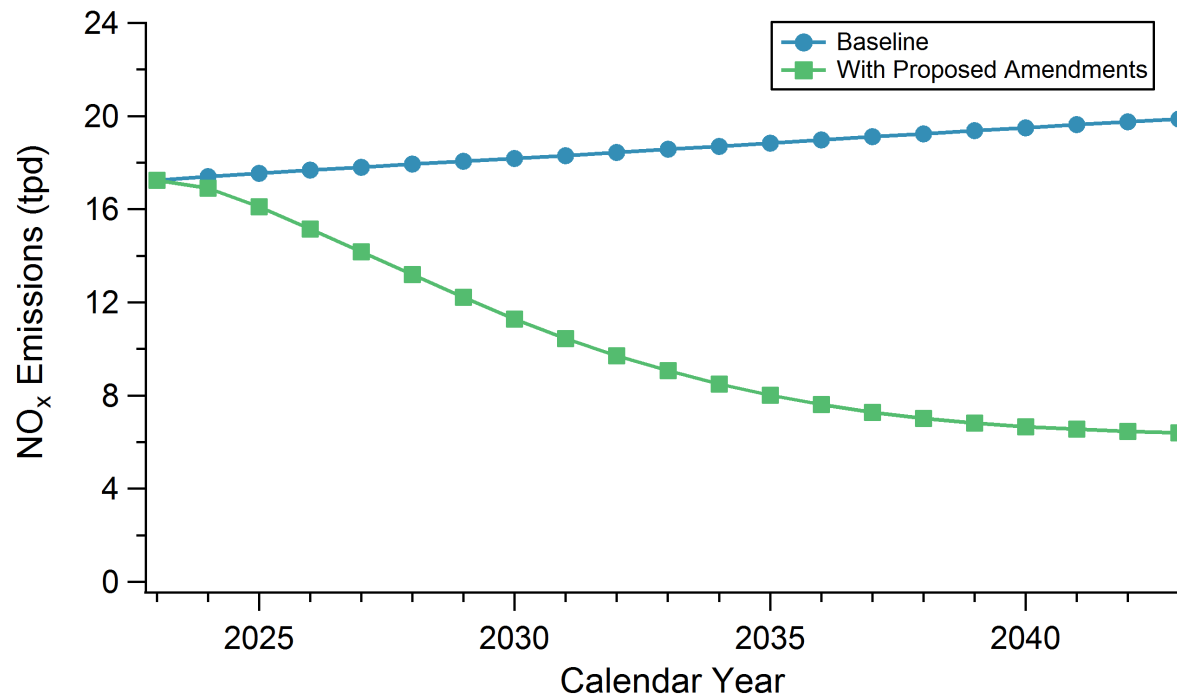
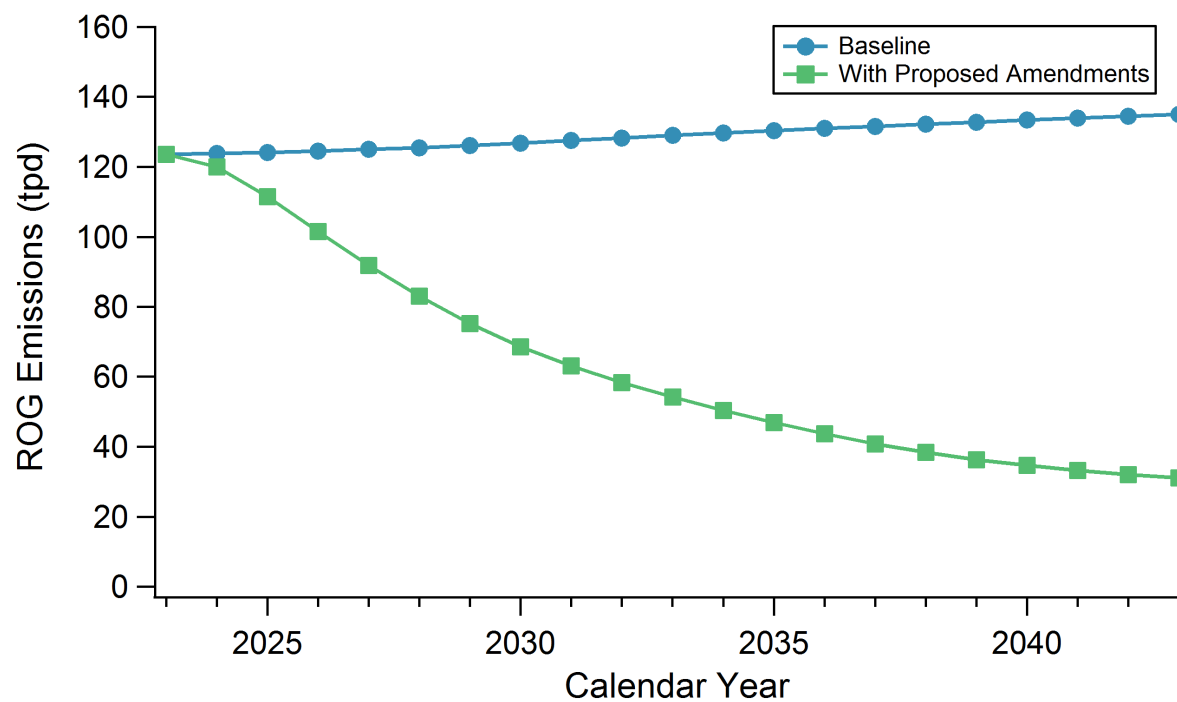


Figure III-3. Summer average ROG emissions under the Proposed Amendments and the Baseline Scenario.



The modelling results indicate that the Proposed Amendments would result in emission reductions from SORE that exceed the expected emission reductions in the 2016 State SIP Strategy (4 tpd of NO_x and 36 tpd of ROG in 2031). Table III-5 shows that the Proposed Amendments would also result in emission reductions greater than those expected in the South Coast and San Joaquin Valley air basins in the 2016 State SIP Strategy. While the 2016 State SIP Strategy estimated the SORE measure would achieve 2 tpd of NO_x and 16 tpd of ROG emissions reductions in the South Coast Air Basin in 2031, the Proposed Amendments would achieve emission reductions of 2.9 tpd of NO_x and 24.8 tpd of ROG in 2031. For the San Joaquin Valley Air Basin, the 2016 State SIP Strategy included an estimated 0.3 tpd of NO_x emission reductions from SORE in 2031. The Proposed Amendments would achieve 0.84 tpd of NO_x emission reductions in 2031. All reductions in emissions from the Proposed Amendments, including those that are beyond the estimate in the 2016 State SIP Strategy, will count towards the State's aggregate emissions reduction commitment in 2031.

Table III-5. Comparison of summer average emission reductions under the Proposed Amendments to 2016 State SIP Strategy expected emissions for SORE for the San Joaquin Valley and South Coast air basins.

| Air Basin | Year | 2016 State SIP Strategy expected NO_x emission reduction (tpd) | Proposed Amendments NO_x emission reduction (tpd) | 2016 State SIP Strategy expected ROG emission reduction (tpd) | Proposed Amendments ROG emission reduction (tpd) |
|--------------------|-------------|---|--|--|---|
| South Coast | 2023 | 0.7 | 0.00 | 7 | 0.00 |
| San Joaquin Valley | 2025 | 0.2 | 0.15 | - | 1.3 |
| San Joaquin Valley | 2031 | 0.3 | 0.84 | - | 6.5 |
| South Coast | 2031 | 2 | 2.9 | 16 | 24.8 |
| Statewide | 2031 | 4 | 7.9 | 36 | 64.5 |

IV. Benefits Anticipated from the Regulatory Action, Including the Benefits or Goals Provided in the Authorizing Statute

The Proposed Amendments would update CARB's SORE regulations to improve air quality, and to clarify and improve the regulations for increased manufacturer flexibility, while reaching lower emission levels and maintaining enforceability. The benefits of the Proposed Amendments would include emission reductions, monetary savings in ongoing costs, and improved health outcomes. The Proposed Amendments would help meet the goals in the 2016 State SIP Strategy, MSS, and EO N-79-20.

The SORE regulations have been successful at reducing emissions over the last 25 years. The Proposed Amendments would continue to improve the SORE regulations to accomplish additional emission reductions and accelerate the adoption of ZEE to help California attain and maintain ambient air quality standards. The Proposed Amendments are designed to achieve the expected emission reductions in the 2016 State SIP Strategy for SORE and would reduce emissions of pollutants that have multiple known adverse health effects. Emissions of NO_x and ROG from SORE contribute to three criteria air pollutants—ozone, PM, and NO₂—either directly (NO₂ and PM) or indirectly (ozone, NO₂, and PM). As described in Chapter I, all of these criteria air pollutants have adverse health effects. The Proposed Amendments would also reduce GHG emissions and petroleum use. The Proposed Amendments are part of a portfolio of “Strategies, in coordination with other State agencies, U.S. Environmental Protection Agency and local air districts, to achieve 100 percent zero-emission from off-road vehicles and equipment operations in the State by 2035,” as directed in EO N-79-20 (California Executive Order No. N-79-20, 2020).

The following sections provide detailed descriptions of emission reduction benefits, as well as benefits for professional and residential users, of the Proposed Amendments. The benefits for individuals include health benefits that would result from the emission reductions under the Proposed Amendments.

A. Emission Benefits

Emission benefits and 2016 State SIP Strategy expected emissions reductions are discussed in Chapter III.B of this Staff Report. The emission reductions discussed in that section are for summer average emissions for May through October. However, emission reductions would occur year round. This chapter discusses the annual average emission reductions because these values are used in the calculation of health benefits. Significant reductions in both NO_x and ROG emissions would begin in calendar year 2025 under the Proposed Amendments. For emissions modelling, it was assumed that once emission standards of zero go into effect, all new equipment purchased would have zero emissions. Useful lifetimes of equipment were assumed to be the same as in the Baseline Scenario to be most conservative. Section I.E.2.c includes a more detailed description of equipment useful lifetimes. Under the Proposed Amendments, the emission reduction benefits would continue to increase as more SORE equipment reaches the end of their life and are replaced with ZEE. In 2031, the statewide annual average emission reductions are expected to be approximately 7.4 tpd of NO_x and 55 tpd of ROG. These are 43 and 51 percent reductions of NO_x and ROG, respectively, compared to current SORE emissions.

Section IV.A.1 provides a more detailed review of the emission reduction benefits under the Proposed Amendments. Section IV.A.2 includes an estimate of additional ROG emission reductions from the decreased filling of PFC with gasoline.

1. Anticipated Emission Reduction Benefits from the Proposed Amendments

Table IV-1 identifies the modeled annual average ROG, NO_x, and CO₂ emission benefits from the Proposed Amendments. CO₂ emission reductions are shown in

millions of metric tons per year (MMT/year). Staff calculated emission benefits based on the difference in modeled emissions between the Baseline Scenario and Proposed Amendments scenario each year for the regulatory horizon of 2023 through 2043. Figures IV-1 and IV-2 graphically show the modeled emissions of NO_x and ROG, respectively, for the Baseline Scenario and Proposed Amendments scenario. In the Baseline Scenario, NO_x and ROG emissions increase year over year due to an increase in population of SORE equipment.

Significant reductions in both NO_x and ROG emissions would begin in calendar year 2025 under the Proposed Amendments. Under the Proposed Amendments, emission benefits continue to increase as more SORE equipment reach the end of their life and are replaced with ZEE. In 2031, the reductions are expected to be approximately 7.4 tpd of NO_x and 55 tpd of ROG. These are 43 percent and 51 percent reductions of NO_x and ROG, respectively, compared to the Baseline Scenario. The total emission reductions from 2023 through 2043 as a result of the Proposed Amendments are approximately 59,307 tons of NO_x and 423,240 tons of ROG compared to the Baseline Scenario. By 2043, NO_x and ROG emissions would not reach zero but would be approximately 6.2 tpd and 27 tpd, respectively. The remaining emissions would be produced by engines that are used in federally-regulated construction and farm equipment or vehicles under 175 horsepower that are included in the SORE2020 model but are preempt and not subject to the SORE regulations.

The Proposed Amendments would significantly reduce criteria air pollutant emissions to achieve 2016 State SIP Strategy expected emission reductions and create associated health benefits. Setting more stringent criteria air pollutant emission standards would also result in GHG emission reductions as ZEE continues to account for a greater fraction of small off-road equipment. Total modeled CO₂ emission reductions compared to the Baseline Scenario for 2023 through 2043 under the Proposed Amendments are 15 million tons. As illustrated in Table IV-1, CO₂ emission reductions would begin in 2024 and increase in each subsequent year.

Table IV-1. Annual average emission reductions under the Proposed Amendments.
(Totals may not add up due to rounding.)

| Year | ROG emission reductions (tpd) | NO_x emission reductions (tpd) | CO₂ emission reductions (MMT/year) |
|----------------|--------------------------------------|---|--|
| 2023 | 0.00 | 0.00 | 0.00 |
| 2024 | 3.3 | 0.46 | 0.05 |
| 2025 | 10.9 | 1.4 | 0.13 |
| 2026 | 19.7 | 2.4 | 0.23 |
| 2027 | 28.4 | 3.4 | 0.31 |
| 2028 | 36.3 | 4.4 | 0.40 |
| 2029 | 43.4 | 5.5 | 0.48 |
| 2030 | 49.6 | 6.5 | 0.57 |
| 2031 | 55.0 | 7.4 | 0.64 |
| 2032 | 59.6 | 8.2 | 0.71 |
| 2033 | 63.7 | 8.9 | 0.77 |
| 2034 | 67.4 | 9.6 | 0.82 |
| 2035 | 70.8 | 10.1 | 0.87 |
| 2036 | 73.9 | 10.7 | 0.91 |
| 2037 | 76.7 | 11.1 | 0.94 |
| 2038 | 79.1 | 11.5 | 0.97 |
| 2039 | 81.2 | 11.8 | 1.0 |
| 2040 | 83.0 | 12.0 | 1.0 |
| 2041 | 84.6 | 12.3 | 1.0 |
| 2042 | 85.9 | 12.5 | 1.1 |
| 2043 | 87.1 | 12.6 | 1.1 |
| Average | 55.2 | 7.7 | 0.66 |
| Total | 423,240 | 59,307 | 13.9 |

Figure IV-1. Annual average NO_x emissions under the Proposed Amendments and the Baseline Scenario.

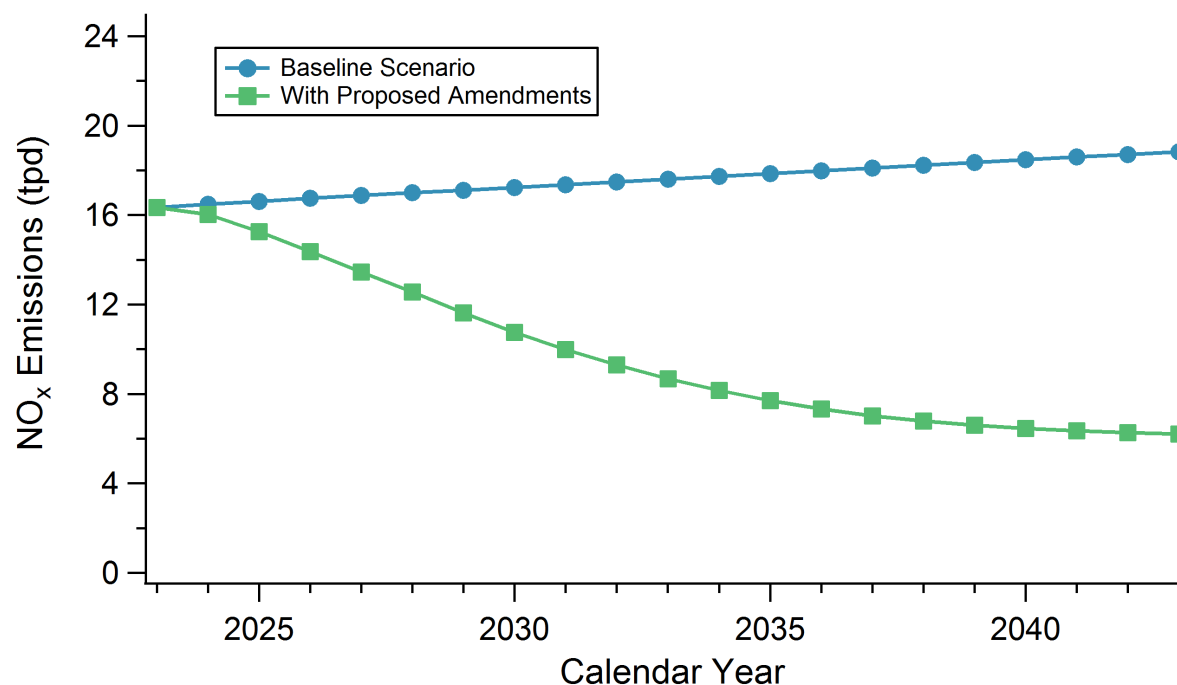
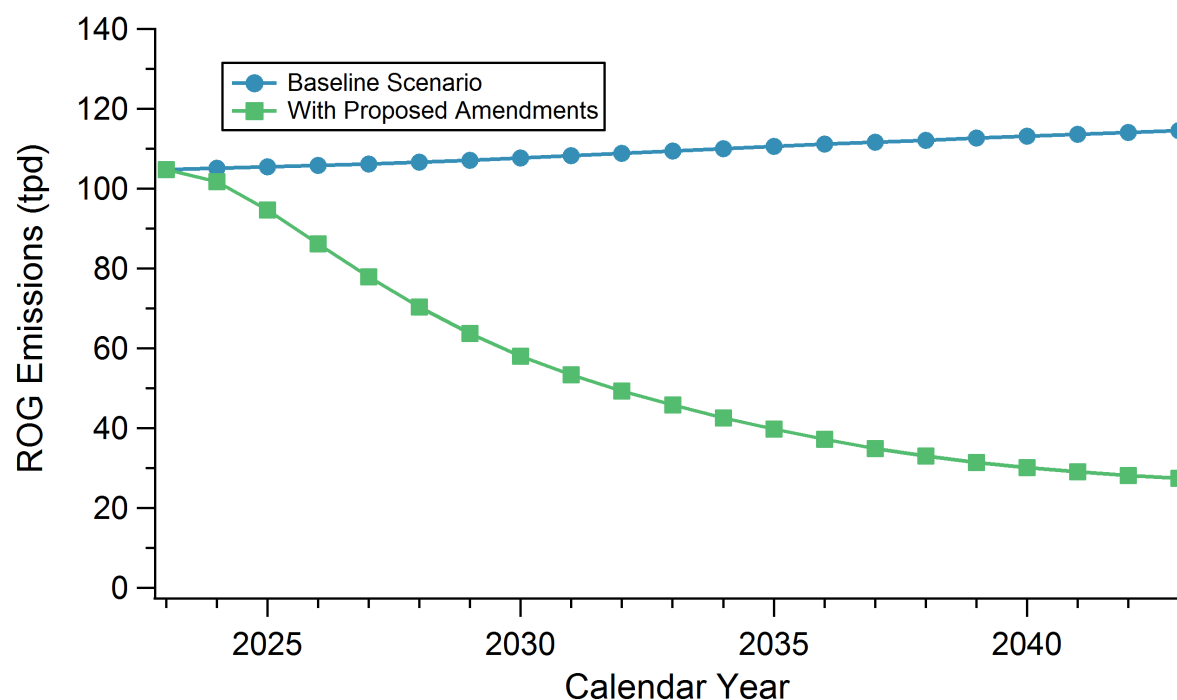


Figure IV-2. Annual average ROG emissions under the Proposed Amendments and the Baseline Scenario.



To demonstrate that differences in the total amount of banked credits would not significantly change the outcome of the emissions analysis, a sensitivity analysis was

performed. Two scenarios were modeled—one with no banked credits, and one with twice the amount of banked credits that manufacturers held at the end of MY 2018. For the scenario with no banked credits, all MY 2024 equipment were assumed to be compliant with the more stringent HC + NO_x emission standards. In this scenario, summer emission reductions in 2031 would be 8.0 tpd and 65 tpd of NO_x and ROG, respectively. These NO_x and ROG emission reductions are 0.1 and 0.5 tpd higher, respectively, than those expected for the Proposed Amendments scenario.

For the scenario with twice the amount of banked credits that manufacturers held at the end of MY 2018, all banked credits were assumed to be fully used between MYs 2024 and 2027 for generators. The emission rates used for this scenario are shown in Tables IV-2 and IV-3. This scenario would result in summer emission reductions in 2031 of 7.7 tpd and 64 tpd of NO_x and ROG, respectively. These NO_x and ROG emission reductions are 0.2 tpd and 0.5 tpd lower, respectively, than those expected for the Proposed Amendments scenario.

Table IV-2. MY 2024-2027 generator exhaust emission standards and emission rates under the Proposed Amendments with twice the amount of banked emission credits that manufacturers held at the end of MY 2018.

| Displacement category | Emissions durability period (hours) | HC + NO_x emission standard (g·kWh⁻¹) | HC + NO_x emission level with credit use (g·kWh⁻¹) |
|------------------------------|--|---|--|
| < 50 cc | 500 | 6.0 | 14.9 |
| 50-80 cc, inclusive | 500 | 6.0 | 10.9 |
| > 80 cc - < 225 cc | 500 | 6.0 | 7.3 |
| 225-825 cc, inclusive | 1,000 | 3.0 | 4.6 |
| > 825 cc | 1,000 | 0.80 | 0.80 |

Table IV-3. MY 2024-2027 generator evaporative emission standards and emission rates under the Proposed Amendments with twice the amount of banked emission credits that manufacturers held at the end of MY 2018.

| Displacement category | Hot soak plus diurnal emission standard (g·test⁻¹) | Hot soak plus diurnal emission level with credit use (g·test⁻¹) | Hot soak emission level with credit use (g·test⁻¹) | Diurnal emission level with credit use (g·test⁻¹) |
|------------------------------|--|---|--|---|
| ≤ 80 cc | 0.50 | 0.86 | 0.31 | 0.55 |
| > 80 cc - < 225 cc | 0.60 | 0.70 | 0.02 | 0.68 |
| ≥ 225 cc | 0.70 | 1.0 | 0.21 | 0.79 |

2. Additional Emission Benefits

A decrease in use of PFCs may result in greater ROG emission reductions than those calculated by the SORE2020 model. PFCs are used to transport gasoline from dispensing facilities (e.g., convenience stores and service stations) to SORE equipment. PFCs are a source of ROG emissions when they are being filled at the dispensing facilities, while they are being used to store fuel, and when they are used to fill SORE fuel tanks. Because of increased adoption of ZEE, staff expects a decreased need for PFC use, which would lead to further ROG emission reductions.

It is possible to estimate the ROG emission reductions from the decreased fueling of PFCs at gasoline dispensing facilities (GDFs) by combining several fueling emission factors with the reduction in gasoline use from the direct cost analysis. CARB has established emission factors for several aspects of fueling, including transfer of gasoline from a cargo tanker to the GDF storage tank (Phase I transfers) and from the storage tank to the vehicle (Phase II transfers) (CARB, 2013). The analysis assumed that all PFCs are fueled at GDFs that are equipped with underground storage tanks and Phase II enhanced vapor recovery controls.ⁿ The emission factors can be added to estimate potential emission reductions at GDFs as 8.82 pounds of ROG emitted per

ⁿ In 2000, CARB approved Enhanced Vapor Recovery (EVR) regulations for GDFs equipped with underground storage tanks. The EVR regulations were enacted to achieve additional emission reductions and to increase equipment reliability by adopting nearly 80 new performance standards or specifications and increasing testing requirements. Not all GDFs throughout California are required to install Phase II EVR controls. Using the emission factors for GDFs with underground storage tanks and Phase II EVR controls provides a conservative emission reduction estimate, i.e., one that may underestimate the total emission reduction benefit of the Proposed Amendments from the filling of PFCs at GDF.

thousand gallons of gasoline dispensed.^o The reduction in gasoline dispensed as a result of the Proposed Amendments is based on total population of SORE equipment in a given year and usage rates for equipment per category, as described in section C.1.d of the SRIA in Appendix I of this Staff Report. Combining these values yields a ROG emission reduction beyond the reductions reported via SORE2020. The ROG emission reductions from reduced fuel dispensing are calculated as 1.3 tpd and 2.6 tpd for 2031 and 2043, respectively. In sum, 11,600 tons of ROG emissions from filling PFCs for fueling SORE equipment would be avoided over the regulatory horizon of 2023 through 2043. Further ROG emission reductions due to permeation from the PFCs, spillage, and fueling the SORE equipment are also likely but cannot be quantified at this time.

B. Benefits to Typical Businesses

Chapter VII discusses all costs directly from a user perspective. Here, typical businesses are considered to be all affected businesses in California that are not small businesses (e.g., businesses that own and use small off-road equipment to maintain their property). A substantial benefit to typical businesses across the state would be the increased durability of the small off-road equipment they purchase. The Proposed Amendments increase the durability requirements for SORE starting in MY 2024. While the emissions durability period is not a feature that is necessarily advertised to consumers, staff expects longer durability periods would lead to longer useful lifetimes for products. This would benefit business users of SORE equipment, such as those using generators during PSPS or other unexpected power outages.

ZEE batteries frequently outlive the lifetime of equipment. The first purchase of ZEE requires purchasing sufficient batteries for use time (e.g., an eight-hour work day). This is a significant contributor to the upfront cost for professional-grade equipment. ZEE batteries can often be used in several products within a manufacturer's family of ZEE. Subsequent equipment purchases may require fewer batteries, therefore lowering the purchase price significantly. In this analysis, upfront equipment prices have been assumed to be constant and include battery costs, as staff has no way of tracing which equipment purchases are new versus subsequent. This creates the most conservative estimate. Maintenance is also much less intensive and required less frequently on ZEE. For example, the owner's manual of a professional-grade SORE lawnmower recommends changing the oil after the first 20 hours of use, and after every 100 hours thereafter. It also recommends changing the spark plug and air filter after 200 hours of use (Honda, 2021). An equivalent professional-grade ZEE lawnmower does not have

^o The following emission factors (CARB, 2013) in pounds of ROG emitted per thousand gallons gasoline dispensed (lbs/kgal) were added to estimate emission reductions that would occur at GDFs under the Proposed Amendments: (a) To estimate emissions while PFCs are open at GDFs: 8.4 lbs/kgal, the uncontrolled emission factor used to characterize Phase II fueling of vehicles that do not have onboard refueling vapor recovery systems; and (b) To estimate other GDF emissions that would be reduced if less gasoline were dispensed to PFCs: (i) 0.15 lbs/kgal for Phase I "revised EVR" bulk transfer losses, (ii) 0.24 lbs/kgal for Phase II "revised EVR" nozzle spillage, (iii) 0.009 lbs/kgal for Phase II "EVR Year 2017" hose permeation, and (iv) 0.024 lbs/kgal for "revised EVR" pressure driven losses.

these maintenance requirements. The only maintenance requirements are replacing or sharpening the blade and cleaning (Greenworks, 2021a), both of which are also required of a SORE lawn mower. Having more durable equipment that is not taken out of service for maintenance reduces the need for backup equipment and spare parts. Owners of ZEE would save time by not having to travel to a gasoline dispensing facility and fill PFCs with fuel for their SORE equipment. They will also not need to purchase replacement or extra PFCs.

C. Benefits to Small Businesses

Chapter VII discusses all costs directly from a user perspective. Examples of small businesses that would be affected by the Proposed Amendments are landscapers, both licensed and unlicensed. The benefits to these businesses would be similar to those discussed in the typical business section, including more reliable ZEE, lower maintenance costs, and less frequent replacement of equipment.

D. Benefits to Individuals

Individuals are all those who live in the state of California, regardless of whether or not they own small off-road equipment. Benefits to individuals from the Proposed Amendments would include a reduction in adverse health outcomes due to emission reductions. The estimated value of the accrued statewide health benefit derived from criteria emission reductions is approximately \$8.82 billion, with \$8.80 billion resulting from reduced premature mortality and \$17.2 million resulting from reduced hospitalizations and ER visits for asthma. Section IV.D.1 describes the health benefits model and results. Section IV.D.2 describes adverse health impacts of emission from SORE. Section IV.D.3 discusses the valuation of these health benefits. Section IV.D.4 describes the valuation of reduced CO₂ emissions from the Proposed Amendments.

1. Health Benefits

a. Background on Health Benefits and Model

The Proposed Amendments would reduce NO_x and PM_{2.5} emissions, resulting in health benefits for individuals in California. The value of health benefits calculated for the amendments include fewer instances of premature mortality and fewer hospital and ER visits for asthma. The health benefits evaluation method used in this analysis is the same as the one used for the Advanced Clean Truck Regulation and the 2018 amendments to the Low Carbon Fuel Standard (CARB, 2018a and 2019b).

CARB analyzed the value associated with four health outcomes in the Baseline Scenario, Proposed Amendments, and regulatory alternatives: cardiopulmonary mortality, hospitalizations for cardiovascular illness, hospitalizations for respiratory illness, and ER visits for asthma. These health outcomes and others have been identified by U.S. EPA as having a *causal or likely causal* relationship with exposure to PM_{2.5} based on a substantial body of evidence (U.S. EPA, 2019a).

U.S. EPA has determined that both long-term and short-term exposure to PM_{2.5} play a *causal* role in premature mortality, meaning that a substantial body of scientific

evidence shows a relationship between PM_{2.5} exposure and increased risk of death. This relationship persists when other risk factors such as smoking rates, poverty and other factors are taken into account (U.S. EPA, 2019a).

U.S. EPA has also determined a *causal* relationship between nonmortality cardiovascular effects and short and long-term exposure to PM_{2.5} and a *likely causal* relationship between nonmortality respiratory effects and short and long-term PM_{2.5} exposure (U.S. EPA, 2019a). These outcomes lead to hospitalizations and ER visits for asthma, and are included in this analysis.

CARB staff evaluated a limited number of statewide noncancer health impacts associated with exposure to PM_{2.5} and NO_x emissions from SORE. NO_x includes nitrogen dioxide, a potent lung irritant, which can aggravate lung diseases such as asthma when inhaled (U.S. EPA, 2016). However, the most serious quantifiable impacts of NO_x emissions occur through the conversion of NO_x to fine particles of ammonium nitrate aerosol through chemical processes in the atmosphere. PM_{2.5} formed in this manner is termed secondary PM_{2.5}. Both directly emitted PM_{2.5} and secondary PM_{2.5} from heavy-duty vehicles is associated with adverse health outcomes, such as cardiopulmonary mortality, hospitalizations for cardiovascular illness and respiratory illness, and ER visits for asthma. As a result, reductions in PM_{2.5} and NO_x emissions are associated with reductions in these health outcomes.

b. Incidence-Per-Ton Methodology

CARB uses the incidence-per-ton (IPT) methodology to quantify the health benefits of emission reductions in cases where dispersion modeling results are not available. A description of this method is included on CARB's webpage (CARB, 2019a). CARB's IPT methodology is based on a methodology developed by U.S. EPA (Fann et al., 2009; Fann et al., 2012; Fann et al., 2018).

Under the IPT methodology, changes in emissions are approximately proportional to changes in health outcomes. IPT factors are derived by calculating the number of health outcomes associated with exposure to PM_{2.5} for a baseline scenario using measured ambient concentrations and dividing by the emissions of PM_{2.5} or a precursor. The calculation is performed separately for each air basin using the following equation:

$$IPT = \frac{\text{number of health outcomes in air basin}}{\text{annual emissions in air basin}}$$

Multiplying the emission reductions from the Proposed Amendments in an air basin by the IPT factor then yields an estimate of the reduction in health outcomes achieved by the Proposed Amendments. For future years, the number of outcomes is adjusted to account for population growth. CARB's current IPT factors are based on a 2014-2016 baseline scenario, which represents the most recent data available at the time the current IPT factors were computed. IPT factors are computed for the two types of PM_{2.5}: primary PM_{2.5} and secondary PM_{2.5} of ammonium nitrate aerosol formed from precursors.

c. Reduction in Adverse Health Impacts

Table IV-4 shows the estimated total avoided premature mortality, hospitalizations, and ER visits for asthma by California air basin that would result from implementation of the Proposed Amendments from 2023 through 2043, relative to the Baseline Scenario. Only the air basins with values of one or higher are shown. The biggest health benefits would occur in the South Coast and San Francisco Bay Area air basins. Table IV-5 shows the estimated avoided health outcomes by year. As described in section IV.A, the Proposed Amendments are estimated to reduce overall emissions of NO_x and ROG in every year starting in 2024, and lead to net reduction in adverse health outcomes statewide, relative to the Baseline Scenario. Health benefits would begin in 2024, and the reduction in incidents and deaths would continue to increase through the end of the regulatory horizon as more SORE equipment are transitioned to ZEE and more units are purchased. Overall, the mortality due to cardiopulmonary causes would decrease by 892 over the regulatory horizon under the Proposed Amendments.

Table IV-4. Modeled regional and statewide avoided mortality and morbidity incidents from 2023 through 2043 under the Proposed Amendments, central estimates^P and 95 percent confidence intervals.

(Totals may not add up due to rounding.)

| Air Basin | Avoided premature cardiopulmonary mortality | Avoided cardiovascular hospitalizations | Avoided acute respiratory hospitalizations | Avoided ER visits for asthma |
|------------------------|--|--|---|-------------------------------------|
| Lake County | 1 (1 - 1) | 0 (0 - 0) | 0 (0 - 0) | 0 (0 - 0) |
| Mojave Desert | 3 (3 - 4) | 0 (0 - 1) | 1 (0 - 1) | 1 (1 - 2) |
| Mountain Counties | 5 (4 - 6) | 0 (0 - 1) | 1 (0 - 1) | 2 (1 - 2) |
| North Central Coast | 4 (3 - 5) | 1 (0 - 1) | 1 (0 - 1) | 2 (1 - 3) |
| North Coast | 1 (1 - 1) | 0 (0 - 0) | 0 (0 - 0) | 0 (0 - 1) |
| Sacramento Valley | 31 (24 - 38) | 4 (0 - 7) | 5 (1 - 8) | 12 (7 - 16) |
| Salton Sea | 3 (2 - 3) | 0 (0 - 1) | 0 (0 - 1) | 1 (1 - 2) |
| San Diego County | 51 (40 - 62) | 7 (0 - 14) | 9 (2 - 15) | 20 (13 - 28) |
| San Francisco Bay Area | 114 (89 - 140) | 18 (0 - 35) | 21 (5 - 38) | 62 (39 - 85) |
| San Joaquin Valley | 56 (44 - 68) | 7 (0 - 13) | 8 (2 - 14) | 20 (13 - 28) |
| South Central Coast | 18 (14 - 21) | 3 (0 - 5) | 3 (1 - 6) | 8 (5 - 10) |
| South Coast | 605 (473 - 739) | 101 (0 - 199) | 121 (28 - 213) | 308 (195 - 421) |
| Statewide | 892 (697 - 1090) | 142 (0 - 278) | 169 (40 - 298) | 438 (277 - 599) |

^P The health benefits modeling is done using an incidence-per-ton methodology allowing for 95 percent confidence intervals and a central estimate to be calculated.

Table IV-5. Annual statewide avoided mortality and morbidity incidents under the Proposed Amendments, central estimates and 95 percent confidence intervals.

(Totals may not add up due to rounding.)

| Year | Avoided premature cardiopulmonary mortality | Avoided cardiovascular hospitalizations | Avoided acute respiratory hospitalizations | Avoided ER visits for asthma |
|--------------|--|--|---|-------------------------------------|
| 2023 | 0 (0 - 0) | 0 (0 - 0) | 0 (0 - 0) | 0 (0 - 0) |
| 2024 | 2 (2 - 3) | 0 (0 - 1) | 0 (0 - 1) | 1 (1 - 2) |
| 2025 | 8 (6 - 10) | 1 (0 - 2) | 1 (0 - 2) | 4 (3 - 5) |
| 2026 | 14 (11 - 17) | 2 (0 - 4) | 2 (1 - 4) | 7 (4 - 10) |
| 2027 | 20 (16 - 24) | 3 (0 - 6) | 3 (1 - 6) | 10 (6 - 14) |
| 2028 | 26 (20 - 32) | 4 (0 - 7) | 4 (1 - 8) | 13 (8 - 18) |
| 2029 | 31 (24 - 38) | 5 (0 - 9) | 6 (1 - 10) | 16 (10 - 22) |
| 2030 | 36 (28 - 44) | 5 (0 - 11) | 7 (2 - 12) | 18 (12 - 25) |
| 2031 | 41 (32 - 50) | 6 (0 - 12) | 7 (2 - 13) | 20 (13 - 28) |
| 2032 | 45 (35 - 55) | 7 (0 - 14) | 8 (2 - 15) | 22 (14 - 31) |
| 2033 | 49 (38 - 59) | 8 (0 - 15) | 9 (2 - 16) | 24 (15 - 33) |
| 2034 | 52 (41 - 63) | 8 (0 - 16) | 10 (2 - 17) | 26 (16 - 35) |
| 2035 | 55 (43 - 67) | 9 (0 - 17) | 10 (2 - 18) | 27 (17 - 37) |
| 2036 | 58 (45 - 70) | 9 (0 - 18) | 11 (3 - 20) | 28 (18 - 39) |
| 2037 | 60 (47 - 73) | 10 (0 - 19) | 12 (3 - 20) | 29 (19 - 40) |
| 2038 | 62 (48 - 76) | 10 (0 - 20) | 12 (3 - 21) | 30 (19 - 41) |
| 2039 | 64 (50 - 78) | 10 (0 - 20) | 12 (3 - 22) | 31 (20 - 42) |
| 2040 | 65 (51 - 80) | 11 (0 - 21) | 13 (3 - 23) | 32 (20 - 43) |
| 2041 | 67 (52 - 82) | 11 (0 - 22) | 13 (3 - 23) | 32 (20 - 44) |
| 2042 | 68 (53 - 83) | 11 (0 - 22) | 13 (3 - 24) | 33 (21 - 45) |
| 2043 | 69 (54 - 85) | 11 (0 - 23) | 14 (3 - 24) | 33 (21 - 46) |
| Total | 892 (697 - 1090) | 142 (0 - 278) | 169 (40 - 298) | 438 (277 - 599) |

Because CARB staff is evaluating a limited number of health impacts (premature cardiopulmonary mortality, cardiovascular hospitalizations, respiratory hospitalizations, and ER visits for asthma), the full health benefits of the Proposed Amendments are expected to be underestimated. An expansion of the assessment of outcomes, including, but not limited to, reduction of additional cardiovascular and respiratory illnesses, nonfatal/fatal cancers, and lost work days would provide a more complete picture of the benefits from reduced exposure to air pollution. Additionally, CARB's mortality and illness assessment is only calculated for a portion of emissions that lead

to primary and secondary PM_{2.5}, and there are other pollutants that can cause health issues. For instance, while NO_x can lead to the formation of secondary PM_{2.5} particles, NO_x can also react with other compounds to form ozone, which can cause respiratory problems. And SORE can also emit TACs, some of which have been determined to cause cancer. Altogether, CARB's current PM_{2.5} mortality and illness evaluation represents only a portion of the benefits of the Proposed Amendments.

d. Potential Future Evaluation of Additional Health Benefits

While CARB's PM_{2.5} mortality and illness valuation has been, and continues to be, a useful method for valuing the health benefits of regulations, it only represents a portion of those benefits. The basis for CARB's current methodology was documented in Appendix J of the Initial Statement of Reasons for CARB's 2010 Truck and Bus Regulation (CARB 2010); since then, there have been additional scientific evidence and updated analysis methods showing more ways of evaluating the health benefits of reducing air pollution. Thus, the full health benefits of the Proposed Amendments are underestimated because not all the adverse health outcomes associated with PM_{2.5} and additional pollutants such as air toxics are evaluated and monetized. Also, CARB's current evaluation methodology does not take into account all PM_{2.5} precursor emissions. An expansion of the emissions inputs and an assessment for other health outcomes, including, but not limited to, additional cardiovascular and respiratory illnesses, nonfatal/fatal cancers, nervous system diseases, and lost work days would provide a more complete picture of the benefits from reduced exposure to air pollution. In 2021, EPA issued a Technical Support Document (TSD) for their Cross-State Air Pollution Rule that provided both health functions and health valuation for lung cancer incidence, Alzheimer's disease, and Parkinson's disease, among other health endpoints related to PM_{2.5} exposures (U.S. EPA, 2021b).

CARB's mortality and illness valuation is just for PM_{2.5}, but there are other pollutants that can cause health issues. For instance, NO_x reacts with other compounds to form ozone, which can then cause respiratory problems. Updated health impact functions and valuation for ozone are also provided in the aforementioned Cross-State Air Pollution Rule TSD provided by the U.S. EPA (U.S. EPA, 2021b). Additionally, some of the TACs emitted from SORE can lead to cancers.

Expanding CARB's health evaluation and economic valuation methodology to include any of the above additional inputs and health outcomes would allow the public to reach a better understanding of the benefits from reducing air pollution by moving toward zero-emission technologies.

The scientific literature has demonstrated the broad impacts of exposures to pollution, which go beyond what CARB staff has quantified in Tables IV-4 and IV-5 and are thus summarized in the next section.

2. Adverse Impacts to Human Health from SORE Emissions

SORE equipment represents a growing source of pollution emissions and health burdens that adversely affect communities in multiple ways. For instance, it has been

projected that the nationwide PM_{2.5} health burden from both commercial and residential lawn and garden equipment may rise approximately 50% in 2025 compared to 2011 (Davidson et al., 2020). This section provides additional information to supplement and build on the discussion of quantified health impacts.

a. Particle Pollution Impacts

Gaseous pollutants that are emitted by SORE equipment include NO_x, which can lead to the formation of ozone and the secondary formation of PM, including PM_{2.5} (World Health Organization, Europe, 2006). Due to their small particle sizes, PM_{2.5} in air can reach the lower respiratory tract and potentially pass into the bloodstream to affect other organs (CARB, 2021h; U.S. EPA, 2021c). By this means, PM_{2.5} air pollution leads not only to increased cancer risk, but it also causes respiratory and cardiovascular diseases and even premature death; adverse health outcomes from PM_{2.5} include asthma, chronic heart disease, and heart attack (CARB, 2021h; U.S. EPA, 2019a; U.S. EPA, 2021c; World Health Organization, Europe, 2013). Moreover, PM_{2.5} air pollution can result in respiratory, cardiac, and mortality effects over short periods of exposure such as hours, days, or weeks (U.S. EPA, 2019a). Exposures to PM_{2.5} may also lead to myriad other health outcomes, including metabolic, nervous system, reproductive, and developmental effects (U.S. EPA, 2019a). For example, adverse health conditions with possible links to airborne PM_{2.5} include high blood pressure, insulin resistance, and other risk factors for Type II Diabetes, as well as psychological/cognitive problems (U.S. EPA, 2019a). PM_{2.5} may especially impact women and children via health effects such as pre-term birth, reduced birth weight, and abnormal lung and cardiovascular development (U.S. EPA, 2019a).

In addition to its ability to increase risk for diseases, PM_{2.5} is also well known to exacerbate underlying illnesses such as asthma, bronchitis, and heart disease (U.S. EPA, 2019a). As a result, the health impacts of PM_{2.5} are typically studied not only using cancer diagnoses and the rates of onset for lung and cardiovascular diseases, but also via metrics on respiratory symptoms (e.g., cough, wheeze, asthma medication usage), measures of abnormal lung and heart functioning (e.g., reduced lung volume, irregular heartbeat), plus rates of hospitalizations, ER visits, and restricted activity days associated with worsening of chronic lung and heart diseases.

b. Ozone Pollution Impacts

NO_x emissions from SORE equipment can also react with other compounds to form ozone, which is the main component of photochemical smog. Based on the extent of evidence from scientific studies, U.S. EPA has determined that short-term exposure to ozone is causally linked to adverse respiratory effects (U.S. EPA, 2020). Ozone can cause irritation of and damage to lung tissue, worsening of asthma and chronic illnesses including chronic obstructive pulmonary disease (COPD) and reduced lung function. For instance, a study conducted in the San Joaquin Valley showed that increased ozone pollution led to increased risk for ER visits for asthma, especially for children and Black residents (Gharibi et al., 2018). Metabolic functions are also likely to be affected by short-term ozone pollution, such as those leading to increased risk for complications and hospitalizations in diabetic individuals (U.S. EPA, 2020). Similar to

PM_{2.5}, other potential health effects from ozone exposure include impacts on the cardiovascular, nervous, and reproductive systems, and even increased risk of mortality (U.S. EPA, 2020).

c. Conclusion

SORE equipment generate criteria pollutants that are known to cause serious health impacts. Section E of this chapter IV provides a discussion of additional health impacts from exposures to noise and TACs. As shown in Tables IV-4 and IV-5, CARB estimates that implementation of the Proposed Amendments would result in substantial health benefits, due to reduced cardiovascular/respiratory hospitalizations, ER visits for asthma, and premature cardiopulmonary mortality. CARB's assessment is limited and thus likely an underestimation, because it does not consider the various other health outcomes that could be avoided with ZEE and lower-emitting SORE equipment. Furthermore, with the growing health impact of SORE equipment, such as lawn and garden equipment, actions like the Proposed Amendments to increase and accelerate adoption of ZEE are critically important.

3. Economic Impact of Health Benefits

In accordance with U.S. EPA practice, health outcomes are monetized by multiplying each incident by a standard value derived from the economic studies. The value per incident is provided in Table IV-6. Values are in 2019 dollars (2019\$) and do account for future inflation. The value for avoided premature mortality is based on willingness to pay, which is a statistical construct based on the aggregated dollar amount that a large group of people would be willing to pay for a reduction in their individual risks of dying in a year. The economic value associated with reduced premature mortality is a key benefit of the Proposed Amendments. This benefit, however, does not correspond to direct changes in expenditures for households and businesses and is not included in the macroeconomic modeling (Chapter VII). Because avoided hospitalizations and ER visits for asthma correspond to reductions in household expenditures on health care, these values are included in the macroeconomic modeling.

Unlike mortality valuation, the savings for avoided hospitalizations and ER visits for asthma are based on a combination of typical costs associated with hospitalization and the willingness of surveyed individuals to pay to avoid adverse outcomes that occur when hospitalized. These include hospital charges, post-hospitalization medical care, out-of-pocket expenses, and lost earnings of both individuals and family members, lost recreation value, and lost household production (e.g., valuation of time-losses from inability to maintain the household or provide childcare). These monetized benefits from avoided hospitalizations and ER visits for asthma are included in the macroeconomic modeling (Chapter VII).

Table IV-6. Valuation per incident for avoided health outcomes (2019\$).

| Outcome | Value per incident |
|-------------------------------------|---------------------------|
| Premature cardiopulmonary mortality | \$9,865,659 |
| Cardiovascular hospitalization | \$58,275 |
| Acute respiratory hospitalization | \$50,831 |
| ER visit for asthma | \$834 |

Staff calculated the statewide valuation of health benefits by multiplying the value per incident in Table IV-6 by the annual number and type of incidents. Table IV-7 provides annual totals. Table IV-8 provides a summarized total throughout the regulatory horizon. The estimated value of the accrued statewide health benefit derived from criteria emission reductions over the regulatory horizon is approximately \$8.82 billion, with \$8.80 billion resulting from reduced premature mortality and \$17.24 million resulting from reduced hospitalizations and ER visits for asthma. The spatial distribution of these benefits across the state follows the distribution of the health impacts by air basin as described in Table IV-4.

Table IV-7. Annual valuation of avoided health outcomes under the Proposed Amendments (million 2019\$).

| Year | Avoided premature cardiopulmonary mortality valuation | Avoided cardiovascular hospitalization valuation | Avoided acute respiratory hospitalization valuation | Avoided ER visit for asthma valuation | Annual total valuation |
|--------------|--|---|--|--|-------------------------------|
| 2023 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| 2024 | \$19.73 | \$0.00 | \$0.00 | \$0.00 | \$19.73 |
| 2025 | \$78.93 | \$0.06 | \$0.05 | \$0.00 | \$79.04 |
| 2026 | \$138.12 | \$0.12 | \$0.10 | \$0.01 | \$138.34 |
| 2027 | \$197.31 | \$0.17 | \$0.15 | \$0.01 | \$197.65 |
| 2028 | \$256.51 | \$0.23 | \$0.20 | \$0.01 | \$256.95 |
| 2029 | \$305.84 | \$0.29 | \$0.30 | \$0.01 | \$306.45 |
| 2030 | \$355.16 | \$0.29 | \$0.36 | \$0.02 | \$355.83 |
| 2031 | \$404.49 | \$0.35 | \$0.36 | \$0.02 | \$405.21 |
| 2032 | \$443.95 | \$0.41 | \$0.41 | \$0.02 | \$444.79 |
| 2033 | \$483.42 | \$0.47 | \$0.46 | \$0.02 | \$484.36 |
| 2034 | \$513.01 | \$0.47 | \$0.51 | \$0.02 | \$514.01 |
| 2035 | \$542.61 | \$0.52 | \$0.51 | \$0.02 | \$543.67 |
| 2036 | \$572.21 | \$0.52 | \$0.56 | \$0.02 | \$573.32 |
| 2037 | \$591.94 | \$0.58 | \$0.61 | \$0.02 | \$593.16 |
| 2038 | \$611.67 | \$0.58 | \$0.61 | \$0.03 | \$612.89 |
| 2039 | \$631.40 | \$0.58 | \$0.61 | \$0.03 | \$632.62 |
| 2040 | \$641.27 | \$0.64 | \$0.66 | \$0.03 | \$642.60 |
| 2041 | \$661.00 | \$0.64 | \$0.66 | \$0.03 | \$662.33 |
| 2042 | \$670.86 | \$0.64 | \$0.66 | \$0.03 | \$672.19 |
| 2043 | \$680.73 | \$0.64 | \$0.71 | \$0.03 | \$682.11 |
| Total | \$8,800.17 | \$8.28 | \$8.59 | \$0.37 | \$8,817.40 |

Table IV-8. Statewide valuation from avoided health outcomes under the Proposed Amendments.

| Outcome | Avoided incidents | Valuation (million 2019\$) |
|-------------------------------------|--------------------------|---------------------------------------|
| Premature cardiopulmonary mortality | 892 | \$8,800.17 |
| Cardiovascular hospitalization | 142 | \$8.28 |
| Acute respiratory hospitalization | 169 | \$8.59 |
| ER visit for asthma | 439 | \$0.37 |
| Total | 1,642 | \$8,817.40 |

4. Social Cost of Carbon

The Proposed Amendments will significantly reduce criteria air pollutants to achieve CARB's 2016 State SIP Strategy expected emission reductions and associated health benefits. By setting more stringent criteria air pollutant emission standards, there will also be associated GHG emission reductions due to increased adoption of ZEE. The benefit of these GHG reductions can be estimated using the Social Cost of Carbon (SC-CO₂), which provides a dollar valuation of the damages caused by one ton of carbon pollution and represents the monetary benefit today of reducing carbon emissions in the future.

In this analysis, CARB utilizes the current Interagency Working Group (IWG) supported SC-CO₂ values to consider the social costs of actions taken to reduce GHG emissions as described in the National Academies of Science, Engineering, and Medicine (NASEM) report (NASEM, 2017). This is consistent with the approach presented in California's 2017 Climate Change Scoping Plan (CARB, 2017a), with U.S. Presidential Executive Order 12866 and the Office of Management and Budget (OMB) Circular A-4 of September 17, 2003, and reflects the best available science in the estimation of the socio-economic impacts of carbon (OMB, 2003).

IWG describes SC-CO₂ as follows:

The social cost of carbon (SC-CO₂) for a given year is an estimate, in dollars, of the present discounted value of the future damage caused by a 1-metric ton increase in carbon dioxide (CO₂) emissions into the atmosphere in that year, or equivalently, the benefits of reducing CO₂ emissions by the same amount in that year. The SC-CO₂ is intended to provide a comprehensive measure of the net damages – that is, the monetized value of the net impacts – from global climate change that result from an additional ton of CO₂.

These damages include, but are not limited to, changes in net agricultural productivity, energy use, human health, property damage from increased flood risk, as well as nonmarket damages, such as the services that natural ecosystems

provide to society. Many of these damages from CO₂ emissions today will affect economic outcomes throughout the next several centuries. (NASEM, 2017)

Table IV-9 presents the range of IWG SC-CO₂ values used in regulatory assessments, including California's 2017 Climate Change Scoping Plan (CARB, 2017a).

Table IV-9. Social cost of carbon 2020-2040 (2007\$ per metric ton).

| Year | 5 Percent Discount Rate | 3 Percent Discount Rate | 2.5 Percent Discount Rate |
|------|-------------------------|-------------------------|---------------------------|
| 2020 | \$12 | \$42 | \$62 |
| 2025 | \$14 | \$46 | \$68 |
| 2030 | \$16 | \$50 | \$73 |
| 2035 | \$18 | \$55 | \$78 |
| 2040 | \$21 | \$60 | \$84 |

The SC-CO₂ is year specific; that is, environmental damages are estimated for a given year in the future and the value of the damages is discounted back to the present. The SC-CO₂ increases over time as systems become stressed from the aggregate impacts of climate change and future emissions cause incrementally larger damages. The SC-CO₂ is highly sensitive to the discount rate. The discount rate is the rate at which future benefits (or costs) are reduced such that they can be compared to a benefit received in the present. In the context of the SC-CO₂, it is intended to represent the tradeoff for society between present and future welfare. Higher discount rates decrease the present value of future environmental benefits (avoided damages). IWG estimates the SC-CO₂ across a range of discount rates that encompass a variety of assumptions regarding the correlation between climate damages and consumption of goods and is consistent with OMB's Circular A-4 guidance including the range of discounts. CARB utilizes the IWG standardized range of discount rates, from 2.5 to 5 percent to represent varying valuation of future damages (NASEM, 2017). Because the IWG SC-CO₂ prices are in 2007 dollars, staff applied an inflation adjustment, using the California Consumer Product Index, to convert them into 2019 dollars, consistent with the rest of this analysis (California Department of Finance, 2020).

If all of the expected emission reductions projected under the Proposed Amendments are achieved and assumed to be equivalent to CO₂ emission reductions, the avoided SC-CO₂ in a given year is the total emission reductions in metric tons of carbon dioxide equivalents (MT CO₂e) multiplied by the SC-CO₂ (in \$/MTCO₂e) for that year. The annual emissions reductions from the Proposed Amendments and the estimated benefits are shown in Table IV-10 below. The total benefits range between \$339 million to \$1.43 billion through 2043, depending on the discount rate.

Table IV-10. Avoided social cost of carbon under the Proposed Amendments (million 2019\$).

| Year | GHG Emissions Reductions (MMT CO₂e) | 5% Discount Rate | 3% Discount Rate | 2.5% Discount Rate |
|--------------|---|-------------------------|-------------------------|---------------------------|
| 2023 | 0.0 | \$0.0 | \$0.0 | \$0.0 |
| 2024 | 0.0 | \$0.8 | \$2.7 | \$4.0 |
| 2025 | 0.1 | \$2.4 | \$7.9 | \$11.7 |
| 2026 | 0.2 | \$4.1 | \$13.7 | \$20.1 |
| 2027 | 0.3 | \$6.0 | \$19.3 | \$28.2 |
| 2028 | 0.4 | \$7.6 | \$25.0 | \$36.2 |
| 2029 | 0.5 | \$9.4 | \$30.7 | \$45.0 |
| 2030 | 0.6 | \$11.8 | \$36.7 | \$53.6 |
| 2031 | 0.6 | \$13.3 | \$42.3 | \$61.4 |
| 2032 | 0.7 | \$15.6 | \$47.6 | \$68.6 |
| 2033 | 0.8 | \$16.8 | \$52.5 | \$75.3 |
| 2034 | 0.8 | \$19.0 | \$57.1 | \$81.4 |
| 2035 | 0.9 | \$20.1 | \$61.4 | \$87.1 |
| 2036 | 0.9 | \$22.2 | \$65.4 | \$92.3 |
| 2037 | 0.9 | \$23.1 | \$69.2 | \$98.3 |
| 2038 | 1.0 | \$25.0 | \$72.6 | \$102.7 |
| 2039 | 1.0 | \$25.7 | \$75.8 | \$106.7 |
| 2040 | 1.0 | \$27.6 | \$78.8 | \$110.3 |
| 2041 | 1.0 | \$28.1 | \$81.5 | \$113.6 |
| 2042 | 1.1 | \$29.9 | \$82.8 | \$116.7 |
| 2043 | 1.1 | \$30.2 | \$85.2 | \$119.6 |
| Total | 13.9 | \$338.6 | \$1,008.3 | \$1,432.8 |

There is an active discussion within government and academia about the role of SC-CO₂ in assessing regulations, quantifying avoided climate damages, and the values themselves. In January 2017, NASEM released a report examining potential approaches for a comprehensive update to the SC-CO₂ methodology to ensure resulting cost estimates reflect the best-available science (NASEM, 2017). The NASEM review did not modify the estimated values of the SC-CO₂, but evaluated the models, assumptions, handling of uncertainty, and discounting used in the estimation of the SC-CO₂. The report titled, "Valuing Climate Damages: Updating Estimation of the

Social Cost of Carbon Dioxide,” recommends near-term improvements to the existing IWG SC-CO₂ as well as long-term comprehensive updates (NASEM, 2017). CARB will continue to follow updates to the IWG SC-CO₂, outlined in the NASEM report, and incorporate appropriate peer-reviewed modifications to estimates based on the latest available data and science.

It is important to note that the SC-CO₂, while intended to be a comprehensive estimate of the damages caused by carbon globally, does not represent the cumulative cost of climate change and air pollution to society. There are additional costs to society outside of the SC-CO₂, including costs associated with changes in co-pollutants, the social cost of other GHGs including methane and nitrous oxide, and costs that cannot be included due to modeling and data limitations. The Intergovernmental Panel on Climate Change (IPCC) has stated that the IWG SC-CO₂ estimates are likely underestimated due to the omission of significant impacts that cannot be accurately monetized, including important physical, ecological, and economic impacts (IPCC, 2007). CARB will continue engaging with experts to evaluate the comprehensive California-specific impacts of climate change and air pollution.

E. Other Benefits

In addition to emission reductions, ZEE offer a number of other benefits to operators when compared to SORE equipment. Small off-road equipment creates noise while in operation. The University of Florida reports that leaf blowers, edgers, hedge trimmers, pressure washers, and riding mowers create sound above the threshold of 85 decibels (dB) set by the Occupational Health and Safety Administration (OSHA) (University of Florida, 2021). OSHA requires employers to implement a hearing conservation program when employees may be exposed to noise above this threshold (OSHA, 2021). According to OSHA, electric lawn mowers expose users to noise from 63 to 85 dB, depending on the mower. SORE lawn mowers expose users to 82 to 91 dB, depending on the lawn mower, with the vast majority over 85 dB (OSHA, 2018). Electric chainsaws expose users to 61 to 84 dB, while SORE chainsaws expose users to 86 to 91 dB (OSHA, 2018). Chronic occupational exposure to sounds over 80 dB has been shown to be correlated with an increased risk for hypertension (Bolm-Audroff et al., 2020).

Specifically related to gasoline-powered lawn and garden equipment, it has been shown that the noise exposure and associated health effects from these will be more pronounced in workers because they will be operating in close proximity to this equipment for a significant amount of time, such as an 8-hour work day (Tint et al., 2012). These workers often lack resources to protect themselves from high noise levels such as using hearing protection devices (Tint et al., 2012; Kearney et al., 2017). While the people in the community will also be exposed to the noise from lawn equipment, they will be farther away from the source and their exposure will be intermittent (Tint et al., 2012). ZEE are quieter, which reduces noise at the worksite as well as in the community where the equipment is operating (Duvauchelle, 2021). Many local jurisdictions such as the City of Los Angeles (1986), City of San Diego (1991), City of Dana Point (2020), and Sacramento County (2020), have noise ordinances that limit

when small off-road equipment can be used. By choosing ZEE, owners may have more flexible working hours with their equipment.

Furthermore, SORE equipment are known to emit CO, PM_{2.5}, and TACs (Baldauf et al., 2006). TACs are compounds that may contribute to mortality or adverse human health effects. Some TACs known to be emitted by lawnmowers are formaldehyde and acetaldehyde (Baldauf et al., 2006). Formaldehyde is a probable human carcinogen and can have eye and lung impacts upon acute exposure (CARB and Office of Environmental Health Hazard Assessment, 1992). Acetaldehyde is also a probable human carcinogen and acute exposure may be related to reproductive and developmental effects (CARB and Office of Environmental Health Hazard Assessment, 1993). By choosing ZEE, users of these equipment types would have less exposure to TACs. CO poisoning deaths from inhalation of SORE equipment exhaust could also be prevented by an increased adoption of ZEE. CO poisoning can occur when users follow manufacturers' instructions. CO poisoning can also occur from improper use of SORE equipment, including using the equipment indoors. The Consumer Product Safety Commission notes that from 2015 through 2017 there were an average of 97 CO poisoning deaths nationally from engine-driven tools per year, including some from preempt equipment. Eighty-five percent of these deaths were attributed to the use of a generator (Hnatov, 2020).

V. Environmental Analysis

A. Introduction

This chapter provides the basis for CARB's determination that no subsequent or supplemental environmental analysis is required for the Proposed Amendments.

CARB's regulatory program, which involves the adoption, approval, amendment, or repeal of emission standards, rules, regulations, or plans for the protection and enhancement of the State's ambient air quality, has been certified by the California Secretary for Natural Resources under Public Resources Code section 21080.5 of the California Environmental Quality Act (CEQA) (14 CCR 15251(d)). Public agencies with certified regulatory programs are exempt from certain CEQA requirements, including but not limited to, preparing environmental impact reports, negative declarations, and initial studies. Instead, CARB, as a lead agency, prepares a substitute environmental document (referred to as an "Environmental Analysis" or "EA") as part of the Staff Report to comply with CEQA (17 CCR 60000-60008). This chapter constitutes that EA.

CARB's regulatory program provides that CARB prepare an addendum to a certified EA for a proposed project if CARB determines that the circumstances set forth in the CEQA Guidelines, Title 14 of the California Code of Regulations, section 15164 (hereafter, "Section 15164") apply to the proposed project (17 CCR 60004(b)(1)(B)). Section 15164 provides that a "lead agency ... shall prepare an addendum to a previously certified [EA] if some changes or additions are necessary [to make to the underlying EA] but none of the conditions described in [Title 14 CCR] section 15162

[hereafter, “Section 15162”] calling for preparation of a subsequent [EA] have occurred.”

The Proposed Amendments are substantively similar to a regulatory concept measure previously included within the 2016 State SIP Strategy (CARB, 2017b) for SORE (hereafter, “SORE SIP Measures”). In its approval of the 2016 State SIP Strategy, CARB certified an EA, entitled Final Environmental Analysis for the Revised Proposed 2016 State Strategy for the State Implementation Plan, (CARB, 2017b) or Final EA, that evaluated the impacts associated with the SORE SIP Measures and mitigated those impacts, to the extent feasible, evaluated overarching alternatives to the 2016 State SIP Strategy and adopted a statement of overriding circumstances for impacts deemed significant and unavoidable. While the Proposed Amendments fill in more detail with respect to specifying the more stringent emission standards and eventual emission standards of zero, the additional detail does not change the potential compliance responses identified in the Final EA. Rather, the only change triggered by the Proposed Amendments that warrants an addendum to the Final EA is the need to add the Proposed Amendments’ detail to the project description of the SORE SIP Measures. Therefore, and for additional reasons in the following paragraphs, since the Final EA adequately evaluated impacts, mitigation and alternatives associated with the SORE SIP Measures and the Proposed Amendments are substantively similar to the SORE SIP Measures, the Proposed Amendments do not trigger the need to prepare a subsequent EA.

Section B of this chapter V discusses the Final EA and its conclusions with respect to the SORE SIP Measures. Section C briefly summarizes the Proposed Amendments and how they fit within the SORE SIP Strategy measure.

B. Prior Environmental Analysis

In March 2017, the Board adopted the 2016 State SIP Strategy. Generally, the 2016 State SIP Strategy is designed to reduce emissions of ozone-forming pollutants and PM_{2.5} and describes the programmatic and regulatory mechanisms of the federal Clean Air Act requirements to meet federal air quality standards. CARB’s 2016 State SIP Strategy describes 27 specific measures and CARB’s commitment to achieve the mobile source and consumer products emission reductions needed to meet NAAQS. The SORE SIP Measures included in the 2016 State SIP Strategy would:

- Establish more stringent engine performance standards for cleaner combustion technologies (Low-NO_x Engine Standard);
- Ensure that emissions control systems remain durable over the lifetime of the vehicle (Lower In-Use Emission Performance Level);
- Increase the penetration of near-zero- and zero-emission technology across a range of applications;
- Expand the requirements for cleaner Low-Emission Diesel fuels;
- Conduct pilot studies to demonstrate new technologies;

- Incentivize the turnover of equipment and fleets to the cleanest technologies;
- Increase system efficiencies; and
- Reduce emissions from consumer products.

When CARB staff proposed the 2016 State SIP Strategy for the Board's consideration in March 2017, it included an EA prepared under CARB's certified regulatory program, referred to here as the Final EA (as mentioned in section A of this Chapter V). The Final EA provided a programmatic analysis of the potentially significant adverse and beneficial environmental impacts resulting from implementation of the 27 measures in the 2016 State SIP Strategy, and their associated reasonably foreseeable compliance responses.

The Final EA was based on the reasonably foreseeable compliance responses of the regulated entities that would be affected, in some manner, by the aforementioned SIP measures, including the SORE SIP Measures. The Final EA concluded that implementation of the SIP measures could result in long-term beneficial impacts to air quality, energy demand, and GHGs. It further concluded that the proposed measures would result in less-than-significant impacts to: energy demand, long-term hazards and hazardous materials, land use and planning, mineral resources, population and housing, public services, and recreational services.

The Final EA also concluded that, taking the 27 proposed measures together, there could be potentially significant and unavoidable adverse impacts to aesthetics, agriculture and forest resources, short-term air quality, biological resources, cultural resources, geology and soils, short-term hazards and hazardous materials, hydrology and water quality, noise, transportation/traffic, and utilities and service systems.

The Final EA identified no direct impacts from the 2016 State SIP Strategy measures. Rather, CARB identified indirect adverse impacts because the impacts are associated with activities that may occur in response to implementing the measures identified in the 2016 State SIP Strategy, not from the act of preparing and adopting the regulation or from its direct implementation and enforcement by CARB and its staff. As such, the indirect adverse impacts may take place by regulated entities and other third parties to comply with the 2016 State SIP Strategy measures. While many of the identified potentially significant adverse impacts could be reduced to a less-than-significant level by mitigation, CARB lacks legal authority to impose the mitigation measures associated with development activities because it has no land-use permitting authority over those activities. (Cal. Const., Article XI, section 7 ["A county or city may make and enforce within its limits all local, police, sanitary, and other ordinances and regulations not in conflict with general laws."]; *California Building Industry Assn. v. City of San Jose* (2015) 61 Cal.4th 435, 455; *Big Creek Lumber Co. v. County of Santa Cruz* (2006) 38 Cal.4th 1139, 1151-1152; HSC sections 39000-44474 [CARB's statutory authority provides no authority to regulate local land use permitting].) Rather, the authority to determine project-level impacts and require project-level mitigation lies with land use and/or other permitting agencies for individual projects, causing inherent uncertainty in the degree of mitigation that may ultimately be implemented to reduce the

project's potentially significant indirect impacts on the environment. Consequently, acknowledging this inherent uncertainty, the Final EA took the conservative approach in its post-mitigation significance conclusions and disclosed that the project may have potentially significant and unavoidable adverse impacts because CARB lacked the permitting authority to address those indirect impacts from development activities associated with the compliance responses.

Even if CARB had authority to mitigate impacts from the 2016 State SIP Strategy, the potential impacts from development activities cannot be quantified in a manner to inform mitigation measures. Generally, in its rulemaking and planning activities, CARB staff seeks input from stakeholders on the issue of what stakeholders may have to do to comply with a regulation or plan. Since there is a great variety of stakeholders subject to a regulation and stakeholders' manufacturing and supply chains are so complex, there is inherent uncertainty relative to the exact compliance activities that may occur in response to a CARB regulation. As a result, there is inherent uncertainty relative to the scope of potential development activities that stakeholders may undertake to comply with a particular regulation; relative certainty would likely occur after the adoption of the regulation and during compliance periods as stakeholders reevaluate their operations to work towards regulatory compliance. With that certainty, stakeholders would then pursue necessary land use approvals and address adverse impacts through the land use permitting process. As a result, when CARB staff prepares an EA for a regulation or a plan, the indirect adverse impacts from a regulation or plan, such as the 2016 State SIP Strategy, are so ill-defined and relatively speculative that it would be nearly impossible to adequately quantify the exact impacts from a regulation for purposes of establishing mitigation. Given this, while the Final EA indicated that there may be potential adverse environmental impacts from the 27 measures in the 2016 State SIP Strategy as a whole, it concluded that these impacts are speculative and cannot be precisely quantified until the scope of the measures is defined by actual proposed regulations. Therefore, CARB's efforts to mitigate for ill-defined, speculative impacts in the Final EA necessarily sought to address overarching themes of the impacts (i.e., dust mitigation from construction activities or addressing potential cultural resource issues), but found that it was speculative to nail down exact mitigation criteria for unquantified impacts-- essentially, lacking the ability to address the "rough proportionality" constitutional metric in a quantified manner, but rather doing so in a general manner since the impacts are also identified in a broad, general manner.⁹

Collectively, taking into account all components of the 2016 State SIP Strategy across all categories, the Final EA concluded that the potential adverse environmental impacts of the 2016 State SIP Strategy are outweighed by the substantial air quality

⁹ As required by the Takings Clause of the 5th Amendment of the U.S. Constitution and codified in the CEQA Guidelines as follows: "(4) Mitigation measures must be consistent with all applicable constitutional requirements, including the following: ...(B) The mitigation measure must be 'roughly proportional' to the impacts of the project. *Dolan v. City of Tigard*, 512 U.S. 374 (1994)" (Title 14 CCR section 15126.4(a)(4)(B).)

benefits that will result from its adoption and implementation. At its hearing on March 23, 2017, the Board adopted Resolution 17-7 certifying the Final EA, approving the written responses to comments on the Final EA, and adopting the findings and statement of overriding considerations. A Notice of Decision was filed with the Office of the Secretary of the Natural Resources Agency for public inspection.

As discussed below, the Proposed Amendments, which implement the SORE SIP Strategy measure, do not require CARB to prepare a Subsequent EA precisely because they merely add to the project description of the SORE SIP Strategy Measure and effectively mirrors the scope and underlying themes of the SORE SIP Strategy as identified in the Final EA. Thus, the Proposed Amendments have the same compliance responses, requiring the same generalized impact analysis that CARB conducted in the Final EA for the SORE SIP Strategy Measure.

The SORE SIP Strategy measure summary and the potential compliance responses for it are included in the following excerpt from the Final EA (CARB, 2017b).

1. Small Off-Road Engines

a. Measure Summary

This measure would reduce emissions from SORE and increase the penetration of zero-emission technology. SORE that are subject to CARB regulations are used in residential and professional lawn and garden equipment, and other utility applications. CARB staff would promote increased use of ZEE, propose tighter exhaust and evaporative emission standards, and enhance enforcement of current emissions standards for SORE.

High failure rates have been observed in evaporative emissions testing of SORE, preventing previously-claimed emission reductions from being realized. Exhaust and evaporative emissions from SORE would be reduced through enhanced enforcement of the current emission standards, development of tighter emission standards, and increased use of ZEE. Strategies would be developed for transitioning to zero-emission technologies, including an initial focus on incentives for use of ZEE, coupled with increasingly stringent emission standards for criteria pollutants and GHGs.

b. Potential Compliance Responses

Reasonably foreseeable compliance responses under this measure would include an increase in manufacturing, production and use of zero-emission technology in SORE. This could require the construction or modification of associated manufacturing facilities to increase the supply of zero-emission technology for SORE, including battery electric-powered equipment. Increased demand for lithium batteries could increase production, along with associated increases in lithium mining and exports from source countries or other states would be anticipated. Disposal of any portion of vehicles, including batteries, would be subject to, and be in compliance with existing laws and regulations governing solid waste, such as California's Universal Waste Rule

(Cal. Code Regs., tit. 22, Chapter 23). That is, disposal of used batteries into landfills is prohibited; however, they could be refurbished or re-used. To meet an increased demand of refurbishing or reusing batteries, new facilities, or modifications to existing facilities, are anticipated to accommodate battery recycling activities. Equipment replacement may result in recycling or selling old equipment.

C. The Proposed Amendments

The Proposed Amendments are discussed in detail in Chapters II and XI of this Staff Report. They include the following elements that implement the SORE SIP Strategy measure:

1. Exhaust Emissions:

- Significantly more stringent HC and NO_x exhaust emission standards on existing certification cycles:
 - For all equipment, except generators, emission standards will be set to 0.00 for MY 2024 and subsequent model years;
 - For generators in MYs 2024 through 2027, HC and NO_x exhaust emissions standards will be decreased by 40-90 percent, depending on engine displacement category, and set to 0.00 for MY 2028 and subsequent model years;
 - Continued use of emission reduction credits from the averaging, banking and trading program until the credits expire, five years after they are generated. The maximum FELs for engine families would be lowered to levels equivalent to the current HC + NO_x exhaust emission standards.
- Other amendments to the exhaust emission regulations include: sunsetting the voluntary “Blue Sky Standards” after MY 2023^r, changes to compliance and production line testing procedures, addition of CO to the averaging, banking and trading program, and a new zero-emission generator credit program;
- Longer emissions durability periods for some engines in MY 2024 and subsequent model years.

2. Evaporative Emissions:

- More stringent evaporative emission standards.
 - For all equipment, except generators, emission standards will be set to 0.00 for MY 2024 and subsequent model years;
 - For generators, hot soak plus diurnal emission standards for MYs 2024 through 2027 will be approximately 50 percent lower than current diurnal emission standards based on certification levels of currently-certified

^r The Blue Sky Standards were developed to allow manufacturers to receive recognition for certifying to lower emission standards, but CARB has no record of anyone taking advantage of the program for engines, so the proposal includes CARB ending its application after MY 2023.

- engines in California and set to 0.00 for MY 2028 and subsequent model years;
- Continued use of emission reduction credits from the averaging, banking and trading program until the credits expire, five years after they are generated;
- Addition of a zero-emission generator credit program, which will allow more flexibility in the regulations and allow manufacturers who generate credits to trade them to other manufacturers;
- Sunsetting the optional Blue Sky Standards after MY 2023 due to lack of use by manufacturers;
- Allowing alternative fuel equipment to qualify for evaporative emission credits;
- Repeal the variance provision, which allows manufacturers to certify without actually meeting all certification requirements and is subject to its own CEQA review process;
- Requirement for fuel caps and tethers to prevent fuel spillage during refueling;
- Minor administrative changes to test procedures, including a tilt test which is designed to account for excess emissions that come from fuel leaks when equipment is turned on its side for cleaning, transportation or storage;

3. Enhanced Enforcement:

- Modification of the compliance testing procedures for enforcement purposes. These would allow CARB to test “one or more” engines for compliance purposes and remove the requirement to test engines in groups of five.

D. Comparison of the Proposed Amendments to the SORE SIP Strategy

While there is more detail added to the Proposed Amendments as compared to the SORE SIP Strategy measure, the general scope of the Proposed Amendments contains the general scope identified in the SORE SIP Strategy measure described above in section B of this Chapter V. Specifically, the general scope of the SORE SIP Strategy includes: “Exhaust and evaporative emissions from SORE would be reduced through enhanced enforcement of the current emission standards, adoption of tighter exhaust and evaporative emission standards, and increased use of zero-emission equipment.” Steps identified in the SORE SIP Strategy, in the quoted language, below, are substantively similar to the Proposed Amendments, including the following substantive similarities:

- SORE SIP Strategy: “Strategies will be developed for transitioning to zero-emissions technologies, including an initial focus on incentives for use of zero-emission equipment, coupled with increasingly stringent emission standards for criteria pollutants...”
 - Proposed Amendments-

- Focus on transitioning sales of small off-road equipment from SORE equipment to ZEE;
 - Addition of a zero-emission generator credit program;
 - Set emission standards to zero for MY 2024 and subsequent model years for all equipment except generators;
 - Set more stringent emission standards for generators for MYs 2024 through 2027 and set emission standards to zero for MY 2028 and subsequent model years.
 - Allows for the use of credits until they expire, even after the emission standards are zero;
 - Setting both exhaust and evaporative emission standards to zero will further enhance the focus on the credit incentive to encourage the use of ZEE.
- Once credits have expired, only ZEE would be produced for sale or lease for use or operation in California, which would achieve the SORE SIP Strategy goal of transitioning to zero-emissions technology.
- SORE SIP Strategy: “Enhance enforcement of current emissions standards for SORE.”
 - Changing regulatory language for compliance testing to allow for broader compliance testing of SORE. This would reduce the burden on CARB’s testing facilities and enable better enforcement of CARB’s SORE regulation.

Additional, administrative and miscellaneous changes were added in the Proposed Amendments (fuel cap tether, tilt test) which are guided by the SORE SIP Strategy measure to reduce emissions from SORE.

E. Analysis

1. Legal Standards

When considering modifications to a CEQA project for which a substitute document equivalent to an Environmental Impact Report (EIR) or negative declaration has previously been prepared, CARB looks to Public Resources Code (PRC) section 21166 and CEQA Guidelines section 15162 for guidance on the requirements for subsequent or supplemental environmental review.

CEQA Guidelines section 15162 states:

- (a) When an EIR has been certified or a negative declaration adopted for a project, no subsequent EIR shall be prepared for that project unless the lead agency determines, on the basis of substantial evidence in the light of the whole record, one or more of the following:*

- (1) Substantial changes are proposed in the project which will require major revisions of the previous EIR or negative declaration due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified significant effects;*
- (2) Substantial changes occur with respect to the circumstances under which the project is undertaken which will require major revisions of the previous EIR or negative declaration due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified significant effects; or*
- (3) New information of substantial importance, which was not known and could not have been known with the exercise of reasonable diligence at the time the previous EIR was certified as complete or the negative declaration was adopted, shows any of the following:*
 - (A) The project will have one or more significant effects not discussed in the previous EIR or negative declaration;*
 - (B) Significant effects previously examined will be substantially more severe than shown in the previous EIR;*
 - (C) Mitigation measures or alternatives previously found not to be feasible would in fact be feasible and would substantially reduce one or more significant effects of the project, but the project proponents decline to adopt the mitigation measure or alternative; or*
 - (D) Mitigation measures or alternatives which are considerably different from those analyzed in the previous EIR would substantially reduce one or more significant effects on the environment, but the project proponents decline to adopt the mitigation measure or alternative.*

If a subsequent or supplemental EIR or negative declaration is not required, the lead agency may document its decision and supporting evidence in an addendum (Title 17 CCR section 60004.4(a); Title 14 CCR section 15164 (e)). The addendum and lead agency's findings should include a brief explanation, supported by substantial evidence, of the decision not to prepare a subsequent or supplemental EIR or negative declaration (Title 14 CCR section 15164(e)). An addendum need not be circulated for public review, but must be considered by the lead agency prior to making a decision on the project (Title 14 CCR section 15164(c), (d)).

2. Basis for Determination

CARB staff has determined that the Proposed Amendments do not involve any changes that result in any new significant adverse environmental impacts or a substantial increase in the severity of the significant adverse impacts previously disclosed in the prior Final EA. Further, there are no changes in circumstances or new information that would otherwise warrant any subsequent or supplemental

environmental review. The Final EA adequately addresses the implementation of the 2016 State SIP Strategy as modified by the Proposed Amendments and no additional environmental analysis is required. The basis for CARB staff's determination that none of the conditions requiring further environmental review are triggered by the Proposed Amendments is based on the following analysis.

- (1) There are no substantial changes to the measures previously analyzed in the Environmental Analysis which require major revisions to the Environmental Analysis involving new significant environmental effects or a substantial increase in the severity of previously identified effects.*

While the Proposed Amendments add more detail to the SORE SIP Strategy measure, the changes are not substantial in such a manner that warrants revisions to the Final EA. As noted earlier, the SORE SIP Strategy measure and the Proposed Amendments are nearly identical in scope and substance, in that they both provide the following: exhaust and evaporative emissions from SORE would be reduced through enhanced enforcement of the current emission standards, development of tighter emission standards, and increased use of ZEE. While the Proposed Amendments include the repeal of the variance provision, the variance provision is an optional procedure within the SORE regulatory program and is subject to a public hearing process and its own CEQA review if CARB receives a variance application; therefore, given its optional feature and separate CEQA process during review of a variance application, repealing this provision will not involve new significant environmental effects or a substantial increase in the severity of previously identified effects.

Since both measures are nearly identical in scope and substance as explained above, effectively creating a similar project description for both, it is foreseeable that the compliance responses identified in the Final EA would be substantially similar to those that may result from implementation of the Proposed Amendments. The Proposed Amendments' changes to the SORE SIP Strategy measure, while adding detail, are not substantial changes such that it would alter the foreseeable compliance responses. Therefore, since the Proposed Amendments would not alter the foreseeable compliance responses identified in the Final EA for the SORE SIP Strategy measure, which constitute the primary means to determine if the Proposed Amendments may have an impact on the environment, then it stands to reason that the nonsubstantial changes to the SORE SIP Strategy measures identified in the Proposed Amendments would not involve new significant environmental effects or a substantial increase in the severity of the previously identified significant effects in the Final EA.

The Final EA evaluated the anticipated indirect significant environmental effects from the reasonably foreseeable compliance responses to all 27 measures in the 2016 State SIP Strategy planning document. The Final EA included the SORE SIP Strategy's compliance response, identified above, in this impact analysis. As noted, the Final EA identified some potential significant and unavoidable impacts in certain resource areas. The Final EA's impact analysis centered on the potential for certain development that may occur in response to adoption of the 2016 State SIP Strategy measures. Specifically, for the SORE SIP Strategy, compliance-response development

that could potentially occur is related to battery development (lithium mining, new or expanded battery recycling/disposal facilities) and new or expanded facilities to accommodate new product lines. As explained above, the Final EA could not, however, predict with any accuracy the level of development and associated impacts that could occur when it adopts more stringent emission standards, creates incentives for adoption of zero-emission technology, eventual transition to ZEE and enhanced enforcement. As a result, the Final EA took a very conservative approach even though it did not have a clear picture of specific projects that could occur in response to the SORE SIP Strategy measure and other measures, and proposed broadly defined mitigation measures that lead agencies should adopt if the compliance response development becomes a reality. However, since CARB has no land use authority to require these measures, it found that the impacts from the 2016 State SIP Strategy measures were potentially significant and unavoidable, triggering the adoption of a statement of overriding considerations to approve the project.

Likewise, notwithstanding the Proposed Amendments' specificity in implementing the general scope of the SORE SIP Strategy measure, the additional specificity does not contribute to an additional understanding of the exact nature, scope and detail of potential compliance response projects and, as a result, does not change the impact analysis of the Final EA. CEQA defines significant effect on the environment as "a substantial, or potentially substantial, adverse change in the environment." (PRC section 21068). A "significant effect on the environment [must] be based on substantial evidence in light of the whole record." (PRC section 21082.2(a)). "Argument, speculation, unsubstantiated opinion or narrative, evidence which is clearly inaccurate or erroneous, or evidence of social or economic impacts which do not contribute to, or are not caused by, physical impacts on the environment, is not substantial evidence. Substantial evidence shall include facts, reasonable assumptions predicated upon facts, and expert opinion supported by facts." (PRC section 21082.2(c)).

Based on the record of the Proposed Amendments, CARB finds that there is no substantial evidence to support a finding that the Proposed Amendments will cause new effects on the environment or increase the severity of those effects previously identified in the Final EA because the Proposed Amendments have the same compliance responses as those that were analyzed in the Final EA, and thus the impact analysis is the same as the impact analysis that evaluated the impacts from the compliance response-related development already disclosed in the Final EA. Notably, like the findings on air quality and GHG in the Final EA, there is also an air quality and GHG benefit from the Proposed Amendments. As discussed in Chapters III and IV, above, the Proposed Amendments will have significant NO_x, ROG, GHG and TAC emission reductions. Additionally, since there is no substantial evidence that can precisely identify project-specific impacts from potential compliance-response development projects due to the unknown nature of these projects, the identified emissions benefits from the Proposed Amendments cannot be counterweighed, without speculation, against any potential air quality impacts from these projects. Therefore, the Proposed Amendments, while adding new detail to the SORE SIP

Strategy Measures, do not involve new significant environmental effects or a substantial increase in the severity of previously identified effects in the Final EA.

- (2) There are no substantial changes with respect to the circumstances under which the Proposed Amendments are being undertaken which require major revisions to the previous Environmental Analysis involving new significant environmental effects or a substantial increase in the severity of previously identified effects.*

There are no substantial changes to the environmental setting or circumstances in which the Proposed Amendments are being implemented compared to those analyzed in the Final EA of the 2016 State SIP Strategy. As explained above, the Proposed Amendments do not substantially alter the types of compliance responses of the regulated entities or result in any changes that significantly affect the physical environment.

- (3) There is no new information of substantial importance, which was not known and could not have been known with the exercise of reasonable diligence at the time the previous Environmental Analysis was certified as complete, that changes the conclusions of the Environmental Analysis with regard to impacts, mitigation measures, or alternatives.*

No new information of substantial importance that changes the conclusions of the Final EA has become available to CARB staff since the Final EA was certified. The information available at the time the Board certified the Final EA included the proposed SORE regulation concepts in 2016 State SIP Strategy, which, as noted, are substantively similar to the Proposed Amendments; thus, the Proposed Amendments do not present new information that was not already known when the Board certified the Final EA. There is likewise no new information of substantial importance that would alter the compliance responses identified in the Final EA because, due to the Proposed Amendments' substantive similarity to the SORE regulation identified in the 2016 State SIP Strategy, the compliance responses for the Proposed Amendments are the same as those in the Final EA. Therefore, there is no new information of substantial importance that changes the conclusions in the Final EA about the potential environmental impacts to any resource areas, mitigation measures for those impacts or alternatives.

In sum, no supplemental or subsequent EA is required for the Proposed Amendments because, as described above, the Proposed Amendments do not result in any new environmental impacts or in a substantial increase in severity to the impacts previously disclosed in the Final EA. Further, there are no changes in circumstances or new information that would otherwise warrant an additional environmental review.

VI. Environmental Justice

State law defines environmental justice as the fair treatment and meaningful involvement of people of all races, cultures, incomes, and national origins, with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies (Gov. Code, § 65040.12, subd. (e)(1)). “‘Environmental justice’ includes, but is not limited to, all of the following: (A) The availability of a healthy environment for all people. (B) The deterrence, reduction, and elimination of pollution burdens for populations and communities experiencing the adverse effects of that pollution, so that the effects of the pollution are not disproportionately borne by those populations and communities. (C) Governmental entities engaging and providing technical assistance to populations and communities most impacted by pollution to promote their meaningful participation in all phases of the environmental and land use decision making process. (D) At a minimum, the meaningful consideration of recommendations from populations and communities most impacted by pollution into environmental and land use decisions.” (Gov. Code, § 65040.12, subd. (e)(2)). The Board approved its Environmental Justice Policies and Actions (Policies) on December 13, 2001, to establish a framework for incorporating environmental justice into CARB's programs consistent with the directives of State law (CARB, 2001). These Policies apply to all communities in California, but are intended to address the disproportionate environmental exposure burden borne by low-income communities and communities of color. Environmental justice is one of CARB's core values and fundamental to achieving its mission.

Beyond the Policies, California's 2017 Climate Change Scoping Plan says, “Equity considerations must likewise be part of the deliberate and thoughtful process in the design and implementation of all policies and measures ...” It also states, “CARB must ensure that its ongoing engagement with environmental justice communities will continue beyond the development of the Scoping Plan and be included in all aspects of its various air pollution programs.” (CARB, 2017a). Together, these documents demonstrate CARB's commitment to environmental justice.

The Proposed Amendments would reduce statewide SORE emissions of NO_x and ROG by about half in 2031, compared to the Baseline Scenario. Reducing NO_x and ROG emissions is an integral part of California reaching its goal of attaining and maintaining national and California ambient air quality standards for ozone, which are protective of the health and welfare of all California residents. Consequently, all communities, including disadvantaged low-income communities and communities of color, would benefit from the Proposed Amendments. Staff expects emission benefits will be greatest in areas with the highest emissions, which are likely to include disadvantaged communities where equipment users may have the oldest and highest-emitting equipment. The Proposed Amendments would help improve the overall health of these communities through fewer instances of premature mortality, fewer hospital and ER visits, and fewer lost days of work. These health benefits would result from reduced tropospheric ozone and PM production as NO_x and ROG emissions decreased.

Users of SORE equipment are exposed to CO, PM_{2.5}, TACs, and other pollutants when operating equipment (Baldauf et al., 2006). Frequent users of lawn and garden equipment, particularly landscaping professionals, would be exposed to these air contaminants less frequently by replacing their SORE equipment with ZEE. Employees of landscaping businesses typically have lower income than an average employee in California. The U.S. Census Bureau estimates the average annual salary for a landscaping business employee in California is \$38,318 (U.S. Census Bureau, 2021). This is substantially lower than the median salary of \$75,235 per year for the overall California population (U.S. Census Bureau, 2021). Further, 67 percent of landscaping business employees in the CSUF survey were identified as being Hispanic or Latino (CSUF SSRC, 2019). These users are disproportionately exposed to CO, PM_{2.5}, and TACs, as noted above. Replacing SORE equipment with ZEE will reduce these exposures and protect the health of users, while offering a potential for cost-savings to businesses. The Proposed Amendments are consistent with CARB's environmental justice policy of reducing exposure to air pollutants and reducing adverse health impacts from TACs in all California communities.

Sole-proprietorships and other small business landscapers may be significantly affected by the direct economic impacts of the Proposed Amendments. Small business landscapers make up more than 99 percent of landscaping businesses in California (U.S. Census Bureau, 2021). U.S. Census Bureau data indicate that more than 95 percent of landscaping businesses have fewer than five employees and approximately 85 percent of landscaping businesses are sole proprietorships (U.S. Census Bureau, 2021). Consequently, the higher upfront costs of ZEE and the batteries needed to power the ZEE for a full work day may be a significant expense for many landscaping businesses. Generally, professional landscapers use a variety of equipment such as chainsaws, lawnmowers, leaf blowers, string trimmers, and hedge trimmers to complete the majority of their work (CSUF SSRC, 2019). Purchasing all new ZEE in addition to the batteries may be burdensome. However, despite larger upfront costs, within the first few years of owning ZEE, net cost savings are expected due to decreasing fuel costs. Also, over time, additional savings are expected from decreased maintenance and repair costs because the businesses would no longer have the costs of routine engine maintenance and repairs. Staff expects that a landscaping business would not need to purchase a full suite of ZEE at once, thereby avoiding a significant one-time cost to transition to ZEE. Rather, staff expects landscaping businesses would replace their equipment with ZEE as it breaks or is replaced for other reasons. The SRIA in Appendix I of this Staff Report includes additional discussion of potential costs and savings for small landscaping businesses.

Staff conducted outreach to landscaping professionals through several landscaping expos around the state. At these expos, staff had an exhibit table with representative ZEE and literature available to increase awareness for ZEE. Staff took the opportunity to inform participants about the ZEE Roadshow and the availability of loans of ZEE through that program. The literature was made available in both English and Spanish to facilitate enhanced accessibility. More information on outreach to landscapers can be found in section X.E of this Staff Report.

Of the 59,342 licensed landscaping companies in California, 50,722 are sole proprietorships, meaning the owner is also the only employee. These sole proprietorships have an average revenue of \$32,000 per year (U.S. Census Bureau, 2021). For these companies, the upfront cost of ZEE can be significant, but if they can take advantage of incentive programs, they can realize cost-savings.

Several air districts, including SCAQMD and SJVAPCD, have existing incentive programs for landscapers. These programs allow landscapers to trade in their existing SORE equipment and get a substantial rebate or discount on their purchase of ZEE (SCAQMD, 2021; SJVAPCD, 2021). A full discussion of available incentive programs can be found in section I.E of this report.

There is further need for incentives to accelerate the adoption of ZEE, particularly for professional users and small businesses. Incentives for purchase of ZEE would help these users meet their operational needs. These users typically operate their equipment more frequently and, therefore, need more batteries to power their equipment throughout a work day. Batteries account for most of the price differential between SORE equipment and ZEE. Incentives can also play a role in technology advancement for those equipment types, such as generators, for which additional challenges exist in adoption of zero-emission technologies. This will help achieve the goal to transition to 100 percent zero-emission off-road vehicles and equipment by 2035 where feasible, as set out in EO N-79-20 (California Executive Order No. N-79-20. September, 2020).

VII. Standardized Regulatory Impact Analysis

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 includes consideration of the impact of the Proposed Amendments 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 or school districts in accordance with instructions adopted by the California Department of Finance (DOF). This estimate is to include any nondiscretionary costs or savings imposed on local agencies and the costs or savings in federal funding to the State.

Government Code section 11346.3, subsection (c) requires a state agency to perform a SRIA before adopting any major regulation. Government Code section 11342.548 defines a "major regulation" as "any proposed adoption, amendment, or repeal of a regulation subject to review by the Office of Administrative Law (OAL) pursuant to Article 6 ... that will have an economic impact on California business enterprises and individuals in an amount exceeding fifty million dollars (\$50,000,000), as estimated by the agency." Because the estimated economic impact of the Proposed Amendments on California business enterprises and individuals exceeds \$50 million in at least one

year during the implementation, the Proposed Amendments constitute a major regulation and requires CARB to prepare a SRIA.

This chapter summarizes results that estimate the economic impacts of the Proposed Amendments. Overall, staff expects the Proposed Amendments would have a net direct cost of \$4.08 billion accrued over the regulatory horizon. When all benefits are considered, the Proposed Amendments would have a cumulative net benefit of \$4.27 billion and a benefit-cost ratio of 1.30 over the regulatory horizon of 2023 through 2043. Residential users of small off-road equipment are expected to experience a net direct cost accrued through 2043 of \$2.79 billion, and professional users are expected to experience an accrued net direct cost of \$1.29 billion. This difference is due to the difference in annual equipment use times between residential and professional users. Macroeconomic modeling shows a small impact on economic indicators such as gross State product, employment, output, and the personal income of individuals in California, as described in detail in this chapter. Thus, this regulatory action would not have a significant adverse economic impact on businesses in California. Details on the calculations and assumptions used to perform this analysis are included in the SRIA, which is in Appendix I of this Staff Report and available on DOF's website.⁵

A. Changes Since Originally-submitted SRIA

On September 9, 2020, DOF published the SRIA for an earlier draft of the Proposed Amendments along with its comments on the document to its website. Since then, staff has updated the Proposed Amendments and the SRIA. An updated version of the SRIA can be found on DOF's website and in Appendix I of this Staff Report. This section summarizes the changes in the economic impact analysis that are incorporated in the updated SRIA as well as a summary of responses to DOF's comments on the original SRIA.

1. Response to DOF Comments

DOF generally agreed with the methods and analysis included in the SRIA. The updated SRIA addresses the comments made by DOF staff. Specifically, the following changes were made:

In response to DOF's request that annual benefits such as avoided health costs and emission reductions be added, staff has added tables delineating the annual reduction in emissions, reduction in negative health outcomes, and associated benefits for both the Proposed Amendments and considered alternatives.

In response to DOF's comment that the SRIA should include a cost and benefit breakdown analysis for each of the nine regulated product categories identified by CARB to identify impacts on representative individuals and businesses that use the equipment, staff has added more discussion of specific equipment types. The reasons for and impacts of the largest upfront costs of adopting zero-emission generators and

⁵ https://www.dof.ca.gov/Forecasting/Economics/Major_Regulations/Major_Regulations_Table/

pressure washers are now discussed. Furthermore, staff has added a table that shows the length of time it would take a typical owner of a piece of ZEE to experience cost-savings compared to SORE for each equipment type. This table shows that owners of some equipment types are expected to break even nearly immediately, and owners of other equipment types may not break even within the median age of the equipment. Finally, staff has added more discussion of the differential impacts on residential versus professional users.

2. Summary of Updated Economic Analysis

a. Direct Costs

The Proposed Amendments are estimated to lead to an average annual net direct cost of \$194.14 million dollars and a net direct cost of \$4.08 billion accrued over the regulatory horizon. Table VII-1 shows the total annual direct costs and cost-savings associated with the Proposed Amendments. The Proposed Amendments would yield annual net cost-savings starting in the year 2037 when the savings in fuel purchases and maintenance costs become greater than the increased cost of ZEE. Figure VII-1 shows the annual costs, cost-savings and net costs graphically.

Tables VII-2 and VII-3 show the total annual direct costs and cost-savings for professional users (nonlandscaping businesses, landscapers, and government entities) and residential users, respectively. Over the regulatory horizon, professional users would have an accrued net direct cost of \$1.29 billion, and residential users would have an accrued net cost of \$2.79 billion. This difference is due to the use time of the equipment by professional users. Residential users use their equipment less and keep their equipment longer than professional users, allowing for less turnover to ZEE and savings from reduced fuel and maintenance costs. While, overall, the Proposed Amendments would result in annual net cost-savings starting in 2037, professional users would experience annual net cost-savings starting in 2034, and residential users starting in 2041.

Table VII-1. Modeled costs to professional and residential users per year under the Proposed Amendments relative to the Baseline Scenario (million 2019\$).

(Negative values indicate cost-savings. Totals may differ slightly due to rounding.)

| Year | Gasoline equipment cost | Electric equipment cost | Gasoline equipment maintenance cost | Gasoline cost | Electricity cost | Total cost | Total cost-savings | Net cost |
|----------------|--------------------------------|--------------------------------|--|----------------------|-------------------------|--------------------|---------------------------|-------------------|
| 2023 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| 2024 | -\$91.75 | \$856.21 | -\$11.81 | -\$19.63 | \$3.91 | \$860.12 | -\$123.19 | \$736.93 |
| 2025 | -\$88.62 | \$854.03 | -\$34.31 | -\$56.55 | \$10.67 | \$864.70 | -\$179.48 | \$685.22 |
| 2026 | -\$85.44 | \$853.02 | -\$58.40 | -\$96.07 | \$18.21 | \$871.23 | -\$239.91 | \$631.32 |
| 2027 | -\$82.22 | \$852.02 | -\$81.61 | -\$136.00 | \$25.81 | \$877.83 | -\$299.83 | \$578.00 |
| 2028 | -\$822.59 | \$1,504.07 | -\$103.16 | -\$178.44 | \$34.08 | \$1,538.15 | -\$1,104.19 | \$433.96 |
| 2029 | -\$828.20 | \$1,508.69 | -\$123.71 | -\$240.75 | \$44.62 | \$1,553.31 | -\$1,192.66 | \$360.65 |
| 2030 | -\$833.89 | \$1,514.50 | -\$142.14 | -\$301.28 | \$55.77 | \$1,570.27 | -\$1,277.31 | \$292.96 |
| 2031 | -\$839.63 | \$1,524.99 | -\$157.93 | -\$359.08 | \$65.33 | \$1,590.32 | -\$1,356.64 | \$233.68 |
| 2032 | -\$845.44 | \$1,535.61 | -\$171.68 | -\$412.74 | \$74.14 | \$1,609.75 | -\$1,429.86 | \$179.89 |
| 2033 | -\$851.31 | \$1,546.34 | -\$183.50 | -\$461.82 | \$82.04 | \$1,628.38 | -\$1,496.63 | \$131.75 |
| 2034 | -\$857.25 | \$1,557.19 | -\$193.72 | -\$506.52 | \$89.10 | \$1,646.29 | -\$1,557.49 | \$88.80 |
| 2035 | -\$863.25 | \$1,568.16 | -\$202.30 | -\$546.21 | \$95.29 | \$1,663.45 | -\$1,611.76 | \$51.69 |
| 2036 | -\$869.32 | \$1,579.26 | -\$209.44 | -\$580.37 | \$100.52 | \$1,679.78 | -\$1,659.13 | \$20.65 |
| 2037 | -\$875.46 | \$1,590.47 | -\$215.32 | -\$609.94 | \$104.98 | \$1,695.45 | -\$1,700.72 | -\$5.27 |
| 2038 | -\$881.67 | \$1,601.81 | -\$219.92 | -\$635.31 | \$108.76 | \$1,710.57 | -\$1,736.90 | -\$26.33 |
| 2039 | -\$887.95 | \$1,613.28 | -\$223.73 | -\$656.75 | \$111.92 | \$1,725.20 | -\$1,768.43 | -\$43.23 |
| 2040 | -\$894.30 | \$1,624.88 | -\$226.59 | -\$674.35 | \$114.50 | \$1,739.38 | -\$1,795.24 | -\$55.86 |
| 2041 | -\$900.72 | \$1,636.60 | -\$228.95 | -\$689.23 | \$116.67 | \$1,753.27 | -\$1,818.90 | -\$65.63 |
| 2042 | -\$907.21 | \$1,648.46 | -\$230.99 | -\$702.09 | \$118.54 | \$1,767.00 | -\$1,840.29 | -\$73.29 |
| 2043 | -\$913.77 | \$1,660.44 | -\$232.76 | -\$713.09 | \$120.14 | \$1,780.58 | -\$1,859.62 | -\$79.04 |
| Average | -\$677.14 | \$1,363.33 | -\$154.86 | -\$408.39 | \$71.19 | \$1,434.53 | -\$1,240.39 | \$194.14 |
| Total | -\$14,219.99 | \$28,630.03 | -\$3,251.97 | -\$8,576.22 | \$1,495.00 | \$30,125.03 | -\$26,048.18 | \$4,076.85 |

Figure VII-1. Statewide Costs, cost-savings, and overall net costs under the Proposed Amendments.

(Negative values indicate cost-savings.)

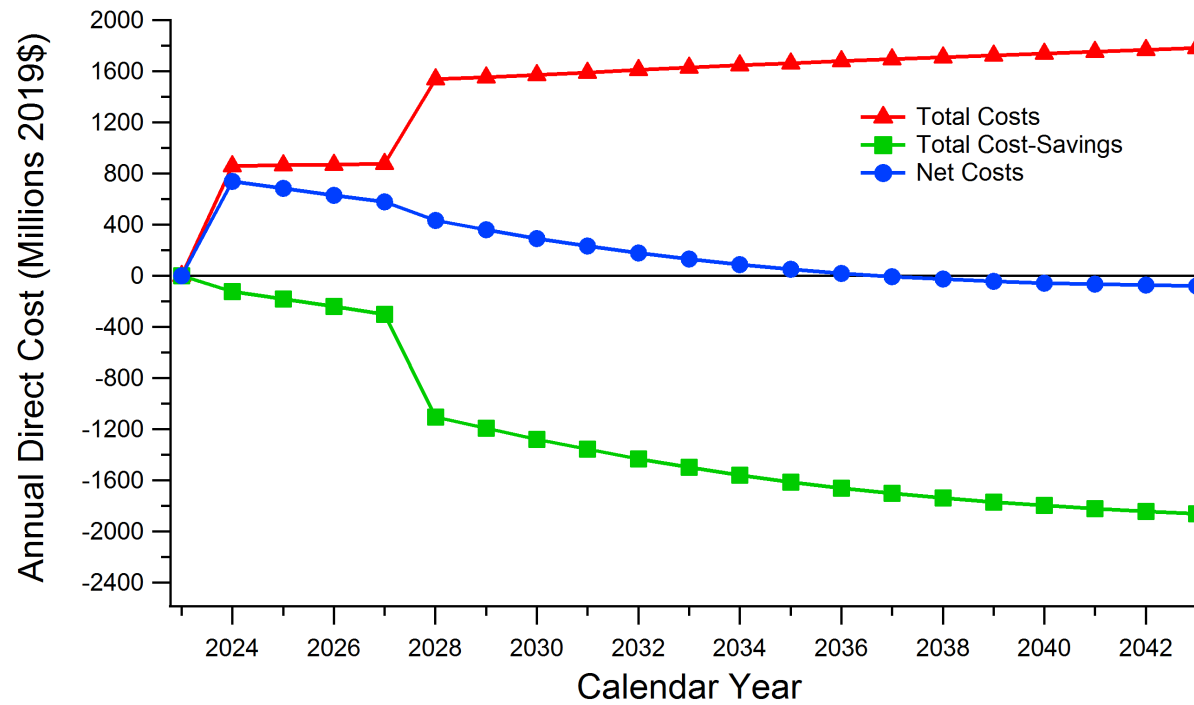


Table VII-2. Modeled costs to professional users (nonlandscaping businesses, landscapers and government entities) per year under the Proposed Amendments relative to the Baseline Scenario (million 2019\$).

(Negative values indicate cost-savings. Totals may differ slightly due to rounding.)

| Year | Gasoline equipment cost | Electric equipment cost | Gasoline equipment maintenance cost | Gasoline costs | Electricity costs | Total costs | Total cost-savings | Net costs |
|----------------|--------------------------------|--------------------------------|--|-----------------------|--------------------------|--------------------|---------------------------|-------------------|
| 2023 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| 2024 | \$46.63 | \$356.17 | -\$5.84 | -\$11.14 | \$2.80 | \$405.60 | -\$16.98 | \$388.62 |
| 2025 | \$48.39 | \$355.70 | -\$17.42 | -\$34.00 | \$7.70 | \$411.79 | -\$51.42 | \$360.37 |
| 2026 | \$50.16 | \$355.66 | -\$29.74 | -\$58.15 | \$13.20 | \$419.02 | -\$87.89 | \$331.13 |
| 2027 | \$51.97 | \$355.61 | -\$41.53 | -\$82.24 | \$18.73 | \$426.31 | -\$123.77 | \$302.54 |
| 2028 | -\$288.10 | \$549.81 | -\$52.27 | -\$105.21 | \$24.34 | \$574.15 | -\$445.58 | \$128.57 |
| 2029 | -\$290.35 | \$551.34 | -\$62.09 | -\$133.13 | \$30.22 | \$581.56 | -\$485.57 | \$95.99 |
| 2030 | -\$292.64 | \$553.30 | -\$70.64 | -\$157.63 | \$36.02 | \$589.32 | -\$520.91 | \$68.41 |
| 2031 | -\$294.94 | \$556.94 | -\$77.76 | -\$180.21 | \$40.77 | \$597.71 | -\$552.91 | \$44.80 |
| 2032 | -\$297.27 | \$560.63 | -\$83.81 | -\$200.31 | \$44.99 | \$605.62 | -\$581.39 | \$24.23 |
| 2033 | -\$299.63 | \$564.35 | -\$88.90 | -\$218.08 | \$48.61 | \$612.96 | -\$606.61 | \$6.35 |
| 2034 | -\$302.02 | \$568.11 | -\$93.21 | -\$233.83 | \$51.72 | \$619.83 | -\$629.06 | -\$9.23 |
| 2035 | -\$304.43 | \$571.92 | -\$96.76 | -\$247.46 | \$54.35 | \$626.27 | -\$648.65 | -\$22.38 |
| 2036 | -\$306.87 | \$575.76 | -\$99.67 | -\$258.97 | \$56.50 | \$632.26 | -\$665.51 | -\$33.25 |
| 2037 | -\$309.34 | \$579.64 | -\$101.99 | -\$268.74 | \$58.27 | \$637.91 | -\$680.07 | -\$42.16 |
| 2038 | -\$311.84 | \$583.56 | -\$103.74 | -\$276.85 | \$59.72 | \$643.28 | -\$692.43 | -\$49.15 |
| 2039 | -\$314.36 | \$587.52 | -\$105.15 | -\$283.62 | \$60.91 | \$648.43 | -\$703.13 | -\$54.70 |
| 2040 | -\$316.92 | \$591.52 | -\$106.16 | -\$289.07 | \$61.87 | \$653.39 | -\$712.15 | -\$58.76 |
| 2041 | -\$319.50 | \$595.56 | -\$106.97 | -\$293.64 | \$62.68 | \$658.24 | -\$720.11 | -\$61.87 |
| 2042 | -\$322.11 | \$599.65 | -\$107.64 | -\$297.58 | \$63.38 | \$663.03 | -\$727.33 | -\$64.30 |
| 2043 | -\$324.75 | \$603.78 | -\$108.21 | -\$300.96 | \$63.98 | \$667.76 | -\$733.92 | -\$66.16 |
| Average | -\$223.71 | \$505.55 | -\$74.26 | -\$187.18 | \$40.99 | \$555.93 | -\$494.54 | \$61.38 |
| Total | -\$4,697.92 | \$10,616.53 | -\$1,559.50 | -\$3,930.82 | \$860.76 | \$11,674.44 | -\$10,385.39 | \$1,289.05 |

Table VII-3. Modeled costs to residential users per year under the Proposed Amendments relative to the Baseline Scenario (million 2019\$).

(Negative values indicate cost-savings. Totals may differ slightly due to rounding.)

| Year | Gasoline equipment cost | Electric equipment cost | Gasoline equipment maintenance cost | Gasoline costs | Electricity costs | Total costs | Total cost-savings | Net costs |
|----------------|-------------------------|-------------------------|-------------------------------------|--------------------|-------------------|--------------------|---------------------|-------------------|
| 2023 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| 2024 | -\$138.38 | \$500.04 | -\$5.97 | -\$8.49 | \$1.11 | \$501.15 | -\$152.84 | \$348.31 |
| 2025 | -\$137.01 | \$498.34 | -\$16.89 | -\$22.56 | \$2.97 | \$501.31 | -\$176.46 | \$324.85 |
| 2026 | -\$135.61 | \$497.37 | -\$28.66 | -\$37.92 | \$5.01 | \$502.38 | -\$202.19 | \$300.19 |
| 2027 | -\$134.19 | \$496.41 | -\$40.08 | -\$53.76 | \$7.08 | \$503.49 | -\$228.03 | \$275.46 |
| 2028 | -\$534.49 | \$954.26 | -\$50.89 | -\$73.23 | \$9.74 | \$964.00 | -\$658.61 | \$305.39 |
| 2029 | -\$537.85 | \$957.35 | -\$61.62 | -\$107.63 | \$14.40 | \$971.75 | -\$707.10 | \$264.65 |
| 2030 | -\$541.25 | \$961.20 | -\$71.50 | -\$143.65 | \$19.76 | \$980.96 | -\$756.40 | \$224.56 |
| 2031 | -\$544.69 | \$968.05 | -\$80.17 | -\$178.87 | \$24.57 | \$992.62 | -\$803.73 | \$188.89 |
| 2032 | -\$548.16 | \$974.98 | -\$87.86 | -\$212.43 | \$29.15 | \$1,004.13 | -\$848.45 | \$155.68 |
| 2033 | -\$551.68 | \$981.99 | -\$94.60 | -\$243.74 | \$33.43 | \$1,015.42 | -\$890.02 | \$125.40 |
| 2034 | -\$555.23 | \$989.08 | -\$100.51 | -\$272.68 | \$37.38 | \$1,026.46 | -\$928.42 | \$98.04 |
| 2035 | -\$558.82 | \$996.25 | -\$105.54 | -\$298.75 | \$40.94 | \$1,037.19 | -\$963.11 | \$74.08 |
| 2036 | -\$562.45 | \$1,003.50 | -\$109.79 | -\$321.40 | \$44.02 | \$1,047.52 | -\$993.64 | \$53.88 |
| 2037 | -\$566.12 | \$1,010.84 | -\$113.33 | -\$341.20 | \$46.70 | \$1,057.54 | -\$1,020.65 | \$36.89 |
| 2038 | -\$569.83 | \$1,018.26 | -\$116.19 | -\$358.45 | \$49.03 | \$1,067.29 | -\$1,044.47 | \$22.82 |
| 2039 | -\$573.59 | \$1,025.76 | -\$118.57 | -\$373.13 | \$51.01 | \$1,076.77 | -\$1,065.29 | \$11.48 |
| 2040 | -\$577.38 | \$1,033.36 | -\$120.43 | -\$385.28 | \$52.63 | \$1,085.99 | -\$1,083.09 | \$2.90 |
| 2041 | -\$581.22 | \$1,041.04 | -\$121.99 | -\$395.59 | \$53.99 | \$1,095.03 | -\$1,098.80 | -\$3.77 |
| 2042 | -\$585.09 | \$1,048.81 | -\$123.34 | -\$404.51 | \$55.16 | \$1,103.97 | -\$1,112.94 | -\$8.97 |
| 2043 | -\$589.02 | \$1,056.66 | -\$124.54 | -\$412.12 | \$56.16 | \$1,112.82 | -\$1,125.68 | -\$12.86 |
| Average | -\$453.43 | \$857.79 | -\$80.59 | -\$221.21 | \$30.20 | \$887.99 | -\$755.23 | \$132.76 |
| Total | -\$9,522.06 | \$18,013.55 | -\$1,692.47 | -\$4,645.39 | \$634.24 | \$18,647.79 | -\$15,859.92 | \$2,787.87 |

b. Costs to Professional Users

Table VII-4 shows the upfront and ongoing costs along with the break-even point for professional users opting for ZEE over SORE at 2023 prices. The prices and assumptions used in the calculation of costs can be found in the SRIA in Appendix I. For most small off-road equipment categories, professional users (nonlandscaping businesses, landscapers, and government entities) can experience cost-savings from purchasing ZEE instead of SORE equipment within five years of purchasing the equipment. ZEE batteries can outlive the equipment for which they are purchased. By keeping the batteries from the previous equipment, a second purchase of a piece of ZEE would cost less. A professional user would reach cost-savings sooner in such a scenario.

Table VII-4. Upfront and annual ongoing costs for professional-grade SORE and ZEE, at 2023 prices.

(Negative values indicate cost-savings.)

| Type of equipment | SORE upfront cost | ZEE upfront cost | SORE annual ongoing cost | ZEE annual ongoing cost | Number of years of ownership before cost-savings with ZEE |
|--------------------------------|-------------------|------------------|--------------------------|-------------------------|---|
| Chainsaw | \$390.55 | \$689.69 | \$139.47 | \$13.56 | 2 |
| Generator Set | \$5,304.57 | \$6,818.88 | \$347.61 | \$34.79 | 5 |
| Lawn Mower | \$1,409.42 | \$1,016.46 | \$220.13 | \$45.41 | 1 |
| Leaf Blower/ Vacuum | \$477.39 | \$1,723.11 | \$358.81 | \$22.80 | 4 |
| Corded Pressure Washer | \$1,170.82 | \$3,036.92 | \$95.81 | \$91.11 | N/A ^t |
| Pump < 2 hp | \$454.62 | \$589.76 | \$98.69 | \$5.30 | 1 |
| Riding Mower | \$11,337.17 | \$20,879.35 | \$952.17 | \$135.46 | 12 |
| Snow blower | \$1,626.42 | \$1,431.81 | \$40.30 | \$7.89 | 1 |
| Trimmer/Edger/ Brush Cutter | \$368.85 | \$860.11 | \$177.68 | \$14.21 | 3 |

There are two notable exceptions to professional users achieving cost-savings within five years. First, a typical professional corded ZEE pressure washer owner would not break even within the unit's lifetime solely as a result of ongoing cost-savings. The

^t A typical professional user may not see cost-savings within the lifetime of a professional-grade corded or cordless pressure washer.

same is true of a cordless unit which has an even higher upfront cost. As described in section C.1.c.v of the SRIA in Appendix I the average frequency of use of a professional-grade pressure washer is less than once per week, which would lead to minimal opportunities for savings through operational cost-savings. It is likely that the price of professional-grade ZEE pressure washers would decrease as a result of the Proposed Amendments, due to more manufacturers entering the ZEE pressure washer market. It is likely that a typical professional user of a pressure washer would have a more economically favorable outcome if they were to rent a pressure washer when needed as opposed to purchasing one. Furthermore, staff assumes that owners of professional-grade cordless pressure washers use their equipment at the average professional rate. It is likely that a professional user that requires a cordless professional-grade pressure washer uses it more frequently than once a week, and will likely see savings much sooner than a typical user.

Second, the break-even point for professional ZEE riding mowers would be 12 years, which is longer than the five-year median age in the CSUF survey. It is likely that more manufacturers may enter the market due to the Proposed Amendments, thereby driving down the upfront cost.

The SRIA describes the potential for typical and small businesses, including landscapers, to realize overall cost-savings due to the Proposed Amendments. A sole-proprietorship landscaping business could realize a savings of over \$2,600 after five years of ownership of a suite of zero-emission lawn and garden equipment as compared to SORE equipment, assuming all such equipment was purchased at once.

In 2024, all professional users of small off-road equipment on a statewide level are expected to incur a \$403 million increase in upfront costs (cost to purchase ZEE and SORE equipment) under the Proposed Amendments (Table VII-2). This would account for 53 percent of the total statewide upfront costs in 2024 associated with buying new ZEE despite professional-grade equipment accounting for less than 10 percent of the total equipment population. This cost is due to the fact that the incremental cost for opting for professional-grade ZEE is higher than the incremental cost for residential-grade ZEE. This upfront cost would increase each year until 2028, when it would decrease to \$262 million. This decrease in cost is a result of the emission standard being zero for MY 2028. The price of a MY 2024 compliant generator is nearly twice as much as the price for an equivalent professional-grade zero-emission generator estimated for this analysis. The annual net upfront cost would increase with each following year until 2043 when it would be \$279 million.

In 2024, professional users are predicted to have statewide savings of \$14.18 million in ongoing operational costs for small off-road equipment as a result of avoided SORE maintenance and gasoline costs under the Proposed Amendments. Professional users would realize 45 percent of the total statewide ongoing operational cost-savings despite accounting for less than 10 percent of the total equipment population due to their higher usage of equipment. The savings in ongoing operational costs would increase each year through 2043 and reach a maximum of \$345 million.

Professional users would realize an overall statewide annual net cost-savings under the Proposed Amendments starting in 2034 due to savings in ongoing operational costs (Table VII-2). Many professional users, especially those who do not use generators or pressure washers, may realize net cost-savings within a few years of purchasing ZEE. It is unlikely that the typical small landscaping business has one of these items. It is possible that a small business landscaper could purchase a small residential-grade zero-emission generator to help charge spare batteries during the workday. Such a generator would cost significantly less than the professional-grade zero-emission generator included in this analysis.

c. Costs to Residential Users

Table VII-5 shows the upfront and ongoing costs along with the break-even point for residential users opting for ZEE over SORE. Residential users would see on average longer ownership times before they reach net cost-savings from lower ongoing costs to offset the increased upfront cost. CSUF survey data showed that residential users often keep their small off-road equipment for more than 10 years. With lifetimes that long, cost-savings from adopting ZEE can be realized for most equipment types.

Table VII-5. Upfront and annual ongoing costs for residential users of small off-road equipment.

(Negative values indicate cost-savings.)

| Type of equipment | SORE upfront cost | ZEE upfront cost | SORE annual ongoing cost | ZEE annual ongoing cost | Number of years of ownership before cost-savings with ZEE |
|--------------------------------|-------------------|------------------|--------------------------|-------------------------|---|
| Chainsaw | \$156.24 | \$586.19 | \$30.97 | \$1.50 | 15 |
| Generator Set | \$861.49 | \$2,138.69 | \$115.41 | \$13.95 | 13 |
| Lawn Mower | \$303.79 | \$424.26 | \$13.39 | \$1.47 | 10 |
| Leaf Blower/ Vacuum | \$161.67 | \$318.64 | \$23.83 | \$1.20 | 7 |
| Pressure Washer | \$400.37 | \$349.05 | \$32.78 | \$3.04 | 1 |
| Pump < 2 hp | \$243.15 | \$264.28 | \$6.10 | \$0.35 | 4 |
| Riding Mower | \$2,633.60 | \$3,253.92 | \$136.52 | \$8.17 | 5 |
| Snow Blower | \$432.72 | \$429.04 | \$0.77 | \$0.14 | 1 |
| Trimmer/Edger/ Brush Cutter | \$165.03 | \$213.85 | \$16.22 | \$1.29 | 3 |

Two equipment types for which residential users may not realize cost-savings are chainsaws and generators. SORE chainsaws are small, currently inexpensive, and

typically used infrequently by residents, making it unlikely that cost-savings would be realized by residential users purchasing zero-emission chainsaws. For the reasons discussed in section I.E.3.b, zero-emission generators currently often have a higher purchase price than SORE generators. While the cost to purchase a zero-emission generator may decrease in the coming years, it will likely still be significantly higher than an equivalent SORE generator. While a 13-year period to break even is beyond the median age for residential generators, many users keep their generators for at least 13 years. Of residential generator owners in the CSUF survey, 39 percent said their generator was at least 10 years old.

In 2024, residential users of small off-road equipment on a statewide level would be expected to incur a \$362 million increase in upfront cost under the Proposed Amendments (Table VII-3). This would account for 47 percent of the total statewide costs in 2024 associated with buying new equipment despite residential equipment accounting for over 90 percent of the total population of equipment. This cost is due to the higher purchase price of residential-grade ZEE relative to SORE equipment. This upfront cost would increase slightly until 2028, when it would increase significantly to \$420 million. This increase in cost is due to the generator emission standards being zero starting in MY 2028. The price of a MY 2024 residential-grade emission-compliant generator is lower than that of a zero-emission generator. The annual net upfront cost would increase slightly with each following year through 2043, when it would be \$468 million.

In 2024, residential users are expected to have statewide savings of \$13.35 million in ongoing operational costs for small off-road equipment as a result of avoided SORE maintenance and gasoline costs under the Proposed Amendments. The savings in ongoing operational costs would increase each year through 2043 and reach a maximum of \$481 million.

Residential users would realize an annual statewide net cost-savings under the Proposed Amendments starting in 2041 due to savings in ongoing operational costs (Table VII-3). This is seven years after professional users are expected to experience a statewide annual net cost-savings. This delay is due to the longer period residential users keep their equipment and the lower rate at which they use it. Residential users often keep their small off-road equipment for more than 10 years. CSUF survey data show that they typically choose not to replace it until it breaks. Therefore, even though ZEE is more prevalent in residential use today than in professional use, it will take much longer for many residential users to adopt ZEE.

Statewide, over the regulatory horizon analyzed in the SRIA attached as Appendix I, residential users would experience an accrued net cost of \$2.79 billion due to the Proposed Amendments. Per U.S. Census data, there are 13,072,122 occupied housing units in California (U.S. Census Bureau, 2018a). From CSUF survey data, only 44 percent of California households own powered lawn and garden equipment, and 40 percent own some other type of small off-road equipment. Assuming that 50 percent of the households in California own at least one piece of small off-road equipment, the net cost of the Proposed Amendments would amount to \$21.34 per household per

year over the period 2024 through 2043. Per U.S. Census data, the median income of California households before taxes is \$75,277 (U.S. Census Bureau, 2018a). The incremental cost would therefore be less than 1/10th of one percent of their pre-tax income. This indicates that a demand response to the slightly increased prices under the Proposed Amendments would be minimal and is not expected to have a significant effect on the results presented in this section.

d. Cost-Effectiveness

The metric to quantify cost-effectiveness of the Proposed Amendments is the ratio of total monetized benefits divided by total monetized costs. A comparison of this type is an appropriate cost-effectiveness measure because the harm associated with increased emissions is captured in the estimates of monetized health impacts. A benefit-cost ratio greater than one implies that the benefits of the scenario are greater than its costs. Benefits include both health benefits and cost-savings after subtracting tax and fee revenue impacts to state and local governments. Table VII-6 indicates that the Proposed Amendments would have a cumulative net benefit of \$4.27 billion and a benefit-cost ratio of 1.30, meaning benefits would be greater than costs during the regulatory horizon.

Table VII-6. Cost-benefit analysis of the Proposed Amendments (billion 2019\$).

| Scenario | Total costs | Health benefits | Cost-savings (benefit) | Tax & fee revenue | Total benefit | Net benefit | Benefit-cost ratio |
|---------------------|-------------|-----------------|------------------------|-------------------|---------------|-------------|--------------------|
| Proposed Amendments | \$14.41 | \$8.82 | \$10.33 | -\$0.47 | \$18.68 | \$4.27 | 1.30 |

e. Emission Reduction Credit Sensitivity Analysis

To demonstrate that differences in the total amount of banked emission reduction credits would not significantly change the outcome of the economic analyses, a sensitivity analysis was performed. Two scenarios were modeled—one with no banked credits, and one with twice the amount of banked credits that manufacturers held at the end of MY 2018.

For the scenario with no banked credits, all new equipment purchased starting in 2024 were assumed to be compliant with the more stringent emission standards. In this scenario, the net direct cost would be \$4.18 billion over the regulatory horizon, \$104.26 million more than in the Proposed Amendments scenario.

For the scenario with twice the amount of banked credits that manufacturers held at the end of MY 2018, all banked credits were assumed to be fully used between MYs 2024 and 2027 for generators. It was assumed that 12.6 percent of new generator sales would be generators with the same price as that of currently compliant generators. This would yield a net direct cost of \$3.97 billion over the regulatory horizon, \$104.27 million less than in the Proposed Amendments scenario.

B. Discussion of Macroeconomic Modeling Results

This section describes the estimated total impact of the Proposed Amendments on the California economy. The Proposed Amendments will result in incremental costs and cost-savings for businesses to comply with the regulations. These costs result in direct changes in expenditures in the economy as these costs are passed on to professional and residential users. These changes in expenditures by users will indirectly affect employment, output, and investment in sectors that supply goods and provide services to affected businesses. These direct and indirect effects lead to induced effects, such as changes in personal income that affect consumer expenditures across other spending categories. The total economic impact is the sum of these effects and is presented in this section.

1. Macroeconomic Model and Inputs

The total economic impact of the Proposed Amendments is simulated relative to the Baseline Scenario using the cost estimates described in SRIA Chapter C. The analysis focuses on the changes in major macroeconomic indicators from 2023 through 2043, including employment, output, personal income, and gross state product. The years of the analysis are used to simulate the Proposed Amendments through more than 12 months post full implementation.

Regional Economic Models, Inc. (REMI) Policy Insight Plus Version 2.4 is used to estimate the macroeconomic impacts of the Proposed Amendments on the California economy. REMI is a structural economic forecasting and policy analysis model that integrates input-output, computable general equilibrium, econometric and economic geography methodologies.^u REMI Policy Insight Plus provides year-by-year estimates of the total economic impacts of the Proposed Amendments, pursuant to the requirements of SB 617 and the California Department of Finance.^v CARB uses the REMI single-region, 160-sector model. Several adjustments were made to the model reference case to reflect the impacts of COVID-19 and to reflect the Department of Finance conforming forecasts. First, the REMI model's National Control was updated with a short-term national forecast based on the U.S. Economic Outlook for 2020-2022 from the University of Michigan's Research Seminar in Quantitative Economics (RSQE)^w release on April 9, 2020, which was made available in the latest REMI model. Second, the National and Regional Controls in REMI were updated to reflect the most recent Department of Finance conforming forecasts which include population projections dated January 2020 and U.S. real GDP forecasts, and California civilian employment growth numbers Dated May 2020. Because the Department of Finance forecasts only

^u For further information and model documentation see: <https://www.remi.com/model/pi/>.

^v Senate Bill 617 (Calderon, Stats. of 2011, Ch. 496; amending Gov. Code §§ 11346.2, 11346.3, 11346.5, 11346.9, 11347.3, 1139.1, 13401, 13402, 13403, 13404, 13405, 13406, 13407 and adding Gov. Code §§ 11342.548, 11346.36, 11349.1.5); Department of Finance Standardized Regulatory Impact Assessment For Major Regulations, Cal. Code Regs., tit. 1, §§ 2000 et seq.

^w This update assumes that the economic contraction is severe but that aggressive federal response to the pandemic maintains the possibility of a vigorous recovery: <https://lsa.umich.edu/econ/rsqe.html>.

extended to 2023, CARB staff assumed that post-2023, U.S. income and employment would continue to grow at the same rate as projected in the RSQE forecast, while California civilian employment would continue to recover at the rate forecasted by the Department of Finance, until it returned to baseline levels.

The results from the REMI model provide estimates of the impact of the Proposed Amendments on the California economy. The California economy is forecasted to grow post-2020. Therefore, negative impacts reported here should be interpreted as a slowing of growth and positive impacts as an acceleration of growth resulting from the Proposed Amendments. The results are reported in VII.B.2 in four-year intervals from 2023 through 2043.

2. Creation and Elimination of Jobs within the State of California

Table VII-7 presents the impact of the Proposed Amendments on total employment in California across all private industries and the public sector. Employment comprises estimates of the number of jobs, full-time plus part-time, by place of work for all industries. Full-time and part-time jobs are counted at equal weight. Employees, sole proprietors, and active partners are included, but unpaid family workers and volunteers are not included. The employment impacts represent the net change in employment across the economy, which is composed of positive impacts for some industries and negative impacts for others. The Proposed Amendments are estimated to result in an initial decrease in employment growth that is less than 0.03 percent of baseline employment that diminishes towards the end of the regulatory horizon.

Table VII-7. California employment impacts under the Proposed Amendments.

| Metric | 2023 | 2027 | 2031 | 2035 | 2039 | 2043 |
|-----------------------|------------|------------|------------|------------|------------|------------|
| California Employment | 22,603,913 | 24,725,694 | 24,765,385 | 25,011,315 | 25,539,578 | 26,209,650 |
| % Change | 0.00% | -0.02% | -0.01% | 0.00% | 0.00% | 0.00% |
| Change in Total Jobs | 0 | -4,908 | -1,465 | -836 | -614 | -453 |

The total employment impacts presented above are net of changes at the industry level. Table VII-8 shows the changes in employment by industries that are directly impacted by the Proposed Amendments. As the requirements of the Proposed Amendments go into effect, the industries generally realizing reductions in production cost or increases in final demand see an increase in employment growth. There is initially a decrease in job growth that corresponds with the higher equipment cost from the emission standards of zero that is not immediately offset by fuel savings. Over time, as the operational savings from zero-emission equipment accrue, landscaping businesses begin to realize gasoline fuel cost-savings and other operational savings that more than offset the incremental equipment cost. These gasoline fuel savings result in lower production costs, diminishing the negative initial impact on job growth over the regulatory period. The oil and gas extraction industry

and personal and household goods repair and maintenance industry see a decreased employment growth rate due to a reduction in final demand for their goods and services. The reduced fuel consumption also reduces tax revenues, resulting in lower state and local government spending and employment as seen in Table VII-8.

Table VII-8. Job impacts by primary and secondary industries under the Proposed Amendments.

| Industry | Unit | 2023 | 2027 | 2031 | 2035 | 2039 | 2043 |
|--|----------------|-------|--------|--------|--------|--------|--------|
| Electric power generation, distribution (2211) | % Change | 0.00% | 0.03% | 0.11% | 0.15% | 0.17% | 0.17% |
| Electric power generation, distribution (2211) | Change in Jobs | 0 | 12 | 41 | 58 | 64 | 65 |
| Petroleum and coal products manufacturing (324) | % Change | 0.00% | -0.11% | -0.24% | -0.33% | -0.36% | -0.35% |
| Petroleum and coal products manufacturing (324) | Change in Jobs | 0 | -15 | -31 | -40 | -42 | -40 |
| Agriculture, construction, and mining machinery manufacturing (3331) | % Change | 0.00% | 0.06% | 0.08% | 0.08% | 0.08% | 0.08% |
| Agriculture, construction, and mining machinery manufacturing (3331) | Change in Jobs | 0 | 2 | 3 | 3 | 3 | 3 |
| Retail trade (44-45) | % Change | 0.00% | 0.01% | 0.02% | 0.01% | 0.01% | 0.01% |
| Retail trade (44-45) | Change in Jobs | 0 | 134 | 372 | 302 | 262 | 248 |
| Services to buildings and dwellings (5617) | % Change | 0.00% | -0.03% | 0.00% | 0.02% | 0.02% | 0.02% |
| Services to buildings and dwellings (5617) | Change in Jobs | 0 | -92 | 12 | 64 | 90 | 100 |
| Personal and household goods repair and maintenance (8114) | % Change | 0.00% | -1.65% | -3.13% | -3.97% | -4.31% | -4.40% |
| Personal and household goods repair and maintenance (8114) | Change in Jobs | 0 | -325 | -593 | -723 | -762 | -757 |
| State & Local Government | % Change | 0.00% | 0.00% | -0.01% | -0.02% | -0.02% | -0.02% |
| State & Local Government | Change in Jobs | 0 | -81 | -246 | -387 | -462 | -479 |

3. Impacts on Business Output within the State of California

Gross output is used as a measure for business impacts because it represents an industry's sales or receipts and tracks the quantity of goods or services produced in a given period. Output is the sum of the amount of production, including all

intermediate goods purchased as well as value added (compensation and profit), across all private industries and the public sector. Output is affected by production cost and demand changes. As production cost increases or demand decreases, output is expected to contract. As production costs decline or demand increases, industry will likely experience output growth.

The results of the assessment of impacts due to the Proposed Amendments show a decrease in output of \$772 million in 2027 and a decrease of \$369 million in 2043 as shown in Table VII-9, representing a change that does not exceed 0.01 percent of baseline output. The results for each impacted industry are also shown in Table VII-9. Similar to the employment impacts, there is an initial negative impact on the services sector that diminishes over time and negative impacts on petroleum and coal products manufacturing, and on personal and household goods repair and maintenance. The public sector also experiences negative impacts as seen in Table VII-9. The negative output impact on manufacturing is primarily driven by the petroleum and coal products manufacturing industry, which is estimated to see a sizeable decrease in final demand for gasoline.

Table VII-9. Change in California output growth by industry under the Proposed Amendments.

| Industry | Metric | 2023 | 2027 | 2031 | 2035 | 2039 | 2043 |
|--|-------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| California Economy | Output (2019\$M)* | 4,848,370 | 5,519,530 | 5,804,974 | 6,209,827 | 6,785,735 | 7,466,638 |
| California Economy | % Change | 0.00% | -0.01% | -0.01% | -0.01% | -0.01% | 0.00% |
| California Economy | Change (2019\$M) | 0 | -772 | -454 | -398 | -393 | -369 |
| Electric power generation, transmission, and distribution (2211) | % Change | 0.00% | 0.03% | 0.11% | 0.15% | 0.17% | 0.17% |
| Electric power generation, transmission, and distribution (2211) | Change (2019\$M) | 0 | 13 | 47 | 71 | 84 | 90 |
| Petroleum and coal products manufacturing (324) | % Change | 0.00% | -0.11% | -0.24% | -0.33% | -0.36% | -0.36% |
| Petroleum and coal products manufacturing (324) | Change (2019\$M) | 0 | -116 | -258 | -369 | -432 | -460 |
| Agriculture, construction, and mining machinery manufacturing (3331) | % Change | 0.00% | 0.06% | 0.08% | 0.08% | 0.08% | 0.08% |
| Agriculture, construction, and mining machinery manufacturing (3331) | Change (2019\$M) | 0 | 2 | 2 | 2 | 2 | 3 |
| Retail trade (44-45) | % Change | 0.00% | 0.01% | 0.02% | 0.02% | 0.01% | 0.01% |
| Retail trade (44-45) | Change (2019\$M) | 0 | 17 | 53 | 48 | 46 | 48 |
| Services to buildings and dwellings (5617) | % Change | 0.00% | -0.03% | 0.00% | 0.02% | 0.02% | 0.03% |
| Services to buildings and dwellings (5617) | Change (2019\$M) | 0 | -7 | 1 | 5 | 8 | 10 |
| Personal and household goods repair and maintenance (8114) | % Change | 0.00% | -1.65% | -3.15% | -4.01% | -4.36% | -4.45% |
| Personal and household goods repair and maintenance (8114) | Change (2019\$M) | 0 | -44 | -81 | -101 | -110 | -112 |
| State & Local Government | % Change | 0.00% | 0.00% | -0.01% | -0.02% | -0.02% | -0.02% |
| State & Local Government | Change (2019\$M) | 0 | -15 | -47 | -76 | -94 | -100 |

* Millions of fixed 2019 dollars (2019M\$)

4. Creation and Elimination of Businesses within the State of California

The REMI model cannot directly estimate the creation or elimination of businesses. Changes in jobs and output for the California economy can be used to understand some potential impacts. The overall jobs and output impacts of the Proposed Amendments are very small relative to the total California economy, representing changes less than 0.03 percent. However, impacts in some specific sectors are larger. The trend of decreasing production costs for the services to buildings and dwellings industry has the potential to result in an expansion or increase in the number of businesses in this industry if sustained over time. The decreasing trend in demand for gasoline following from the Proposed Amendments has the potential to result in a decrease in the number of businesses in this industry if sustained over time. The personal and household maintenance and repair industry sees the largest relative decrease in industry employment and output from the Proposed Amendments and may be indicative of potential business contraction or eliminations. In particular, we expect small-engine repair shops to see significant impacts to their business. ZEE do not contain an engine and are expected to need significantly less repair than SORE equipment. The remaining revenue for these businesses would likely come from repair of equipment other than SORE, such as saws and hand tools, from repair that would be conducted on both ZEE and SORE, including blade sharpening, as well as from sales of new equipment.

5. Significant Statewide Adverse Economic Impact Directly Affecting Business

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.

6. Competitive Advantage or Disadvantage

The small off-road equipment manufacturers that must comply with requirements of the Proposed Amendments are mostly based outside of California and therefore do not present any competitiveness impacts for this industry inside California. Small off-road equipment dealers may potentially find themselves at a competitive disadvantage as a result of the Proposed Amendments. Businesses, or individuals could purchase small off-road equipment out of state and bring it into California for use. Due to the small price differences on the household side of the market between SORE equipment and ZEE, this is unlikely to happen at the individual level. However, the higher upfront costs associated with professional ZEE may make this enticing for large businesses. The additional costs of transportation for purchasing and repair may prevent some of this. In contrast, online sales of noncompliant equipment are expected to be low, as CARB staff searches for such equipment and has initiated enforcement mechanisms against online retailers selling noncompliant SORE. The requirements result in an incremental net savings to professional users of the equipment. These net savings are anticipated to be realized generally across professional users and are not anticipated to result in any competitive advantages or disadvantages within industries.

7. Impacts on Investments in California

Private domestic investment consists of purchases of residential and nonresidential structures and of equipment and software by private businesses and nonprofit institutions. It is used as a proxy for impacts on investments in California because it provides an indicator of the future productive capacity of the economy.

The relative changes to growth in private investment for the Proposed Amendments are shown in Table VII-10 and show a decrease of private investment by about \$231 million in 2027 and an increase of \$41 million in 2043, not exceeding 0.05 percent of baseline investment.

Table VII-10. Change in gross domestic private investment growth under the Proposed Amendments.

| Metric | 2023 | 2027 | 2031 | 2035 | 2039 | 2043 |
|-------------------------------------|---------|---------|---------|---------|---------|---------|
| Private Investment (million 2019\$) | 360,677 | 465,577 | 489,344 | 525,926 | 578,181 | 636,163 |
| % Change | 0.00% | -0.05% | 0.00% | 0.01% | 0.01% | 0.01% |
| Change (million 2019\$) | 0 | -231 | 13 | 48 | 43 | 41 |

8. Incentives for Innovation

The Proposed Amendments to the SORE regulations are written to give maximum flexibility to manufacturers, while still meeting California's air quality goals. A new zero-emission generator credit program is being added to incentivize an earlier adoption of zero-emission generators by allowing credit generation to offset emissions from SORE.

9. Benefits of the Regulation

Benefits of the Proposed Amendments to public health, worker safety, and the state's environment are described in detail in Chapter IV. Public health benefits when monetized yield a cost-savings of \$8.82 billion.

VIII. Evaluation of Regulatory Alternatives

Government Code section 11346.2, subdivision (b)(4) requires CARB to consider and evaluate reasonable alternatives as compared to the selected alternative, the Proposed Amendments, and provide reasons for rejecting those alternatives. This section discusses the alternatives to the Proposed Amendments that CARB evaluated and provides the reasons why these alternatives were not ultimately selected or included in the Proposed Amendments.

During the development process of the Proposed Amendments, CARB staff solicited public input regarding alternatives that would achieve the Proposed Amendments' goals. Staff evaluated several alternatives to the proposal, including suggestions from both public and industry stakeholders. CARB staff discussed these potential alternatives with stakeholders. Staff has chosen three alternatives to the Proposed Amendments for formal evaluation. The evaluation of alternatives considered includes an analysis of cost impacts and health benefits of each alternative using the same modeling methods as identified above for the Proposed Amendments and a discussion of reasons for rejection. As explained below, no alternative proposal was found to be less burdensome and equally effective in achieving the purposes of the Proposed Amendments in a manner that ensures full compliance with the authorizing law being implemented or made specific by the Proposed Amendments. The Board has not identified any reasonable alternatives that would lessen any adverse impact on small business. Table VIII-1 shows a summary of the costs and benefits for each alternative considered as compared to the Proposed Amendments.

Table VIII-1. Cost-benefit comparison of the Proposed Amendments and regulatory alternatives (billion 2019\$).

(Totals may differ slightly due to rounding.)

| Scenario | Total costs | Health benefits | Cost-savings (benefit) | Tax & fee revenue | Total benefit | Net benefit | Benefit-cost ratio |
|--|-------------|-----------------|------------------------|-------------------|---------------|-------------|--------------------|
| Proposed Amendments ^y | \$14.41 | \$8.82 | \$10.33 | -\$0.47 | \$18.68 | \$4.27 | 1.30 |
| Alternative 1 ^z | \$14.06 | \$9.04 | \$11.57 | -\$0.73 | \$19.89 | \$5.83 | 1.41 |
| Alternative 2 ^{aa} | \$14.66 | \$8.20 | \$8.77 | \$0.11 | \$17.09 | \$2.43 | 1.17 |
| Small Business Alternative ^{bb} | \$11.73 | \$6.49 | \$7.23 | \$0.70 | \$14.43 | \$2.70 | 1.23 |

^y Under the Proposed Amendments, the HC + NO_x emission standards would be 0 for MY 2024 and subsequent model years for all SORE except generator engines. The HC + NO_x emission standards for generator engines would be 0 for MY 2028 and subsequent model years. For more detail, see II.A.2.

^z Under Alternative 1, the HC + NO_x emission standards would be 0 for MY 2024 and subsequent model years for all SORE. For more detail, see VIII.A.1.

^{aa} Under Alternative 2, the HC + NO_x emission standards would be more stringent than the existing emission standards for MYs 2024 through 2025 for all SORE. The HC + NO_x emission standards would be 0 in MY 2026 and subsequent model years for all SORE except generator engines. The HC + NO_x emission standards for generator engines would be 0 for MY 2030 and subsequent model years. For more detail, see VIII.B.1.

^{bb} Under the Small Business Alternative, the HC + NO_x emission standards would be 0 for MY 2028 and subsequent model years for all SORE except generator engines. The HC + NO_x emission standards for generator engines would be 0 for MY 2032 and subsequent model years. For more detail see VIII.C.1.

A. Alternative 1

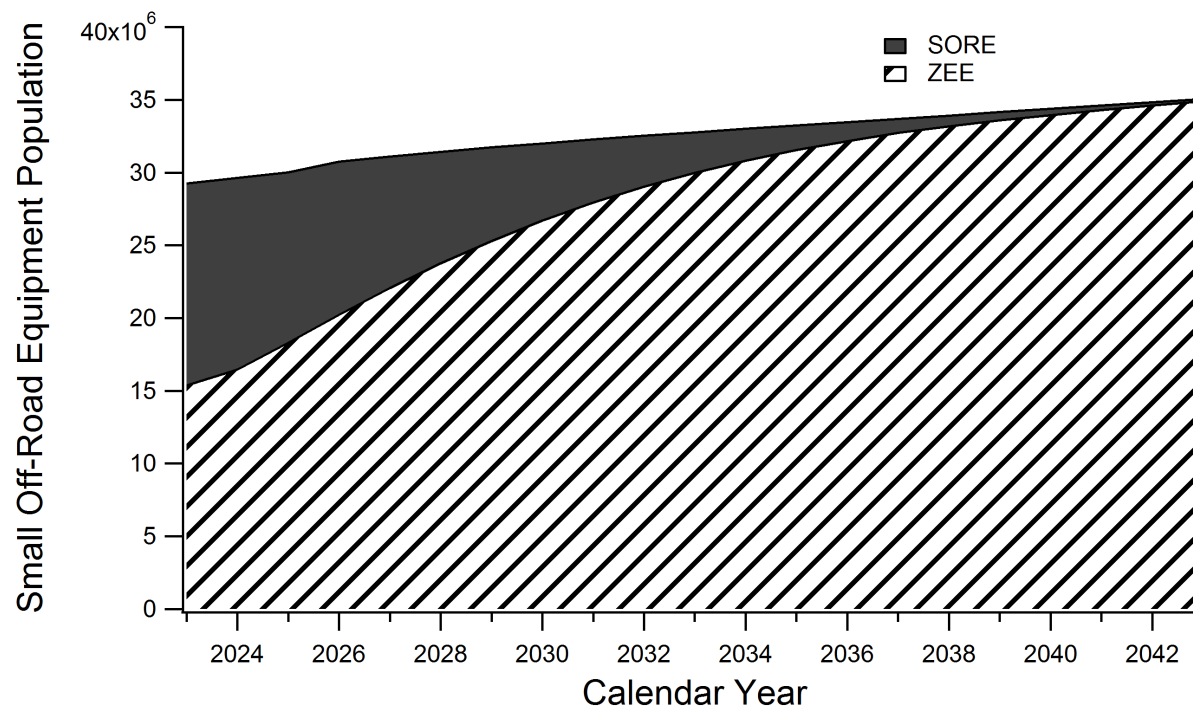
1. Description of Alternative 1

Alternative 1 would increase the adoption of ZEE faster than the Proposed Amendments and has been suggested by many environmental organizations and members of the public. This alternative would set the emission standards to zero for all SORE, including generators, for MY 2024 and subsequent model years.

No further emission reduction credit generation would be possible after MY 2023. Manufacturers could use their remaining credit banks and would likely do so sooner as opposed to holding on to them for several years. The analysis assumed that manufacturers would use all of their remaining credits to produce 4.9 percent of the number of engines that would have been produced in the Baseline Scenario in MY 2024 and still meet the proposed emission standards of zero. The assumption that manufacturers would use all of their banked credits in MY 2024 is the most conservative assumption from an economic perspective. The analysis assumes all equipment sales in 2025 would be ZEE if manufacturers used their banked credits for MY 2024. If manufacturers used their banked credits over several model years, the economic impact would be smaller in the years in which they used their credits.

The fraction of ZEE in the overall population would increase sooner in Alternative 1, as shown in Figure VIII-1, than with the Proposed Amendments (Figure II-3). Under Alternative 1, 94.9 percent of the small off-road equipment population subject to the SORE regulations would be ZEE in 2035, as compared to 93.4 percent under the Proposed Amendments. EO N-79-20 sets a goal "to transition to 100 percent zero-emission off-road vehicles and equipment by 2035 where feasible". The remaining 5.1 percent would continue to transition over the following years, reaching 99.5 percent ZEE in 2043, as compared to 99.4 percent under the Proposed Amendments.

Figure VIII-1. Modeled small off-road equipment population statewide under Alternative 1.



2. Costs

Staff assumed that cost inputs would be the same as in the Proposed Amendments, as the only change is the removal of the delay for generator adoption of ZEE. Table VIII-2 shows annual costs for Alternative 1. There is no expected increase in upfront costs in 2028 in Alternative 1 because emission standards for generators would be zero for MY 2024 and subsequent model years. Instead, annual costs would gradually increase as population increases. Annual cost-savings in Alternative 1 would increase as more ZEE is adopted. The rate of change in annual cost-savings would decrease through 2043. In 2043, annual cost-savings would be approximately \$1.87 billion. Annual net cost-savings would occur statewide starting in the year 2035, two years earlier than with the Proposed Amendments. Alternative 1 would have a net direct cost of \$2.49 billion accrued through 2043, which is \$1.59 billion less than with the Proposed Amendments. Figure VIII-2 illustrates the total costs and cost-savings of Alternative 1. For reference, the same graphical representation of direct costs for the Proposed Amendments is Figure VII-1.

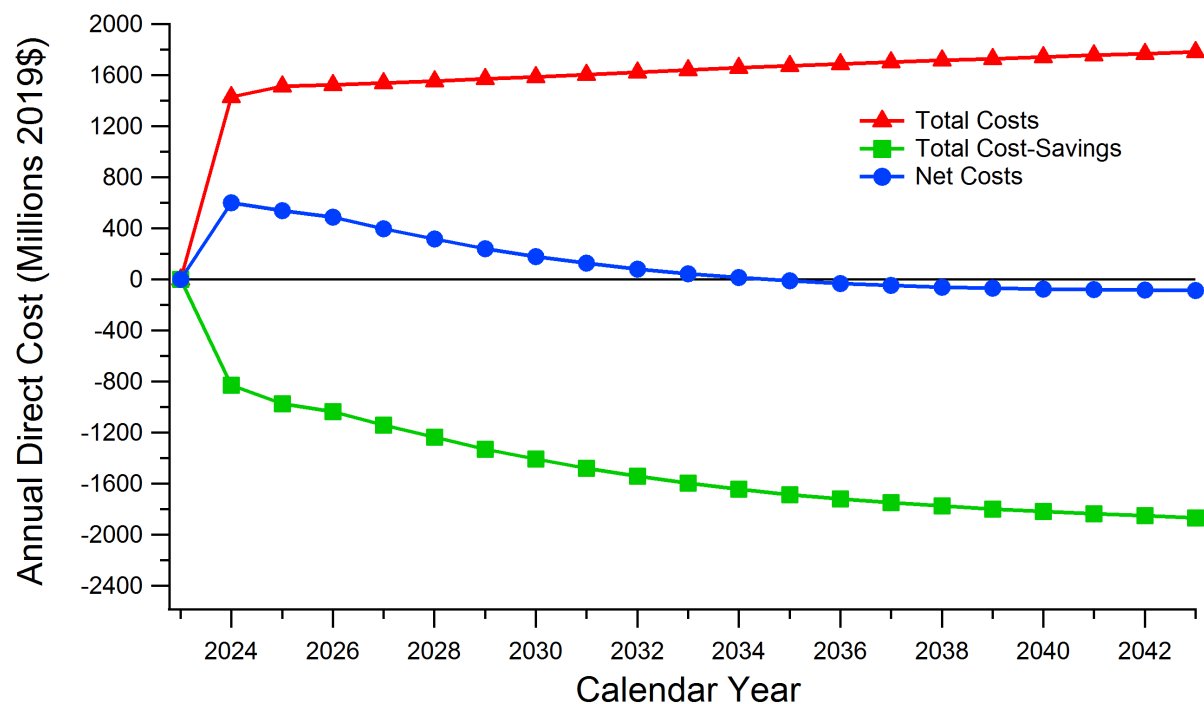
Table VIII-2. Modeled costs to professional and residential users per year under Alternative 1 relative to the Baseline Scenario (millions 2019\$).

(Negative values indicate cost-savings. Totals may differ slightly due to rounding.)

| Year | Gasoline equipment costs | Electric equipment costs | Gasoline equipment maintenance costs | Gasoline Costs | Electricity costs | Total costs | Total cost-savings | Net costs |
|----------------|--------------------------|--------------------------|--------------------------------------|--------------------|-------------------|--------------------|---------------------|-------------------|
| 2023 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| 2024 | -\$761.49 | \$1,420.20 | -\$13.69 | -\$52.21 | \$7.91 | \$1,428.11 | -\$827.39 | \$600.72 |
| 2025 | -\$806.10 | \$1,492.66 | -\$40.63 | -\$128.30 | \$19.78 | \$1,512.44 | -\$975.03 | \$537.41 |
| 2026 | -\$811.54 | \$1,496.06 | -\$64.07 | -\$160.40 | \$26.44 | \$1,522.50 | -\$1,036.01 | \$486.49 |
| 2027 | -\$817.03 | \$1,499.49 | -\$90.07 | -\$233.04 | \$38.24 | \$1,537.73 | -\$1,140.14 | \$397.59 |
| 2028 | -\$822.59 | \$1,504.07 | -\$113.75 | -\$299.59 | \$49.85 | \$1,553.92 | -\$1,235.93 | \$317.99 |
| 2029 | -\$828.20 | \$1,508.69 | -\$134.57 | -\$366.56 | \$61.10 | \$1,569.79 | -\$1,329.33 | \$240.46 |
| 2030 | -\$833.89 | \$1,514.50 | -\$152.55 | -\$420.91 | \$71.88 | \$1,586.38 | -\$1,407.35 | \$179.03 |
| 2031 | -\$839.63 | \$1,524.99 | -\$167.72 | -\$471.49 | \$80.47 | \$1,605.46 | -\$1,478.84 | \$126.62 |
| 2032 | -\$845.44 | \$1,535.61 | -\$180.60 | -\$515.31 | \$87.95 | \$1,623.56 | -\$1,541.35 | \$82.21 |
| 2033 | -\$851.31 | \$1,546.34 | -\$191.43 | -\$552.93 | \$94.30 | \$1,640.64 | -\$1,595.67 | \$44.97 |
| 2034 | -\$857.25 | \$1,557.19 | -\$200.59 | -\$585.46 | \$99.72 | \$1,656.91 | -\$1,643.30 | \$13.61 |
| 2035 | -\$863.25 | \$1,568.16 | -\$208.10 | -\$612.83 | \$104.26 | \$1,672.42 | -\$1,684.18 | -\$11.76 |
| 2036 | -\$869.32 | \$1,579.26 | -\$214.23 | -\$635.41 | \$107.93 | \$1,687.19 | -\$1,718.96 | -\$31.77 |
| 2037 | -\$875.46 | \$1,590.47 | -\$219.18 | -\$654.27 | \$110.95 | \$1,701.42 | -\$1,748.91 | -\$47.49 |
| 2038 | -\$881.67 | \$1,601.81 | -\$222.93 | -\$669.89 | \$113.41 | \$1,715.22 | -\$1,774.49 | -\$59.27 |
| 2039 | -\$887.95 | \$1,613.28 | -\$226.00 | -\$682.93 | \$115.44 | \$1,728.72 | -\$1,796.88 | -\$68.16 |
| 2040 | -\$894.30 | \$1,624.88 | -\$228.28 | -\$693.85 | \$117.12 | \$1,742.00 | -\$1,816.43 | -\$74.43 |
| 2041 | -\$900.72 | \$1,636.60 | -\$230.18 | -\$703.33 | \$118.57 | \$1,755.17 | -\$1,834.23 | -\$79.06 |
| 2042 | -\$907.21 | \$1,648.46 | -\$231.84 | -\$711.92 | \$119.86 | \$1,768.32 | -\$1,850.97 | -\$82.65 |
| 2043 | -\$913.77 | \$1,660.44 | -\$233.35 | -\$719.84 | \$121.05 | \$1,781.49 | -\$1,866.96 | -\$85.47 |
| Average | -\$812.77 | \$1,482.06 | -\$160.18 | -\$470.02 | \$79.34 | \$1,561.40 | -\$1,442.97 | \$118.43 |
| Total | -\$17,068.12 | \$31,123.16 | -\$3,363.76 | -\$9,870.47 | \$1,666.23 | \$32,789.39 | -\$30,302.35 | \$2,487.04 |

Figure VIII-2. Statewide costs, cost-savings, and overall net costs under Alternative 1.

(Negative values indicate cost-savings.)



3. Benefits

For emissions modeling in Alternative 1, staff considered the emissions credit banks as discussed in VIII.A.1. For MY 2024, staff assumed manufacturers would produce 4.9 percent of the number of engines that would have been produced in the Baseline Scenario with both exhaust and evaporative emissions equal to the emissions of the current average engine. This percentage is limited by the current evaporative emission credit bank, which allows for the manufacture of fewer average engines than the exhaust emission credit bank. The engines produced in MY 2024 would use the remaining evaporative emission credit bank, leaving some exhaust credits unused. To account for this, staff assumed that all MY 2023 engines would emit $0.74 \text{ g}\cdot\text{kWh}^{-1}$ excess exhaust emissions above the current emission standards, because manufacturers would be unable to use the remaining exhaust emission credits for MY 2024. Table VIII-3 shows annual emission reductions for ROG, NO_x and CO_2 . Figures VIII-3 and VIII-4 show the reductions in NO_x and ROG emissions for each modeled year. In 2031, the emission reductions would be 7.9 tpd and 57.4 tpd for NO_x and ROG, respectively. These represent 7 and 4 percent greater emission reductions, respectively, than under the Proposed Amendments.

Emission reductions would begin in 2024, which is the same as with the Proposed Amendments. Emissions in 2043 under Alternative 1 would be similar to those with the Proposed Amendments, approximately 6.2 tpd and 27 tpd, for NO_x and ROG, respectively. Over the regulatory horizon, this would lead to a total of 61,299 tons of

NO_x emission reductions and 432,979 tons of ROG emission reductions, compared to the Baseline Scenario. These reductions are only marginally higher than the emission reductions under the Proposed Amendments.

Table VIII-4 shows the avoided health outcomes and the valuation of these outcomes as a result of Alternative 1 for the regulatory horizon. The total incidence of avoided health outcomes and their valuation are both slightly higher in Alternative 1 as compared to the Proposed Amendments.

Table VIII-3. Annual average emission reductions under Alternative 1.
(Totals may not add up due to rounding.)

| Year | ROG emission reductions (tpd) | NO_x emission reductions (tpd) | CO₂ emission reductions (MMT/year) |
|----------------|--------------------------------------|---|--|
| 2023 | -0.13 | -0.02 | 0.00 |
| 2024 | 3.2 | 0.45 | 0.05 |
| 2025 | 11.1 | 1.5 | 0.17 |
| 2026 | 20.5 | 2.6 | 0.29 |
| 2027 | 29.9 | 3.8 | 0.40 |
| 2028 | 38.4 | 5.0 | 0.51 |
| 2029 | 45.8 | 6.0 | 0.60 |
| 2030 | 52.1 | 7.0 | 0.68 |
| 2031 | 57.4 | 7.9 | 0.74 |
| 2032 | 61.9 | 8.6 | 0.80 |
| 2033 | 65.9 | 9.3 | 0.85 |
| 2034 | 69.4 | 9.9 | 0.89 |
| 2035 | 72.6 | 10.5 | 0.92 |
| 2036 | 75.5 | 10.9 | 0.95 |
| 2037 | 78.1 | 11.3 | 0.98 |
| 2038 | 80.2 | 11.6 | 1.0 |
| 2039 | 82.1 | 11.9 | 1.0 |
| 2040 | 83.7 | 12.1 | 1.0 |
| 2041 | 85.1 | 12.3 | 1.0 |
| 2042 | 86.3 | 12.5 | 1.1 |
| 2043 | 87.3 | 12.7 | 1.1 |
| Average | 56.5 | 8.0 | 0.72 |
| Total | 432,979 | 61,299 | 15.1 |

Figure VIII-3. Annual average NO_x emissions under Alternative 1 and the Baseline Scenario.

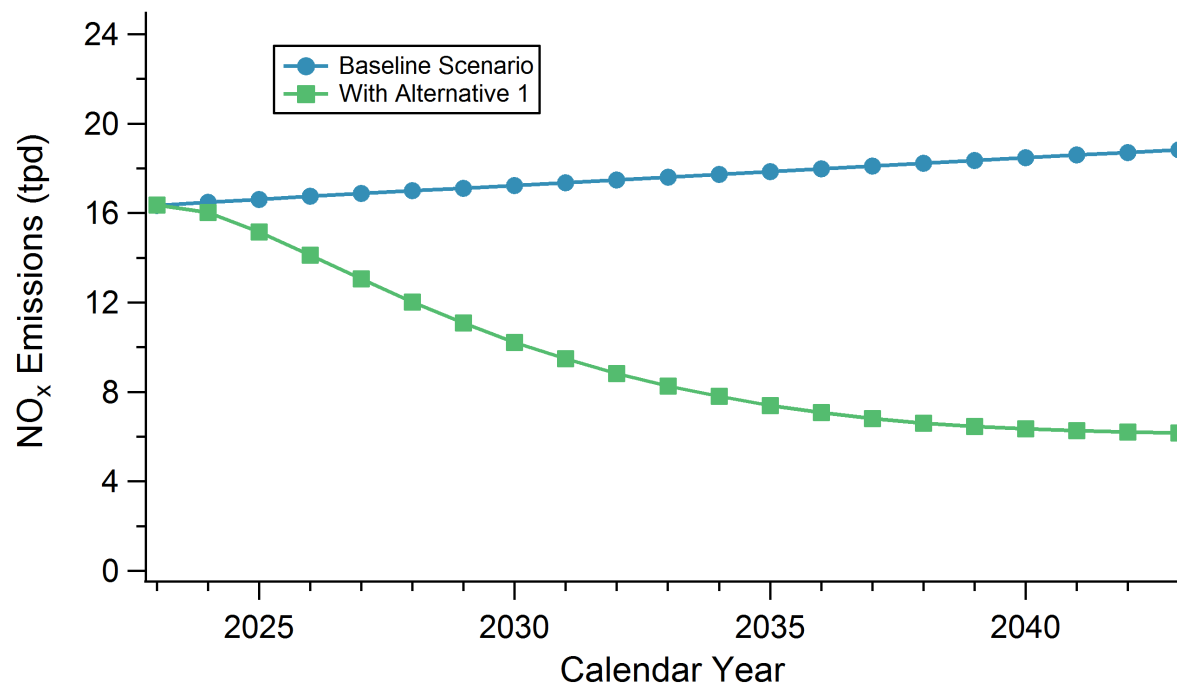


Figure VIII-4. Annual average ROG emissions under Alternative 1 and the Baseline Scenario.

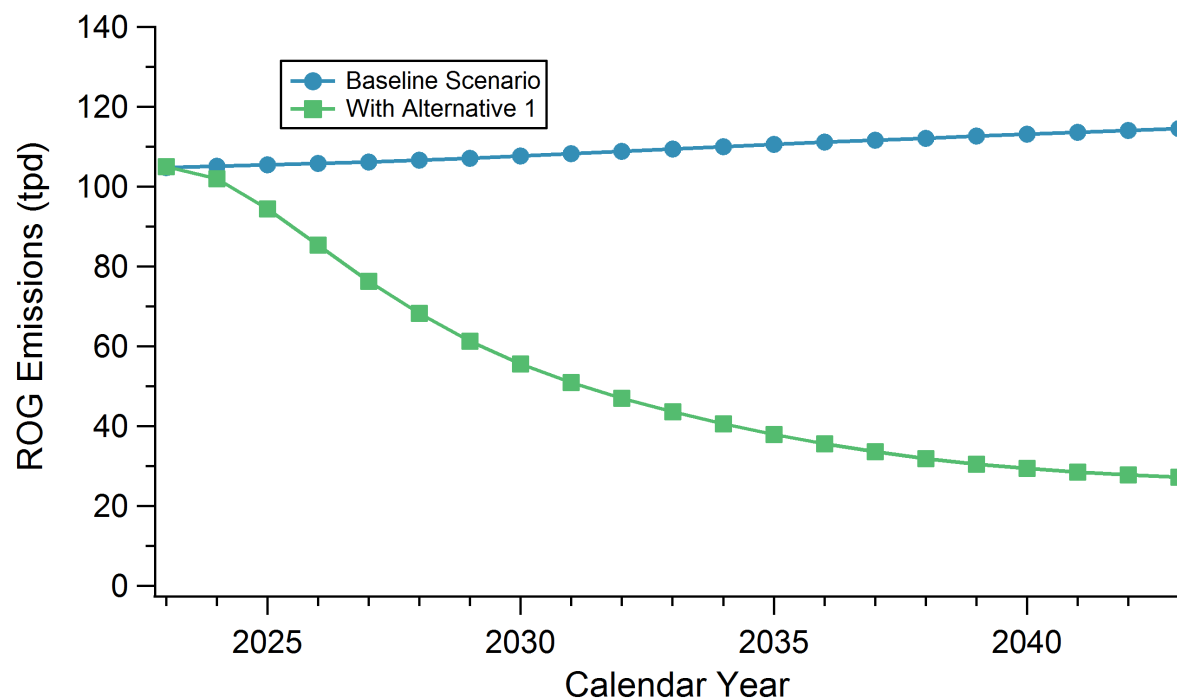


Table VIII-4. Statewide valuation from avoided health outcomes under Alternative 1.

| Outcome | Avoided incidents | Valuation (million 2019\$) |
|-------------------------------------|--------------------------|---------------------------------------|
| Premature cardiopulmonary mortality | 915 | \$9,027.08 |
| Cardiovascular hospitalization | 145 | \$8.45 |
| Acute respiratory hospitalization | 173 | \$8.79 |
| ER visit for asthma | 450 | \$0.38 |
| Total | 1,683 | \$9,044.70 |

4. Cost-Effectiveness

The metric to quantify cost-effectiveness of the Proposed Amendments and Alternative 1 is the ratio of total monetized benefits divided by total monetized costs. A comparison of this type is an appropriate cost-effectiveness measure because the harm associated with increased emissions is captured in the estimates of monetized health impacts. A benefit-cost ratio greater than one implies that the benefits of the scenario are greater than its costs. Benefits include both health benefits and cost-savings after subtracting tax and fee revenue impacts to state and local governments. Table VIII-5 indicates that the Proposed Amendments would have an accrued net benefit of \$4.27 billion and a benefit-cost ratio of 1.30, meaning benefits would be greater than costs during the regulatory horizon of 2023 through 2043. Alternative 1 would have an accrued net benefit of \$5.83 billion, and a benefit-cost ratio of 1.41, meaning Alternative 1 would be more cost-effective than the Proposed Amendments.

Table VIII-5. Cost-benefit comparison of the Proposed Amendments and Alternative 1 (billion 2019\$).

| Scenario | Total costs | Health benefits | Cost-savings (benefit) | Tax & fee revenue | Total benefit | Net benefit | Benefit-cost ratio |
|---------------------|--------------------|------------------------|-------------------------------|------------------------------|----------------------|--------------------|---------------------------|
| Proposed Amendments | \$14.41 | \$8.82 | \$10.33 | -\$0.47 | \$18.68 | \$4.27 | 1.30 |
| Alternative 1 | \$14.06 | \$9.04 | \$11.57 | -\$0.73 | \$19.89 | \$5.83 | 1.41 |

5. Reason for Rejecting

Staff rejected Alternative 1 on technological feasibility grounds. The primary reason for not pursuing this alternative is to provide more time for the zero-emission generator market to mature. Currently, as noted in I.E.3.b, the availability and variety of zero-emission generators is limited. Manufacturers of zero-emission generators may not be poised to meet the entire market demand that could occur if fewer SORE generators were produced starting in MY 2024. Currently, based on population modelling done using the SORE2020 model, demand for generators is relatively

constant, year over year. Requiring zero-emission generators in MY 2024 could increase the price of available zero-emission generators due to demand. This price increase would create added costs for residential users and professional users in the state.

One of the leading companies making zero-emission generators that could be considered a replacement for a SORE generator describes on its website the time involved in developing a zero-emission generator. It took over three years from the founding of the business to create its first zero-emission generator with performance equivalent to SORE generators (Goal Zero, 2021a). Giving manufacturers an additional four years before emission standards of zero are implemented for generators would ensure adequate time for product development, manufacturing, and marketing of a new product.

The additional four-year period (MYs 2024 through 2027) allowing sale of SORE generators that meet more stringent emission standards in the Proposed Amendments would ease concerns about the need for generators due to PSPS. Some small portable generators are purchased for home backup power, and zero-emission generators that can cover a multi-day power outage have a higher purchase price than SORE generators.

B. Alternative 2

1. Description of Alternative 2

Alternative 2 would allow for a more gradual adoption of ZEE than the Proposed Amendments. Starting in MY 2024, more stringent exhaust and evaporative emission standards would be implemented for all SORE. Then, in MY 2026, the emission standards would be zero for SORE used in all equipment except generators. The emission standards for generator engines would be zero for MY 2030 and subsequent model years. This alternative would allow for a slower uptake of ZEE, and allow manufacturers who have invested in and are producing lower-emitting SORE to continue to do so for a few more model years. Tables VIII-6 through VIII-9 show the emission standards for this alternative.

Emission reduction credit generation would be allowed for all SORE through MY 2025 and exclusively for generators through MY 2029. Based on CARB's historical records of the emission reduction credit banks, the sum of banked credits has remained relatively constant over the last several years. Therefore, to evaluate this alternative staff assumed that the amount of banked credits at the end of MY 2023 would be equal to the amount at the end of MY 2018 and that the banked credits would all be used in MYs 2024 through 2025 for all equipment types. Staff did not assume any manufacturer preference for one equipment type over another.

In terms of emissions modeling, this means that all SORE produced in MYs 2024 through 2025 could emit slightly above the emission standards, as shown in Tables VIII-6 and VIII-8. The cost would be slightly lower than in a scenario in which only equipment that met the emission standards were produced. The population of ZEE

would grow more gradually than in the Proposed Amendments, as shown in Figure VIII-5, given that emission standards for SORE generators would not be zero until MY 2030. Under Alternative 2, 89.3 percent of the small off-road equipment population subject to the SORE regulations would be ZEE in 2035, as compared to 93.4 percent under the Proposed Amendments. The remaining 10.7 percent would continue to turnover to ZEE over the following years, reaching 98.8 percent ZEE in 2043, as compared to 99.4 percent under the Proposed Amendments.

Table VIII-6. MYs 2024-2025 SORE exhaust emission standards and emission levels assuming complete use of banked credits under Alternative 2.

| Displacement category | Emissions durability period (hours) | HC + NO_x emission standard (g·kWh⁻¹) | HC + NO_x emission level with credit use (g·kWh⁻¹) |
|-------------------------------|--|---|--|
| < 50 cc, handheld | 300 | 20.0 | 22.5 |
| 50-80 cc, inclusive, handheld | 300 | 13.0 | 15.2 |
| > 80 cc - < 225 cc, handheld | 500 | 6.0 | 6.4 |
| < 225 cc, nonhandheld | 500 | 6.0 | 6.4 |
| 225-825 cc, inclusive | 1,000 | 3.0 | 3.3 |
| > 825 cc | 1,000 | 0.80 | 1.3 |

Table VIII-7. MYs 2026-2029 exhaust emission standards under Alternative 2.

| Displacement category | Emissions durability period (hours) | HC + NO_x emission standard for generators (g·kWh⁻¹) | HC + NO_x emission standard for all other SORE (g·kWh⁻¹) |
|------------------------------|--|--|--|
| < 225 cc | 500 | 6.0 | 0.00 |
| 225-825 cc, inclusive | 1,000 | 3.0 | 0.00 |
| > 825 cc | 1,000 | 0.80 | 0.00 |

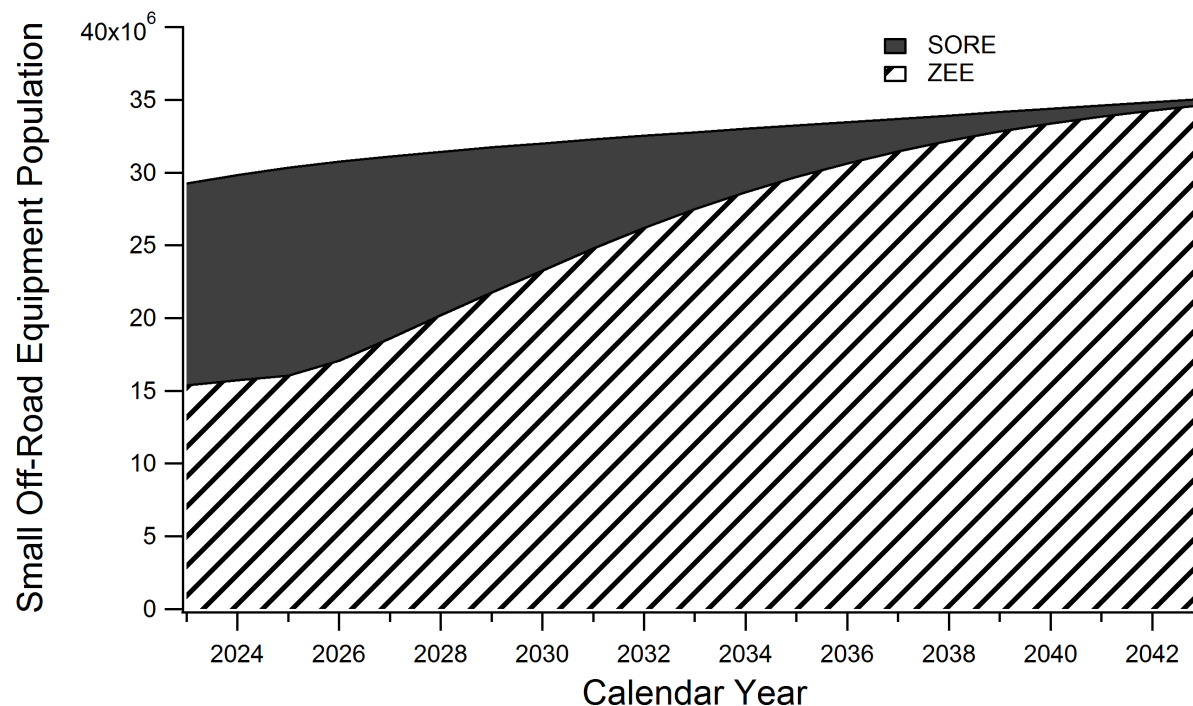
Table VIII-8. MYs 2024-2025 SORE evaporative emission standards and emission levels assuming complete use of banked credits under Alternative 2.
(Totals may not add up due to rounding.)

| Displacement category | Hot soak plus diurnal emission standard (g·test⁻¹) | Hot soak plus diurnal emission level with credit use (g·test⁻¹) | Hot soak emission level with credit use (g·test⁻¹) | Diurnal emission level with credit use (g·test⁻¹) |
|---|--|---|--|---|
| ≤ 80 cc | 0.50 | 0.55 | 0.13 | 0.42 |
| > 80 cc - < 225 cc, except walk-behind mowers | 0.60 | 0.61 | 0.06 | 0.56 |
| > 80 cc - < 225 cc walk-behind mowers | 0.60 | 0.61 | 0.06 | 0.56 |
| ≥ 225 cc | 0.70 | 0.75 | 0.11 | 0.64 |

Table VIII-9. MYs 2026-2029 evaporative emission standards and emission levels under Alternative 2.

| Displacement category | Hot soak plus diurnal emission standard for generators (g·test⁻¹) | Hot soak emission level for generators (g·test⁻¹) | Diurnal emission level for generators (g·test⁻¹) | Hot soak plus diurnal emission standard for all other SORE (g·test⁻¹) |
|---|---|---|--|---|
| ≤ 80 cc | 0.50 | 0.12 | 0.38 | 0.00 |
| > 80 cc - < 225 cc, except walk-behind mowers | 0.60 | 0.06 | 0.54 | 0.00 |
| > 80 cc - < 225 cc walk-behind mowers | 0.60 | 0.06 | 0.54 | 0.00 |
| ≥ 225 cc | 0.70 | 0.10 | 0.60 | 0.00 |

Figure VIII-5. Modeled small off-road equipment population statewide under Alternative 2.



2. Costs

For MYs 2024 through 2025, SORE produced for sale or lease for use or operation in California would be required to meet the more stringent emission standards in Tables VIII-6 and VIII-8 in Alternative 2. Staff used manufacturers' certification data to identify existing equipment that meet these emission standards. An example unit for each SORE equipment category was used to estimate the price of SORE equipment in 2024 and 2025. The specific equipment used as the representative examples are identified in Tables G-5 and G-6 of the SRIA in Appendix I of this Staff Report. Snow blowers are not required to certify to or comply with the HC + NO_x emission standards as set out in the regulations, but are required to meet the CO emission standards. The CO emission standards in this alternative would not change from the existing emission standards; therefore, it is assumed that currently compliant snow blowers would not be affected.

As described in VIII.B.1, staff assumed banked credits would be completely used for MYs 2024 through 2025 engines. Staff calculated that manufacturers would be able to use credits to produce 3.5 percent of the number of engines that would have been produced in the Baseline Scenario for MYs 2024 through 2025 and still meet the emission standards in Alternative 2. This would fully use the credits banked as of the end of MY 2023 if the amount of banked credits were the same as the amount at the end of MY 2018. Therefore, in the cost analysis for this alternative, staff assumed that the purchase price of 3.5 percent of new engine production in MYs 2024 through 2025 would be equal to that of currently compliant equipment for all categories. Staff assumed all generators would comply with the emission standards in Tables VIII-7 and

VIII-9 for MYs 2026 through 2029 because no credits would remain after MY 2025. The prices used in the SRIA for the MYs 2026 through 2029 generators in Alternative 2 are the same as those used for MYs 2024 through 2025, since the emission standards are the same.

Table VIII-10 shows the upfront and ongoing costs in Alternative 2 for each year from 2023 through 2043. Figure VIII-6 graphically shows the total costs and cost-savings. For reference, the same graphical representation of direct costs for the Proposed Amendments is Figure VII-1. Assuming that price and continued availability of SORE equipment would influence consumers' purchases, less ZEE would be purchased over the regulatory horizon under Alternative 2 than under the Proposed Amendments. Therefore, annual cost-savings from purchasing and using ZEE would not be realized until 2026, because ZEE would not make any gains in market share relative to the Baseline Scenario if SORE equipment were still readily available. Annual net cost-savings would be realized statewide starting in the year 2039. The net direct cost of this alternative accrued through 2043 would be \$5.88 billion. This is \$1.81 billion dollars more than the Proposed Amendments would cost over the same regulatory horizon.

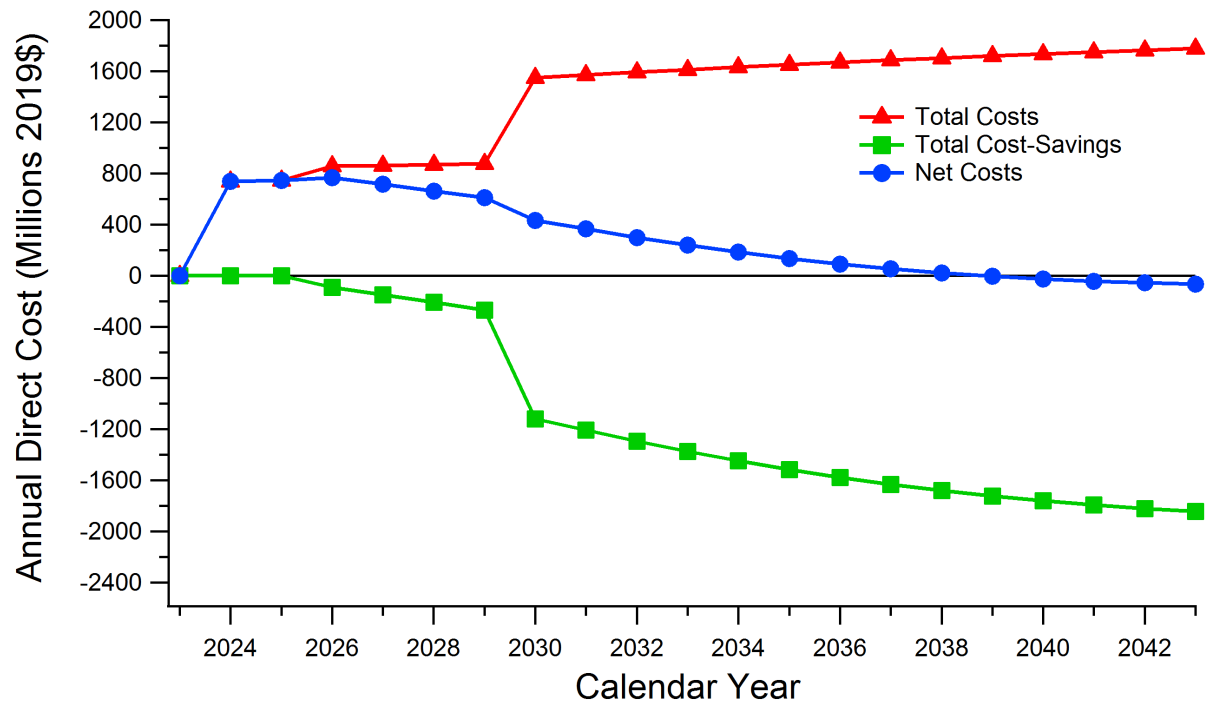
Table VIII-10. Modeled costs to professional and residential users per year under Alternative 2 relative to the Baseline Scenario (millions 2019\$).

(Negative values indicate cost-savings. Totals may differ slightly due to rounding.)

| Year | Gasoline equipment costs | Electric equipment costs | Gasoline equipment maintenance costs | Gasoline costs | Electricity costs | Total costs | Total cost-savings | Net costs |
|----------------|--------------------------|--------------------------|--------------------------------------|--------------------|-------------------|--------------------|---------------------|-------------------|
| 2023 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| 2024 | \$738.73 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$738.73 | \$0.00 | \$738.73 |
| 2025 | \$744.77 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$744.77 | \$0.00 | \$744.77 |
| 2026 | -\$59.22 | \$853.02 | -\$11.82 | -\$19.79 | \$4.03 | \$857.05 | -\$90.83 | \$766.22 |
| 2027 | -\$55.69 | \$852.02 | -\$34.34 | -\$57.39 | \$11.04 | \$863.06 | -\$147.42 | \$715.64 |
| 2028 | -\$52.11 | \$851.60 | -\$58.44 | -\$97.23 | \$18.87 | \$870.47 | -\$207.78 | \$662.69 |
| 2029 | -\$48.48 | \$851.20 | -\$81.68 | -\$137.94 | \$26.76 | \$877.96 | -\$268.10 | \$609.86 |
| 2030 | -\$833.89 | \$1,514.50 | -\$103.25 | -\$180.26 | \$35.40 | \$1,549.90 | -\$1,117.40 | \$432.50 |
| 2031 | -\$839.63 | \$1,524.99 | -\$123.88 | -\$240.69 | \$45.72 | \$1,570.71 | -\$1,204.20 | \$366.51 |
| 2032 | -\$845.44 | \$1,535.61 | -\$142.40 | -\$304.05 | \$56.26 | \$1,591.87 | -\$1,291.89 | \$299.98 |
| 2033 | -\$851.31 | \$1,546.34 | -\$158.28 | -\$362.81 | \$65.96 | \$1,612.30 | -\$1,372.40 | \$239.90 |
| 2034 | -\$857.25 | \$1,557.19 | -\$172.10 | -\$417.40 | \$74.91 | \$1,632.10 | -\$1,446.75 | \$185.35 |
| 2035 | -\$863.25 | \$1,568.16 | -\$184.01 | -\$467.36 | \$82.93 | \$1,651.09 | -\$1,514.62 | \$136.47 |
| 2036 | -\$869.32 | \$1,579.26 | -\$194.31 | -\$512.89 | \$90.11 | \$1,669.37 | -\$1,576.52 | \$92.85 |
| 2037 | -\$875.46 | \$1,590.47 | -\$202.95 | -\$553.34 | \$96.40 | \$1,686.87 | -\$1,631.75 | \$55.12 |
| 2038 | -\$881.67 | \$1,601.81 | -\$210.16 | -\$588.17 | \$101.72 | \$1,703.53 | -\$1,680.00 | \$23.53 |
| 2039 | -\$887.95 | \$1,613.28 | -\$216.09 | -\$618.32 | \$106.26 | \$1,719.54 | -\$1,722.36 | -\$2.82 |
| 2040 | -\$894.30 | \$1,624.88 | -\$220.73 | -\$644.21 | \$110.11 | \$1,734.99 | -\$1,759.24 | -\$24.25 |
| 2041 | -\$900.72 | \$1,636.60 | -\$224.58 | -\$666.10 | \$113.34 | \$1,749.94 | -\$1,791.40 | -\$41.46 |
| 2042 | -\$907.21 | \$1,648.46 | -\$227.47 | -\$684.07 | \$115.96 | \$1,764.42 | -\$1,818.75 | -\$54.33 |
| 2043 | -\$913.77 | \$1,660.44 | -\$229.86 | -\$699.25 | \$118.18 | \$1,778.62 | -\$1,842.88 | -\$64.26 |
| Average | -\$521.58 | \$1,219.52 | -\$133.16 | -\$345.30 | \$60.66 | \$1,350.82 | -\$1,070.68 | \$280.14 |
| Total | -\$10,953.17 | \$25,609.83 | -\$2,796.35 | -\$7,251.27 | \$1,273.96 | \$28,367.29 | -\$22,484.29 | \$5,883.00 |

Figure VIII-6. Statewide costs, cost-savings, and overall net costs under Alternative 2.

(Negative values indicate cost-savings.)



3. Benefits

Table VIII-11 shows the annual emission reductions for ROG, NO_x, and CO₂ for Alternative 2. Figures VIII-7 and VIII-8 show the emission reductions for NO_x and ROG for each year from 2023 through 2043. Emission reductions would occur later in Alternative 2 compared to the Proposed Amendments. In 2031, the emissions reductions would be 6.8 tpd and 50.2 tpd for NO_x and ROG, respectively. These emission reductions are 9 and 8 percent, respectively, less than with the Proposed Amendments.

Over the regulatory horizon, this would lead to a total of 56,495 tons of NO_x emissions reductions and 395,438 tons of ROG emissions reductions, compared to the Baseline Scenario. These emission reductions are 5 and 7 percent less than the emission reductions expected with the Proposed Amendments for NO_x and ROG, respectively.

Table VIII-11. Annual average emission reductions under Alternative 2.
(Totals may not add up due to rounding.)

| Year | ROG emission reductions (tpd) | NO_x emission reductions (tpd) | CO₂ emission reductions (MMT/year) |
|----------------|--------------------------------------|---|--|
| 2023 | 0.00 | 0.00 | 0.00 |
| 2024 | 1.8 | 0.26 | 0.00 |
| 2025 | 6.1 | 0.82 | 0.00 |
| 2026 | 12.8 | 1.7 | 0.05 |
| 2027 | 21.2 | 2.8 | 0.14 |
| 2028 | 29.7 | 3.8 | 0.23 |
| 2029 | 37.4 | 4.9 | 0.32 |
| 2030 | 44.2 | 5.8 | 0.40 |
| 2031 | 50.2 | 6.8 | 0.49 |
| 2032 | 55.5 | 7.7 | 0.58 |
| 2033 | 60.0 | 8.5 | 0.65 |
| 2034 | 64.0 | 9.2 | 0.72 |
| 2035 | 67.5 | 9.8 | 0.78 |
| 2036 | 70.7 | 10.3 | 0.83 |
| 2037 | 73.6 | 10.8 | 0.88 |
| 2038 | 76.3 | 11.2 | 0.92 |
| 2039 | 78.7 | 11.6 | 0.95 |
| 2040 | 80.9 | 11.9 | 0.98 |
| 2041 | 82.7 | 12.1 | 1.0 |
| 2042 | 84.3 | 12.4 | 1.0 |
| 2043 | 85.8 | 12.6 | 1.1 |
| Average | 51.6 | 7.4 | 0.57 |
| Total | 395,438 | 56,495 | 12.0 |

Figure VIII-7. Annual average NO_x emissions under Alternative 2 and the Baseline Scenario.

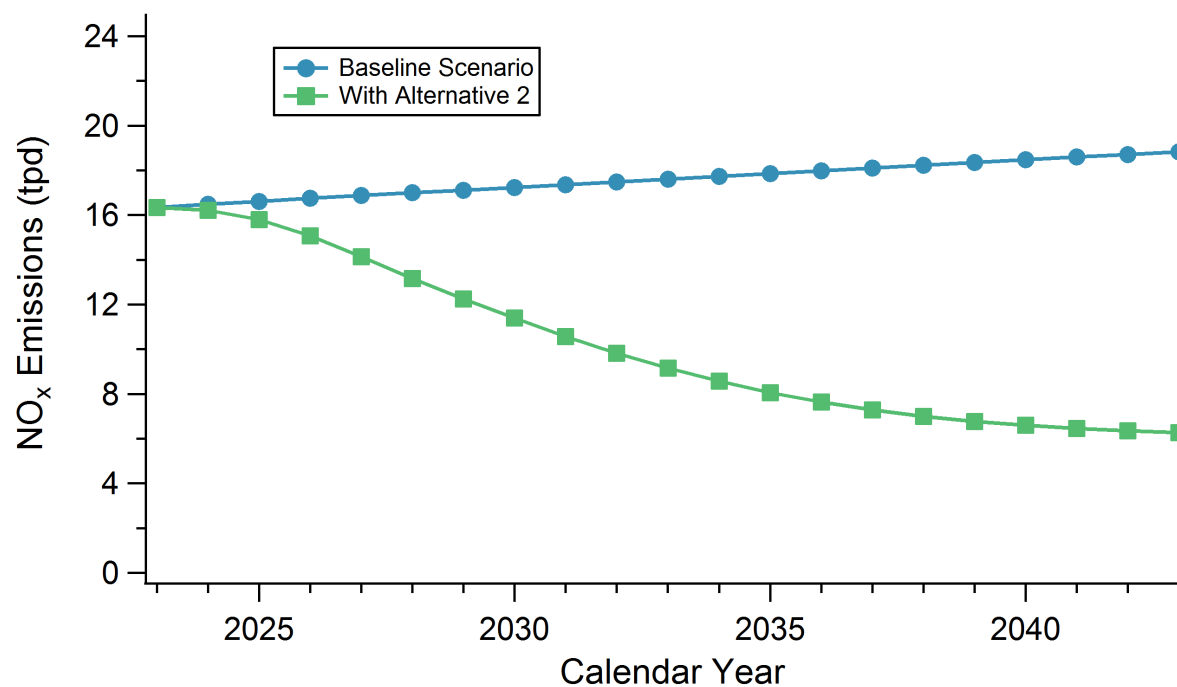


Figure VIII-8. Annual average ROG emissions under Alternative 2 and the Baseline Scenario.

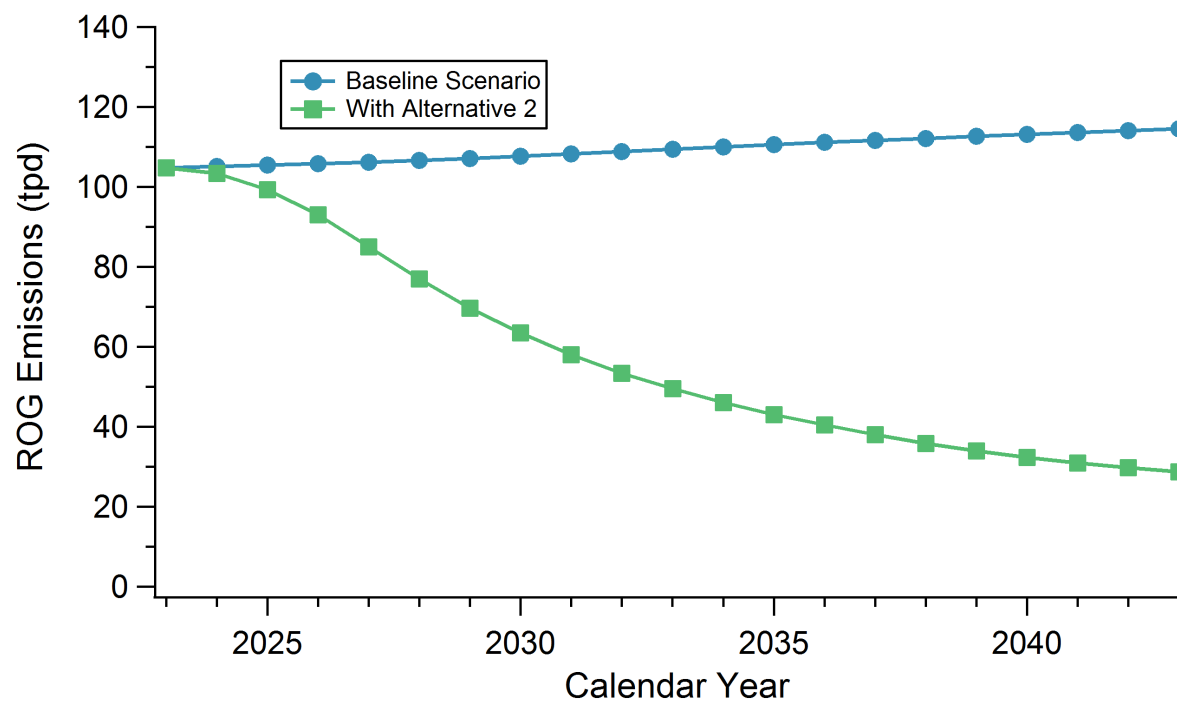


Table VIII-12 shows the avoided health outcomes under Alternative 2 and the valuation of these outcomes during the regulatory horizon. The total number of avoided health incidents and their valuation are both slightly smaller than in the Proposed Amendments.

Table VIII-12. Statewide valuation from avoided health outcomes under Alternative 2.

| Outcome | Avoided incidents | Valuation (million 2019\$) |
|-------------------------------------|-------------------|----------------------------|
| Premature cardiopulmonary mortality | 830 | \$8,188.50 |
| Cardiovascular hospitalization | 132 | \$7.69 |
| Acute respiratory hospitalization | 158 | \$8.03 |
| ER visit for asthma | 407 | \$0.34 |
| Total | 1,528 | \$8,204.56 |

4. Cost-Effectiveness

Table VIII-13 indicates that the Proposed Amendments would have an accrued net benefit of \$4.27 billion and a benefit-cost ratio of 1.30, meaning benefits would be greater than costs during the regulatory horizon of 2023 through 2043. Alternative 2 would have an accrued net benefit of \$2.43 billion, and a benefit-cost ratio of 1.17, meaning that Alternative 2 would be less cost-effective than the Proposed Amendments.

Table VIII-13. Cost-benefit comparison of the Proposed Amendments and Alternative 2 (billion 2019\$).

| Scenario | Total costs | Health benefits | Cost-savings (benefit) | Tax & fee revenue | Total benefit | Net benefit | Benefit-cost ratio |
|---------------------|-------------|-----------------|------------------------|-------------------|---------------|-------------|--------------------|
| Proposed Amendments | \$14.41 | \$8.82 | \$10.33 | -\$0.47 | \$18.68 | \$4.27 | 1.30 |
| Alternative 2 | \$14.66 | \$8.20 | \$8.77 | \$0.11 | \$17.09 | \$2.43 | 1.17 |

5. Reason for Rejecting

Staff rejected Alternative 2 for two reasons. First, Alternative 2 would not be as cost-effective as the Proposed Amendments or Alternative 1. Alternative 2 would have a \$1.81 billion higher direct cost and a lower benefit-cost ratio than the Proposed Amendments. Second, Alternative 2 would make it more difficult for CARB to achieve its air quality goals both under EO N-79-20 and the 2016 State SIP Strategy. Under

Alternative 2, only 89.3 percent of the small off-road equipment population subject to the SORE regulations would be ZEE in 2035, as compared to 93.4 percent under the Proposed Amendments. The remaining 10.7 percent would continue to turnover to ZEE over the following years, reaching 98.8 percent ZEE in 2043. Emission benefits under Alternative 2 in 2031 would be 6.8 tpd and 50.2 tpd of NO_x and ROG, respectively. These emission reductions are both smaller than those that would occur with the Proposed Amendments. While these emission reductions would meet the 2016 State SIP Strategy expected emission reductions for SORE, they would fail to maximize health benefits that could be achieved and would make less progress toward statewide commitments. As provided in CARB's enabling statutory authority, "[t]he control and elimination of ... air pollutants is of prime importance for the protection and preservation of the public health and well-being, and for the prevention of irritation to the senses, interference with visibility, and damage to vegetation and property." (HSC section 43000, subd. (b)). Therefore, since public health benefits are one of the primary purposes of CARB's statutory mandate for adopting and implementing regulations, like the Proposed Amendments, Alternative 2's failure to maximize health benefits to the same extent as the Proposed Amendments would not be consistent with HSC section 43000, subsection (b), and it must be rejected for this reason and on cost-effectiveness grounds.

C. Small Business Alternative

Government Code section 11346.2(b)(4)(B) requires a description of reasonable alternatives to the regulation that would lessen any adverse impact on small businesses and the agency's reasons for rejecting those alternatives. The Proposed Amendments to the SORE regulations could have an impact on costs to small businesses. The primary category of small business directly impacted by the regulation would be landscapers, who would have a higher upfront cost for ZEE.

1. Description of Alternative

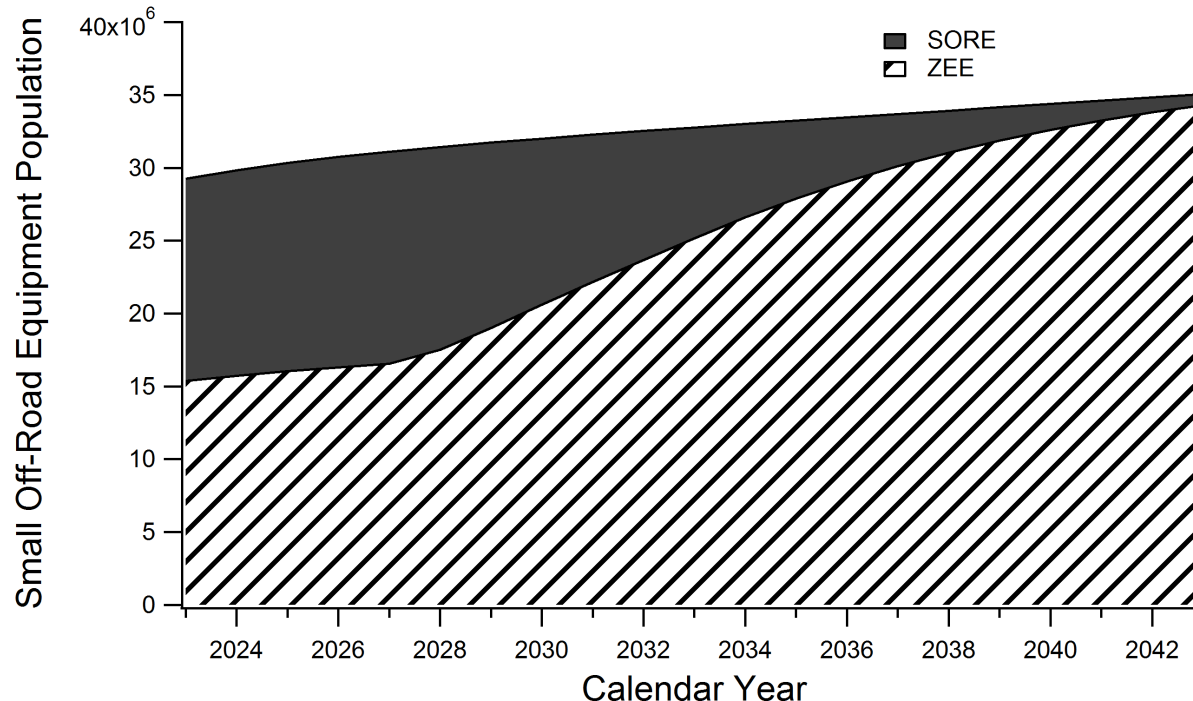
The Small Business Alternative would push the increase in adoption of ZEE to a later time than the Proposed Amendments and would avoid the higher upfront cost of lower emitting gasoline-powered equipment. Current emission standards would remain in place through MY 2027. For MY 2028, the emission standards would be zero for all small off-road equipment, except generators. Beginning in MY 2028, generators would be subject to the same emission standards as they would in MYs 2024 through 2027 under the Proposed Amendments (Tables II-1 and II-2). These emission standards would remain in place through MY 2031. For MY 2032, the generator emission standards would be zero. This alternative would delay the adoption of ZEE to continue to allow for the development of the ZEE market, especially for professional equipment.

Credit generation could continue for all SORE through MY 2027 and exclusively for generators through MY 2031. To analyze this alternative, staff assumed that in MY 2024 and subsequent model years there would be no excess credit generation (i.e., no

excess credits would be banked and credit banks would remain constant). The amount of banked credits at the end of MY 2027 would therefore be equal to the amount of banked credits at the end of MY 2018. This assumption means any generation and use of credits during or after MY 2024 would not affect costs or emissions modeling. It is assumed that the credit banks would be used for MYs 2028 through 2031 generators. Use of banked credits would allow 6.3 percent of all generators produced between MYs 2028 and 2031 to have emission levels equivalent to the current average. The price of those 6.3 percent of generators would be the same as that of currently compliant generators. The rest of the MYs 2028 through 2031 generators were assumed to have the same price as MYs 2024 through 2027 generators under the Proposed Amendments. The population of ZEE would grow more gradually than in the Proposed Amendments, as shown in Figure VIII-9, because emission standards for generators would not be zero until MY 2032.

Under the Small Business Alternative, 83.9 percent of equipment subject to the SORE regulations would be ZEE in 2035, as compared to 93.4 percent under the Proposed Amendments. The remaining 16.1 percent would continue to turnover to ZEE over the following years, reaching 97.8 percent ZEE in 2043, as compared to 99.4 percent under the Proposed Amendments.

Figure VIII-9. Modeled small off-road equipment population statewide under the Small Business Alternative.



2. Costs

Staff assumed that cost inputs would be the same as in the Proposed Amendments, as the only change would be in the overall timing of implementation. Table VIII-14 shows annual costs for the Small Business Alternative. Figure VIII-10 graphically shows the total costs and cost-savings. For reference, the same graphical representation of direct costs for the Proposed Amendments is Figure VII-1. Costs and cost-savings would increase and decrease in a similar manner to those for the Proposed Amendments. Annual net cost-savings would occur statewide starting in the year 2041, four years later than with the Proposed Amendments. The Small Business Alternative would have a net direct cost of \$4.50 billion accrued through 2043, which is \$419 million higher than the Proposed Amendments.

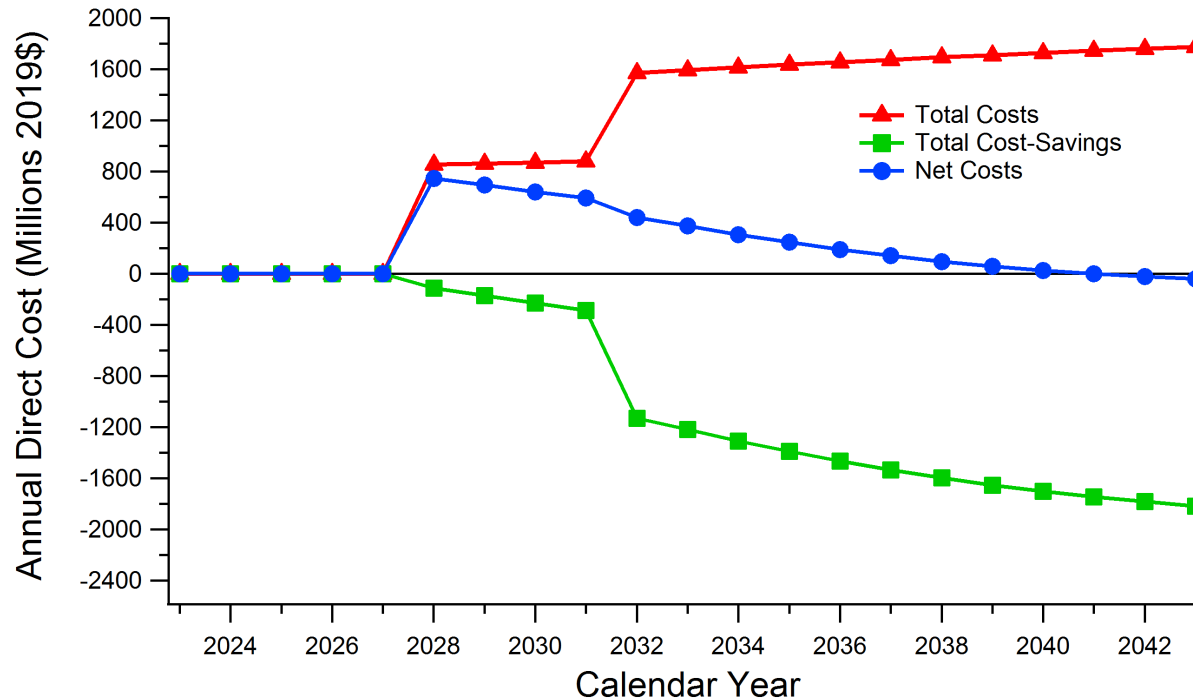
Table VIII-14. Modeled costs to professional and residential users per year under the Small Business Alternative relative to the Baseline Scenario (millions 2019\$).

(Negative values indicate cost-savings. Totals may differ slightly due to rounding.)

| Year | Gasoline equipment costs | Electric equipment costs | Gasoline equipment maintenance costs | Gasoline Costs | Electricity costs | Total costs | Total cost-savings | Net costs |
|----------------|--------------------------|--------------------------|--------------------------------------|--------------------|-------------------|--------------------|---------------------|-------------------|
| 2023 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| 2024 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| 2025 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| 2026 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| 2027 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| 2028 | -\$78.96 | \$851.60 | -\$11.83 | -\$20.04 | \$4.18 | \$855.78 | -\$110.83 | \$744.95 |
| 2029 | -\$75.66 | \$851.20 | -\$34.36 | -\$58.21 | \$11.44 | \$862.64 | -\$168.23 | \$694.41 |
| 2030 | -\$72.31 | \$851.39 | -\$58.49 | -\$98.14 | \$19.58 | \$870.97 | -\$228.94 | \$642.03 |
| 2031 | -\$68.91 | \$853.93 | -\$81.74 | -\$137.50 | \$27.36 | \$881.29 | -\$288.15 | \$593.14 |
| 2032 | -\$845.44 | \$1,535.61 | -\$103.35 | -\$181.24 | \$35.62 | \$1,571.23 | -\$1,130.03 | \$441.20 |
| 2033 | -\$851.31 | \$1,546.34 | -\$124.06 | -\$242.51 | \$46.07 | \$1,592.41 | -\$1,217.88 | \$374.53 |
| 2034 | -\$857.25 | \$1,557.19 | -\$142.66 | -\$306.88 | \$56.75 | \$1,613.94 | -\$1,306.79 | \$307.15 |
| 2035 | -\$863.25 | \$1,568.16 | -\$158.63 | -\$366.62 | \$66.60 | \$1,634.76 | -\$1,388.50 | \$246.26 |
| 2036 | -\$869.32 | \$1,579.26 | -\$172.54 | -\$422.16 | \$75.68 | \$1,654.94 | -\$1,464.02 | \$190.92 |
| 2037 | -\$875.46 | \$1,590.47 | -\$184.53 | -\$473.02 | \$83.84 | \$1,674.31 | -\$1,533.01 | \$141.30 |
| 2038 | -\$881.67 | \$1,601.81 | -\$194.90 | -\$519.41 | \$91.14 | \$1,692.95 | -\$1,595.98 | \$96.97 |
| 2039 | -\$887.95 | \$1,613.28 | -\$203.62 | -\$560.64 | \$97.54 | \$1,710.82 | -\$1,652.21 | \$58.61 |
| 2040 | -\$894.30 | \$1,624.88 | -\$210.88 | -\$596.14 | \$102.96 | \$1,727.84 | -\$1,701.32 | \$26.52 |
| 2041 | -\$900.72 | \$1,636.60 | -\$216.87 | -\$626.89 | \$107.58 | \$1,744.18 | -\$1,744.48 | -\$0.30 |
| 2042 | -\$907.21 | \$1,648.46 | -\$221.56 | -\$653.31 | \$111.50 | \$1,759.96 | -\$1,782.08 | -\$22.12 |
| 2043 | -\$913.77 | \$1,660.44 | -\$225.45 | -\$675.65 | \$114.79 | \$1,775.23 | -\$1,814.87 | -\$39.64 |
| Average | -\$516.36 | \$1,074.79 | -\$111.69 | -\$282.78 | \$50.13 | \$1,124.92 | -\$910.82 | \$214.09 |
| Total | -\$10,843.49 | \$22,570.62 | -\$2,345.47 | -\$5,938.36 | \$1,052.63 | \$23,623.25 | -\$19,127.32 | \$4,495.93 |

Figure VIII-10. Statewide costs, cost-savings, and overall net costs under the Small Business Alternative.

(Negative values indicate cost-savings.)



3. Benefits

Table VIII-15 shows the annual emission reductions for ROG, NO_x, and CO₂, under the Small Business Alternative. Figures VIII-11 and VIII-12 show the emission reductions for NO_x and ROG for each modeled year. Emission reductions would occur later in the Small Business Alternative as compared to the Proposed Amendments. In 2031, the emissions reductions would be 3.5 tpd and 28.7 tpd for NO_x and ROG, respectively. These emission reductions are 53 and 48 percent, respectively, less than with the Proposed Amendments. Over the regulatory horizon this would lead to a total of 42,429 tons of NO_x emission reductions, and 303,490 tons of ROG emission reductions, compared to the Baseline Scenario. These emission reductions are 28 percent less than the emission reductions expected with the Proposed Amendments for both NO_x and ROG.

Table VIII-15. Annual average emission reductions under the Small Business Alternative.

(Totals may not add up due to rounding.)

| Year | ROG emission reductions (tpd) | NO_x emission reductions (tpd) | CO₂ emission reductions (MMT/year) |
|----------------|--------------------------------------|---|--|
| 2023 | 0.00 | 0.00 | 0.00 |
| 2024 | 0.00 | 0.00 | 0.00 |
| 2025 | 0.00 | 0.00 | 0.00 |
| 2026 | 0.00 | 0.00 | 0.00 |
| 2027 | 0.00 | 0.00 | 0.00 |
| 2028 | 3.4 | 0.48 | 0.05 |
| 2029 | 11.0 | 1.4 | 0.14 |
| 2030 | 19.9 | 2.4 | 0.23 |
| 2031 | 28.7 | 3.5 | 0.32 |
| 2032 | 36.7 | 4.6 | 0.40 |
| 2033 | 44.0 | 5.6 | 0.49 |
| 2034 | 50.3 | 6.6 | 0.58 |
| 2035 | 55.7 | 7.6 | 0.65 |
| 2036 | 60.5 | 8.4 | 0.72 |
| 2037 | 64.7 | 9.2 | 0.78 |
| 2038 | 68.5 | 9.8 | 0.84 |
| 2039 | 72.0 | 10.4 | 0.88 |
| 2040 | 75.2 | 11.0 | 0.93 |
| 2041 | 78.0 | 11.4 | 0.96 |
| 2042 | 80.5 | 11.8 | 0.99 |
| 2043 | 82.6 | 12.1 | 1.02 |
| Average | 39.6 | 5.5 | 0.47 |
| Total | 303,490 | 42,429 | 10.0 |

Figure VIII-11. Annual average NO_x emissions under the Small Business Alternative and the Baseline Scenario.

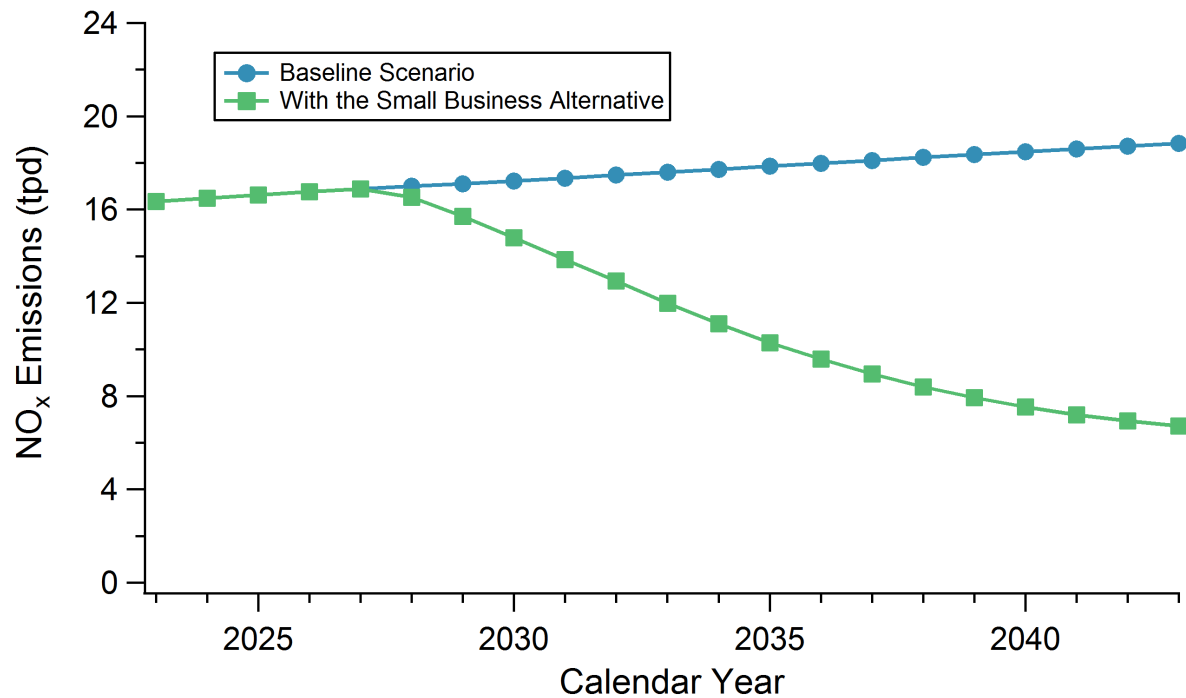


Figure VIII-12. Annual average ROG emissions under the Small Business Alternative and the Baseline Scenario.

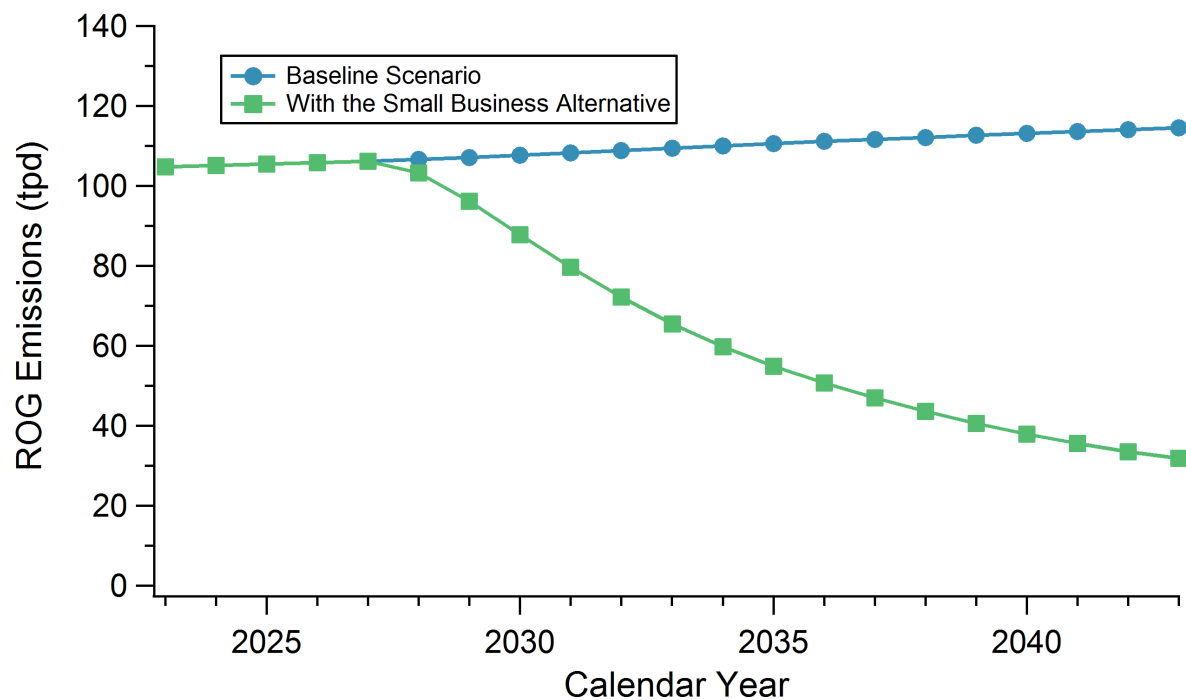


Table VIII-16 shows the avoided health outcomes as a result of the Small Business Alternative and the valuation of these outcomes during the regulatory horizon. The total number of avoided incidents and their valuation are both smaller than in the Proposed Amendments.

Table VIII-16. Statewide valuation from avoided health outcomes under the Small Business Alternative.

| Outcome | Avoided incidents | Valuation (million 2019\$) |
|-------------------------------------|-------------------|----------------------------|
| Premature cardiopulmonary mortality | 657 | \$6,481.74 |
| Cardiovascular hospitalization | 106 | \$6.18 |
| Acute respiratory hospitalization | 127 | \$6.46 |
| ER visit for asthma | 321 | \$0.27 |
| Total | 1,211 | \$6,494.64 |

4. Cost-Effectiveness

Table VIII-17 indicates that the Proposed Amendments have an accrued net benefit of \$4.27 billion and a benefit-cost ratio of 1.30, meaning benefits would be greater than costs during the regulatory horizon of 2023 through 2043. The Small Business Alternative would have an accrued net benefit of \$2.70 billion, and a benefit-cost ratio of 1.23, meaning that the Small Business Alternative would be less cost-effective than the Proposed Amendments.

Table VIII-17. Cost-benefit comparison of the Proposed Amendments and the Small Business Alternative (billion 2019\$).

| Scenario | Total costs | Health benefits | Cost-savings (benefit) | Tax & fee revenue | Total benefit | Net benefit | Benefit-cost ratio |
|----------------------------|-------------|-----------------|------------------------|-------------------|---------------|-------------|--------------------|
| Proposed Amendments | \$14.41 | \$8.82 | \$10.33 | -\$0.47 | \$18.68 | \$4.27 | 1.30 |
| Small Business Alternative | \$11.73 | \$6.49 | \$7.23 | \$0.70 | \$14.43 | \$2.70 | 1.23 |

5. Reason for Rejecting

Staff rejected the Small Business Alternative due to its failure to meet expected emissions reductions in the 2016 State SIP Strategy. The 2016 State SIP Strategy expects 4 tpd of NO_x emission reductions and 36 tpd of ROG emission reductions in 2031 from the SORE category. Emission benefits under the Small Business Alternative in 2031 would be 3.5 tpd and 28.7 tpd of NO_x and ROG, respectively. Under the Small

Business Alternative, only 83.9 percent of equipment subject to the SORE regulations would be ZEE in 2035. Approximately 10 percent less of the small off-road equipment population would be ZEE in 2035 under the Small Business Alternative than with the Proposed Amendments.

The Small Business Alternative would, also, fail to maximize health benefits that can be achieved. As provided in CARB's enabling statutory authority, "[t]he control and elimination of ... air pollutants is of prime importance for the protection and preservation of the public health and well-being, and for the prevention of irritation to the senses, interference with visibility, and damage to vegetation and property." (HSC section 43000, subd. (b)). Therefore, since public health benefits are one of the primary purposes of CARB's statutory mandate for adopting and implementing regulations, like the Proposed Amendments, the Small Business Alternative's failure to maximize health benefits to the same extent as the Proposed Amendments would not be consistent with HSC section 43000, subsection (b), and it must be rejected for this reason, and on the other listed grounds.

D. Performance Standards in Place of Prescriptive Standards

Government Code section 11346.2(b)(4)(A) requires that when CARB proposes a regulation that would mandate the use of specific technologies or equipment, or prescribe specific actions or procedures, it must consider performance standards as an alternative. The Proposed Amendments to the SORE regulations, which would set more stringent emission standards and increase adoption of ZEE, are performance standards, as they do not prescribe the type of technology that must be used or explicitly require the purchase of a certain type of equipment. Therefore, the requirements of Government Code section 11346.2(b)(4)(A) do not apply to the Proposed Amendments.

E. Health and Safety Code Section 57005 Major Regulation Alternatives

CARB estimates the Proposed Amendments will have an economic impact on the state's business enterprises of more than \$10 million in one or more years of implementation. CARB will evaluate alternatives submitted to CARB and consider whether there is a less costly alternative or combination of alternatives that would be equally as effective in achieving increments of environmental protection in full compliance with statutory mandates within the same amount of time as the proposed regulatory requirements, as required by HSC section 57005.

IX. Justification for Adoption of Regulations Different from Federal Regulations Contained in the Code of Federal Regulations

When California's SORE exhaust emission standards were adopted in 1990, and when California's SORE evaporative emission standards were adopted in 2003, no comparable federal rules existed. In 1995, U.S. EPA adopted 40 CFR Part 90, to

control exhaust emissions from new nonroad spark-ignition engines at or below 19 kW, and in 2008, U.S. EPA adopted 40 CFR Parts 1054 and 1060, to control exhaust emissions from new, small nonroad spark-ignition engines and equipment and evaporative emissions from new and in-use nonroad and stationary equipment, respectively. Subsequent California rulemakings in 2011 and 2016 helped to align California's exhaust and evaporative test and certification procedures with federal requirements, but differences remain between the two sets of regulations.

Significant additional stringency in California regulations of SORE is justified in light of California's unique air quality concerns. Low rates of compliance with evaporative emission standards in CARB's validation studies, compliance testing and other testing suggest the expected emission reduction benefits of CARB's regulations have not been completely realized. Replacing new SORE equipment with ZEE would ensure emission reductions are achieved, as expected under the 2016 State SIP Strategy. California's SORE exhaust and evaporative emission regulations, as specified in Title 13, California Code of Regulations, sections 2400-2409 and 2750-2774, are already equivalent to or more stringent than the existing federal standards. However, even with equivalent or more stringent emission standards for SORE, the total contribution of NO_x and ROG from SORE in summer in California, approximately 141 tons per day in 2021, is approximately equal to the NO_x and ROG emissions from light-duty passenger cars, according to the most recent inventories, SORE2020 and EMFAC2021. Furthermore, significant portions of California, particularly the South Coast and San Joaquin Valley air basins, remain severe or extreme ozone nonattainment areas. The measure defined in the 2016 State SIP Strategy to address this continuing nonattainment will require significant reductions of both NO_x and ROG emissions from SORE. These expected emission reductions cannot be achieved, and the associated public health and environmental benefits cannot be realized, without adopting significantly more stringent emission standards than the current federal emission standards.

Staff's proposal would deviate from, and be more stringent than federal requirements as follows:

Beginning with MY 2024, the HC+NO_x standard for exhaust emissions would be zero grams per kilowatt-hour for all equipment, except generators. Generators would be subject to more stringent emission standards for MYs 2024 through 2027. Exhaust emission standards for generators would be zero grams per kilowatt-hour for MY 2028 and subsequent model years, as described in Tables IX-1 and IX-2. The more stringent emission standards are necessary to achieve the greater level of control of exhaust emissions needed in California to meet its SIP commitments.

Table IX-1. Current SORE exhaust emission standards and exhaust emission standards under the Proposed Amendments.

| Displacement category | Current HC + NO_x emission standard^{cc} (g·kWh⁻¹) | Proposed HC + NO_x emission standard for MYs 2024-2027 generators^{dd} (g·kWh⁻¹) | Proposed HC + NO_x emission standard for all other SORE for MY 2024 and later (g·kWh⁻¹) |
|------------------------------|--|--|---|
| < 50 cc | 50 | 6.0 | 0.00 |
| 50-80 cc, inclusive | 72 | 6.0 | 0.00 |
| > 80 cc - < 225 cc | 10.0 | 6.0 | 0.00 |
| 225-825 cc, inclusive | 8.0 | 3.0 | 0.00 |
| > 825 cc | 8.0 | 0.80 | 0.00 |

Table IX-2. Current SORE evaporative emission standards and evaporative emission standards under the Proposed Amendments.

| Displacement category | Current diurnal emission standard (g·day⁻¹) | Proposed hot soak plus diurnal emission standard^{ee} for MYs 2024-2027 generators (g·test⁻¹) | Proposed hot soak plus diurnal emission standard for all other SORE for MY 2024 and later (g·test⁻¹) |
|--|---|---|--|
| ≤ 80 cc | N/A | 0.50 | 0.00 |
| > 80 cc - < 225 cc except walk-behind mowers | 0.95 + 0.056 × nominal capacity (liters) | 0.60 | 0.00 |
| > 80 cc - < 225 cc walk-behind mowers | 1.0 | N/A | 0.00 |
| ≥ 225 cc | 1.20 + 0.056 × nominal capacity (liters) | 0.70 | 0.00 |

^{cc} g·kWh⁻¹: grams (g) of emissions per kilowatt-hour (kWh). A kilowatt-hour is a unit of energy equal to one kilowatt of power sustained for one hour.

^{dd} For MY 2028 and subsequent model years, the proposed exhaust emission standards for generators are 0.00 g·kWh⁻¹ for HC + NO_x.

^{ee} For MY 2028 and subsequent model years, the proposed evaporative emission standards for generators are 0.00 g·test⁻¹.

CO emission standards for SORE would also be more stringent for some engines beginning with MY 2024, as shown in Table IX-3. The CO emission standards for generators would be more stringent beginning with MY 2024. The CO emission standards for marine generator engines would be 4.5 g·kWh⁻¹, which are consistent with the CO emission standards set by U.S. EPA for marine generators tested with California test fuel. The more stringent emission standards for CO from generators are necessary to avoid adverse health outcomes associated with exposure to CO from generators. CO emission standards would not change for engines with displacement less than or equal to 825 cc used in all other equipment. The CO emission standard for engines with displacement greater than 825 cc would be the same as for LSI engines with displacement greater than 825 cc.

Table IX-3. Current SORE exhaust CO emission standards and exhaust CO emission standards under the Proposed Amendments.

| Displacement category | Current CO emission standard (g·kWh⁻¹) | Proposed CO emission standard^{ff} for MY 2024 and later generators (g·kWh⁻¹) | Proposed CO emission standard for MY 2024 and later for all other SORE (g·kWh⁻¹) |
|------------------------------|--|---|--|
| < 50 cc | 536 | 400 | 536 |
| 50-80 cc, inclusive | 536 | 400 | 536 |
| > 80 cc - < 225 cc | 549 | 400 | 549 |
| 225-825 cc, inclusive | 549 | 200 | 549 |
| > 825 cc | 549 | 20.6 | 20.6 |

The California PM exhaust emission standards for two-stroke generator engines with displacement less than or equal to 80 cc would continue to be 2.0 grams per kilowatt-hour for MYs 2024 through 2027. The California PM exhaust emission standards for two-stroke engines with displacement less than or equal to 80 cc used in all other equipment would be zero beginning with MY 2024. Federal regulations have no PM emission standards for SORE. The more stringent emission standards are necessary to achieve the greater level of exhaust emissions control needed in California.

Current requirements for California include evaporative emission standards for diurnal emissions that control all sources of evaporative emissions from SORE, whereas the federal requirements only control fuel tank permeation, fuel line permeation, and running loss emissions. The Proposed Amendments would change to a hot soak plus

^{ff} The proposed exhaust emission standards for CO for marine generator engines are 4.5 g·kWh⁻¹

diurnal emission standard for MY 2024 and sunset fuel tank and fuel line permeation emission standards for engines with displacement of 80 cc or smaller. The more stringent emission standards are necessary to achieve the greater level of control of evaporative emissions needed in California.

The Proposed Amendments for California specify that an engine family subject to exhaust compliance testing fails if any of the tested engines yields emission results above the applicable emission standard. Comparable federal regulations require a certain number of engines be tested to determine success or failure. The number of engines tested for federal compliance testing depends on the projected family sales and the pass or failure rate at each stage. By requiring every tested unit or component to comply with emission standards, staff expects that manufacturers will place a greater emphasis on quality control and consistently producing compliant products. The more stringent requirements are necessary to achieve the greater level of control of emissions needed in California.

The differences between the proposed California requirements and existing federal requirements are intended to lead to the reduction of NO_x and ROG emissions and replacement of the SORE equipment fleet with ZEE as soon as feasible so as to alleviate the health and environmental burden of SORE emissions, allow California to meet the 2016 State SIP Strategy commitments, and help ensure that SORE equipment sold and used in California will comply with the exhaust and evaporative emission standards over its useful life. The cost of these regulations is justified by their benefit to human health and the environment from ensuring SORE meet the emission standards.

These differences are also authorized by State and federal law. CARB may regulate emissions from off-road engines under the authority granted to it by the California Legislature in the HSC, and under the provisions of the federal Clean Air Act that direct EPA to authorize California to regulate emissions from off-road engines.

The Proposed Amendments requiring emission standards of zero for SORE produced for sale or lease for use or operation in California are technologically feasible. ZEE are commercially available, and their use is economically favorable. Increasing adoption of ZEE is desirable to help achieve the expected emission reductions. Furthermore, because the population of small off-road equipment includes preempt equipment, i.e., farm and construction vehicles and equipment, over which CARB does not have regulatory authority, achieving the expected emission reductions will ultimately require replacing SORE equipment that is not preempt with ZEE. Presently, no federal regulation for small off-road equipment incentivizes or requires the adoption of ZEE.

X. Public Process for Development of the Proposed Action (Pre-Regulatory Information)

Consistent with Government Code sections 11346, subdivision (b), and 11346.45, subdivision (a), and with the Board's long-standing practice, CARB staff held public workshops and other meetings with interested stakeholders during the development of the Proposed Amendments. These informal pre-rulemaking discussions provided staff with useful information that staff considered during development of the Proposed Amendments that are now available for formal public comment. This chapter describes the history of public process that staff conducted in relationship to the development of this rulemaking.

A. Survey Development and Informational Update to the Board

Throughout development of the survey conducted by CSUF (CSUF SSRC, 2019), meetings of the SORE Working Group were held to get feedback on the survey questions. The SORE Working Group consists of interested stakeholders, including manufacturers, trade associations, government agencies, individuals, and environmental organizations. At each stage of the survey, all parties were invited to give feedback on the questions asked, and the survey questionnaires were improved as a result.

1. October 27, 2017, SORE Working Group Meeting

The SORE Working Group met via conference call on October 27, 2017, to discuss the residential survey questionnaire, among other topics. The discussion included an overview of the survey. CARB staff described the phases of the survey, targeted numbers of responses, the method of response collection, and the samples from which potential respondents would be selected. Stakeholders asked questions and provided suggestions for modifications to the survey questionnaire during this meeting. CARB staff provided clarifications in response to questions during the meeting. As a result of the feedback provided by stakeholders and further discussions, CARB staff worked with CSUF staff to make revisions to the residential survey questionnaire. Those revisions included:

- Adding a question to confirm the respondent lived in California
- Adding a question to confirm the type of phone line (landline or cellular) the respondent was using
- Modifying a question regarding who maintains the lawn, garden or landscaped areas at the respondent's home
- Modifying questions regarding the frequency of use of a piece of equipment
- Modifying questions regarding the age of a piece of equipment
- Modifying questions regarding the amount of time a respondent expected to keep a piece of equipment

- Modifying questions to ask about “engine maintenance” rather than all types of “maintenance”
- Adding a question to assess whether a respondent who planned to purchase electric equipment would purchase corded or cordless electric equipment
- Modifying questions regarding a respondent’s decision to purchase electric or gasoline-powered equipment to avoid leading respondents toward any of the response options
- Modifying a question regarding the age of gas cans
- Modifying a question regarding the frequency of filling gas cans
- Adding a section to ensure households were not counted more than once in the survey and the respondents were representative of the state population

2. June 8, 2018, SORE Working Group Meeting

The SORE Working Group discussed the business survey questionnaire and updates to the residential survey questionnaire, among other topics, during a meeting via conference call on June 8, 2018. The draft business survey questionnaire discussed in the meeting incorporated revisions to the residential survey questionnaire that resulted from the October 27, 2017, working group meeting. CARB provided updates on the status of the residential survey and reminded the working group of the phases of the survey, targeted numbers of responses, the method of response collection, and the samples from which potential respondents would be selected. Stakeholders asked questions and provided suggestions for modifications to the survey questionnaire during this meeting. CARB staff provided clarifications in response to questions during the meeting. As a result of the feedback provided by stakeholders and further discussions, CARB staff worked with CSUF staff to make revisions to the business survey questionnaire.

3. January 10, 2019, SORE Working Group Meeting

The SORE Working Group met via conference call on January 10, 2019, to discuss the landscaper survey questionnaire and updates on the status of the residential and business surveys, among other topics. The draft landscaper survey questionnaire discussed in the meeting incorporated revisions to the business survey questionnaire that resulted from the June 8, 2018, working group meeting. CARB staff worked with CSUF staff to make revisions to the landscaper survey questionnaire based on feedback and suggestions from stakeholders.

4. April 17, 2019, SORE Working Group Meeting

The SORE Working Group met on April 17, 2019, via conference call. Topics of discussion included MY 2020 certification and testing. CARB staff provided an update on the survey and answered questions from stakeholders.

5. November 2018 Informational Update to the Board

Staff presented an update to the Board during its public hearing in November 2018 titled, “Informational Update on Reducing Emissions from Small Off-Road Engines: Operator Exposure, Health Risks, and Pathways to Zero Emissions.” The staff update included information about demonstration projects that provide professional landscapers an opportunity to use and test professional-grade battery-operated landscaping equipment. Additionally, staff provided information on cities in California that had already replaced their SORE municipal landscaping equipment with ZEE. Staff noted that some colleges and universities in California are also on the path to adopt ZEE to replace their SORE equipment. There was a showcase of ZEE outside the meeting room with 8 manufacturers and businesses showing their newest ZEE. A similar showcase of ZEE was conducted in the November 2016 Board meeting when staff proposed amendments to the SORE evaporative regulations.

B. Public Workshops

Staff conducted three public workshops to discuss the development of the Proposed Amendments with stakeholders. All the workshops were announced with the issuance of a public workshop notice prior to their occurrence. These notices were posted to the program’s website and sent out to over 5,000 subscribers to the “SORE Working Group” and “Mobile Source Program Mailouts” public email list serves. Each of these workshops were open to all members of the public. CARB staff made documents and/or presentations available in advance of the meetings/workshops to help stakeholders prepare for the discussions.

The first workshop was held on September 26, 2019, in person at Sacramento, California, with an option for remote participation via webinar. The workshop introduced regulatory concepts and a plan to require new small off-road equipment to be ZEE. Staff also presented the results of a recently completed statewide survey of SORE population and activity conducted by CSUF (CSUF SSRC, 2019).

A second workshop was held on June 9, 2020, via webinar. Draft regulatory text was released in advance of the workshop on May 29, 2020. At this workshop, staff presented a summary of the draft changes to the regulations. The staff presentation was followed by a lengthy discussion— some participants requested rapid implementation of a zero-emission requirement, while others recommended a slower transition to zero-emissions, either for all SORE equipment, or for specific equipment types.

A third workshop was held on March 24, 2021, via webinar. Updated draft regulatory text, incorporating the changes made since the June 2020 workshop, was posted online to facilitate an informed discussion. The workshop presentation included a summary of the potential regulatory changes, including an updated timeline for implementation of emission standards of zero and introduction of the zero-emission generator credit program. Feedback was directly requested on the zero-emission

generator credit program, which would allow manufacturers to offset emissions from generators with emission levels above the potential emission standards by using credits earned from certifying zero-emission generators. An updated timeline for the rulemaking process was also presented.

C. Solicitation of Alternatives

On November 19, 2019, CARB staff sent an email to the CARB-maintained listserv for the SORE Working Group and the Mobile Source Program Mailouts, soliciting alternatives to what was presented in the September 2019 workshop. Appendix J includes a copy of the email text. The SORE Working Group list has approximately 4,000 subscribers, and the Mobile Source Program Mailouts has approximately 5,000 subscribers, with many overlapping subscribers between the two. Thirteen replies were received, with most responders asking CARB to require zero-emissions as soon as possible. The respondents asking CARB to require zero-emissions as soon as possible included the American Lung Association in California, the Clean Air Coalition, the Environmental Council of Sacramento, the Sierra Curtis Neighborhood Association, and several individual residents. OPEI, which represents, "more than 100 manufacturers and their suppliers of gas and electric-powered outdoor power equipment and utility vehicles" also submitted comments. OPEI's comments offered no regulatory alternative, but said, "OPEI estimates that the SORE sector emissions inventory levels will fall through 2031. As a result, OPEI suggests the SIPs original SORE reduction goals may be met without any new or additional regulations." No data were provided to support this assertion.

D. Stakeholder Meetings

During the rulemaking process, staff held numerous meetings with stakeholders. Staff met with OPEI, Truck and Engine Manufacturers Association (EMA), and Air Improvement Resource, Inc. on January 8, 2019, to discuss emissions from SORE and emission reduction goals. Included in material presented to CARB staff by OPEI and EMA was the meeting objective, "Establish the foundation for the cooperative and open-minded industry / agency relationship necessary for California to achieve its goals." On March 4, 2019, OPEI presented at the Outdoor Power Equipment and Engine Service Association meeting in Miami, Florida. Included in a slide that discussed OPEI's 2019 priorities was, "Establish public record counter to CA emissions rulemaking." (OPEI, 2019).

Shortly after the workshop in September 2019, staff met with EMA, Honda, and Briggs & Stratton to discuss the potential proposals. Staff also met with the Clean Air Coalition. Honda and Stihl met separately with staff in January 2020 to discuss the rulemaking. In January 2020, staff also met with Greenworks to discuss zero-emission riding mowers and a potential credit program.

In February 2020, staff met with staff from the office of Supervisor Katie Rice in Marin County to discuss potential SORE rulemaking. Staff briefed staff members from the

State Legislature about SORE and possible rulemaking approaches that were discussed in the public workshops. Manufacturers of Emission Controls Association (MECA) also met with staff to discuss SORE emission control technologies and their potential. Finally, staff met with Onyx Solutions, who make propane engines and conversion kits, to discuss the SORE regulations.

In March 2020, staff met with the American Green Zone Alliance (AGZA) to talk about adoption of ZEE in place of SORE equipment and training for landscapers. The Clean Air Coalition and other environmental organizations met with staff in May 2020 to discuss the rulemaking.

After the workshop in June 2020, staff met with Deniz Bolbol to discuss potential regulations and Bolbol's efforts to have his community adopt zero-emission lawn and garden equipment. Honda also met with CARB staff to discuss the workshop and their suggestions for CARB's regulatory approach. In July 2020, staff met with MECA to discuss the draft proposal. Staff also met with the RV Industry Association and OPEI separately in August 2020 about the potential rulemaking and the June workshop.

In October 2020, staff met with Onyx Power who produce zero-emission generators. The state of zero-emission generators and their future potential were discussed. In November 2020, staff met with Wacker Neuson who make both SORE equipment and ZEE. Their equipment and goals were discussed.

Staff members from the State Legislature were again briefed in February 2021 about SORE and the rulemaking proposal discussed in public workshops.

Following the March 2021 workshop, staff met with other stakeholder groups. The Sacramento area organization, Mow Better, was briefed on the rulemaking workshop. Westerbeke and the National Marine Manufacturers Association met with staff about marine generators. MECA also met with staff to discuss the draft proposal.

E. Stakeholder Outreach

To encourage faster adoption of ZEE, in October 2018 CARB began the ZEE Roadshow that showcases professional-grade, battery-powered landscaping equipment from eight manufacturers. A CARB trailer was designed to transport the ZEE Roadshow to interested parties such as schools, colleges, state agencies, municipalities, and landscapers who would then try out the electric equipment for a predetermined period. To date, 20 entities have been able to use and evaluate the professional-grade landscaping equipment. After hosting the ZEE Roadshow, several of the participants have purchased ZEE. Of the 7 participants who have responded to inquiries, 4 have already purchased ZEE, and 2 have plans to purchase. One participant has purchased over 800 pieces of ZEE.

The City of Ojai held events related to its replacement of its engine-powered municipal landscaping equipment with ZEE. The city received funding for ZEE from the

Ventura County Air Pollution Control District. CARB staff attended a “ribbon-cutting” ceremony in August 2018 where city staff and elected officials highlighted the benefits of ZEE for the community. The city grounds crew showcased the equipment. Staff attended a celebration marking the one-year anniversary of the acquisition of ZEE for the city in April 2019. In December 2019, CARB staff attended a ceremony in which the SORE equipment that had been replaced with ZEE was destroyed and recycled. CARB staff spoke at each of these events, congratulating Ojai on its leadership in setting an example that ZEE can be used for municipal grounds keeping and landscaping work and discussing the benefits of ZEE for operators and others. Ojai built on the success of its use of ZEE for municipal landscaping work and adopted municipal regulations in April 2020 that prohibit the use of leaf blowers, nonriding lawn mowers, string trimmers, hedge trimmers, lawn edgers, pole hedge trimmers, and pole saws powered by internal combustion engines anywhere within the city.

CARB staff has attended four conventions held for landscapers in California. These conventions have provided opportunities for staff to inform professional landscapers about upcoming regulation changes and about ZEE capabilities and availability. Events attended include the Green Schools Summit in Pasadena in November 2018, California Landscape Industry Show in Ontario in February of 2019, Long Beach Landscape Expo in October 2019, and the NorCal Landscape Show in February of 2020.

CARB staff has presented information about zero-emission landscaping equipment and the potential for regulatory amendments aimed at transitioning from SORE equipment to ZEE at several meetings attended by landscapers and local decision-makers in California. Presentations were given to the Pleasanton Committee on Energy and the Environment in January 2019, the San Francisco Integrated Pest Management Technical Advisory Committee in March 2019, the San Mateo Integrated Pest Management Workshop in April 2019, the San Francisco Commission on the Environment in November 2019, and the Tri Valley Air Quality Community Alliance in April 2021.

XI. The Specific Purpose and Rationale of Each Adoption, Amendment, or Repeal

This chapter provides the specific purpose of each proposed amendment and the rationale for CARB staff’s determination of why the Proposed Amendments are reasonably necessary to carry out the purpose of the provisions of law they are implementing and to address the problems described in Chapter II. Appendices A through G of this Staff Report provide the full text of the Proposed Amendments shown in strikeout and underline formatting.

A. Exhaust Emission Regulations

This section provides a summary, purpose, and rationale for each Proposed Amendment to CCR Title 13, Division 3, Chapter 9 §§ 2401 through 2408.2. Appendix A of this Staff Report provides the full proposed regulatory language of these sections.

Global Amendments throughout the Exhaust Emission Regulations

The following proposed global changes provide updated and clarifying text that does not alter current requirements for SORE equipment.

Acronym Change

Purpose. The Proposed Amendments change “ARB” and “the ARB” to “CARB,” and add “California” before “Air Resources Board,” for consistency with recent CARB document style practices designed to improve clarity.

Rationale. This change reflects the California Air Resources Board’s recent change to, and preferred use of, the acronym “CARB” versus the prior acronym, “ARB,” and the entire agency title, “California Air Resources Board.”

Capitalization Change

Purpose. The Proposed Amendments change the formatting of text in all capital letters to mixed case to aid in making documents accessible to everyone, including people with visual impairments and assistive technology users.

Rationale. Mixed case words and sentences are easier to read and consistent with current accessibility guidelines.

Division Name Change and Address Change

Purpose. The Proposed Amendments change “Emissions Compliance, Automotive Regulations and Science Division” to “Emissions Certification and Compliance Division,” and change “Off-Road Certification/Audit Section” to “Off-Road Spark-Ignited Engine Certification Section,” throughout the exhaust emission regulations because of the reorganization of divisions within CARB. In addition, the Proposed Amendments change “9528 Telstar Avenue, El Monte, California 91731” to “4001 Iowa Street, Riverside, CA 92507” to reflect the address of CARB’s new Southern California headquarters.

Rationale. These changes are necessary because CARB divisions have been reorganized and renamed, and construction of the new Southern California headquarters has been completed. The Off-Road Spark-Ignited Engine Certification Section within the Emissions Certification and Compliance Division now has responsibility for reviewing certification applications, so the division and section names

have been updated. Division staff and the vehicle emissions testing laboratories will be housed at the new headquarters.

Description of When Reports Are Submitted

Purpose. Throughout the regulations, the Proposed Amendments change notations of “within XX days of” to “within XX days after” to increase clarity regarding the deadline by which documents must be submitted.

Rationale. Certification holders are required to demonstrate compliance with new engine compliance and production line testing provisions and credit provisions after the end of each calendar quarter under § 2407, and to submit reports on sales after the model year has ended under §§ 2408 and 2408.1. Changing “of” to “after” better describes when reports are due and clarifies that these reports should have complete information from the entire calendar quarter or model year.

“Family Emission Level” Term Usage

Purpose. The Proposed Amendments change the term “Family Emission Limit” to “Family Emission Level” to restore consistency of term usage throughout the exhaust emission regulations. The Proposed Amendments include this change in the following sections: 2404(l)(1), 2408(b)(5), 2408(f)(1), 2408(h)(1)(B), 2408.1(b)(4), and 2408.1(h)(1)(B).

Rationale. These proposed changes are necessary to prevent confusion for manufacturers and other readers and do not affect SORE emission standards nor testing requirements. The California SORE regulations traditionally use the term “Family Emission Level” while the federal regulations for small nonroad spark-ignition engines use the term “Family Emission Limit.” The term “Family Emission Limit” has inadvertently been used interchangeably with “Family Emission Level” because their definitions are virtually identical:

- Per Title 13, California Code of Regulations, § 2401(a): ““Family emission level” or “FEL” means an emission level that is declared by the manufacturer to serve for the averaging, banking, and trading program and in lieu of an emission standard for certification. The FEL serves as the engine family’s emission standard for emissions compliance efforts. If the manufacturer does not declare an FEL for an engine family, the applicable emissions standard must be treated as that engine family’s FEL for the purposes of any provision of this Article.”
- Per California Part 1054.801: “*Family emission limit (FEL)* means an emission level declared by the manufacturer that will be used in the ABT program. The family emission level will take the place of an otherwise applicable emission standard. The family emission limit must be expressed to the same number of decimal places as the emission standard it replaces. The family emission limit serves as the emission standard for the engine family (exhaust) or emission family (evaporative) with respect to all required testing.”

- Per federal Part 1054.801: “*Family emission limit (FEL)* means an emission level declared by the manufacturer to serve in place of an otherwise applicable emission standard under the ABT program in subpart H of this part. The family emission limit must be expressed to the same number of decimal places as the emission standard it replaces. The family emission limit serves as the emission standard for the engine family (exhaust) or emission family (evaporative) with respect to all required testing.”

The proposed changes to provide consistent use of the term “Family Emission Level” satisfy clarity requirements under California regulations (Title 1, CCR, § 16(a)(4)).

§ 2401. Definitions

§ 2401(a)(12)

Purpose. The current regulations in § 2401(a)(12) define the meaning and calculation of “deterioration factor” and identify the procedures required for its determination as “Part II, Section 3 of the 1995-2004 Test Procedures, and Subpart B, Section 90.104 of the 2005 and Later Test Procedures.” The Proposed Amendments replace the text “2005 and later” with “2005-2012” to reflect the applicability of Part 90 test procedures to MYs 2005 through 2012. To identify the required procedure for MY 2013 and subsequent model years, the Proposed Amendments add the text “or Subpart C, section 1054.245 of the “California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1054),” adopted October 25, 2012, and amended [insert amended date], as applicable.” The Proposed Amendments include a placeholder for the amended date, “[insert amended date]”, that will be updated to reflect the CARB adoption date of the Proposed Amendments.

Rationale. This change is necessary to update the definition for consistency with existing and proposed changes to other SORE regulations. Part II, Section 3 of the 1995-2004 Test Procedures and Subpart B of the 2005-2012 Test Procedures were used for earlier model years. The “California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1054),” is the updated test procedures that has been used for MY 2013 and subsequent engines. Referencing these test procedures in the exhaust regulations is necessary to clarify which procedures to use for determining deterioration factors. This change does not alter current requirements for SORE equipment.

§ 2401(a)(15)

Purpose. The current regulations in § 2401(a)(15) define the meaning of “emissions durability period” and provide multiple references from which to select a durability period, including a reference to a table in § 2403(b) of the exhaust regulations. The Proposed Amendments remove the references to “Part II, Section 1 of the 1995-2004

Test Procedures and Subpart B, Section 90.104 of the 2005 and Later Test Procedures” and leave only the reference to the table in § 2403(b) because the emissions durability periods are listed in the table in § 2403(b).

Rationale. This change is necessary to clarify and simplify the definition and to reduce the potential for confusion and conflicting instructions. The 1995-2004 and 2005-2012 Test Procedures were used for earlier model years and have not been used for MY 2013 and later model year engines. The reference to “2005 and Later Test Procedures” was outdated; the title of those procedures was updated in amendments adopted by CARB in 2011, but the reference in this definition was not updated at that time. This change does not alter current requirements for SORE equipment.

§ 2401(a)(19) [newly proposed definition]

Purpose. The Proposed Amendments add a new definition for “Engine” to clarify what qualifies as an engine. The definition specifies that “Engine” means a complete, operational engine, and that any engine block or kit with the parts necessary to assemble an engine block with or without an installed crankshaft is also considered an engine. The definition specifically excludes gas turbine engines.

Rationale. The term engine was not defined in past regulations, which led to the sale of complete sets of “replacement parts.” The parts in these kits appear to be aftermarket and counterfeit rather than original equipment manufacturer replacement parts. The parts can be assembled into a working engine that is not certified or compliant with the applicable emission standards. The newly proposed definition of “engine” is necessary to prevent circumvention of regulation requirements.

§ 2401(a)(19) [renumbered to (20)]

Purpose. The current regulations define “engine family” as a subclass of a basic engine based on similar emission characteristics and specifies that the engine family is the groupings of engine that is used for the purposes of certification. The Proposed Amendments add text to the definition to include “zero-emission small off-road equipment” in the definition. “Zero-emission small off-road equipment” has the same meaning as “zero-emission equipment” or “ZEE” for the purposes of the SORE regulations and this Staff Report.

Rationale. The change is necessary to provide clarity and consistency with § 2400(a)(4), which states, “This article may apply to zero-emission small off-road equipment.” In addition, existing requirements in § 2408.1 and many of the Proposed Amendments to the exhaust emission regulations explicitly or implicitly refer to ZEE. Adding ZEE to the definition of engine family will help prevent confusion for readers.

§§ 2401(a)(19) through (53)

Purpose. The Proposed Amendments add seven new definitions to § 2401(a). The newly proposed definitions are numbered 19, 29, 30, 32, 36, 58, and 59 so that they

are in alphabetical order with the previously included definitions. Consequently, the Proposed Amendments also renumber the definitions that were previously included in this section so that all definitions in this section are in alphabetical order and sequentially numbered.

Rationale. These changes are necessary to maintain a correctly numbered, alphabetical list of definitions and to prevent confusion for the reader.

§§ 2401(a)(29) and (30) [newly proposed definitions]

Purpose. The Proposed Amendments add definitions for “generator” (as § 2401(a)(29)) and “generator engine” (as § 2401(a)(30)) to specify that “generator” means off-road equipment that exclusively produces electric power, and “generator engine” means an engine installed exclusively in a generator.

Rationale. These changes are necessary to provide clarity and regulatory certainty because the Proposed Amendments to § 2403 include exhaust emission standards for generator engines that differ from emission standards for engines in other types of small off-road equipment. In addition, the Proposed Amendments specify a new, generator-specific exhaust emission reduction credit program in a new 2408.2 section. Failure to specify definitions of the terms generator and generator engine in the exhaust emission regulations could result in noncompliant equipment being introduced for sale or lease for use in California, or inappropriate credit generation calculations and credit use. Regulatory definitions for these terms are necessary to ensure no excess emissions result from improper implementation of the proposed emission standards or credit program. Furthermore, the regulatory definitions help provide a fair and equitable process for all manufacturers that choose to apply for certification under the new emission standards or participate in the credit program.

§ 2401(a)(32) [newly proposed definition]

Purpose. The Proposed Amendments add a definition for the term “Handheld” to specify what types of equipment are considered to be handheld equipment. The proposed definition specifies that “handheld” means relating to off-road equipment using an engine with displacement less than or equal to 80 cc that meets either of the following criteria: (A) It is carried by the operator throughout the performance of the manufacturer’s intended function. (B) It has a combined engine and equipment dry weight under 16.0 kilograms, has no more than one wheel, and the operator provides support or attitudinal control for the equipment throughout the performance of the manufacturer’s intended function. Support means to hold a piece of equipment in position to prevent it from falling, slipping, or sinking, without carrying it. Attitudinal control involves regulating the horizontal or vertical position of the equipment.

Rationale. This change is necessary to provide clarity and regulatory certainty because handheld equipment generally has less stringent requirements under the current regulations than other small off-road equipment. Nonhandheld equipment such as

generators and pressure washers can meet more stringent requirements because it is not carried or continuously supported by operators during use. Failure to define the term “handheld” in the exhaust emission regulations could result in noncompliant equipment being introduced for sale or lease for use in California, or inappropriate credit calculation and credit use for manufacturers that participate in the exhaust emission reduction credit program. A regulatory definition with clear criteria is necessary to ensure no excess emissions result from improper implementation of the emission standards or credit program. Furthermore, a regulatory definition helps provide a fair and equitable process for all manufacturers that choose to apply for certification under the new emission standards or participate in the credit program.

§ 2401(a)(31) [renumbered to (35)]

Purpose. The current regulations specify that “model year” means the manufacturer’s annual production period that includes January 1 of a calendar year or, if the manufacturer has no annual production period, the calendar year. The Proposed Amendments add text that further specifies the allowable date range for any model year. The Proposed Amendments specify that the model year may not begin before January 2 of the prior calendar year or extend beyond December 31 of the named model year.

Rationale. This change clarifies existing requirements and is necessary to provide consistency and regulatory certainty because manufacturer-named model years may have annual production periods that extend beyond a given calendar year. For a manufacturer whose annual production period does not coincide with the calendar year, clarifying that the model year may not begin before January 2 of the prior calendar year or extend beyond December 31 of the named model year better ensures that no reader would misinterpret the definition of “model year.”

§ 2401(a)(36) [newly proposed definition]

Purpose. The Proposed Amendments add a definition for the term “NEMA 5-15” to specify that it means a receptacle that complies with the industry standard for NEMA 5-15 as established in ANSI/NEMA WD 6-2016 (February 11, 2016), and incorporates ANSI/NEMA WD 6-2016 by reference.

Rationale. This definition is necessary to provide clarity for a requirement included in the Proposed Amendments for the new Zero-Emission Generator Credits Averaging, Banking, and Trading Provisions in the new 2408.2 section. The proposed § 2408.2(b)(4)(D)(1)a. specifies, “A zero-emission generator must have a device capable of providing 120-Volt nominal alternating current power as well as at least one NEMA 5-15 receptacle.” NEMA 5-15 is a commonly used industry standard for household electrical receptacles. Adding this definition with the incorporated reference for ANSI/NEMA WD 6-2016 will prevent ambiguity when determining whether certain equipment can qualify for zero-emission generator credits.

§ 2401(a)(58) and (59) [newly proposed definitions]

Purpose. The Proposed Amendments add definitions for “zero-emission generator” (as § 2401(a)(58)) and “zero-emission generator credits” (as § 2401(a)(59)). The proposed definition specifies that “zero-emission generator” means any small off-road equipment that generates or stores energy and distributes electrical power while producing zero emissions of any criteria pollutant (or precursor pollutant) under any and all possible operational modes and conditions. The proposed definition specifies that “zero-emission generator credits” means the amount of emission reductions generated by using zero-emission generators in place of small spark-ignition off-road equipment, and that zero-emission generator credits are calculated pursuant to § 2408.2 and approved by CARB.

Rationale. This change is necessary to provide clarity and regulatory certainty because the Proposed Amendments specify a new, generator-specific exhaust emission reduction credit program in a new 2408.2 section. This voluntary program would allow manufacturers to offset emissions from generators with emission levels above the proposed emission standards by using credits generated by zero-emission generators. The goal of the proposed credit program is to incentivize manufacturers to increase development and production of zero-emission generators, particularly zero-emission generators with the greatest energy storage and highest power output. Such incentive is needed to increase the availability and reduce the cost of zero-emission generators. Failure to specify definitions of the terms “zero-emission generator” and “zero-emission generator credits” could result in inappropriate credit generation calculations and credit use. Regulatory definitions for these terms are necessary to ensure no excess emissions result from improper implementation of the credit program, and to help achieve the goal of the proposed credit program, which is to increase development and production of zero-emission generators. Furthermore, the regulatory definitions help provide a fair and equitable process for all manufacturers that choose to participate in the credit program.

§ 2403. Exhaust Emission Standards and Test Procedures – Small Off-Road Engines

§ 2403(b)(1)

Purpose. The current regulations in § 2403(b)(1) specify the exhaust emission standards for HC + NO_x, CO, and PM emissions from SORE, by displacement category, produced on and after the model years specified in a multi-part table in that section. For the emission standards applied to model year ranges that do not have an end date (e.g., “2005 and subsequent”), the Proposed Amendments replace the “and subsequent” text with “through 2023” to limit the applicability of all current emission standards to engines manufactured through MY 2023. The headings for PM emission standards currently read “Particulate.” The Proposed Amendments change these to “Particulate Matter.” In addition, the Proposed Amendments expand the current table to apply new, more stringent exhaust emission standards for MY 2024 and subsequent

model years. The purpose of the proposed emission standards is to further reduce SORE emissions in order to improve air quality in California.

The proposed new exhaust emission standards for MY 2024 and subsequent model years differ from the current standards in the following ways:

- First, the Proposed Amendments provide two new table sections for the proposed emission standards, one for standards for all SORE except generator engines, and the second for standards for generator engines. In contrast, the current regulations have one set of emission standards for engines used in all SORE equipment. The Proposed Amendments provide a separate table section for generator engine emission standards to indicate with as much clarity as possible for readers that generator engines have requirements different from other SORE for MY 2024 and subsequent model years.
- Second, the Proposed Amendments would set HC + NO_x and PM emission standards to zero for all SORE, except generator engines, beginning in MY 2024, and for generator engines beginning in MY 2028. The purpose of setting these emission standards to zero is to accelerate the adoption of ZEE to replace SORE equipment and to achieve the maximum degree of technologically feasible, cost-effective emission reductions from SORE by the earliest practicable date. Chapter VIII and Appendix I describe other alternatives considered and provide CARB staff's analyses that support the conclusion that these Proposed Amendments would enable the most cost-effective emission reductions from SORE. When the HC + NO_x and PM emission standards of zero become effective, exhaust emission reduction credits could be used to offset any HC + NO_x and PM emissions from SORE manufactured for sale or lease for use in California. Sections 2408 and 2408.1 contain the current regulations for the voluntary exhaust emission reduction credit programs, and, as described later in this chapter, the Proposed Amendments include revisions to those credit programs to further incentivize manufacturers to accelerate their development and production of zero-emission generators and other ZEE.
- Third, for generator engines in MYs 2024 through 2027, the Proposed Amendments set HC + NO_x and PM emission standards that are approximately 40 to 90 percent more stringent than current emission standards, depending on the engine displacement category. The purpose of these interim emission standards for generator engines is to require further emission reductions from generator engines, while at the same time, allow more time to implement the proposed emission standards of zero for generator engines.
- Fourth, the Proposed Amendments establish CO emission standards of 4.5 g·kWh⁻¹ for marine generator engines. The Proposed Amendments establish a CO emission standard of 20.6 g·kWh⁻¹ for all engines with displacement greater than 825 cc, except marine generator engines. The Proposed Amendments also establish two new CO emission standards for generator engines other than marine generator engines for the MY 2024 and subsequent

model years, with displacement less than or equal to 825 cc: a standard of 400 g·kWh⁻¹ for generator engines with displacement less than 225 cc; and a standard of 200 g·kWh⁻¹ for generator engines with displacements between 225 cc and 825 cc, inclusive. The proposed CO emission standards for all other SORE with displacement less than or equal to 825 cc—536 or 549 g·kWh⁻¹, depending on the displacement category—are the same as current emission standards for recent model year SORE.

- Fifth, the Proposed Amendments add a new category in both table sections for engines with displacement greater than 825 cc to align the SORE exhaust emission standards with the current exhaust emission standards for large spark-ignition engines (i.e., engines rated greater than 19 kilowatts), which have different emission standards for engines with displacement greater than 825 cc than for those with displacement less than or equal to 825 cc. The delineation of the four smaller displacement categories remains the same: < 50 cc; 50-80 cc, inclusive; > 80 cc - < 225 cc; and 225-825 cc, inclusive.
- Sixth, the Proposed Amendments update the emissions durability period values in both tables for MY 2024 and subsequent model years. As currently defined by § 2401(a)(15), the “emissions durability period” is the period that represents an engine’s useful life. The durability period is used to determine an engine family’s deterioration factors and in the calculation of certification emission reduction credits. The current regulations allow applicants for certification to select a durability period for their engines from a range of choices that generally reflect “moderate,” “intermediate,” or “extended,” use. The Proposed Amendments would lengthen the emissions durability periods for some engines to more accurately reflect the actual lifetime of SORE equipment, and would allow only one option per displacement category. This would prevent manufacturers from certifying to unrealistically short emissions durability periods and only meeting the emission standards for a small portion of the equipment’s lifetime.

Rationale. These changes are necessary to achieve the maximum degree of technologically feasible, cost-effective emission reductions from SORE by the earliest practical date, as required by state law. The Proposed Amendments to the exhaust emission standards, along with the Proposed Amendments to the evaporative emission standards in § 2754(a) (described in section B of this chapter), are necessary to achieve emission reductions expected under the 2016 State SIP Strategy. In addition, these changes are a necessary component of the strategy to achieve 100 percent zero-emission from off-road vehicles and equipment operations in the State by 2035, as ordered in EO N-79-20.

As described in section C.2 of Chapter I of this Staff Report, current SORE regulations will not achieve emission reductions expected under the 2016 State SIP Strategy. The 2016 State SIP Strategy calls for more stringent emission standards and additional incentives to accelerate the deployment of ZEE to prevent SORE emissions from

increasing and ultimately to achieve emission reductions necessary to attain ambient air quality standards for ozone by 2031 and protect the health and welfare of all California residents. As described in section B of Chapter III, SORE emissions modelling results indicate implementation of the proposed exhaust and evaporative emission standards would result in emission reductions that would fulfill the 2016 State SIP Strategy commitments to reduce statewide SORE emissions of ROG by 36 tpd and NO_x by 4 tpd in 2031, as well as emission reduction commitments specific to the South Coast and San Joaquin Valley air basins.

New emission standards for all SORE would apply beginning with MY 2024 to provide the lead time required by the federal Clean Air Act § 209 in U.S. Code § 7543. That section requires that, "California ... adopt such standards at least 2 years before commencement of the period for which the standards take effect." The two-year lead time provides manufacturers with lead time to develop and manufacture equipment to meet the new emission standards in the Proposed Amendments. Implementing emission standards at the earliest date would result in greater emission reductions and further progress in meeting EO N-79-20.

The Proposed Amendments allow more time for generators to meet emission standards of zero by setting the exhaust HC + NO_x and PM emission standards for generator engines to zero for MY 2028 rather than MY 2024 as is done for engines in other SORE equipment. This is necessary for two reasons:

- While zero-emission generators are available to meet users' demand, there is still a need to allow manufacturers more time to continue to innovate and grow to meet the future demands of the zero-emission generator market. The fraction of all generators currently in use that are ZEE is significantly lower than that for lawn and garden equipment, such as lawn mowers and trimmers.
- One of the main uses of generators is backup power supply. Some people depend on generators for power backup during outages. The longer time for generators to meet emission standards of zero will allow for these people to identify suitable power backup options.

As a result, the Proposed Amendments include generator-specific exhaust emission standards in § 2403(b), and evaporative emission standards in § 2754(a), for the MYs 2024-2027 period that are more stringent and comprehensive than the current emission standards, but are not zero. These proposed emission standards will enable emission reductions to be achieved while allowing more time for manufacturers to develop additional options for zero-emission generators. Section D.3.b in Chapter I provides additional information that supports the rationale for the necessity to allow more time for generators to meet emission standards of zero. It is important to note that the SORE regulations do not apply to stationary generators, which are not moved for equipment operation or storage. These stationary generators are frequently powered by natural gas or propane and usually installed on a concrete pad. To the extent that Californians rely on generators subject to CARB's SORE regulations, the

time between the Board adoption of the Proposed Amendments and the MY 2028 effective date of the emission standards of zero will provide adequate time for manufacturers to assess power outages in California, better understand consumer needs during these outages, and develop zero-emission generators to better meet those needs.

The selection of a MY 2028 effective date for the emission standards of zero for generator engines is based on, and balances, multiple factors. Manufacturers informed CARB staff following the June 2020 public workshop that an interim period of two years for the lower emission standards would not allow time for sufficient sales of generators certified to the more stringent emission standards to make back their investment to design, certify and produce the lower-emitting generators.

At the same time, the existing exhaust and evaporative emission reduction credit programs described in § 2408, § 2408.1, and § 2754.1, and the proposed expansion of the voluntary credit programs to incentivize additional production of zero-emission generators (newly proposed §§ 2408.2 and 2754.3 in this section A in this chapter), are expected to provide compliance flexibility for manufacturers. Under the current regulations and Proposed Amendments, manufacturers may continue to generate emission reduction credits through MY 2027 through the averaging, banking, and trading programs to offset generator emissions beyond MY 2027 (up to five years after credit generation). This flexibility could make it cost-effective for the manufacturers that are able and choose to participate in the programs to sell their new lower-emitting generators for a longer period, or even to proceed directly to the design and production of zero-emission generators.

Finally, an effective date later than MY 2028 would confound the primary goal of the Proposed Amendments: Accelerate the adoption of ZEE in place of SORE equipment to achieve the necessary SORE emission reductions by 2031 as expected under the 2016 State SIP Strategy, and to meet obligations under California EO N-79-20. The 2016 State SIP Strategy and EO N-79-20 are designed to achieve the maximum cost-effective emission reductions by the earliest practical date, as required by state law, and to meet obligations under the Clean Air Act, all of which are designed to achieve emission reductions necessary to attain ambient air quality standards for ozone by 2031 and protect the health and welfare of all California residents. The emission modelling described in Chapter III of this Staff Report takes into account both the proposed effective dates of the emission standards of zero for generators and other SORE equipment, and the potential use of banked credits that could delay the full benefit of the emission standards.

Available information indicates that all of the newly proposed emission standards for SORE in § 2403(b)(1) and § 2754(a)—emission standards of zero for all SORE exhaust and evaporative emissions, and the MY 2024-2027 exhaust and evaporative emission standards for generator engines—are technologically feasible and cost-effective as explained below.

Emission standards of zero for exhaust HC + NO_x, PM, and evaporative emissions: Emission standards of zero for SORE have been demonstrated to be feasible as evidenced by equipment currently certified for sale or lease for use in California. Approximately 52 percent of small off-road equipment in use in California are ZEE (CSUF SSRC, 2019). CARB staff's economic analysis found that consumers could experience net savings with ZEE compared to SORE with certain equipment types, and some would experience savings as soon as one year after ZEE purchase. The Proposed Amendments would yield statewide cost-savings beginning in 2037 when the savings in fuel purchases and maintenance costs become greater than the increased upfront cost to purchase ZEE. In addition, public health benefits would yield a cost-savings of \$8.82 billion statewide over the regulatory time-horizon of 2023 through 2043. Sections I.E, II.A, IV.B through IV.D, and Appendix I, in this Staff Report provide the supporting documentation for these findings.

MY 2024-2027 generator-specific standards for exhaust HC + NO_x, CO, and PM emissions and evaporative emissions: These generator-specific emission standards are based on engines already certified for sale or lease for use in California (CARB, 2021g⁹⁹), which indicates they are both technologically feasible and cost-effective. In each displacement category, except greater than 825 cc, several SORE engine families are certified at or below the proposed emission standards, including at least one SORE engine family used in generators. The proposed emission standards and emissions durability period for engines with displacement greater than 825 cc are aligned with the emission standards and emissions durability period for model year 2015 and subsequent large spark-ignition engines, i.e., those rated greater than 19 kW and with displacement greater than 825 cc, as established in § 2433(b). In addition to the generator engines that already meet these emission standards, CARB staff expects that other equipment engines that meet the standards could be adapted for generators, which would further decrease the cost of compliant generators. It is also possible that some of those engine families that meet the proposed emission standards are already installed in generators although the manufacturers may not declare such use of the engines in their certification applications.

⁹⁹ CARB staff compiled and evaluated certification data for HC + NO_x, CO, and evaporative emissions. Ten MY 2020 engine families have HC + NO_x certification test emissions lower than the MY 2024-2027 generator engine emission levels with credit use listed in Table III-2 and are certified to the longest of the current emissions durability periods (ranging from 300 to 1,000 hours, depending on displacement category). Of those ten engine families, eight also have CO certification test emissions lower than the proposed MY 2024-2027 generator engine emission standards listed in Table IX-3. Nine MY 2020 evaporative families have hot soak plus diurnal certification test emissions lower than the MY 2024-2027 generator engine emission levels with credit use listed in Table III-3. The data are available in the following document:

CARB. 2021g. Technical Support Document: Compilation and Evaluation of Small Off-Road Engine Certification Data. Microsoft Excel workbook prepared by staff of the Monitoring and Laboratory Division. October 2021.

Carbon monoxide emission standards: Similarly, the proposed new CO emission standards for generator engines (except for marine generator engines) and other engines with displacement greater than 825 cc are aligned with the current emission standards for large spark-ignition engines with displacement greater than 825 cc, as established in § 2433(b). The proposed new CO emission standards for generators with displacement less than or equal to 825 cc are based on engines already certified for sale or lease for in California. The proposed new CO emission standards for marine generator engines are aligned with the CO emission standards for marine generator engines set by U.S. EPA in Title 40, Code of Federal Regulations, § 1054.145(n)(2). The emission standards set by U.S. EPA have applied since MY 2013 for engine families tested with California's LEV III certification gasoline. It is necessary to adopt these CO emission standards for marine generator engines to ensure CARB's emission standards for these engines are at least as stringent as U.S. EPA's. CARB staff expects that adopting these emission standards for marine generator engines will not impose new requirements on manufacturers because they already have to certify to these emission standards when using LEV III certification gasoline.

New displacement category: The Proposed Amendments add a new category for engines with displacement greater than 825 cc to align the SORE exhaust emission standards with the current exhaust emission standards for large spark-ignition (LSI) engines (i.e., engines rated greater than 19 kilowatts) with displacement greater than 825 cc. In the current regulations, these larger displacement engines are included in the "≥ 225 cc" displacement category. The proposed change to specify a separate category for the large engines is necessary to ensure that SORE with displacement greater than 825 cc are not subject to less stringent emission standards than LSI engines with displacement greater than 825 cc. Some SORE and LSI engines have similar designs and are tuned differently to produce different amounts of power, with those producing 19 kW or less meeting the definition of SORE and those producing more than 19 kW meeting the definition of LSI engines. Having less stringent emission standards for SORE than for LSI engines may have incentivized the production of large-displacement SORE rather than LSI engines for some applications since MY 2015. Aligning the emission standards will ensure the greatest emission reductions because SORE with displacement greater than 825 cc will meet emission standards that have been met by similar LSI engines.

Emissions durability periods: The proposed new emissions durability periods are also based on engines already certified for sale or lease for use in California. The proposed durability period for all SORE with displacement less than or equal to 80 cc other than generator engines is 300 hours. The proposed durability period for generator engines with displacement less than or equal to 80 cc is 500 hours. The proposed durability period for engines with displacement greater than 80 cc and less than 225 cc is 500 hours. The proposed durability period for engines with displacement greater than or equal to 225 cc is 1,000 hours. The emissions durability periods in the Proposed Amendments are the longest of the current durability periods for each displacement

category for engines other than generator engines with displacement less than or equal to 80 cc.

Actual use times, as found in the CSUF survey (CSUF SSRC, 2019), are often much longer than the emissions durability periods defined in the current regulations. For example, the 75th percentile age of in-use residential generators is 15 years. A generator used at the average residential activity level of 62 hours per year would be used for 930 hours in 15 years. The average professional activity rate is 146 hours per year, and the 75th percentile age is 15 years. Those generators would be used for 2,190 hours in 15 years. The longer emissions durability periods would help ensure products meet emission standards over their full lifetimes.

Generators are not handheld equipment and do not have the same limitations of space and weight as handheld equipment. Among generators that use engines with displacement less than or equal to 80 cc, most have 80 cc engines. The design of many 80 cc engines is closer to that of an engine with displacement greater than 80 cc than it is to that of engines used in handheld equipment. The example in this section illustrates that a residential generator with an engine with displacement less than or equal to 80 cc used at the average residential activity level may be used well in excess of its current 50- to 300-hour durability period. A 500-hour durability period assures more residential generators using engines with displacement less than 225 cc will meet the emission standard for their lifetime. For all displacement categories except greater than 825 cc, there are currently engines certified below the proposed emission standards at the longest current emissions durability periods. The proposed emission standards and emissions durability period for engines with displacement greater than 825 cc are aligned with the current emission standards and emissions durability period for similar large spark-ignition engines, i.e., those rated greater than 19 kW and with displacement greater than 825 cc.

In addition to actual use time, many manufacturers advertise use of their products for longer than the emissions durability period. Honda's GX120, GX160, and GX200 engines are among the best-selling general purpose utility engines in California. These engines are each certified to an emissions durability period of 500 hours. However, the maintenance schedule in the owner's manual for these engines indicates the cyclone type air filter should be changed for the first time after 2 years or 600 hours of engine operation, and every 2 years or 600 hours thereafter. Changing an air filter is a basic maintenance item and is performed on an engine that will continue to be used, not on an engine that is beyond its useful life and can no longer be used. The owner's manual for these engines also recommends the combustion chamber be cleaned after every 500 hours of operation. This is a more extensive maintenance item than changing an air filter, as it involves removing the cylinder head from the engine. It would not be practical to perform such maintenance on an engine that had reached the end of its useful life. Nonetheless, the owner's manual suggests an owner could perform this maintenance at least twice, since it is to be performed after every 500 hours of operation (rather than after 500 hours of operation). Westerbeke's 9.9E, J3 and J4

generators are each certified to an emissions durability period of 250 hours, but their website says, "It is not uncommon to hear that generator sets and engines have run up to 10,000 hours with no major repairs." (Westerbeke, 2016). Echo's CS-310 chainsaw is certified to an emissions durability period of 50 hours. The operator's manual recommends several maintenance items, such as replacing the air filter and inspecting, cleaning, or replacing the spark plug and muffler spark arrestor every 3 months or 90 hours of operation (Echo, 2020). The operator's manual for the CS-310 also recommends an operator inspect or replace the fuel filter and replace the fuel cap gasket yearly or after 600 hours of operation. Engine manufacturers measure emissions from their engines through the end of the emissions durability period in certification testing to demonstrate that their engines will meet the emission standards or FELs for the engines' entire useful life. Emissions are expected to continue to increase as engines are operated beyond the emissions durability period. The discrepancy between the emissions durability periods and the actual number of operating hours for engines means the engines may be emitting at levels above the emission standards for a large portion of their use time.

Therefore, based on this better understanding of engines' actual life in terms of operating hours, the proposed change to emissions durability periods is necessary to more accurately reflect the current lifetime use period of engines and to ensure excess emissions do not occur over the life of the engines. These durability periods are technologically and economically feasible.

As discussed further in section F of this chapter, the Proposed Amendments add flexibility for manufacturers by allowing them to select a longer emissions durability period than what is specified in § 2403(b)(1). This added flexibility could enable manufacturers to generate emission reduction credits for engines that are designed to have a useful life longer than the 300-, 500-, or 1,000-hour emissions durability periods listed in § 2403(b)(1). The proposed emissions durability periods may not ensure all engines meet the emission standards throughout their life because some engines are used beyond the proposed emissions durability periods. However, the Proposed Amendments will require every engine to meet the longest of the currently applicable emissions durability periods, which will increase the portion of engines that are expected to meet the emission standards throughout their life. The proposed emissions durability periods also can be implemented more quickly than emissions durability periods that exceed the length of the current options. Further testing would be required to determine whether emissions durability periods that exceed the length of the current options are technologically feasible. Implementing the proposed emissions durability periods will help achieve the maximum technologically-feasible emission reductions at the earliest date.

Improved table headings: The change in the table headings for PM emission standards from "Particulate" to "Particulate Matter" is necessary to clarify the existing requirements and does not change the emission standards or their applicability.

§ 2403(b)(2)

Purpose. The current regulations in § 2403(b)(2) establish voluntary, more stringent exhaust HC + NO_x and PM emission standards and other requirements for engines to be designated “Blue Sky Series” engines. The Blue Sky Series emission standards were developed to allow manufacturers to receive recognition for certifying to lower standards, but CARB has no record of any spark-ignition engine family being certified to meet these voluntary emission standards. There are three types of Proposed Amendments to this section:

- The first amends the applicable model years to sunset these voluntary emission standards for engines produced after MY 2023 due to lack of use by manufacturers. Under the current regulations, the voluntary emission standards do not have an end date. The Proposed Amendments add the text, “valid through model year 2023,” to the first sentence of § 2403(b)(2) to specify the Blue Sky Standards will apply only through MY 2023 for consistency with Proposed Amendments to other sections. The Proposed Amendments also replace “and subsequent” with “through 2023” for the applicable model years in the table of voluntary emission standards that follows § 2403(b)(3) to specify the Blue Sky Standards will apply only through MY 2023.
- The second amendment adds the text, “, and amended [insert amended date]” to the references to the below two test procedures cited in § 2403(b)(2)(B), to include the last amended date for each.

California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1054)

California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1065)

- The third amendment changes the heading for PM emission standards from “Particulate” to “Particulate Matter” in the table of voluntary emission standards that follows § 2403(b)(3).

The Proposed Amendments include a placeholder for the amended date, “[insert amended date]”, that will be updated to reflect the CARB adoption date of the Proposed Amendments to these procedures described in sections F and G later in this chapter, and provided in their entirety in Appendices F and G. Per current regulations in § 2403(b)(2)(B), manufacturers of zero-emission small off-road equipment applying for Blue Sky Series designation must file an application of certification and comply with the administrative requirements outlined as applicable in these test procedures. The Proposed Amendments to these procedures do not affect the administrative requirements for the manufacturers applying for Blue Sky Series designation.

Rationale. As described in the prior section of this chapter, beginning with MY 2024, the Proposed Amendments set the exhaust HC + NO_x and PM emission standards for all SORE except generator engines to zero, and set more stringent emission standards for generator engines. The Proposed Amendments set the exhaust emission standards

for generator engines to zero beginning in MY 2028. The Blue Sky Series standards will no longer be lower than the exhaust emission standards once the emission standards of zero become effective. These changes obviate the need to certify any SORE generators to the Blue Sky Series standards beginning in MY 2028, and any other SORE equipment beginning earlier in MY 2024. Staff expects sunseting the Blue Sky Series standards will not have any impacts on manufacturers or individuals because no manufacturer has yet certified any SORE to meet the Blue Sky voluntary emission standards.

The changes to the citations to the two test procedures are necessary to provide consistency given the Proposed Amendments include changes to the procedures. However, the Proposed Changes to the procedures do not affect the requirements for manufacturers applying for Blue Sky Series designation.

The change from “Particulate” to “Particulate Matter” in the PM emission standards column heading in the table of voluntary emission standards is necessary to provide consistency with proposed changes to the exhaust emission standards tables in § 2403(b)(2). The change clarifies the existing requirements and does not change the voluntary emission standards or their applicability.

§ 2403(b)(3)

Purpose. Section 2403(b)(3) currently states: “In lieu of meeting the requirements of subsection 2403(b)(2)(B), manufacturers of zero-emission small off-road equipment may obtain zero-emission equipment credits as detailed in section 2408.1.” In the current regulations, this section appears before the “Voluntary Emission Standards” table. However, this table is referenced by § 2403(b)(2)(B), which precedes § 2403(b)(3), and § 2403(b)(3) does not reference the table. To fix this sequence error, the Proposed Amendments re-locate § 2403(b)(3) text to follow the “Voluntary Emission Standards” table.

Rationale. This change is necessary to correct a table placement error made at the time the current regulations were adopted, which will improve readability and prevent confusion. This change does not affect any requirements for SORE certification and testing.

§ 2403(d)

Purpose. Current regulations in § 2403(d) set forth applicable test procedures for determining compliance with standards for exhaust emissions from new SORE. The Proposed Amendments add the text, “, and amended [insert amended date]” to the references to the below two test procedures cited in § 2403(d), to incorporate the amended date for each.

California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1054)

California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1065)

The Proposed Amendments include a placeholder for the amended date, “[insert amended date]”, that will be updated to reflect the CARB adoption date of the Proposed Amendments to these procedures.

Rationale. This change is necessary to ensure manufacturers follow the most up-to-date testing procedures for SORE. Adding the amendment dates for the test procedures clarifies the versions of the test procedures that must be used. Most proposed updates to the test procedures would further harmonize CARB’s test procedures with Title 40, Code of Federal Regulations, Part 1054 and Part 1065 (“federal Part 1054 and Part 1065”) test procedures and incorporate updates made to federal Part 1054 and Part 1065 since CARB’s test procedures were adopted. Sections F and G later in this chapter describe the purpose and rationale for the Proposed Amendments for Part 1054 and Part 1065, respectively, and Appendices F and G provide the Proposed Amendments in their entirety.

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

§ 2404(c)

Purpose. The current regulations in § 2404 specify requirements for engine or equipment manufacturers to affix a label (or labels) on each production engine (or equipment, as applicable) to provide:

- The engine or equipment owner and service mechanic with information necessary for the proper maintenance of these parts in customer use; and
- The potential consumers with information regarding relative emissions levels.

Section 2404(c) specifies requirements for engine label location, content, and formatting. There are three types of Proposed Amendments to this section:

- **Capitalization.** The Proposed Amendments delete the current requirement in § 2404(c)(3) to use block letters, numerals, and upper case characters, to aid in making the label text accessible to everyone, including people with visual impairments and assistive technology users. Engine label information would continue to be required to be written using sans serif letters. For the same reason, the Proposed Amendments change the capitalization of required label headings and content text specified in § 2404(c)(4)(A), (C), (E), and (H), and § 2404(c)(5)(B), from all upper case to mixed case.
- **Organization name change.** The Proposed Amendments changes the text “the Society of Automotive Engineers” to “SAE” in § 2404(c)(4)(D) to reflect how SAE International (previously known as the Society of Automotive Engineers) now refers to itself and its publications.

- Reference edition update. The Proposed Amendments replaces the text, “: April 30, 2002”, April 2002,” in the reference to SAE J1930 in § 2404(c)(4)(D) with the text, “Revised March 2017, and which is incorporated by reference in this article.” The March 2017 edition of the SAE Recommended Practice document—“Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations and Acronyms - Equivalent to ISO/TR 15031-2”—is the most recent edition of the document and supersedes the April 2002 edition. CARB staff evaluated the differences between the two editions and determined that the 2017 edition does not relax any labelling requirements and therefore is an appropriate replacement for the 2002 edition. CARB staff does not expect any cost impacts or other adverse effects to industry as a result of the proposed reference update to the March 2017 edition.

Rationale. The rationales for the Proposed Amendments to § 2404(c) are as follows:

- The capitalization changes are necessary to make label text easier to read and consistent with current accessibility guidelines. All capital, block lettering is more difficult for many people to read. Using a sans serif font and mixed-case letters is most accessible. Removing the requirement to use block letters and numerals will give manufacturers additional flexibility in creating emission control labels that meet the requirements of § 2404.
- The organization name change is necessary to provide clarity necessary to help ensure the correct document is referenced by manufacturers, given the organization formerly known as the Society of Automotive Engineers is now known as SAE International.
- The reference edition update is necessary to better enable widely-understood label information by incorporating the most recent version of the SAE procedure by reference in the regulations to ensure manufacturers use the most recently updated terms. In addition, industry requested that CARB reference the most recent versions of industry standards documents to prevent potential confusion and the additional cost of maintaining and referencing multiple editions, given manufacturers typically use the most recent editions of standards documents in addition to any earlier editions required by regulations.

§ 2404(l)

Purpose. The current regulations in § 2404(l) specify requirements for the Air Index label content and locations. For engines certified to emission standards subject to an emissions durability period as set forth in § 2403(b) and for engines used to meet the requirements of §2403(c), each engine manufacturer currently must make Air Index and durability period information available to potential consumers. The Air Index for each engine family is determined by a formula provided in § 2404(l)(1). The Air Index equals the Family Emission Level (or emission standard, if averaging is not being used) for the engine multiplied by three (3) and divided by the HC + NO_x emission standard, as applicable in § 2403 (b). Section 2404(l)(2) specifies that the emissions durability

period must be indicated by the actual hours, by the descriptive terms shown in the table provided in that section, or by both. The table has two sections, one for descriptive terms applicable to MYs 2000 through 2004, and the second for descriptive terms applicable to MY 2005 and subsequent model years. The Proposed Amendments change model year applicability for the second table section from model year "2005 and subsequent," to "2005 through 2023," for consistency with other Proposed Amendments.

The Proposed Amendments also include the following changes:

- Correct a typographical error in § 2404(l)(3)(A) by deleting a spurious "the," indicated by strikeout in this sentence: "The Air Index information should be conveyed in the general ~~the~~ form of the following example."
- Change the capitalization of required label content text specified in § 2404(l)(5)(B) from all upper case to mixed case.

Rationale. The rationales for the Proposed Amendments to § 2404(l) are as follows:

- The change to the model year applicability is necessary to provide consistency with the Proposed Amendments to emissions durability periods specified in § 2403(b)(1) for MY 2024 and subsequent model years. The proposed emissions durability periods are the same for all engines within a displacement class. Therefore, using a descriptive term on the emission control label to supplement the number of hours in the emissions durability period will no longer be necessary.
- The change to correct a typographical error is necessary to provide clarity for readers and does not change any of the labeling requirements.
- The capitalization change is necessary to make label text easier to read and consistent with current accessibility guidelines.

§ 2404(m)(1)

Purpose. The current regulations in § 2404(m)(1) specify requirements for zero-emission equipment label content and placement. The Proposed Amendments correct a typographical error by changing a reference from § 2108.1 to § 2408.1 for accuracy. The current regulations reference professional-level specifications for zero-emission SORE indicated in "Table 1, subsection 2108.1(b)(4)(D)," but these specifications are in Table 1 in § 2408.1.

Rationale. This change is necessary to ensure manufacturers are able to reference the correct specifications.

§ 2405. Defects Warranty Requirements for 1995 and Later Small Off-Road Engines

§§ 2405(c)(1) through (c)(3)

Purpose. The current regulations in § 2405(c) specify how the warranty on emissions-related parts will be interpreted. Subsections (1), (2), and (3) all reference “Subsection (d)” regarding the requirement to furnish with each new engine written instructions for the maintenance and use of the engine by the owner. However, their reference text contains a typographical error. Subsection (d) specifies requirements for inclusion of an emission warranty parts list with each new engine, while Subsection (e) specifies the requirement to furnish with each new engine written instructions for the maintenance and use of the engine by the owner. The Proposed Amendments correct the typographical error by changing the reference from Subsection (d) to (e).

Rationale. This change is necessary to provide clarity for readers and does not change any of the warranty requirements.

§ 2405(f)

Purpose. The current regulations in § 2405(f) specify that engine manufacturers must submit the documents required by “Subsection (d)” with their certification applications, and that the documents are required as a condition of certification. Section 2405(d) specifies requirements for manufacturers to include an emission warranty parts list with each new engine. However, § 2405(e) specifies the requirement for manufacturers to include written instructions for the maintenance and use of the engine by the owner with each new engine, and further specifies that the instructions must be consistent with this article and applicable regulations contained herein. To provide consistency with the requirements of § 2405(e), the Proposed Amendments change the “Subsection (d)” references in § 2405(f) to “Subsections (d) and (e)” so that the written instructions that are required to be provided to engine owners are also required to be provided to CARB as a part of the manufacturer’s application for certification.

Rationale. This change is necessary to improve regulatory certainty by correcting an oversight in § 2405(f) that occurred at the time the regulations were adopted. Because § 2405(e) requires that the written instructions be “consistent with this article and applicable regulations contained herein,” CARB must receive a copy of the instructions to verify compliance. Also, § 1054.205(i) requires manufacturers to include

the maintenance and warranty instructions they will give to the ultimate purchaser^{hh} of each new engine.

§ 2405(h)(1)

Purpose. The current regulations in § 2405(h) specify zero-emission equipment warranty requirements. The Proposed Amendments add text as indicated in underline in the following: “The manufacturer of zero emission small off road equipment that wishes to obtain zero emission equipment credits, as described in section 2408.1 or 2408.2, must warrant to the ultimate purchaser, and each subsequent purchaser, that the equipment, including batteries and battery chargers, as applicable, is: ...”

Rationale. This change is necessary to provide consistency with the Proposed Amendments that add a new 2408.2 section to establish a new, generator-specific exhaust emission reduction credit program. The proposed addition of “as described in section 2408.1 or 2408.2” to § 2405(h)(1) informs the reader that one of two exhaust emission reduction credit programs may be applicable.

§ 2405.3. Ordered Recalls

§ 2405.3(a)

Purpose. The current requirements in § 2405.3(a) specify the steps to be taken by a manufacturer and CARB if the Executive Officer determines that a substantial number of any class or category of engines do not conform to the regulations prescribed under §§ 2400 through 2409 when in actual use throughout their durability period. Subsection 2405.3(a)(1)(B) includes provisions that afford the manufacturer and other interested persons an opportunity to present their views and evidence in support thereof at a public hearing pursuant to Title 17, California Code of Regulations, Division 3, Chapter 1, Subchapter 1.25, Article 1. The Proposed Amendments delete this reference and add the following reference: “Chapter 15, Title 13, California Code of Regulations, Section 2771.”

Rationale. This change is necessary to help ensure manufacturers reference the current hearing procedures because Article 1 in Title 17, California Code of Regulations, Division 3, Chapter 1, Subchapter 1.25 has been repealed. The provisions in Title 13 CCR § 2771 and its internal references to the Administrative Hearing Procedures for Petitions for Review of Executive Officer Decisions (Title 17, California Code of Regulations, Division 3, Chapter 1, Article 2, commencing with § 60055.1) provide the current hearing procedures.

^{hh} “Ultimate purchaser” means the first person who in good faith purchases a new small off-road engine or equipment using such an engine for purposes other than resale.

§ 2406. Emission Control System Warranty Statement

§ 2406(a)

Purpose. The current requirements in § 2406(a) specify text to be included in emission control system warranty statements. The Proposed Amendments change the capitalization of required headings from all upper case to mixed case to aid in making the label text accessible to everyone, including people with visual impairments and assistive technology users.

Rationale. This change is necessary to make label text easier to read and consistent with current accessibility guidelines.

§ 2407. New Engine Compliance and Production Line Testing – New Small Off-Road Engine Selection, Evaluation, and Enforcement Action

§ 2407(a)

Purpose. The current regulations in § 2407(a) specify the compliance test procedures for engines and production line test procedures. Currently, engine families can pass compliance testing even if many of the engines tested have emissions that exceed the emission standard for one or more pollutants. The Proposed Amendments include the following changes to improve compliance testing methods, and to increase the pace of compliance testing, which would reduce the number of engines sold in California that exceed the emission standards.

- Current regulations in § 2407(a)(1) specify that the Executive Officer may order an engine manufacturer to make available for compliance testing and/or inspection “a reasonable number of engines”, or have an engine manufacturer compliance test and/or inspect a “a reasonable number of engines” at the engine manufacturer’s facility under the supervision of a CARB Enforcement Officer. The current regulations further specify: “Engines must be selected at random from sources specified by the Executive Officer according to a method approved by the Executive Officer, that, insofar as practical, must exclude engines that would result in an unreasonable disruption of the engine manufacturer’s distribution system.” The Proposed Amendments change the text “a reasonable number of engines” to “one or more engines” to provide consistency with proposed changes to § 2407(a)(9) [renumbered to § 2407(a)(8)], which would allow as few as one engine to be tested.
- The current regulations in § 2407(a)(8) specify that engines must be tested in groups of five until a “Pass” or “Fail” decision is reached, based on the emission test results, the number of engines tested, and an equation and table of threshold values also specified in § 2407(a)(8). The Proposed Amendments remove this entire subsection to provide consistency with proposed changes to § 2407(a)(9) [renumbered to § 2407(a)(8)].

- The current regulations in § 2407(a)(9) specify the Executive Officer is required to make a failing compliance determination based on the use of the equation for the calculation of a quantity “U” and thresholds table currently in § 2407(a)(8), which assess whether the emission test results for the tested engines are similar and exceed an applicable emission standard. For example, if 5 engines subject to an HC + NO_x emission standard of 10 g·kWh⁻¹ were tested and yielded results of 100, 100, 100, 100, and 50 g·kWh⁻¹, respectively, the calculation would give U = 2.17. This would not result in a “Fail” determination. The average emission result for these 5 engines would be 90 g·kWh⁻¹, 9 times the emission standard. Another group of 5 engines would be tested before calculating U again. The Proposed Amendments remove this requirement, as indicated by ~~strikeout~~ and underline in the following sentence in § 2407(a)(9) [renumbered to § 2407(a)(8)], and instead require a failing compliance determination if any engine test result exceeds an applicable emission standard:

“The Executive Officer will find that a group of engines has failed the compliance testing ~~pursuant to the above table~~ if the Executive Officer finds that the ~~average~~ emissions of the any engines within the selected engine family or subgroup exceed the applicable ~~calendar~~ model year new engine emission standard for at least one pollutant.”

- The Proposed Amendments also change “calendar year” to “model year” because, while the historical emission standards were applied by calendar year, the current emission standards are applied by model year.
- The current regulations in § 2407(a)(10) specify that up to 30 engines may need to be tested for the Executive Officer to make a failing compliance determination:

“If no decision can be reached after 20 engines have been tested, the Executive Officer will not make a “Fail” decision for the selected engine family or subgroup on the basis of these 20 tests alone. Under these circumstances the Executive Officer will elect to test 10 additional engines. If the average emissions from the 30 engines tested exceed any one of the exhaust emission standards for which a “Pass” decision has not been previously made, the Executive Officer will render a “Fail” decision.”

For example, if 20 engines subject to an HC + NO_x emission standard of 10 g·kWh⁻¹ were tested, 9 of those engines yielded results of 14 g·kWh⁻¹, one engine yielded a result of 13 g·kWh⁻¹, and the other 10 engines yielded results of 9 g·kWh⁻¹, the calculation would give U = 2.27. This would not result in a “Fail” determination. The average emission result for these 20 engines would be 11.5 g·kWh⁻¹, 15 percent higher than the emission standard. Ten additional engines would be tested, for a total of 30 engines, before making a “Pass” or “Fail” determination. The Proposed Amendments remove this requirement by deleting the entirety of § 2407(a)(10) to provide consistency with the proposed changes to § 2407(a)(9) [renumbered to § 2407(a)(8)].

The Proposed Amendments also include the following changes to improve clarity, to provide consistency with other exhaust emission regulations, and to correct typographical errors:

- The current regulations in § 2407(a)(1) also specify: “A subgroup may be selected for compliance testing only if the Executive Officer has reason to believe that the emissions characteristics of that subgroup are substantially in excess of the emissions of the engine family as a whole.” The Proposed Amendments would remove this requirement to facilitate selection of any engine for testing.
- Section 2407(a)(4) currently specifies: “Engine service accumulation (i.e., break-in) before testing may be performed on test engines to the same extent it is performed on production line testing engines (See subsection (d)). No break in or modifications, adjustments, or special preparation or maintenance will be allowed on engines chosen for compliance testing without the written consent of the Executive Officer.” To provide consistency with this requirement, the Proposed Amendments would make the changes to § 2407(a)(5) indicated by strikeout and underline in this sentence: “If the engine manufacturer elects to specify a different break-in or adjustments, they will ~~may~~ be performed by the engine manufacturer only upon written approval by the Executive Officer and under the supervision of CARB personnel.”
- Section 2407(a)(7) currently specifies that engines must be randomly chosen from the selected engine family or subgroup, and that each chosen engine must be tested according to one of the applicable emission standards and test procedures identified in a list in that section to determine its emissions, depending on the model year. The Proposed Amendments delete the parenthetical phrase from the reference to the first procedure in that list, “California Exhaust Emission Standards and Test Procedures for 1995-2004 Small Off-Road Engines” (~~“Emission Standards and Test Procedures”~~), adopted March 20, 1992, and last amended July 26, 2004.” The purpose of this change is to prevent confusion given that all the procedures referenced in that section have “Emission Standards and Test Procedures” in their titles.
- The Proposed Amendments also add the text, “, and amended [insert amended date]” to the references to the below two test procedures cited in § 2407(a)(7), to include the last amended date for each.

California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1054)

California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1065)
- The Proposed Amendments include a placeholder for the amended date, “[insert amended date]”, that will be updated to reflect the CARB adoption date of the Proposed Amendments to these procedures described in sections F

and G later in this chapter, and provided in their entirety in Appendices F and G.

- Section 2407(a)(7) also specifies: “Procedures must be supplied by the engine manufacturer within seven days after the request for such speciality hardware or personnel. Failure to supply this unique specialty hardware or personnel may not be used by the engine manufacturer as a cause for invalidation of the subsequent tests.” The Proposed Amendments correct a typographical error by replacing “speciality” with “specialty.”
- The Proposed Amendments change the numbering of §§ 2407(a)(9), (11) and (a)(12) to (8), (9), and (a)(10), respectively, to accommodate the proposed removal of §§ 2407(a)(8) and (10) and maintain sequential section numbering.

Rationale. The changes to §§ 2407(a)(1), (8), (9), and (10) are necessary to adequately enforce the exhaust emission standards and achieve emission reductions expected under the exhaust emission standards specified in § 2403. CARB developed the compliance test procedures through a public process that involved manufacturers and other stakeholders and adopted the compliance test procedures in 1990. The engine selection and test date evaluation methods allow for variation in engine emission control performance, such that, depending on how many engines are tested, one or more engines from a given engine family or subgroup may have one or more emitted pollutants exceed applicable emission standard(s) but overall still be considered in compliance so long as the average emissions do not exceed the applicable emission standards. The current regulations specify that CARB must test engines in groups of five and must test up to 30 engines before coming to a determination of noncompliance. As illustrated in one of the examples provided in the purpose of the changes to § 2407(a), five engines could be tested and all fail, with average results many times the emission standard, but not meet the criterion for a “Fail” decision. In the other example, a “Fail” decision could not be made after testing 20 engines with average results 15 percent above the emission standard. These examples demonstrate challenges that can occur when conducting compliance testing. In both cases, noncompliance of the engine family would be evident before a “Fail” decision could be made. It is necessary to prevent excessive testing before making a “Fail” decision for a noncompliant engine family to make enforcement of emission standards more efficient. With the flexibility to test one or more engines, CARB will be able to make a determination whether additional testing is needed before the Executive Officer finds that an engine family has failed compliance testing.

Recent evaporative emission compliance testing shows a low rate of compliance (CARB, 2016b and 2021f; also see section A in Chapter II). Based on the amount of failed compliance tests, there is likely an even greater number of engines that are out of compliance with evaporative emission standards, which increases statewide emissions beyond those contemplated under a regulatory compliance scenario and confounds efforts to achieve emission reductions expected under the 2016 State SIP Strategy. The low compliance rate with evaporative emission standards suggests poor

quality management of production engines. It may also suggest that engines tested for certification are not representative of production engines. A manufacturer would not have an incentive to submit failing compliance test results, because it could not obtain certification with failing results. CARB has no guarantee that certification engines are not specifically prepared or adjusted to ensure passing results. If manufacturer noncompliance with exhaust emission standards is similar to demonstrated noncompliance with evaporative emission standards, excess exhaust emissions are far greater than CARB's current estimates. However, without reducing the current burden of testing up to 30 engines before determining that an engine family is noncompliant, CARB will not be able to increase the pace of testing needed to enforce emission standards and help reduce emissions.

In addition, the amount of failed evaporative emission compliance tests suggests testing so many engines is not necessary to make a determination on compliance. Furthermore, manufacturers are currently required to test only one engine for certification. This one engine is used to demonstrate compliance with the emission standards. The Proposed Amendments would enable CARB to similarly test one engine for compliance. Finally, the current regulations in § 2407(a)(11)(A) provide a process that incorporates additional data evaluation following a CARB determination that an engine family exceeds the emission standards for one or more pollutants: "Prior to revoking or suspending the Executive Order, or seeking to enjoin an engine manufacturer, the Executive Officer will consider production line test results, if any, and any additional test data or other information provided by the engine manufacturers and other interested parties, including the availability of emission reductions credits to remedy the failure." This process would ensure that the Executive Officer's decision regarding suspension or revocation of an Executive Order of Certification would be based on all available emission results and other information for the engine family. These findings indicate the current requirements for the number of engines to test for compliance are overly onerous. To adequately enforce the exhaust emission standards, CARB needs to complete compliance testing in a reasonable timeframe. The proposed changes to § 2407(a) are necessary to increase the pace of compliance testing, better ensuring enforcement of emission standards through more compliance testing, which will help reduce emissions. This is vital to control emissions from SORE in California and protect the health of Californians.

The rationales for the additional Proposed Amendments to §§ 2407(a) are as follows:

- The change to § 2407(a)(1) to remove the requirement that a subgroup be selected for compliance testing only if its emissions characteristics are substantially in excess of the emissions of the engine family as a whole is necessary to provide consistency with other existing regulations and to better ensure excess emissions do not occur. Engine models are grouped into an engine family "based on similar emission characteristics," as described in the definition of "engine family" in § 2401. Section 1054.230 of the "California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small

Off-Road Engines; Engine-Testing Procedures (Part 1054)," describes criteria for selecting engine families. Any engine the Executive Officer selects for compliance testing should represent the emissions characteristics of the engine family. Therefore, it does not matter whether the Executive Officer selects engines from one subgroup of an engine family for compliance testing. Limiting the Executive Officer's discretion in choosing engines for compliance testing would make enforcing the emission standards more difficult. Allowing the Executive Officer to request a subgroup (e.g., a specific engine model) to test without the need for a discussion regarding a "reason to believe that the emissions characteristics of the subgroup are substantially in excess of the emissions of the engine family as a whole" would better enable CARB to enforce the exhaust emission standards and prevent excess emissions.

- The proposed changes to § 2407(a)(5) to require written approval by the Executive Officer is necessary to provide consistency with the requirements stated in § 2407(a)(4) and to prevent confusion for manufacturers. This proposed change would not affect current procedural requirements but instead improves clarity and regulatory certainty. The current requirement in § 2407(a)(4) for the break-in period to match that used for certification testing and production line testing unless otherwise approved by the Executive Officer is necessary to ensure compliance testing results can be compared to the manufacturer's certification and production line testing results. If a manufacturer requires an exception to the standard break-in period requirements or wishes to follow different procedures than those used in certification and production line testing, it must receive written approval by the Executive Officer to ensure such an exception is appropriate. Certification testing, production line testing, and compliance testing are all intended to ensure engines meet emission standards and to produce comparable results. Inappropriate changes to break-in or adjustments could produce emission results that could not be compared to certification test results and would not represent real world emissions. Approval from the Executive Officer for any changes is necessary to prevent an incorrect determination of compliance, which could lead to excess emissions occurring. Providing additional clarity to further help ensure any exceptions or alternative procedures are done only with Executive Officer approval better helps maintain a level playing field amongst manufacturers.
- The removal of the briefer title, "Emission Standards and Test Procedures," as a substitute for the full title, "California Exhaust Emission Standards and Test Procedures for 1995- 2004 Small Off -Road Engines," is necessary to prevent confusion regarding the applicable emission standards and test procedures for each model year. Later model years are subject to different emission standards and test procedures, which also have "Emission Standards and Test Procedures" in their titles. The briefer reference to "Emission Standards and Test Procedures" should be used only to refer to the group of procedures, not to any individual procedure.

- Including the amendment dates for the “California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1054),” and the “California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1065),” is necessary to ensure the amended test procedures are used for compliance testing once they become effective. The most up-to-date test procedures must be followed by all manufacturers of MY 2013 and subsequent model year engines to ensure SORE meet the emission standards. Adding the amendment dates for the test procedures clarifies the versions of the test procedures that must be used. Most proposed updates to the test procedures would further harmonize CARB’s test procedures with the federal Part 1054 and Part 1065 test procedures and incorporate updates made to federal Part 1054 and Part 1065 since CARB’s test procedures were adopted. Sections F and G later in this chapter describe the purpose and rationale for the Proposed Amendments to Part 1054 and Part 1065, respectively, and Appendices F and G provide the Proposed Amendments in their entirety.
- The correction of the typographical error in § 2407(a)(7) by replacing “speciality” with “specialty” is necessary to improve readability and clarity, and does not affect the compliance testing requirements.
- Changing “calendar year” to “model year” in § 2407(a)(9) [renumbered to § 2407(a)(8)] is necessary to provide consistency with the application of current emission standards under § 2403 and prevent confusion for the reader.
- The change in subsection numbering from §§ 2407(a)(9), (11) and (a)(12) to (8), (9), and (a)(10), respectively, is necessary to provide consistent numbering and to prevent confusion for the reader.

All of these Proposed Amendments will help ensure that engines manufactured for sale or lease for use in California comply with the exhaust emission standards and achieve emission reductions expected under the 2016 State SIP Strategy.

§ 2407(b)

Purpose. The current regulations in § 2407(b) specify quality-audit production line test procedures for 1996 and subsequent calendar (model) years. The Proposed Amendments include capitalization and grammar corrections for two subsections:

- The Proposed Amendments correct the capitalization in subsection 2407(b)(3) as indicated by underline and strikeout in the following subsection title text: “(3) Alternate Quality Audit Engine Selection Criteria ~~For The~~ for the 1996 Through 1999 Calendar Years.”
- Subsection 2407(b)(4) specifies the compliance evaluation method and notification requirements. Subsection 2407(b)(4)(B) specifies: “At the end of the quarter, all of the data accumulated during the quarter are evaluated, and the compliance of the engine family with the family emission levels or emission

standards, whichever is applicable, is determined. If a sample size for a particular production quarter is less than ten engines, the data from that quarter must be combined with all of the data from each successive quarter of the calendar year until data from at least ten engines that have been quality audit tested are included in the quarterly evaluation." The Proposed Amendments replace "less than ten engines" with "fewer than ten engines" to correct the grammar.

These changes do not affect any of the product line testing, evaluation, or notification requirements.

Rationale. These changes are necessary to correct capitalization and grammar mistakes and prevent confusion for readers. Common capitalization convention is to not capitalize prepositions and articles, such as "for" and "the," respectively. Common grammar convention is to use the word "fewer" with nouns for countable objects and concepts (discretely quantifiable nouns). Engines are countable objects, so "fewer" is the correct word choice.

§ 2407(c)

Purpose. The current regulations in § 2407(c) specify cumulative sum production line test procedures for MY 2000 and subsequent model years. The Proposed Amendments include five changes in four subsections, § 2407(c)(2)(B)9., § 2407(c)(3)(A)1., § 2407(c)(3)(A)3., and § 2407(c)(4)(A).

- Subsection 2407(c)(2) specifies the engine sample selection method requirements. Subsection 2407(c)(2)(B)9. specifies: "Manufacturers may elect to test additional randomly chosen engines. All additional randomly chosen engines tested in accordance with the testing procedures specified in the Emission Standards and Test Procedures must be included in the Sample Size and Cumulative Sum equation calculations as defined in paragraphs (B)1 and (c)(3)(A)1 of this section, respectively." The Proposed Amendments add the word "applicable" before the "Emission Standards and Test Procedures" text, and add ", as set forth in Subsection 2403(d)" after that text, to remind readers they will need to select the appropriate procedures from multiple options, which are identified in 2403(d).
- Subsection 2407(c)(3) specifies the procedure and equation for the calculation of the cumulative sum statistic. Subsection 2407(c)(3)(A)1. provides the Cumulative Sum Equation and defines its variables. The Proposed Amendments correct a typographical error in the definition of the variable Φ by removing the spurious "is" after the equal sign and correcting the capitalization of "the", indicated by strikeout and underline in this sentence: " Φ ~~= is the~~ The sample standard deviation and is recalculated after each test."
- Subsection 2407(c)(3)(A)3. specifies: "If, at any time during the model year, a manufacturer amends the application for certification for an engine family as specified in Part I, Sections 28 and 29 of the 1995-2004 Emission Standards and

Test Procedures, or Subpart B, §90.120 and §90.122 of the 2005 and Later Emission Standards and Test Procedures, as applicable, by performing an engine family modification (i.e., a change such as a running change involving a physical modification to an engine, a change in specification or setting, the addition of a new configuration, or the use of a different deterioration factor), all previous sample size and Cumulative Sum statistic calculations for the model year will remain unchanged.” To provide applicable test procedures for all model years, the Proposed Amendments change “2005 and Later” in the second reference to “2005-2012”, and add the following text, “Subpart C, section 1054.225 of the “California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1054),” adopted October 25, 2012, and amended [insert amended date].” The Proposed Amendments include a placeholder for the amended date, “[insert amended date]”, that will be updated to reflect the CARB adoption date of the Proposed Amendments to these procedures described in section F later in this chapter, and provided in their entirety in Appendix F. The Proposed Amendments also correct a typographical error by replacing “i.e.” with “e.g.,” given the list provided in the parentheses describes examples of potential engine family modifications.

- Subsection 2407(c)(4)(A) specifies: “Initial test results are calculated following the applicable test procedure specified in “California Exhaust Emission Standards and Test Procedures for 1995-2004 Small Off-Road Engines” or “California Exhaust Emission Standards and Test Procedures for 2005 and Later Small Off-Road Engines,” as applicable.” To provide applicable test procedures for all model years, the Proposed Amendments change “2005 and Later” in the second reference to “2005-2012”, and add the following text, “or the “California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1054),” adopted October 25, 2012, and amended [insert amended date].” The Proposed Amendments include a placeholder for the amended date, “[insert amended date]”, that will be updated to reflect the CARB adoption date of the Proposed Amendments to these procedures described in section F later in this chapter, and provided in their entirety in Appendix F.

Rationale. The rationales for the Proposed Amendments to § 2407(c) are as follows:

- The addition in § 2407(c)(2)(B)9. of the text “applicable” and “, as set forth in Subsection 2403(d)” before and after “Emission Standards and Test Procedures”, respectively, is necessary to provide clarity for manufacturers to help ensure the correct procedures are followed and all required engine tests are included in the sample size and cumulative sum equation calculations. Proper inclusion of all engine tests in calculations will help ensure that manufacturers identify any noncompliance of their engines.

- The change in § 2407(c)(3)(A)1. to correct a typographical error is necessary to provide clarity for readers and does not change the calculation method for the cumulative sum statistic.
- The changes in § 2407(c)(3)(A)3. and § 2407(c)(4)(A) to the references for the test procedures are necessary to update the references and to ensure manufacturers follow the correct procedures for their model year.
- The change in § 2407(c)(3)(A)3. to correct a typographical error is necessary to provide clarity for readers and does not change the effect of providing examples of amendments to an application for certification.

§ 2407(d)

Purpose. The current regulations in § 2407(d) specify the procedures applicable to all production line testing. The Proposed Amendments include changes in three subsections:

- Subsection 2407(d)(1) specifies the applicable emission standards and procedures for testing. The Proposed Amendments add “applicable” before each mention of the “Emission Standards and Test Procedures” throughout this subsection, and add “as set forth in Subsection 2403(d),” after the first mention of “Emission Standards and Test Procedures,” to remind readers they will need to select the appropriate procedures from multiple options, which are identified in 2403(d). This proposed change does not alter current requirements.
- Subsection 2407(d)(2) specifies that CARB “personnel and mobile laboratories must have access to engine or equipment assembly plants, distribution facilities, and test facilities for the purpose of engine selection, testing, and observation. Scheduling of access must be arranged with the designated engine manufacturer’s representative and must not unreasonably disturb normal operations (See Section 31 of the 1995-2004 Emission Standards and Test Procedures or Section 90.126 of the 2005 and Later-Emission Standards and Test Procedures, as applicable).” To provide the most recent access requirements, the Proposed Amendments change “2005 and Later” in the second reference to “2005-2012”, and add the following text, “or section 1054.821 of the “California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1054),” adopted October 25, 2012, and amended [insert amended date].” The Proposed Amendments include a placeholder for the amended date, “[insert amended date]”, that will be updated to reflect the CARB adoption date of the Proposed Amendments to these procedures are described in section F later in this chapter, and provided in their entirety in Appendix F.
- Subsection 2407(d)(3) specifies requirements for engine sample selection, § 2407(d)(3)(A) specifies that selected engines must be representative of the engine manufacturer’s California sales and describes sample selection requirements, and § 2407(d)(3)(B) specifies the type of California sales data required by model year. Subsection 2407(d)(3)(B)2. specifies: “For the 2000 and

later model years, engine manufacturers must provide actual California sales, or other information acceptable to the Executive Officer, including, but not limited to, an estimate based on market analysis and federal production or sales.” The Proposed Amendments add a new requirement: “Information supporting the manufacturer’s market analysis and any other information forming the basis of a manufacturer’s determination of sales must be provided to the Executive Officer within 30 days upon request.”

Rationale. The rationales for the Proposed Amendments to § 2407(d) are as follows:

- The addition in § 2407(d)(1) of the text “applicable” and “, as set forth in Subsection 2403(d)” before and after “Emission Standards and Test Procedures,” respectively, is necessary to provide clarity for manufacturers to help ensure the correct procedures are followed for the model year of each engine. This will help ensure that manufacturers identify any noncompliance of their engines. The changes in § 2407(d)(2) to the references for the access procedures are necessary to update the references and to ensure manufacturers and CARB staff follow the correct procedures.
- Manufacturers must report sales of their engines as part of the production line testing requirements. This helps to ensure the sample size of engines tested meets the requirements of § 2407. Accurate sales reports are also important for purposes of verifying compliance with warranty, emission-related defect reporting, recall, and emission reduction credit requirements. Manufacturers are required by the existing regulations to provide actual California sales or other information acceptable to the Executive Officer, including, but not limited to, an estimate based on market analysis and federal production or sales. The additional requirement in § 2407(d)(3)(A) to provide supporting information to the Executive Officer within 30 days upon request will ensure CARB will receive necessary information in a timely manner to enable staff to verify the basis for a manufacturer’s sales figures. Thirty days is a reasonable amount of time to allow for submission of information. This requirement is not expected to have any cost impact for manufacturers because manufacturers would not be required to create new information. The requirement is merely to provide existing information to the Executive Officer.

§ 2408. Emission Reduction Credits – Certification Averaging, Banking, and Trading Provisions

§ 2408(a) and (b)

Purpose. The current regulations in § 2408(a) describe the applicability of the certification averaging, banking, and trading provisions in § 2408, and § 2408(b) specifies the general provisions. The provisions currently apply to HC + NO_x (or NMHC + NO_x, as applicable) and PM emissions. The Proposed Amendments add CO to the list of pollutants for which the provisions apply.

Rationale. The proposed emission standards in § 2403 include more stringent emission standards for CO for generator engines and all engines with displacement greater than 825 cc. Allowing averaging, banking, and trading of emission reduction credits for CO is necessary to facilitate manufacturers' compliance with the more stringent emission standards. This change will not result in higher overall emissions of CO. It could result in higher emissions of CO from individual engines, but no existing provisions in the regulations require CO emissions to be below the emission standards. (The requirement is that emissions must not exceed the emission standards.) For example, a manufacturer may measure CO emissions of 200 g·kWh⁻¹ in a certification test, but production engines would not be out of compliance unless their emissions exceeded 536 or 549 g·kWh⁻¹. Allowing averaging, banking, and trading of emission reduction credits for CO may also result in manufacturers banking a significant amount of credits for future use. Manufacturers have historically banked HC + NO_x credits, as discussed in section A.3 of Chapter III of this Staff Report, because they have not used all of the credits they generate in a given model year for averaging or trading. Manufacturers may choose to do the same with CO credits. Banking credits can be used as a strategy to facilitate manufacturers' compliance with more stringent emission standards that may be adopted at a future date. As a result, manufacturers may bank more credits than they need for their engine families and more credits than the market demands for trading. In such a case, credit may expire before they are used for averaging or trading. This would result in lower CO emissions from engines on average. The changes to § 2408(b)(6) in the Proposed Amendments would also prohibit any manufacturer from setting an FEL above the current emission standards to prevent any engine from having higher CO emissions than it does currently.

Under the Proposed Amendments, if manufacturers choose to utilize the proposed ABT program for CO, they would be required to demonstrate compliance under the averaging, banking, and trading provisions consistent with current requirements for the other pollutants. This requirement is necessary for CARB to be able to verify compliance with program requirements, which is necessary to prevent potential inappropriate generation and subsequent use of credits that could lead to excess emissions. CARB staff expects any potential reporting costs would be negligible and would have no impact on costs to consumers because manufacturers would not be required to create new information. Manufacturers are already required to maintain and submit sales reports under current regulations for purposes of verifying compliance with production line testing, warranty, emission related defect reporting, recall, and emission reduction credit requirements.

§ 2408(b)(5)

Purpose. Both exhaust and evaporative emission regulations currently include provisions for averaging, banking, and trading programs, also called emission reduction credit programs. The emission reduction credit programs allow manufacturers to generate credits when they produce SORE that emit at levels lower

than the current emission standards. These credits may be used to produce SORE that emit at higher levels, banked for future years, or traded with other manufacturers. Section 2408 provides the requirements for manufacturers' participation in the voluntary certification averaging, banking, and trading program for SORE produced in MY 2000 and subsequent model years.

The current regulations in § 2408(b)(5) specify: "A manufacturer may certify engine families at Family Emission Limits (FELs) above or below the applicable emission standard subject to the limitation in paragraph (6) of this section, provided the summation of the manufacturer's projected balance of credits from all credit transactions for each engine class in a given model year is greater than or equal to zero, as determined under paragraph (f)." The phrase "for each engine class" in the regulations specifies that all exhaust emission credits must be used within the same engine class in which they are generated. The Proposed Amendments remove this requirement by deleting the phrase, "for each engine class," in order to provide additional flexibility for credit usage. In a given model year, the balance of credits from all credit transactions must be greater or equal to zero across all engine classes. Allowing credit calculations across all engine classes increases flexibility for manufacturers. This proposed change would not impact overall emission reduction benefits (i.e., it would not result in excess emissions) because the proposed change does not alter the current requirement that credit balances be greater than or equal to zero.

Rationale. This change is necessary to incentivize the manufacture of low-emission engines and ZEE. The ability to use exhaust emission credits across all engine classes will provide manufacturers more flexibility in planning engine sales to meet California market demand, without increasing overall emissions from SORE equipment. The total emissions from credit usage would remain the same, but manufacturers would be able to use the credits generated by one engine class for engines in other classes without the requirement to maintain a balance of credits that is greater than or equal to zero in each engine class. This flexibility would facilitate compliance with the averaging, banking, and trading provisions when the emission standards are zero for most SORE equipment and more stringent for generator engines for MY 2024. Historically, the exhaust emission standards for SORE have allowed for relatively high-emitting engines to be introduced into California commerce. Requiring the balance of credits from all credit transactions for each engine class in a given model year to be greater than or equal to zero has been important to ensure that emission reductions of one class of engine do not result in overall higher emissions of engines in other classes. For example, if Class I walk-behind lawn mower engines had emissions below the emission standards and the credits generated by those engines were used to offset higher emissions from Class IV string trimmer engines, consumers might be unable to find low-emitting string trimmers. Such potential problems would be mitigated under the Proposed Amendments by the wide availability of ZEE, the reduction in the maximum FELs in § 2408(b)(6), and the implementation of more stringent emission standards. The more stringent emission standards in the Proposed Amendments would reduce

the possibility of extremely high-emitting engines being introduced into California commerce. The proposed emission standards also may result in manufacturers deciding to phase out high-emitting models or entire classes of engines if it is less profitable to produce such engines than to produce different models or classes of engines. For example, a manufacturer could determine that using credits to offset emissions from a high-emitting handheld engine that would be installed in a low-cost piece of equipment (e.g., a string trimmer with a retail price of \$70) would be less profitable than using those credits to offset emissions from an engine that would be installed in a riding lawn mower with a retail price of \$15,000.

§ 2408(b)(6)

Purpose. Section § 2408(b)(6) specifies that no engine family may have a family emission level (FEL) that is greater than the HC + NO_x emission levels in the table provided in this subsection. The table lists the maximum FELs for HC + NO_x for each displacement category of engines by model year. As defined by § 2401(a)(24), "Family emission level" or "FEL" means an emission level that is declared by the manufacturer to serve for the averaging, banking, and trading program and in lieu of an emission standard for certification. The Proposed Amendments would establish new maximum HC + NO_x and CO emission levels for all SORE equipment beginning with MY 2024 by making these changes:

- For the emission levels applied to model year ranges that do not have an end date (e.g., "2005 and subsequent"), the Proposed Amendments replace the "and subsequent" text with "through 2023" to limit the applicability of all current emission levels to model years through 2023.
- The Proposed Amendments expand the current table to apply new, more stringent maximum emission levels for HC + NO_x and add maximum CO emission levels for MY 2024 and subsequent model years. The Proposed Amendments set maximum FELs that are approximately 40 to 90 percent more stringent than current maximum FELs for HC + NO_x, depending on the engine displacement category. The maximum FELs for HC + NO_x and CO are equal to the applicable current emission standards for each pollutant and displacement category.

Rationale. Establishing more stringent FELs is necessary to accelerate exhaust emission reductions in order to achieve the necessary SORE emission reductions by 2031 as expected under the 2016 State SIP Strategy. The new maximum FELs in the Proposed Amendments are equal to the current exhaust emission standards for HC + NO_x and CO. These new, more stringent maximum FELs for HC + NO_x would ensure that no MY 2024 or subsequent model year engines are introduced for sale or lease for use in California with excessive exhaust emissions, while still allowing manufacturers flexibility to use the credits they have generated to sell engines with emissions above the proposed, more stringent emission standards in § 2403(b) in the Proposed Amendments. The new maximum CO emission levels would ensure that no MY 2024 or subsequent model year engine introduced into California commerce has emissions

higher than the current applicable CO emission standard. Engines that are currently certified to FELs higher than the current emission standards could not be certified for introduction into California commerce for MY 2024 or subsequent model years unless their emissions were reduced. This will ensure the highest-emitting engines, which have the greatest impact on air quality and expose operators to the greatest amounts of pollutants, are phased out as soon as possible.

§ 2408(f)

Purpose. The current regulations in § 2408(f) specify the requirements for credit calculation and manufacturer compliance with emission standards.

Subsection 2408(f)(1) specifies the equation for calculation of credits for HC + NO_x and PM. The Proposed Amendments add CO to the list of pollutants for which credits may be calculated.

Rationale. This change is necessary to provide clarity for manufacturers and to provide consistency with the addition of CO to the list of pollutants for which the provisions of § 2408 apply. Any manufacturer who elects to participate in the averaging, banking, and trading program must do so in compliance with the regulations set forth in § 2408, including calculating credits.

§ 2408(g)(1)(B)

Purpose. The current regulations in § 2408(g) specify the requirements for certification using credits. The current provision in § 2408(g)(1)(B) specifies: "Declare an FEL for each engine family for HC+NO_x (NMHC+NO_x) and Particulate Matter, if applicable." The Proposed Amendments add CO to the list of pollutants for which a manufacturer must declare an FEL.

Rationale. This change is necessary to provide clarity for manufacturers and to provide consistency with the addition of CO to the list of pollutants for which the provisions of § 2408 apply. Any manufacturer who elects to participate in the averaging, banking, and trading program must do so in compliance with the regulations set forth in § 2408, including declaring an FEL for CO.

§ 2408(g)(1)(E)

Purpose. The current regulations in § 2408(g) specify the requirements for certification using credits. The current provision in § 2408(g)(1)(E) specifies: "Zero emission equipment credits can be used to compensate for negative certification emission credits, up to forty percent above the standard. If an engine family has emissions higher than forty percent above the standards, certification emission credits can be used to account for the remaining emission deficit." The Proposed Amendments change "Zero emission" to "Zero-emission" and delete the text that limits the usage of zero-emission equipment credits to 40 percent to instead allow 100 percent of excess emissions from an engine to be offset by zero-emission equipment credits.

Rationale. The change to “Zero-emission” is necessary to provide consistent terminology. The compound adjective “zero-emission” is used extensively in the regulations when referring to zero-emission equipment. The change to the limit on use of zero-emission equipment credits is necessary to further incentivize the manufacture of ZEE during the time before emission standards of zero go into effect. The Proposed Amendments would encourage the increased manufacture of zero-emission equipment by allowing manufacturers to offset all excess emissions above the emission standards, up to the maximum FEL, with zero-emission equipment credits. In particular, this would encourage more manufacturers to produce professional-grade ZEE, which would grow the market even further and help accelerate the adoption of ZEE by professional users. For example, the fraction of small off-road equipment that is ZEE is 6 percent for professional landscapers compared to 55 percent for residential users (CARB, 2020). This change is needed to achieve emission reductions to ensure that California attains its air quality standards as soon as possible. Only professional-level ZEE may generate credits under the provisions of § 2408.1. An increase in the number of ZEE engine families being certified to the requirements of § 2408.1 will increase credit generation, provide flexibility for manufacturers and help to further develop the market for professional-level ZEE.

§ 2408(h)(5)

Purpose. The current regulations in § 2408(h) describe requirements for records maintenance. Subsection 2408(h)(5) specifies: “Pursuant to a request made by the Executive Officer, the manufacturer must submit to the Executive Officer the information that the manufacturer is required to retain.” The Proposed Amendments add the text “within 30 days” before “the information” to specify that the manufacturer must submit the information within 30 days of the Executive Officer’s request.

Rationale. This change is necessary to correct an oversight in § 2408(h)(5) that occurred at the time the regulations were adopted. The regulations should have included a deadline for information submission to ensure CARB will receive necessary information in a timely manner to enable staff to verify credit calculations. This change clarifies timing for a manufacturer to submit information pursuant to a request made by the Executive Officer. This change is consistent with a comparable requirement in the current SORE regulations for the evaporative emission reduction credit program, which specifies 30 days as the time within which a manufacturer must submit information to the Executive Officer upon request. This requirement is in § 2754.1(g)(4) (updated to 2754.1(h)(5) in the Proposed Amendments). Thirty days is a reasonable amount of time for a manufacturer to provide records it is required to retain.

§ 2408(i)(1)

Purpose. The current regulations in § 2408(i) specify requirements for end-of-year and final reports. Subsection 2408(i)(1) specifies: “The report must include a calculation of

credit balances to show that the credit summation for each class of engines is equal to or greater than zero (or less than zero in cases of negative credit balances as permitted in paragraph (f)(3).” The Proposed Amendments remove the text “for each class of engines” so that manufacturers would no longer be required to provide credit summations by engine class, consistent with the Proposed Amendments to remove similar language from § 2408(b)(5), and to remove §§ 2408.1(c)(3), (c)(4), and (g)(1)(C), to allow manufacturers additional flexibility for credit usage. This proposed change would not impact emission reduction benefits (i.e., it would not result in excess emissions) because the proposed change does not alter the current requirement that credit balances be equal to or greater than zero. The Proposed Amendments also add “)” at the end of the sentence to close the parenthetical phrase, “(or less than zero in cases of negative credit balances as permitted in paragraph (f)(3).”

Rationale. The first change is necessary to incentivize the manufacture of a wider range of ZEE in all equipment categories for professional users. The flexibility to use exhaust emission credits across all engine classes will allow manufacturers more flexibility in planning engine sales to meet California market demand, without increasing overall emissions from SORE equipment. The total emissions from credit usage would remain the same, but manufacturers would be able to use the credits generated by one engine class for engines in other classes without the requirement to maintain a balance of credits that is greater than or equal to zero in each engine class. This flexibility would facilitate compliance with the averaging, banking, and trading provisions when the emission standards are zero for most SORE and more stringent for generator engines for MY 2024.

The second change is necessary to correct a typographical error where a parenthesis was accidentally not included.

§ 2408(i)(2)

Purpose. The current regulations in § 2408(i) describe requirements for participants in the credit program for end-of-year and final reports. The current regulations in § 2408(i)(2) specify: “The calculation of eligible sales (as defined in section 2401) for end-of-year and final reports must be based on the location of the point of first retail sale (for example, retail customer or dealer) also called the final product purchase location.” The definition of “point of first retail sale” in § 2401(a) is “the point that the engine is first sold directly to the ultimate purchaser.” The current text of § 2408(i)(2) provides “retail customer or dealer” as examples of “the location of the point of first retail sale,” which is incorrect per the adopted definition in § 2401(a). The Proposed Amendments remove this example text to provide consistency with the definitions and calculation methods in § 2401(a).

Rationale. This change corrects a mistake made in the regulations at the time of their adoption, which is necessary to provide consistency with the existing requirement to calculate eligible sales based on the location of the point of first retail sale. The terms “sales,” “point of first retail sale,” and “ultimate purchaser” are defined in § 2401,

enabling manufacturers to accurately calculate sales in compliance with the requirements of this section. The examples provided in this subsection did not add clarity. Removing them will ensure the term “point of first retail sale” will be interpreted as defined in § 2401.

§ 2408(i)(6)

Purpose. This subsection provides that errors discovered by either CARB or the manufacturer in the end-of-year report, including errors in credit calculation, may be corrected in the final report. The Proposed Amendments change “may” to “must” to require that any errors in credit calculations that are discovered by either CARB or by the manufacturer must be corrected in the final report.

Rationale. This change is necessary to correct a mistake made when the credit program requirements were adopted. This correction is necessary to ensure correct records maintenance and reporting, which in turn is necessary to ensure no excess emissions result from implementation of the credit program.

§ 2408.1. Emission Reduction Credits – Zero-Emission Equipment Credits Averaging, Banking, and Trading Provisions

§ 2408.1(b)(4)

Purpose. The current regulations in § 2408.1 identify zero-emission equipment credits averaging, banking, and trading provisions specific to small off-road equipment produced in the 2010 and later model years. Subsection 2408.1(b)(4) specifies that a manufacturer of zero-emission small off-road equipment that wishes to generate zero emission equipment credits must certify zero-emission equipment engine families at FELs of zero grams per kilowatt-hour. The Proposed Amendments include changes to § 2408.1(b)(4) and two of its subsections:

- The Proposed Amendments change “zero emission equipment credits” to “zero-emission equipment credits” because “zero-emission equipment credits” is used throughout the regulations.
- Subsection 2408.1(b)(4)(D) specifies the minimum professional-level requirements for zero-emission small off-road equipment, and § 2408.1(b)(4)(D)1. requires an engine family certified as a zero-emission equipment engine family to be able to operate continuously, allowing for any battery exchanges, for a minimum of one hour and meet the minimum specifications indicated in Table 1 in that section. The title of Table 1 is “Minimum Professional Level Requirements for Zero-Emission Equipment Eligibility.” Table 1 includes, as applicable, durability test power load, minimum supplied battery capacity, minimum cutter speed and other performance requirements or parameters for each equipment type. The Proposed Amendments correct a typographical error by replacing “For” with “for” in the table title, and remove the minimum cutter speed of 6,500 revolutions per minute for edgers and for split boom systems.

- Subsection 2408.1(b)(4)(H) contains two requirements: “1. Batteries in an equipment manufacturer’s original standard battery package must be identified with unique part numbers that differ from the part numbers of any applicable replacement batteries” and “2. Replacement batteries cannot be used to generate zero-emission equipment credits.” The Proposed Amendments remove the first requirement entirely so that there is no longer a requirement to differentiate between batteries sold with the equipment and replacement batteries by different part numbers. The Proposed Amendments also remove “2.” from the second requirement because under the Proposed Amendments, there would be only one requirement in this subsection and no longer a need for the numbering.

Rationale. The rationales for the Proposed Amendments to § 2408.1(b)(4) are as follows:

- The change to “zero-emission equipment credits” is necessary to provide consistent terminology. The compound adjective “zero-emission” is used extensively in the regulations when referring to zero-emission equipment or zero-emission equipment credits.
- The correction in § 2408.1(b)(4)(D)1. of the typographical error in the Table 1 title is necessary to improve readability. The removal of the minimum cutter speed of 6,500 revolutions per minute for edgers and for split boom systems in Table 1 is necessary for Table 1 requirements to better represent the actual requirements for performing tasks with professional-level equipment, and to enable equipment that performs at the required level to qualify for zero-emission equipment credits. Removal of the minimum cutter speed would help further incentivize ZEE production and increase the rate of ZEE adoption. Electric equipment often generates more torque than gasoline-powered equipment with comparable power. Although edgers and split boom systems that use SORE may need a cutter speed of 6,500 revolutions per minute to prevent the engine from stalling when cutting through thick grass, such high cutter speed is not needed for electric equipment. Therefore, the cutter speed requirement is not as important for electric equipment. Manufacturers have informed CARB staff that the speed requirement does not represent the true requirements for performing tasks with professional-level equipment. Additionally, CARB staff received feedback from users of zero-emission edgers and split boom systems that the equipment performs at the required level although it does not qualify for zero-emission equipment credits.
- The change to § 2408.1(b)(4)(H) is necessary to remove an impediment to implementing a portion of the exhaust emission reduction credit program, which is necessary to further encourage participation in the ZEE credit program and encourage increased manufacturing of ZEE. Most professional-grade ZEE is sold a la carte (i.e., the tool, batteries, and chargers are sold separately). Differentiating between batteries that are sold as part of an equipment manufacturer’s original standard battery package and replacement batteries

represents a challenge for manufacturers. Manufacturers and retailers would be required to produce and stock uniquely labeled batteries for original purchase and replacement, even though those batteries would be the same product. Manufacturers have expressed that this would be infeasible for them. The proposed change would encourage and support additional participation in the ZEE credit program.

§ 2408.1(c)

Purpose. The current regulations in § 2408.1(c) specify four provisions for averaging:

“(1) Fifty percent of negative credits from engine families with FELs above the applicable emission standard may be offset by positive zero-emission equipment credits, as allowed under the provisions of section 2408.1. The remaining negative credits must be offset by positive certification emission credits. Averaging of credits in this manner is used to determine compliance under subsection 2408(f)(2).

(2) Subject to the limitations above, zero-emission equipment credits used in averaging for a given model year may be obtained from zero-emission equipment credits banked in previous model years, or zero-emission equipment credits of previous model years obtained through trading.

(3) Zero-emission equipment credits generated from zero-emission small off-road equipment that performs equivalently to professional-level spark-ignition engine powered equipment, with a displacement of 80cc or less, may only be used to offset emissions from other gasoline-powered equipment with a displacement of 80cc or less.

(4) Zero-emission equipment credits generated from zero-emission small off-road equipment that performs equivalently to spark-ignition engine powered equipment, with a displacement between 80cc and 225cc, may only be used to offset emissions from other gasoline-powered equipment with a displacement between 80cc and 225cc.”

In § 2408.1(c)(1), the Proposed Amendments change the text “Fifty percent” to “One hundred percent” in the first sentence, and delete the entire second sentence, so that 100 percent of negative credits from engine families with FELs above the applicable emission standard may be offset by zero-emission equipment credits. In addition, the Proposed Amendments remove subsections (c)(3) and (c)(4) to allow manufacturers to utilize zero-emission equipment credits to offset emissions from SORE of any engine displacement.

Rationale. The changes to § 2408.1(c)(1) are necessary to increase flexibility for manufacturers, which is necessary to further incentivize the manufacture of ZEE. The Proposed Amendments remove an existing limit for how much of the negative credits from engine families with FELs above the applicable emission standard may be offset by positive zero-emission equipment credits. In particular, this will encourage more

manufacturers to produce professional-grade ZEE, further developing the market and giving professional users more ZEE options. For example, the fraction of small off-road equipment that is ZEE is 6 percent for professional landscapers compared to 55 percent for residential users (CARB, 2020). This change is needed to help accelerate the adoption of ZEE in place of SORE equipment by professional users, such as professional landscapers, to achieve emission reductions and ensure that California attains its air quality standards as soon as possible. Only professional-level ZEE may generate credits under the provisions of § 2408.1. An increase in the number of ZEE engine families being certified to the requirements of § 2408.1 will increase credit generation, providing flexibility for manufacturers and helping to further develop the market for professional-level ZEE.

The removal of subsections (c)(3) and (c)(4) is necessary to further incentivize the manufacture of more ZEE options in all equipment categories for professional users. The flexibility to use exhaust emission credits across displacement categories will allow manufacturers more flexibility in planning engine sales to meet California market demand, without increasing overall emissions from SORE equipment. The total emissions from credit usage would remain the same, but manufacturers would be able to use the credits generated by one engine displacement category for engines in other displacement categories. This flexibility would facilitate compliance with the averaging, banking, and trading provisions when the emission standards are zero for most SORE and more stringent for generator engines for MY 2024. These changes are similar to those in § 2408(b)(5), and the rationale for the changes is also similar.

§ 2408.1(g)(1)

Purpose. The current regulations in § 2408.1(g) specify the requirements for certification using zero-emission equipment credits. The current provision in § 2408.1(g)(1)(C) specifies that, in the application for certification, a manufacturer using zero-emission equipment credits must: “Indicate that the zero-emission equipment credits used came from the same displacement category as those needed for the engine family.” The Proposed Amendments remove subsection (g)(1)(C) to provide consistency with the Proposed Amendments to § 2408.1(c) that would allow manufacturers to utilize zero-emission equipment credits to offset emissions from SORE of any engine displacement. The Proposed Amendments also change the subsection letters for subsequent subsections from (D) and (E) to (C) and (D), respectively, to accommodate the removal of subsection (C) and maintain sequential section lettering.

Rationale. The removal of the requirement specified by § 2408.1(g)(1)(C) is necessary to provide consistency with Proposed Amendments to § 2408.1(c), which are necessary to further incentivize the manufacture of ZEE before emission standards of zero go into effect. The rationale for the proposed removal of § 2408.1(g)(1)(C) is the same as the rationale for the Proposed Amendments to remove §§ 2408.1(c)(3) and (4) described above in the prior section of this chapter. The change in subsection

lettering from (D) and (E) to (C) and (D), respectively, is necessary to provide consistent lettering and to prevent confusion for the reader.

§ 2408.1(g)(2)

Purpose. The current regulations in §2408.1(g)(2) specify: “The manufacturer of zero-emission small off-road equipment may supply the information required in subsections 2408.1(g)(1)(C), 2408.1(g)(1)(D), and 2408.1(g)(1)(E), by use of an electronic spreadsheet detailing the manufacturer's annual production plans, and the zero-emission equipment credits generated by each zero-emission equipment engine family.” The Proposed Amendments add the text “2408.1(g)(1)(B),” before “2408.1(g)(1)(C)” to specify that the information required by § 2408.1(g)(1)(B) also may be supplied by use of an electronic spreadsheet. The Proposed Amendments also remove the reference to § 2408.1(g)(1)(E) to provide consistency with the proposed removal of § 2408.1(g)(1)(C) and proposed re-lettering of the subsections following § 2408.1(g)(1)(C).

Rationale. The addition of the reference to § 2408.1(g)(1)(B) is necessary to correct an oversight in §2408.1(g)(2) that occurred at the time the regulations were adopted. A reference to § 2408.1(g)(1)(B) should have been included because § 2408.1(g)(1)(B) is projected sales volume, which is important in the calculation of total credits and may be easier to submit by use of an electronic spreadsheet. Removing the reference to § 2408.1(g)(1)(E) is necessary to update the references to reflect the proposed changes to § 2408.1(g)(1) and prevent confusion for the reader. These changes allow for the use of a spreadsheet to supply similar information to that listed in § 2408(g)(2), which includes information from three subsections of § 2408(g)(1).

§ 2408.1(h)(5)

Purpose. The current regulations in § 2408.1(h) describe requirements for records maintenance. Subsection 2408.1(h)(5) specifies: “Pursuant to a request made by the Executive Officer, the manufacturer must submit to the Executive Officer the information that the manufacturer is required to retain.” The Proposed Amendments add the text “within 30 days” before “the information” to specify that the manufacturer must submit the information within 30 days of the Executive Officer’s request.

Rationale. This change is necessary to correct an oversight in § 2408.1(h)(5) that occurred at the time the regulations were adopted. The regulations should have included a deadline for information submission to ensure CARB will receive necessary information in a timely manner to enable staff to verify credit calculations. This change clarifies timing for a manufacturer to submit information pursuant to a request made by the Executive Officer. This change is consistent with a comparable requirement in the current SORE regulations for the evaporative emission reduction credit program, which specifies 30 days as the time within which a manufacturer must submit information to the Executive Officer upon request. This requirement is in

§ 2754.1(g)(4) (updated to 2754.1(h)(5) in the Proposed Amendments). Thirty days is a reasonable amount of time for a manufacturer to provide records it is required to retain.

§ 2408.1(i)(1)

Purpose. The current regulations in § 2408.1(i) specify requirements for end-of-year and final reports. Subsection 2408.1(i)(1) specifies: “The report must include a calculation of zero-emission equipment credit balances to show that the zero-emission equipment credit summation for each class of engines is equal to or greater than zero.” The Proposed Amendments remove the text “for each class of engines” so that manufacturers would no longer be required to provide credit summations by engine class, consistent with the Proposed Amendments to remove the same language from § 2408(b)(5), and to remove §§ 2408.1(c)(3), (c)(4), and (g)(1)(C), to allow manufacturers additional flexibility for credit usage. This proposed change would not impact emission reduction benefits (i.e., would not result in excess emissions) because the proposed change does not alter the current requirement that credit balances be equal to or greater than zero.

Rationale. This change is necessary to incentivize the manufacture of a wider range of ZEE in all equipment categories for professional users. The flexibility to use exhaust emission credits across all engine classes will allow manufacturers more flexibility in planning engine sales to meet California market demand, without increasing overall emissions from SORE equipment. The total emissions from credit usage would remain the same, but manufacturers would be able to use the credits generated by one engine class for engines in other classes without the requirement to maintain a balance of credits that is greater than or equal to zero in each engine class. This flexibility would facilitate compliance with the averaging, banking, and trading provisions when the emission standards are zero for most SORE and more stringent for generator engines for MY 2024.

§ 2408.1(i)(2)

Purpose. The current regulations in § 2408.1(i)(2) specify: “The calculation of eligible sales, as defined in section 2401, for end-of-year and final reports, must be based on the location of the point of first retail sale (for example, retail customer or dealer), which is also called the final product purchase location.” The definition of “point of first retail sale” in § 2401(a) is “the point that the engine is first sold directly to the ultimate purchaser.” The current text of § 2408.1(i)(2) provides “retail customer or dealer” as examples of “the location of the point of first retail sale,” which is incorrect per the adopted definition in § 2401(a). The Proposed Amendments remove this example text to provide consistency with the definitions and calculation methods in § 2401(a).

Rationale. This change corrects a mistake made in the regulations at the time of their adoption, which is necessary to provide consistency with the existing requirement to

calculate eligible sales based on the location of the point of first retail sale. The terms “sales,” “point of first retail sale,” and “ultimate purchaser” are defined in § 2401, enabling manufacturers to accurately calculate sales in compliance with the requirements of this section. The examples provided in this subsection did not add clarity. Removing them will ensure the term “point of first retail sale” will be interpreted as defined in § 2401.

§ 2408.1(i)(5)

Purpose. This subsection provides that errors discovered by either CARB or the manufacturer in the end-of-year report, including errors in zero-emission equipment credit calculation, may be corrected in the final report. The Proposed Amendments change “may” to “must” to require that any errors in credit calculations that are discovered by either CARB or by the manufacturer must be corrected in the final report.

Rationale. This change is necessary to correct a mistake made when the credit program requirements were adopted. This correction is necessary to ensure correct records maintenance and reporting, which in turn is necessary to ensure no excess emissions result from implementation of the credit program.

§ 2408.2. Emission Reduction Credits – Zero-Emission Generator Credits Averaging, Banking, and Trading Provisions

Purpose. The Proposed Amendments add a new 2408.2 section to establish a new, generator-specific exhaust emission reduction credit program. This voluntary program would allow manufacturers to offset emissions from generators with emission levels above the proposed exhaust emission standards by using credits earned by zero-emission generators. All SORE, including generator engines, may be included in engine families participating in the certification averaging, banking, and trading program described in § 2408. Zero-emission generators, however, are not among the equipment types included in the zero-emission equipment credits averaging, banking, and trading program described in § 2408.1. The program in § 2408.1 prioritized lawn and garden equipment because professional landscapers use such equipment extensively. The emission inventory calculated with SORE2020 indicates that generators produce the highest statewide emissions of any small off-road equipment type. In 2020, generators accounted for approximately 14 percent of the total population of SORE equipment, and 19 percent of all ROG and NO_x emissions from SORE (CARB, 2020). Generators also operate somewhat differently from other equipment types. Because their function is to provide electrical power rather than perform mechanical work (as lawn and garden equipment does), zero-emission generators often do not contain an electric motor. Instead, zero-emission generators often convert chemical energy to electrical energy without the use of an electric motor. This makes incorporation of zero-emission generators into the same zero-emission equipment credits averaging, banking, and trading provisions as lawn and garden equipment less straightforward.

The Proposed Amendments add a new and separate program for zero-emission generators for simplicity. The program is tiered, granting more emission reduction credits for zero-emission generators with greater energy storage and power delivery than for those with less energy storage and power delivery. The purpose of the tier system is to provide the greatest credit benefits to manufacturers who develop zero-emission generators in the least developed sector of the market (i.e., zero-emission generators with the greatest energy storage and highest power output). The proposed zero-emission generator credits would be subject to similar provisions to those in the existing emission reduction credit programs, including a five-year limit on banking credits.

Rationale. This change is necessary to incentivize manufacturers to increase development and production of zero-emission generators, particularly zero-emission generators with the greatest energy storage and highest power output. Currently, the availability of zero-emission generators is limited and their price is often more than that of a comparable SORE generator. This credit program aims to decrease the price of zero-emission generators while allowing increased flexibility for manufacturers of SORE generators as more models of zero-emission generators enter the market.

§ 2408.2(a)

Purpose. The Proposed Amendments define the applicability of the zero-emission generator credit program. The Proposed Amendments specify the program requirements are applicable to all zero-emission generators as defined in § 2401 produced in MYs 2022 through 2026. The Proposed Amendments establish that participation is voluntary, but if a manufacturer elects to participate, it must follow all provisions set forth in § 2408.2. In addition, the Proposed Amendments limit the provisions of this section 2408.2 to HC + NO_x (or NMHC + NO_x, as applicable) emissions.

Rationale. This section is necessary to define which manufacturers are eligible to participate in the program to prevent confusion. Including a reference to the newly proposed definition of zero-emission generator provided by the Proposed Amendments in § 2401, rather than restating the definition, prevents unnecessary redundancy in the regulations. Like the existing credit programs, the proposed generator-specific program is voluntary; nonetheless, to prevent confusion, the Proposed Amendments explicitly state that while the program is voluntary, there are still requirements for participation. The Proposed Amendments limit the provisions of this § 2408.2 to HC + NO_x (or NM HC + NO_x, as applicable) emissions, which are also included in the existing credit programs. CO and PM emissions are not included in the proposed zero-emission generator credit program. Unlike existing credit programs, the Proposed Amendments specify that the generator-specific program is limited to zero-emission generators in MYs 2022 through 2026. This model year constraint is intended to incentivize manufacturers to accelerate their development and production of zero-emission generators. Manufacturers who certify zero-emission generators for

MY 2022 will be able to begin generating credits as early as possible and for the maximum amount of time. Their early action could accelerate the market by offering consumers more zero-emission generator choices as soon as possible. Manufacturers may receive additional benefits from the use or trading of credits earned from their early action. There may be significant demand for credits earned in MY 2022 and 2023 to offset emissions from MY 2024 and subsequent model year SORE generators. Ending generation of zero-emission generator credits at the end of MY 2026 will limit the total time that banked zero-emission generator credits may be used to offset emissions of SORE generators.

Under the Proposed Amendments, the exhaust and evaporative emission standards for all generators will be zero for MY 2028 and subsequent model years. However, zero-emission generator credits earned in MY 2026 could be used to offset emissions from generator engines through MY 2031. Such a timeline could provide both public health benefits and economic benefits for manufacturers. Manufacturers could generate credits for MY 2022-2026 zero-emission generators to offset emissions from MY 2022-2031 SORE generators. Generation of additional emission reduction credits would lessen the cost impacts for manufacturers (and those purchasing equipment), especially during the early years of a developing generator market. The implementation of a credit market will spread out the cost impact over a longer period by allowing manufacturers to produce SORE generators for a longer time. Some manufacturers may need additional time for design development, particularly those developing zero-emission generators with the greatest energy storage and highest power output. At the same time, incentivizing manufacturers to produce zero-emission generators sooner by allowing them to earn zero-emission generator credits starting in MY 2022, before more stringent emission standards are implemented, would enable more rapid reductions in generator emissions and associated adverse health impacts in California.

§ 2408.2(b)

Purpose. The Proposed Amendments establish four general provisions for credit use, generation, and calculation:

- The first requires that zero-emission generator credits may only be used to offset emissions from engine families that only contain generator engines.
- The second requires that zero-emission generator credit generation be calculated based only on zero-emission generators that are sold and used in California.
- The third allows a manufacturer, at its option, to include its entire production of an engine family in its calculation of credit usage for a given model year if using zero-emission generator credits to compensate for negative certification emission credits (i.e., to compensate for emissions above the applicable emission standards) for that engine family.

- The fourth requires a manufacturer of zero-emission generators that wishes to generate zero-emission generator credits to certify zero-emission generators at a FEL of zero grams per kilowatt-hour, and explicitly states that certification of a zero-emission generator engine family may enable the manufacturer to generate positive zero-emission generator credits for averaging, banking, or trading, or a combination thereof. Subsections of this provision also establish the following requirements for credit generation:
 - Zero-emission generator energy, power and durability requirements for different levels (aka “tiers”) of credit eligibility, that grants more emission reduction credits for larger zero-emission generators (those with greater energy storage and higher power output), as described in the proposed Table 1 of § 2408.2(b)(4)(B);
 - Options for credit generation for zero-emission generators that cannot achieve the applicable full durability period;
 - Requirements that a small off-road equipment family must meet to be eligible for certification as a zero-emission generator family;
 - Requirements for durability testing to demonstrate compliance with the durability requirements;
 - Requirements for manufacturers to provide the consumer with all equipment and accessories necessary to meet the durability requirements;
 - Requirements for the specific information a manufacturer of zero-emission generators must include in the certification application about the operational sequence over one deployment of the zero-emission generator; and
 - The requirement for manufacturers to demonstrate compliance under the averaging, banking, and trading provisions of this § 2408.2 for a particular model year within 270 days after the end of the model year.

Rationale. These provisions are necessary to ensure no excess emissions result from implementation of the credit program. The second and third provisions are consistent with provisions in the existing credit programs and, because of their importance, are restated here rather than simply referenced to prevent confusion for manufacturers. The rationales for the provisions that differ from those in other credit programs are as follows.

- The first provision requires zero-emission generator credits to be used to offset emissions only from generators in order to further incentivize development of the zero-emission generator market. As described in section D.2 of Chapter I, there is still a need for innovation and growth in the zero-emission generator market, particularly for zero-emission generators with the greatest energy storage and highest power output. Requiring too rapid a transition to zero-emission generators could have unintended negative impacts on power supply

in some regions of California. The Proposed Amendments to add a generator-specific credit program are intended to increase flexibility for manufacturers and reduce cost impacts of the proposed requirements to accelerate the deployment of ZEE. Limiting credit use to offset emissions from generators is necessary to help ensure those benefits for manufacturers also work towards addressing the public's need for reliable and affordable power supply. Using credits earned by zero-emission generators to offset emissions from generator engines will ensure that the benefits of the credits are used toward the continued availability of SORE generators as the market for zero-emission generators continues to mature. Use of zero-emission generator credits for other equipment types could limit options for California consumers to use SORE generators in situations where an appropriate zero-emission generator may not yet be available or cost-effective as the market matures.

- The fourth provision establishes a tiered credit eligibility approach that is necessary to incentivize manufacturers to develop additional zero-emission generators in the least developed sector of the market: zero-emission generators with the greatest energy storage and highest power output. The program would award a greater amount of credits to zero-emission generators that store more energy or produce more power. The credit eligibility ranges from 1,500 g of HC + NO_x credits for a Level 1 zero-emission generator to 4,700 g of HC + NO_x credits for a Level 4 zero-emission generator. The credits generated by a zero-emission generator could offset either a portion or all of the emissions from a generator engine, depending on the emission level, power, emissions durability period, and displacement of the generator engine.
- The fourth provision also establishes a suite of certification requirements necessary to ensure manufacturers obtain credits only for equipment that achieves the goal of this new credit program—increase options in the currently least developed sector of the ZEE market—without resulting in the inappropriate generation and subsequent use of credits that could lead to excess emissions.
- The requirement for generator engines to be certified at a FEL of zero grams per kilowatt-hour is necessary to provide clarity that this new credit program allows credits to be granted only for zero-emission generators and not for low-emission generator engines.
- The requirement for a longer durability period (minimum 500 hours) is necessary to incentivize manufacturers to develop zero-emission generators that address the public's need for reliable power supply.
- The energy and power requirements are necessary to ensure only equipment that fulfills the intent of this generator-specific program are certified for credit generation. For example, the first requirement for a Level 1 zero-emission generator is to supply 2.5 kilowatt-hours of energy over an 8-hour period. This would require an average power delivery of 312.5 watts over an 8-hour period, which represents a modest load on a small generator. The second requirement

for a Level 1 zero-emission generator is to supply surge power of 3,000 watts for 10 seconds, to power devices that require greater power on startup, such as a refrigerator. These requirements would enable a Level 1 zero-emission generator to power a small number of devices. The duration would depend on a number of factors, including the power consumption of the devices, the energy storage of the zero-emission generator, if any, and the ability to generate power using features such as solar panels or hydrogen fuel. The energy and power requirements for Level 2, Level 3, and Level 4 zero-emission generators would enable them to power a greater number of devices with greater power consumption or power devices for a longer time. These zero-emission generators could therefore be used in more situations where consumers currently use SORE generators.

- The minimum requirements for eligibility for certification as a zero-emission generator family are necessary to ensure only equipment that fulfill the intent of this generator-specific program earn credits. The requirement to have a device capable of providing 120-Volt nominal alternating current power as well as at least one NEMA 5-15 receptacle is necessary to ensure consumers will be able to power common electrical devices. The NEMA 5-15 receptacle is the most common electrical receptacle used in California delivering 120-Volt nominal alternating current power. The requirement to contain a zero-emission power generation device, an energy storage device, or any combination of both of these devices is necessary to ensure a zero-emission generator will be capable of providing power for consumers' devices. This requirement is technology neutral to allow zero-emission generators that 1) store energy and provide power, but may not be capable of generating power once the stored energy has been depleted; 2) generate and deliver power, but may not be capable of storing sufficient energy to meet the requirements in Table 1 of this § 2408.2; or 3) store energy, generate power, and provide power. The requirement for a zero emission generator to meet the minimum specifications indicated in Table 1 of this § 2408.2 is necessary to provide certainty to manufacturers regarding the durability period, energy, and power requirements for each level of zero-emission generator.
- The option for a small off-road equipment family that is certified as a zero-emission generator family, but cannot achieve the full durability period, to generate 75 percent of the zero-emission generator credits if the zero-emission generator can meet a minimum of 75 percent up to 99 percent of the durability period is necessary to encourage manufacturers to certify zero-emission generators at the earliest date. This will help accelerate zero-emission generator market development.
- Requirements for durability testing to demonstrate compliance with the durability requirements are necessary for CARB to ensure only generator engines that can meet the durability requirements are granted credits. Zero-emission generators must be sufficiently durable to meet the minimum requirements in this section for 500 hours to match the expected life of most

generator engines. Although some generator engines are certified to emissions durability periods of 1,000 hours, others are certified to emissions durability periods of 50 hours. This proposed zero-emission generator credit program sets durability periods of 500 hours. This 500-hour durability period is at least as long as that for most SORE generators and could enable more zero-emission generators to be certified than could be certified to a 1,000-hour durability period. It is necessary for durability testing to be performed in a representative configuration to ensure that consumers will be able to achieve the performance demonstrated in durability testing. Conducting durability testing using a five-mode duty cycle that is also used for generator engines that have no idle mode, as described in the "California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off Road Engines; Engine Testing Procedures (Part 1054)," will ensure zero-emission generator durability testing is comparable to generator engine durability testing. Using an electrical load bank to apply a load to a zero-emission generator is necessary because generators provide electric power rather than performing mechanical work, as other equipment types do.

- Requirements for manufacturers to provide the consumer with all equipment and accessories necessary to meet the durability requirements are necessary to enable in-use generator performance to be comparable to performance at the time of certification testing, which is necessary to address the public's need for reliable power supply.
- As defined by current regulations in § 2401(a)(13), the operational sequence "reflects periods of equipment use, and applicable battery recharging and exchanging." Requirements that specify the information about the operational sequence to be included in the certification application for this generator-specific credit program are consistent with provisions in existing credit programs. These requirements are necessary for CARB to assess the power capabilities and durability of a zero-emission generator, which is necessary to determine program eligibility and credit amount. A description of an operational sequence will also help CARB staff verify compliance of zero-emission generators with the requirements of this § 2408.2.
- The requirement for manufacturers to demonstrate compliance under the averaging, banking, and trading provisions of this § 2408.2 for a particular model year within 270 days after the end of the model year is consistent with requirements for existing credit programs. This requirement is necessary for CARB to be able to verify compliance with program requirements, which is necessary to prevent potential inappropriate generation and subsequent use of credits that could lead to excess emissions. CARB staff expects any potential reporting costs would be negligible and would have no impact on costs to consumers because manufacturers would not be required to create new information. Manufacturers are already required to maintain and submit sales reports under current regulations for purposes of verifying compliance with

production line testing, warranty, emission related defect reporting, recall, and emission reduction credit requirements.

§ 2408.2(c)

Purpose. The Proposed Amendments establish averaging requirements that:

- Allow 100 percent of negative credits from engine families with FELs above the applicable emission standard to be offset by positive zero-emission generator credits; and
- Allow zero-emission generator credits used in averaging for a given model year to be obtained from zero-emission generator credits banked in previous model years, or zero-emission generator credits of previous model years obtained through trading.

Rationale. These averaging requirements are necessary to support the key goals of the zero-emission generator credit program: allow manufacturers flexibility, while reducing emissions from generator engines and accelerating market development of zero-emission generator options in advance of emission standards of zero for all generators for MY 2028 and subsequent model years. Allowing all excess emissions from generator engines to be offset by zero-emission generator credits is necessary to provide manufacturers flexibility to produce SORE generators that may emit at levels higher than the more stringent MY 2024-2027 emission standards as the market for zero-emission generators develops further. This flexibility is warranted as it supports the goal of encouraging manufacturers to produce more zero-emission generators. These proposed averaging requirements are consistent with existing requirements and the Proposed Amendments to the existing credit programs.

§ 2408.2(d)

Purpose. The Proposed Amendments establish provisions for banking that:

- Beginning with model year 2022, allow manufacturers to bank zero-emission generator credits for use in subsequent model years for the purposes of averaging and trading;
- Allow manufacturers to bank credits only after submission of all final reports and verification of the reporting by CARB;
- Require that, during the model year, and before submittal of the end-of-year report, credits originally designated in the certification process for banking will be considered reserved, and may be re-designated for trading in the end-of-year report and final report;
- Allow zero-emission generator credits to be banked for up to five years;
- Require zero-emission generator credits that are unused after five years to expire, and no longer allow these expired credits to be used toward offsetting negative certification emission credits from other eligible engine families.

Rationale. These provisions are necessary to ensure that any banked credits are calculated correctly and use of banked credits in future years does not result in excess emissions. The five-year expiration date for credits prevents credits from being banked indefinitely and provides a known timeline for all new generators sold in California to be zero-emission generators. These proposed banking requirements are consistent with requirements for existing credit programs.

§ 2408.2(e)

Purpose. The Proposed Amendments establish provisions for trading that:

- Allow a manufacturer to exchange zero-emission generator credits with other manufacturers in trading;
- Allow zero-emission generator credits banked in previous years to be used for trading; and
- Allow traded zero-emission generator credits to be used for averaging or banking for up to five years from the time of zero-emission generator credit generation.

Rationale. The first two provisions are necessary to enable flexibility for manufacturers, which supports one of the goals of this credit program: lessen the initial cost impacts for manufacturers (and those purchasing equipment) that could result while the zero-emission generator market develops further. The five year expiration date from the time of credit generation is necessary to prevent credits from being traded and banked indefinitely, which is necessary to prevent excess emissions, and to provide a known timeline for all new generators sold in California to be zero-emission generators. These proposed trading requirements are consistent with requirements for existing credit programs. This consistency is necessary to prevent confusion, calculation errors, and costs of additional manufacturer time spent on learning and maintaining different methods and resolving errors.

§ 2408.2(f)

Purpose. The Proposed Amendments provide an equation, steps, and definitions required to calculate HC + NO_x zero-emission generator credits and assess manufacturer compliance with emission standards. For calculating the total credits earned for a zero-emission generator engine family, the credits indicated in Table 1 in subsection (b) are multiplied by the sales of that family. The Proposed Amendments reference the existing definition of sales provided in § 2401. Section 2401(a)(37) [to be amended to (42)] defines sales as follows:

““Sales” or “Eligible sales” means the actual or calculated sales of an engine family in California for the purposes of averaging, banking or trading. Upon Executive Officer approval, an engine manufacturer may calculate its eligible sales through market analysis of actual federal production or sales volume.... Actual sales are sales calculated at the end of a model year based on that model year’s production, rather than on estimates of production.”

The Proposed Amendments in § 2408.2(f) also specify that annual sales projections are used to project credit availability for initial certification, and actual sales volume is used in determining actual credits for end-of-year compliance determination.

Rationale. An equation with detailed steps and definitions is necessary to ensure consistency and provide a fair and equitable process for all manufacturers that choose to participate in the credit program. In addition, such consistency is necessary to ensure use of credits does not result in excess emissions. The proposed equation and steps are consistent with requirements for existing credit programs. This consistency is necessary to prevent confusion, calculation errors, and costs of additional manufacturer time spent on learning and maintaining different methods and resolving errors.

§ 2408.2(g)

Purpose. The Proposed Amendments specify requirements for certification using zero-emission generator credits that:

- Identify the specific materials that must be submitted in the certification application by a manufacturer using zero-emission generator credits, and allows information required by §§ 2408.2(g)(1)(C) and 2408.2(g)(1)(D) to be supplied in an electronic spreadsheet;
- Establish all Executive Orders of Certification issued are conditional upon manufacturer compliance with the provisions of this § 2408.2 both during and after the model year of production, and failure to comply with all provisions of this section will be considered to be a failure to satisfy the conditions upon which the Executive Order of Certification was issued; and
- Require the manufacturer to bear the burden of establishing to the satisfaction of the Executive Officer that the conditions upon which the Executive Order of Certification was issued were satisfied or waived.

Rationale. These requirements are necessary to ensure proper documentation of zero-emission generator credit use in certification applications, which is necessary for CARB to ensure compliance with program requirements and to prevent excess emissions from the improper use of credits. The proposed requirements are consistent with requirements for existing credit programs. This consistency is necessary to prevent confusion, errors, and costs of additional manufacturer time spent on learning and maintaining different methods and resolving errors.

§§ 2408.2(h) and (i)

Purpose. The Proposed Amendments specify detailed records maintenance requirements in § 2408.2(h) and requirements for end-of-year and final reports in § 2408.2(i). The actions required in these subsections for the proposed zero-emission generator exhaust emission reduction credit program are identical to actions required by existing credit programs.

Rationale. The addition of records maintenance and reporting requirements is necessary for CARB to be able to verify credit balances for participants and their compliance with emission standards, and to ensure no excess emissions result from credit use. Aligning the proposed records maintenance and reporting requirements with the requirements for other credit programs makes them more easily understood by participants in the credit market, and better ensures their effectiveness in preventing any excess emissions to result from credit use.

B. Evaporative Emission Regulations

This section provides the summary, purpose, and rationale for each Proposed Amendment to CCR Title 13, Division 3, Chapter 15 §§ 2750 through 2774. Appendix B provides the full proposed regulatory language of these sections with Proposed Amendments shown in strikeout and underline formatting.

Global Amendments throughout the Evaporative Emission Regulations

Acronym Change

Purpose. The Proposed Amendments change “ARB” and “the ARB” to “CARB,” and add “California” before “Air Resources Board,” for consistency with recent CARB document style practices designed to improve clarity.

Rationale. This change reflects the California Air Resources Board’s recent change to, and preferred use of, the acronym “CARB” versus the prior acronym, “ARB,” and the entire agency title, “California Air Resources Board.”

Capitalization Change

Purpose. The Proposed Amendments change the formatting of text in all capital letters to mixed case to aid in making documents accessible to everyone, including people with visual impairments and assistive technology users.

Rationale. Mixed case words and sentences are easier to read and consistent with current accessibility guidelines.

Division Name Change and Address Change

Purpose. The Proposed Amendments change “Emissions Compliance, Automotive Regulations and Science Division” to “Emissions Certification and Compliance Division” throughout the evaporative emission regulations because of the reorganization of divisions within CARB. In addition, the Proposed Amendments change “9528 Telstar Avenue, El Monte, California 91731” to “4001 Iowa Street, Riverside, CA 92507” to reflect the address of CARB’s new Southern California headquarters.

Rationale. These changes are necessary because CARB divisions have been reorganized and renamed, and construction of the new Southern California headquarters has been completed. The Emissions Certification and Compliance Division now has responsibility for reviewing certification applications, so the division name has been updated. Division staff and the vehicle emissions testing laboratories will be housed at the new headquarters.

"Actively Purged" to "Actively-Purged" Term Change

Purpose. The Proposed Amendments change "actively purged carbon canister" to "actively-purged carbon canister" in §§ 2754(b)(1) and 2766(b)(1) to improve grammar and consistency.

Rationale. These changes are necessary to correct nonstandard grammar in the previously adopted text. California Administrative Law (Title 1, CCR, § 16(a)(4)) requires that California regulations be free of grammatical errors. In addition, these changes provide consistency with Proposed Amendments to §§ 2752(a)(1) and 2754(h), TP-902 §§ 2.2 and 2.4, which use the term "actively-purged carbon canister," and Proposed Amendments to § 2752(a)(22) and TP-902 § 5.2, which use the term "passively-purged carbon canister."

Description of Timing for Demonstrating Compliance and Submitting Documents

Purpose. Throughout the regulations, the Proposed Amendments change notations of "within nnn days of the end of the model year" to "within nnn days after the end of the model year" to increase clarity regarding the deadline by which compliance must be demonstrated or documents must be submitted.

Rationale. Certification holders are required to demonstrate compliance with credit provisions and submit production volume reports after the model year has ended. Changing "of" to "after" better describes when reports are due and clarifies that these reports should have complete information from the entire model year.

Update to References to SAE J1737

Purpose. SAE J1737 is the SAE Surface Vehicle Recommended Practice document, "Test Procedure to Determine the Hydrocarbon Losses from Fuel Tubes, Hoses, Fittings, and Fuel Line Assemblies by Recirculation." The Proposed Amendments remove the phrase "(Stabilized May 2013)" from references to "SAE J1737" because SAE J1737 has been updated since May 2013. SAE International published the newest version in August 2019, and this version of the test procedure will be referenced throughout the regulations. SAE J1737 is intended for the determination of the permeation of emissions through component walls, as well as through "microleaks" at interfaces of assembled components such as fuel lines while controlling temperature and pressure independently of each other. SAE J1737 was revised to include an alternative test method because the previous methodology was not adequate to

measure the low emission levels of new materials and constructions. CARB staff evaluated these revisions and has determined that these changes do not relax certification standards or testing procedures. In addition, any changes do not adversely affect industry and do not have cost impacts.

Rationale. SAE J1737 is a test procedure used to determine the permeation emissions from fuel hoses in SORE. SAE International previously “stabilized” this document in May 2013, indicating that no further changes would likely be made to this test procedure. In August 2019, SAE International updated SAE J1737 to include test methods that reflect the most up to date technology and industry standards. This reference is being changed to allow the use of the most up to date testing methods and technology to determine the permeation emissions from fuel hoses used in SORE. For example, the revised procedure adds a third practical mean to determine steady state which is to allow the use of an isothermal mini- or micro-sealed housing evaporative determination to measure weight change after preconditioning. Additionally, as discussed in the purpose and rationale for § 2752 in this section B of this chapter, the Proposed Amendments also change the definition of SAE J1737 in the definitions section of these regulations to reflect this update.

“Diurnal” Phrase Changes to Incorporate “Hot Soak” Emissions

Purpose. As described in Chapter II of this Staff Report and detailed in the following sections, the Proposed Amendments incorporate “hot soak” emissions into the evaporative emission standards for SORE. “Evaporative emission standards” refers to diurnal emission standards, permeation emission standards, and hot soak plus diurnal emission standards, as diurnal emissions, permeation emissions, and hot soak emissions are all types of evaporative emissions. To support the inclusion of the “hot soak” emissions, the Proposed Amendments make these phrasing changes throughout the regulations:

- Change “diurnal emission rate” to “diurnal or hot soak plus diurnal emission rate” or “evaporative emission rate” depending on the context of a particular sentence;
- Change “diurnal emission standard” to “diurnal or hot soak plus diurnal emission standard;”
- Change “diurnal emission test results” to “diurnal or hot soak plus diurnal emission test results;” and
- Change “diurnal emissions” to “diurnal or hot soak plus diurnal emissions” or “evaporative emissions” depending on the context of a particular sentence.

Rationale. As an engine is operated, it builds up heat, which must be dissipated once the engine is no longer operating. The residual heat from the engine dissipates in all directions, including to the fuel tank and its contents. As the fuel in the fuel tank is heated, both the rate at which liquid fuel vaporizes and the rate at which fuel permeates through the fuel tank walls increase. The increase in vaporization rate of the

fuel can lead to excess fuel vapors being emitted to the atmosphere through a fuel tank vent or through carbon canister breakthrough. The increase in the permeation rate can also lead to excess fuel permeating through the fuel tank walls, resulting in excess emissions being emitted to the atmosphere. As described in Chapter II of this Staff Report, the evaporative emission test procedure for complete engines consists of several steps, including running the equipment and putting it into a sealed housing for evaporative determination (SHED), where emissions are collected and measured. Under the current regulations, the SHED is first held at 95°F for one hour. This “hot soak” period represents placing a hot engine in storage after use on a hot summer day. This is then followed by a period of cooling and the “diurnal cycle,” a 24-hour period during which the engine is exposed to a temperature cycle akin to a typical summer day, including typical overnight cooling. Currently, the evaporative emission standards established for complete engines in § 2754 only apply to the 24-hour diurnal cycle, and only emissions during that 24-hour period are used to determine compliance with the emission standards. However, some engines tested by CARB have met the 24-hour diurnal emission standard, but had hot soak emissions several times higher than the diurnal emission standards. In order to control these emissions that could reduce the expected benefits of the emission standards, it is necessary to change § 2754 to incorporate hot soak emissions into the evaporative emission standards. The Proposed Amendments update text throughout the regulations to reflect this change.

§ 2750. Purpose

§ 2750(b)

Purpose. The current regulations in § 2750(b) require manufacturers to select one of two allowable options for certification of engines and state that the options are identified in § 2754(a) and in § 2754(b). Those options are referred to as “performance certification” and “design certification.” Both options require running loss emissions to be controlled during engine operation, which results in greater evaporative emission reductions. Under the current regulations, both options are available beginning with MY 2006. The Proposed Amendments add new text that requires manufacturers to certify each evaporative family to meet the hot soak plus diurnal emission standards in § 2754(a) for MY 2024 and subsequent model years. Section 2754(a) specifies the diurnal emission and design standards for SORE with displacements greater than 80 cc in Table 1 and requires that diurnal emissions from any SORE with displacement greater than 80 cc must not exceed those standards. Section 2754(b) requires an applicant to submit in the certification application: (1) a determination that running loss emissions are controlled from being emitted into the atmosphere; and (2) either the Executive Order of Certification number approving the fuel lines pursuant to § 2767.1, or test data showing that all fuel lines meet the permeation requirement of 15 grams of ROG per square meter of surface area of the surface in contact with fuel per day when tested in accordance with one of the procedures specified in § 2754(b). The current regulations in § 2754(c) require a manufacturer to choose (1)

“performance certification,” and provide diurnal emission test data for the engine or equipment model in the evaporative family that is expected to exhibit the highest diurnal emission rate relative to the applicable diurnal emission standard, in accordance with TP-902; or (2) “design certification,” and provide information in the certification application showing that the fuel tank and carbon canister meet the applicable design standards listed in Table 1 of § 2754. Under the Proposed Amendments, design certification would not be an allowable option for MY 2024 and subsequent model years.

Rationale. This change is necessary to ensure engines meet the more stringent emission standards and support the effective inclusion of hot soak emissions in the emission standards. The Proposed Amendments specify revisions to § 2754(a) and add a new subsection 2754(d) that, beginning with MY 2024, would require manufacturers to demonstrate compliance with evaporative emission standards that incorporate hot soak emissions and to submit data showing that hot soak plus diurnal emissions will not exceed the new emission standards prior to certification.

The current design standards cannot be expected to ensure that engines meet the proposed hot soak plus diurnal emission standards because the design standards do not account for all sources of emissions during a TP-902 test. The design standards set limits for fuel tank and fuel line permeation emissions based on the components’ internal surface area and require carbon canisters to have vapor storage working capacity that depends on the fuel tank nominal capacity. However, the design standards do not account for emissions from carburetors or connections between components of the evaporative emission control system. Whether or not an engine meets the diurnal emission standard depends on the emissions from the carburetor and connections, the quality of the components and their assembly, and other factors, in addition to the compliance of the fuel tank, fuel lines, and carbon canister with the design standards. Consequently, to better ensure that certification testing captures all potential emissions from the test unit, the Proposed Amendments are necessary to allow only performance certification for MY 2024 and subsequent model year generators.

CARB staff solicited information during public workshops and other stakeholder meetings regarding design standards that would enable engines to meet the proposed emission standards in a way that would make design certification effective. CARB staff did not receive such information, but did receive comments indicating that manufacturers believed design certification was a valuable option. The perceived value of design certification for manufacturers was not supported with sufficient evidence for CARB to determine that design-certified engines meet the proposed hot soak plus diurnal emission standards. Consequently, the Proposed Amendments to § 2750 require manufacturers to use performance certification to certify each evaporative family to meet the hot soak plus diurnal emission standards for MY 2024 and subsequent model years.

§ 2752. Definitions

§ 2752(a)

Purpose. The Proposed Amendments add four new definitions to § 2752(a). The newly proposed definitions are numbered (1), (3), (22), and (31) so that they are in alphabetical order with the previously included definitions. Consequently, the Proposed Amendments also renumber the definitions that were previously included in this section so that all definitions in this section are in alphabetical order and sequentially numbered.

Rationale. The changes are necessary to maintain a correctly-numbered, alphabetical list of definitions and to prevent confusion for the reader.

§ 2752(a)(1) *[newly proposed definition]*

Purpose. The Proposed Amendments add a definition for “actively-purged carbon canister” to clarify references to carbon canisters. The current regulations and the Proposed Amendments discuss two categories of carbon canisters: actively-purged and passively-purged carbon canisters. The newly proposed definition explains how an actively-purged carbon canister relies on the operation of the engine to purge the carbon canister of trapped vapors. Defining what constitutes an actively-purged carbon canister clarifies which regulatory requirements apply to equipment using an actively-purged carbon canister as opposed to regulatory requirements that only apply to equipment using passively-purged carbon canisters.

Rationale. Use of an actively-purged carbon canister meeting the requirements of the current regulations means approval by the Executive Officer is not required for running loss determination. This newly proposed definition is necessary to clarify which manufacturers are required to seek Executive Officer approval for running loss determination and to clarify which procedure in TP-902 is used for purging the carbon canister for testing.

§ 2752(a)(3) *[newly proposed definition]*

Purpose. The Proposed Amendments add a definition for ANSI/OPEI B71.10-2018 and incorporate this standards document by reference. ANSI/OPEI B71.10-2018 provides an update to the 2013 version of the American National Standard performance specifications and test procedures for off-road ground-supported outdoor power equipment with gasoline fuel systems. The updated version of this document recognizes additional equipment types for which this standard is applicable, fuel tank impact resistance testing, as well as many other durability standards that different parts of SORE must meet. This definition was added so that equipment manufacturers may certify their equipment using test data that was generated in accordance with this new version of the standard. The Proposed Amendments require all fuel lines to be securely connected to prevent fuel leakage throughout the useful life of the evaporative emission control system and require fuel line assembly testing to be

conducted in accordance with the Fuel line connection tensile test in section 5.5 of ANSI/OPEI B71.10 2018 for MY 2024 and subsequent model years.

Rationale. The current regulations incorporate by reference the 2013 version of this standards document. This definition has been added so that a manufacturer can reference this document in a certification application. Since this is the most up to date version of this set of standards, manufacturers may be required by other agencies, distributors, or retailers to certify to these standards. In order to prevent requiring unnecessary testing, CARB has determined that the most up to date version of these standards may also be referenced. It is also necessary to include a definition for this standards document because § 2754(g) in the Proposed Amendments requires testing according to this standards document for MY 2024 and subsequent model years.

§ 2752(a)(3) [renumbered to (5)]

Purpose. The Proposed Amendments update the definition of CARB certification procedure CP-902 to reflect proposed changes to the title, from “Certification Procedure for Evaporative Emission Control Systems on Engines with Displacement Greater Than 80 Cubic Centimeters” to “Certification Procedure for Evaporative Emission Control Systems on Small Off-Road Engines.” The Proposed Amendments include a placeholder for the last amended date, “[insert amended date]”, that will be updated to reflect the CARB adoption date of the Proposed Amendments to CP-902.

Rationale. This change to the definition is necessary because the Proposed Amendments include changes to the title of CP-902, as described in the “Applicability Change” subsection in section E of this chapter. The amended title reflects the Proposed Amendments to CP-902 that would apply it to all SORE, rather than just those with displacement greater than 80 cc.

§ 2752(a)(8) [renumbered to (10)]

Purpose. The Proposed Amendments update the definition of “Evaporative Family” by adding the new text, “or zero-emission small off-road equipment grouped together based on similar performance characteristics”, to the end of the “Evaporative Family” definition’s first sentence, ““Evaporative Family” means small off-road engine or equipment models in the same engine class that are grouped together based on similar fuel system characteristics as they relate to evaporative emissions.”

Rationale. This change is necessary to help provide consistent use of terms across the evaporative emission regulations and facilitate manufacturers’ participation in the emission reduction credit programs, which in turn help accelerate the deployment of ZEE. Updating the definition of Evaporative Family to include ZEE would enable continued use of familiar terms in the newly proposed zero-emission generator credit program, which would make it easier for manufacturers to understand the requirements than if new terms were created. Use of familiar terms would make it

easier for manufacturers to participate effectively in the newly proposed zero-emission generator credit program.

§ 2752(a)(10) [renumbered to (12)]

Purpose. The Proposed Amendments change the reference to Table 1 § 2754(a) to “Tables 1, 2, or 3” in the definition of “Evaporative Family Emission Differential Limit” (EFELD) because the Proposed Amendments add Tables 2 and 3 to include proposed new emission standards.

Rationale. This change is necessary because, as defined in § 2752(a)(12), the EFELD is calculated by the difference between the evaporative emission standard for the model of engine or equipment within the evaporative family that is expected to exhibit the highest emission rate relative to the applicable emission standard and the evaporative model emission limit (EMEL) declared for the model. In § 2754(a), the Proposed Amendments add new evaporative emission standards for MY 2024 and subsequent model years. Those emission standards are provided in new Tables 2 and 3 in the section, so this definition has been updated to reference those tables.

§ 2752(a)(22) [newly proposed definition]

Purpose. The Proposed Amendments add a definition for “passively-purged carbon canister” to clarify references to carbon canisters. The current regulations and the Proposed Amendments discuss two categories of carbon canisters: actively-purged and passively-purged carbon canisters. The newly proposed definition explains how a passively-purged carbon canister relies on the natural vacuum created by normal diurnal temperature variations to purge the carbon canister of stored compounds. Defining what constitutes a passively-purged carbon canister clarifies which regulatory requirements apply to equipment using a passively-purged carbon canister as opposed to regulatory requirements that only apply to equipment using actively-purged carbon canisters.

Rationale. Use of a passively-purged carbon canister means approval by the Executive Officer is required for running loss determination. This newly proposed definition is necessary to clarify which manufacturers are required to seek Executive Officer approval for running loss determination and to clarify which procedure in TP-902 is used for purging the carbon canister for testing.

§§ 2752(a)(25), (26), (27), and (28) [renumbered to (28), (29), (30), and (32), respectively]

Purpose. The Proposed Amendments add the text, “and which is incorporated by reference in this Article,” to each of the definitions for SAE J30, SAE J1527, SAE J1737, and SAE J2996, to improve clarity and completeness.

Rationale. This change is necessary to provide clarity by noting earlier in the regulations (where terms are defined) that these SAE procedures are incorporated by

reference. These SAE procedures are the test procedures that current regulations require manufacturers to use to determine the permeation emissions from fuel hoses when applying for a component certification for a fuel hose. The Proposed Amendments to the definitions do not alter current requirements for certification and testing of SORE equipment because the current regulations already state that versions of these procedures are incorporated by reference in § 2754(b)(2), and cite these procedures in §§ 2752(a)(7), 2753(b)(2)(B), 2754(b)(2), 2755(b), 2758(b)(2)(B)2., and 2758(b)(3)(B). It is necessary to incorporate the amended version of SAE J1737 because it has not previously been incorporated by reference in the SORE regulations. The revised procedure adds a third practical mean to determine steady state, which is to allow the use of an isothermal mini- or micro-SHED to measure weight change after preconditioning and does not alter requirements for manufacturers.

§ 2752(a)(31) [newly proposed definition]

Purpose. The Proposed Amendments add a new definition for the most recent version of SAE J1930 and explicitly incorporate it by reference to reflect the reference to this standard later in the current regulations.

Rationale. This change is necessary to provide clarity by defining and explicitly incorporating this SAE standard by reference in the regulations. SAE J1930 was already implicitly incorporated by reference because the current regulations already reference its use in § 2759(c)(4)(C) as a source for allowable abbreviations for use on evaporative emission control system certification labels. The proposed definition for SAE J1930 references the most recent version of the standard available, March 2017, to ensure manufacturers use the most recently updated industry standard terms, definitions, abbreviations, and acronyms to enable common terminology for diagnostic tools and publications. The revised SAE J1930 standard adds references to the following SAE and ISO publications:

- SAE J1979 E/E Diagnostic Test Modes;
- SAE J2012 Diagnostic Trouble Code Definitions;
- SAE J2012DA Digital Annex of Diagnostic Trouble Code Definitions and Failure Type Byte Definitions;
- ISO 15031-2:2010 (Ed. 1) Road vehicles -- Communication between vehicle and external equipment for emissions-related diagnostics -- Part 2: Guidance on terms, definitions, abbreviations and acronyms;
- ISO 15031-5:2015 (Ed. 3) Road vehicles -- Communication between vehicle and external equipment for emissions-related diagnostics -- Part 5: Emissions-related diagnostic services; and
- ISO 15031-6:2015 (Ed. 3) Road vehicles -- Communication between vehicle and external equipment for emissions-related diagnostics -- Part 6: Diagnostic trouble code definitions.

These added references are intended to better enable manufacturers to understand appropriate terminology when using SAE J1930.

§ 2752(a)(31) [renumbered to (35)]

Purpose. The Proposed Amendments update the definition of CARB test procedure TP-901 to include an updated “last amended date.” The Proposed Amendments include a placeholder for the last amended date, “[insert amended date]”, that will be updated at the completion of the rulemaking process to reflect the CARB adoption date of the Proposed Amendments to TP-901.

Rationale. This change to the definition is necessary because the Proposed Amendments include changes to TP-901, as described in section C of this chapter.

§ 2752(a)(32) [renumbered to (36)]

Purpose. The Proposed Amendments update the definition of CARB test procedure TP-902 to reflect proposed changes to the title, from “Test Procedure for Determining Diurnal Emissions from Small Off-Road Engines” to “Test Procedure for Determining Evaporative Emissions from Small Off-Road Engines.” The Proposed Amendments include a placeholder for the last amended date, “[insert amended date]”, that will be updated to reflect the CARB adoption date of the Proposed Amendments to TP-902.

Rationale. This change to the definition is necessary because the Proposed Amendments include changes to the title of TP-902, as described on in the ““Diurnal” Phrase Changes to Incorporate “Hot Soak” Emissions” subsection of section D of this chapter. The amended title reflects the Proposed Amendments to TP-902 that would require the evaluation of both diurnal and hot soak emissions for comparison to the emission standards, rather than only diurnal emissions.

§ 2753. Certification Requirements and Procedures

§ 2753(a)

Purpose. The current regulations in § 2753(a) specify which versions of certification procedures CP-901 or CP-902 manufacturers (“applicants”) must follow to annually certify that their SORE evaporative emission control systems comply with the evaporative emission standards set out in §§ 2754 through 2757. The required versions vary by SORE model year. For MY 2020 and subsequent model years, the current regulations require manufacturers to follow CP-901, as amended September 18, 2017, or CP-902, as amended September 18, 2017, as applicable. The Proposed Amendments require all applicants to follow the amended version of CP-902 described in section E of this chapter and provided in its entirety in Appendix E (“updated CP-902”) for MY 2024 and subsequent model years. For MYs 2022 and 2023, the Proposed Amendments allow applicants the option of using CP-901, last amended September 18, 2017, or CP-902, last amended September 18, 2017, as applicable, or the updated CP-902. When using the updated

CP-902, applicants must meet the emission standards for MY 2024 and subsequent model years, as shown in the proposed Table 2 or 3 of § 2754, as applicable.

Rationale. As summarized in Chapter II of this Staff Report, and described further in later sections of this chapter, the Proposed Amendments establish new and more stringent emission standards and test procedures beginning with MY 2024. The proposed changes to this section (§ 2753(a)) are necessary to implement the new emission standards and test procedures for MY 2024 and subsequent model years, while at the same time continuing to allow flexibility for earlier model years.

§ 2753(b)

Purpose. The current regulations in § 2753(b) define certification requirements specific to engines with displacement greater than 80 cc. The current regulations do not specify model years to which the requirements apply, and therefore the requirements currently apply to all model years. In addition, the current regulations allow applicants the option to use certain certified components in place of measuring diurnal emissions of a complete engine with evaporative emission control system using TP-902. The Proposed Amendments add text that specifies the requirements will apply only through MY 2023. As described later in this chapter, the Proposed Amendments provide text in a new subsection 2753(d) that requires all evaporative families in MY 2024 and subsequent model years to undergo full evaporative emission testing using TP-902, rather than allowing for design certification. Under the Proposed Amendments, the option to use certain certified components in place of evaporative emission testing using TP-902 will not be available after MY 2023.

Rationale. As described in Chapter II and later sections of this chapter, the Proposed Amendments set the evaporative emission standards for all SORE except generator engines to zero, and set more stringent emission standards for generator engines, beginning in MY 2024. The proposed changes to this section (§ 2753(a)) are necessary to implement the new emission standards and test procedures for MY 2024 and subsequent model years, while at the same time continuing to allow flexibility for earlier model years. Under the Proposed Amendments to § 2753(b) and (d), all SORE equipment must use evaporative emission testing using TP-902 for certification. For equipment other than generators, evaporative emission credits must be used to offset evaporative emissions. Certification using evaporative emission credits already requires performance certification. For generators, it is not known what design standards would ensure engines would meet the more stringent emission standards; consequently, the proposed change to § 2753(b) is necessary to allow only performance certification for MY 2024 generators and subsequent model years.

§ 2753(c)

Purpose. The current regulations in § 2753(c) define certification requirements specific to engines with displacement less than or equal to 80 cc. The current regulations require an application for certification of an evaporative emission control system to the

fuel tank permeation emission standard specified in § 2755 or § 2757 to include fuel tank permeation data for the fuel tank in the evaporative family that is expected to exhibit the highest permeation rate relative to the applicable permeation emission standard. The current regulations also require an application to detail the criteria used to determine which fuel tank in the evaporative family is expected to exhibit the highest permeation rate relative to the applicable permeation emission standard.

The current regulations do not specify model years to which the § 2753(c) requirements apply, and therefore the requirements currently apply to all model years. The Proposed Amendments add text that specifies the requirements will apply only through MY 2023, for consistency with Proposed Amendments to other sections. The Proposed Amendments provide text in a new subsection 2753(d) that requires all evaporative families in MY 2024 and subsequent model years to obtain certification of a complete evaporative emission control system, and to use the same test and certification procedures, regardless of their displacement category. Under the Proposed Amendments, the separate certification procedure for engines less than 80 cc will not be used after MY 2023.

Rationale. The change to this section (§ 2753(b)) is necessary to implement the proposed new emission standards and test procedures for MY 2024 and subsequent model years, while at the same time continuing to allow flexibility for earlier model years. Under the Proposed Amendments to § 2753(c) and (d), all evaporative families must use performance certification, including those evaporative families for engines with displacement less than or equal to 80 cc.

§ 2753(d) [newly proposed subsection]

Purpose. The Proposed Amendments add text in a new subsection 2753(d) that requires all evaporative families in MY 2024 and subsequent model years to undergo evaporative emission testing using TP-902. Testing applies to both diurnal and hot soak emissions using the model in the evaporative family that is expected to exhibit the highest hot soak plus diurnal emissions relative to the applicable hot soak plus diurnal emission standard. The Proposed Amendments require all evaporative families in MY 2024 and subsequent model years to conduct testing in accordance with TP-902 regardless of their displacement category. The purpose of this change is to ensure all engines certified meet the proposed, more stringent evaporative emission standards for SORE.

Rationale. As described in Chapter II and later sections of this chapter, the Proposed Amendments set the evaporative emission standards for all SORE except generator engines to zero, and set more stringent emission standards for generator engines, beginning in MY 2024. The proposed text in the new subsection 2753(d) is necessary to implement the proposed new emission standards and test procedures for MY 2024 and subsequent model years. Under the Proposed Amendments, all evaporative families must use performance certification. For equipment other than generators, evaporative emission credits must be used to offset evaporative emissions.

Certification using evaporative emission credits requires whole engine certification under current regulations.

The current design standards cannot be expected to ensure that engines meet the proposed hot soak plus diurnal emission standards because the design standards do not account for all sources of emissions during a TP-902 test. The design standards set limits for fuel tank and fuel line permeation emissions based on the components' internal surface area and require carbon canisters to have vapor storage working capacity that depends on the fuel tank nominal capacity. However, the design standards do not account for emissions from carburetors or connections between components of the evaporative emission control system. Whether or not an engine meets the diurnal emission standard depends on the emissions from the carburetor and connections, the quality of the components and their assembly, and other factors, in addition to the compliance of the fuel tank, fuel lines, and carbon canister with the design standards. Consequently, to better ensure that certification testing captures all potential emissions from the test unit, the proposed text in § 2753(d) is necessary to allow only performance certification for MY 2024 and subsequent model year generators.

§§ 2753(d), (e), and (f)

Purpose. The Proposed Amendments change the list lettering of the existing subsections (d), (e), and (f), to (e), (f), and (g), respectively, to provide sequential lettering of the subsections.

Rationale. This change is necessary because the Proposed Amendments add a new subsection 2753(d).

§ 2753(d)(2) [re-lettered to (e)(2)]

Purpose. The current regulations in § 2753(d)(2) (now § 2753(e)(2) in the Proposed Amendments) state the conditions under which modification of a certified evaporative emission control system invalidates the certification of the control system. The current regulations provide a list of the CP-902 versions applicable to different model years that a manufacturer must follow to obtain a new certification when any evaporative emission control system's certification is invalidated due to an unapproved modification. The Proposed Amendments update the list to include CP-902 with an updated "last amended" date. The Proposed Amendments include a placeholder for the last amended date, "[insert amended date]", that will be updated at the completion of the rulemaking process to reflect the CARB adoption date of the Proposed Amendments to CP-902.

Rationale. This change is necessary to provide consistency with the Proposed Amendments to require compliance with the proposed new test and certification procedures for SORE beginning with model year 2024, as described later in this chapter.

§ 2753(f) [re-lettered to (g)]

Purpose. The current regulations in § 2753(f) (now § 2753(g) in the Proposed Regulations) require a manufacturer whose Executive Order of Certification has been suspended or revoked to submit diurnal emission test results determined using TP-902, as described in § 2753(b), according to a schedule based on the number of noncompliance findings. The current regulations specify that the requirements apply only to evaporative families using engines with displacement greater than 80 cc. The Proposed Amendments add “or hot soak plus diurnal” to the emission test results requirement and add an associated reference to § 2753(d) to determine applicability. In addition, the Proposed Amendments delete the text that specifies the data submission requirements apply only to evaporative families using engines with displacement greater than 80 cc.

Rationale. These changes are necessary to provide consistency with the Proposed Amendments to the regulations in the earlier sections, §§ 2753(b) and (d). A manufacturer whose Executive Order of Certification has been suspended or revoked could certify evaporative families with displacement greater than 80 cc to meet the diurnal emission standards in § 2754 through MY 2023. For MY 2024 and subsequent model years, a manufacturer must certify all of its evaporative families to meet the hot soak plus diurnal emission standards in § 2754. This includes evaporative families using engines with displacement less than or equal to 80 cc, which are not currently required to meet diurnal or hot soak plus diurnal emission standards. It is therefore necessary to remove the text that refers to evaporative families using engines with displacement greater than 80 cc so that evaporative families using engines with displacement less than or equal to 80 cc will also be subject to the requirements of this subsection. These changes would ensure a manufacturer whose Executive Order of Certification has been suspended would submit evaporative emission test results, determined using TP-902, that correspond to the applicable evaporative emission standards for MY 2024 and subsequent model years, according to the schedule in this § 2753(g). Section 4.4 of CP-902 allows certification test data of an evaporative family to be carried over, in lieu of new tests, to subsequent model years, provided there have been no changes to the evaporative emission control system or to any evaporative emission control system component, subject to approval by the Executive Officer. Approval to carry certification test data over to subsequent model years may not be granted to a manufacturer whose Executive Order of Certification has been suspended or revoked. For example, an Executive Order of Certification may be suspended or revoked after failing a compliance test. Submission of new certification test data for all of a manufacturer’s evaporative families each model year according to the schedule in this § 2753(g) would better ensure that the families meet the hot soak plus diurnal emission standards and that no changes have been made that would cause engines not to meet the emission standards.

§ 2754. Diurnal and Hot Soak Plus Diurnal Emission and Design Standards

Purpose. The Proposed Amendments change the title of this section from “Diurnal Emission and Design Standards” to “Diurnal and Hot Soak Plus Diurnal Emission and Design Standards” to incorporate the change in evaporative emission standards to include the hot soak period.

Rationale. This change is necessary for consistency with the Proposed Amendments to later subsections that, beginning in MY 2024, include the hot soak period in addition to the diurnal period in the evaporative emission standards.

§ 2754(a)

Purpose. The current regulations in § 2754(a) specify the diurnal emission and design standards for diurnal emissions from SORE with displacements greater than 80 cc on and after the model years specified in Table 1. The Proposed Amendments divide the current § 2754(a) text into two new subsections, (a)(1) and (a)(2), for clarity, and add new text to those new subsections to limit the applicability of the diurnal emission standards in Table 1 in § 2754 to model years through MY 2023.

New subsection (a)(1) also provides clarity for certain LSI engines subject to the diurnal emissions regulations. The Proposed Amendments add the sentence “The standards in Table 1 shall continue to apply to large spark-ignition engines subject to section 2433(b)(4)(B) in Title 13, Chapter 9, Article 4.5 of the California Code of Regulations after the 2023 model year.” to new subsection (a)(1). Section 2433(b)(4)(B) in Title 13, Chapter 9, Article 4.5 of the California Code of Regulations (section 2433(b)(4)(B)) requires that LSI engines with an engine displacement less than or equal to 1.0 liter that run on a volatile liquid fuel (such as gasoline), must meet the evaporative emission requirements for small off-road engines, which are specified in Title 13, Chapter 15, Article 1 of the California Code of Regulations. Prior to this rulemaking, CARB adopted the most recent substantive updates to the referenced small off-road engine evaporative emission requirements in Title 13, Chapter 15, Article 1 of the California Code of Regulations in 2017, which became operative January 1, 2018. Manufacturers of these LSI engines have thus been complying with the aforementioned and current 2017/2018 evaporative emission requirements for small off-road engines, as specified in Title 13, Chapter 15, Article 1 of the California Code of Regulations. The Proposed Amendments to section 2754(a)(1) are necessary to remove confusion as to which emission standards the engines subject to section 2433(b)(4)(B) must meet.

The Proposed Amendment in subsection (a)(1) related to these LSI engines does not alter the requirements, rights, responsibilities, conditions, or prescriptions contained in the existing regulations as adopted by CARB and approved by OAL because, following approval of this change, applicable LSI engine manufacturers will continue to comply with the existing evaporative emission standards in Title 13, Chapter 15, Article 1 of the California Code of Regulations. Therefore, the adoption of the Proposed Amendments to subsection (a)(1) related to these LSI engines is not

expected to cause any cost impacts to the LSI engine manufacturers subject to section 2433(b)(4)(B).

In addition, the Proposed Amendments add new subsections (a)(3) through (a)(6), and new Tables 2 and 3 in § 2754, to require new, more stringent hot soak plus diurnal emission standards for MY 2024 and subsequent model years for all engine displacement categories. The new (a)(3) and (a)(4) subsections and Table 2 in § 2754 establish new hot soak plus diurnal emission standards for all SORE except generator engines beginning with MY 2024. These emission standards are 0.00 grams of organic material hydrocarbon equivalent per test for all engine displacement categories.

The new (a)(5) and (a)(6) subsections and Table 3 in § 2754 establish new diurnal emission standards for generator engines. Under the Proposed Amendments, emission standards for MY 2024 through 2027 generator engines will be 0.50 g/test for engine displacement less than or equal to 80 cc, 0.60 g/test for engine displacement greater than 80cc and less than 225 cc, and 0.70 for engine displacement greater than or equal to 225 cc. The Proposed Amendments set diurnal emission standards of zero for MY 2028 and subsequent model year generator engines in all engine displacement categories. The purpose of setting these emission standards to zero is to accelerate the production of ZEE in place of SORE equipment and to meet the 2016 State SIP Strategy emission reductions for the SORE sector. Chapter VIII describes other alternatives considered and provides CARB staff's analyses that support the conclusion that the Proposed Amendments would enable the maximum degree of technologically feasible, cost-effective emission reductions from SORE.

Under the Proposed Amendments, beginning with MY 2024 the evaporative emission standards will cover a greater portion of an engine's evaporative emissions. This will ensure greater control of evaporative emissions from MY 2024 and subsequent model year SORE equipment sold or leased for use in California. Currently, the diurnal emission standards only apply to the 24-hour diurnal cycle, while under the Proposed Amendments they would also apply to the hot soak period. As manufacturers are already required to measure and report hot soak emissions, this will not add any testing burden or cost. The purpose of this change is to eliminate the potential for higher-than-expected hot soak evaporative emissions, which would reduce the actual emission reduction benefits of the diurnal emission standards if the certification testing did not account for those hot soak emissions.

Rationale. The Proposed Amendments to § 2754(a) are necessary to achieve the maximum degree of technologically feasible, cost-effective emission reductions from SORE by the earliest practicable date as required by state law. The Proposed Amendments to the evaporative emission standards in § 2754(a), along with the Proposed Amendments to the exhaust emission standards described in section A of this chapter, are also necessary to achieve emission reductions from SORE expected under the 2016 State SIP Strategy. In addition, these changes are a necessary

component of the strategy to achieve 100 percent zero-emission from off-road vehicles and equipment operations in the State by 2035, as ordered in EO N-79-20. The Proposed Amendments to § 2754(a) are also necessary to clarify that the evaporative emission standards in Title 13, Chapter 15, Article 1 of the California Code of Regulations applicable to LSI engines subject to section 2433(b)(4)(B) are the existing evaporative emission standards.

As described in section C.2 of Chapter I, current SORE regulations will not achieve emission reductions expected under the 2016 State SIP Strategy. The 2016 State SIP Strategy calls for more stringent emission standards and additional incentives to accelerate the transition to ZEE to prevent SORE emissions from increasing and ultimately to achieve emission reductions necessary to attain ambient air quality standards for ozone by 2031 and protect the health and welfare of all California residents. As described in section B of Chapter III, SORE emission modelling results indicate implementation of the proposed evaporative and exhaust emission standards would result in emission reductions that would meet the expected emission reductions in the 2016 State SIP Strategy measure to reduce statewide SORE emissions of ROG by 36 tpd reduction and NO_x by 4 tpd in 2031, as well as emission reduction commitments specific to the South Coast and San Joaquin Valley air basins.

The proposed new emission standards for all SORE would apply beginning with MY 2024 to provide the lead time required by the federal Clean Air Act section 209. The federal Clean Air Act states, "California and such State adopt such standards at least 2 years before commencement of the period for which the standards take effect." The two-year period provides manufacturers with lead time to develop and manufacture equipment to meet new emission standards in the Proposed Amendments. Implementing emission standards at the earliest date would result in greater emission reductions and further progress in meeting EO N-79-20.

Available evidence identified throughout this Staff Report indicates all of the proposed new evaporative emission standards for SORE are technologically feasible and cost-effective, which is further explained in the rationale provided for the proposed exhaust emission standards in § 2403(b)(1) in section A of this chapter.

The Proposed Amendments allow more time for generator engines to meet emission standards of zero by setting the evaporative emission standards for generator engines to zero for MY 2028 rather than MY 2024 as done for other SORE equipment. While there are ZEE generators currently available to meet users' demand and most of their basic uses, there is still a need to allow manufacturers more time to continue to innovate and grow to meet the future demands of the zero-emission generator market. The rationale for this finding is provided with the rationale for the proposed MY 2024-2027 exhaust emission standards for generator engines in § 2403(b)(1) in section A of this chapter.

§ 2754(b)

Purpose. The current regulations in § 2754(b) require an applicant certifying engines or equipment to comply with the diurnal emission standards in § 2754 to submit a determination in the certification application that running loss emissions are controlled from being emitted into the atmosphere and to provide information showing that all fuel lines meet the permeation emission standard in Table 1 of § 2754(a). The current regulations do not specify model years to which the requirements apply, and therefore the requirements currently apply to all model years. The Proposed Amendments add text that specifies the requirements will apply only through MY 2023. As described in the purpose and rationale for a new subsection 2754(d) in section B of this chapter, the Proposed Amendments require an applicant certifying engines or equipment to comply with the hot soak plus diurnal emission standards to provide diurnal and hot soak emission test data for testing using TP-902. As described in the purpose and rationale for a new subsection 2754(h) in section B of this chapter, the Proposed Amendments add a procedure to TP-902 to demonstrate that running loss emissions are controlled from being emitted into the atmosphere and retain the requirement to obtain Executive Officer approval for such a determination.

Rationale. As described in Chapter II and the purpose and rationale for the Proposed Amendments to § 2754(a) in section B of this chapter, the Proposed Amendments set the evaporative emission standards for all SORE except generator engines to zero, and set more stringent emission standards for generator engines, beginning in MY 2024. The proposed changes to this section (§ 2754(b)) are necessary to implement the new emission standards and test procedures for MY 2024 and subsequent model years, while at the same time continuing to allow flexibility for earlier model years. Under the Proposed Amendments to § 2754(d), all SORE equipment must use evaporative emission testing using TP-902 for certification. It is not necessary to ensure all fuel lines meet the permeation emission standard in Table 1 of § 2754(a) after MY 2023 because design standards would not apply to MY 2024 and subsequent model year engines.

§ 2754(c)

Purpose. The current regulations in § 2754(c) require applicants certifying SORE to comply with the diurnal emission standards to also choose one of two options: provide diurnal emission test data in accordance with TP-902; or provide information showing that the fuel tank and carbon canister meet the applicable design standards listed in Table 1 of § 2754. The current regulations do not specify model years to which the requirements apply, and therefore the requirements currently apply to all model years. The Proposed Amendments add text that specifies the requirements will apply only through MY 2023. As described in the next section of this chapter, the Proposed Amendments provide text in a new subsection 2754(d) that requires manufacturers to submit diurnal and hot soak emission test data to demonstrate compliance with the proposed hot soak plus diurnal emission standards in accordance with TP-902 for all evaporative families in MY 2024 and subsequent model years. Under the Proposed

Amendments, the option to provide test data or Executive Order of Certification numbers for the fuel tank and carbon canister in place of evaporative emission testing using TP-902 will not be available after MY 2023.

Rationale. The proposed changes to this section are necessary to implement the proposed, more stringent evaporative emission standards for MY 2024 and subsequent model years, while at the same time continuing to allow flexibility for earlier model years. The rationale for this change is the same as that for the change proposed for § 2753(b), provided in the purpose and rationale section for § 2753(b) in this section B of this chapter.

§ 2754(d) [newly proposed subsection]

Purpose. The Proposed Amendments add a new subsection 2754(d) that requires all applicants to provide hot soak plus diurnal emission test data for the engine or equipment model in the evaporative family that is expected to exhibit the highest hot soak plus diurnal emission rate relative to the applicable hot soak plus diurnal emission standard, in accordance with TP-902, for MY 2024 and subsequent model years. The purpose of this change is to ensure that all engines certified will meet the proposed, more stringent evaporative emission standards for SORE.

Rationale. This new subsection is necessary to implement the proposed, more stringent evaporative emission standards for MY 2024 and subsequent model years. The rationale for this change is the same as that for the change proposed for § 2753(c), described earlier in this section B of this chapter.

§ 2754(d) [re-lettered to (e)]

Purpose. The Proposed Amendments change the list lettering of the current subsection (d) to (e) to provide sequential lettering of the subsections.

Rationale. This change is necessary because the Proposed Amendments add a new subsection 2754(d).

§ 2754(e) [re-lettered to (f)]

Purpose. The current regulations in this section set requirements for SORE fuel line testing for MY 2020 and subsequent model years in accordance with the Fuel Line Assembly Tensile Test in section 5.4 of ANSI/OPEI B71.10-2013 to ensure fuel lines are securely connected to prevent fuel leakage. There are four Proposed Amendments to this section:

- The first changes the subsection list lettering from (e) to (f) to provide sequential lettering of the subsections;
- The second amends the text to specify the fuel line testing requirements per ANSI/OPEI B71.10-2013 will apply only through MY 2023;

- The third deletes the text that follows the reference to ANSI/OPEI B71.10-2013, “, which is incorporated by reference herein;” and
- The fourth adds text to allow applicants the option to conduct testing in accordance with the Fuel line connection tensile test in section 5.5 of ANSI/OPEI B71.10-2018.

Rationale. The rationales for the Proposed Amendments to § 2754(e) are as follows:

- The change to the subsection list lettering is necessary because the Proposed Amendments add a new subsection 2754(d).
- The change to apply the requirement to test according to ANSI/OPEI B71.10-2013 only through MY 2023 is necessary because a more recent version of the test is available. Industry requested that CARB reference the most recent version, given manufacturers typically use the most recent editions of standards documents in addition to any earlier editions required by regulations. CARB staff evaluated the differences between the two editions and determined that the 2018 edition does not relax any standards or testing procedures and therefore is an appropriate replacement for the 2013 edition. The changes to the Fuel line connection tensile test in the 2018 edition versus the 2013 edition were editorial or provided clarification of the existing requirements. An informative Annex A included in the 2018 edition that provided rationales for changes did not mention any changes to the Fuel line connection tensile test.
- The deletion of the text, “which is incorporated by reference herein,” is necessary to prevent redundancy, given the definition provided in § 2752(a)(2) already states that this document is incorporated by reference.
- The addition of text to allow applicants the option to test in accordance with either ANSI/OPEI B71.10-2018 or ANSI/OPEI B71.10-2013 is necessary to allow flexibility for manufacturers for earlier model years (e.g., MYs 2022 and 2023) with design and testing already underway.

§ 2754(g) [newly proposed subsection]

Purpose. The Proposed Amendments add a new subsection 2754(g) that requires all applicants to conduct fuel line assembly testing in accordance with the Fuel line connection tensile test in section 5.5 of ANSI/OPEI B71.10-2018 for MY 2024 and subsequent model years to ensure fuel lines are securely connected to prevent fuel leakage and associated evaporative emissions.

Rationale. This change is necessary because a more recent version of the test is available. Industry requested that CARB reference the most recent version, given manufacturers typically use the most recent editions of standards documents in addition to any earlier editions required by regulations. CARB staff evaluated the differences between the 2013 and 2018 editions and determined that the 2018 edition does not relax any standards or testing procedures and therefore is an appropriate replacement for the 2013 edition. The changes to the Fuel line connection tensile test

in the 2018 edition versus the 2013 edition were editorial or provided clarification of the existing requirements. An informative Annex A included in the 2018 edition that provided rationales for changes did not mention the changes to the Fuel line connection tensile test.

§ 2754(h) [newly proposed subsection]

Purpose. The Proposed Amendments add a new subsection 2754(h) that requires an applicant certifying SORE to comply with the proposed hot soak plus diurnal emission standards to submit a determination that running loss emissions are controlled from being emitted to the atmosphere. The proposed determination requires approval from the Executive Officer unless actively-purged carbon canisters meeting the requirements of the regulations are used. The Proposed Amendments require testing in accordance with the procedures specified in TP-902 § 2.4, which are newly added by the Proposed Amendments. The purpose of the Proposed Amendments to § 2754(h) and TP-902 is to better ensure that all manufacturers are meeting the requirement that running loss evaporative emissions be controlled.

Rationale. This addition is necessary for consistency with the new testing requirements proposed for TP-902 § 2.4, which are described in section D of this chapter. Adding a procedure to demonstrate that running loss evaporative emissions are controlled from being emitted into the atmosphere will give manufacturers certainty regarding the method to use for such demonstrations.

§ 2754.1. Certification Averaging, Banking, and Trading

Purpose. Both exhaust and evaporative emission regulations currently include provisions for certification averaging, banking, and trading programs, also called emission reduction credit programs. The emission reduction credit programs allow manufacturers to generate credits when they produce SORE that emit at levels lower than the current emission standards. These credits may be used to offset emissions from SORE that emit at higher levels, banked for future years, or traded with other manufacturers. Section 2754.1 provides the requirements for manufacturers' participation in the voluntary certification averaging and banking program for SORE with complete evaporative emission control systems certified to the evaporative emissions standards specified in § 2754(a) or § 2757. The Proposed Amendments change the title of this section from, "Certification Averaging and Banking" to "Certification Averaging, Banking, and Trading," and change all references to "averaging and banking" in this section to "averaging, banking, and trading." These changes reflect the new trading provisions proposed for the section.

Rationale. This change is necessary to provide clarity and consistency with the proposed new trading provisions described in the new subsection 2754.1(e).

§ 2754.1(b)(3)

Purpose. The current regulations in § 2754.1(b)(3) specify that a manufacturer cannot include in its calculation of credit generation any new engines or equipment not subject to this Article. As specified in § 2750(a) and § 2751(c), the evaporative emission standards apply to gasoline-fueled, spark-ignition small off-road engines rated at less than or equal to 19 Kilowatts, and equipment utilizing such engines, and do not apply to engines or equipment that use compression-ignition engines, or engines or equipment powered with CNG, propane, liquefied petroleum gas (LPG), or liquefied natural gas (LNG) (collectively, “alternative fuels”). The Proposed Amendments add new text to § 2754.1(b)(3) that allows SORE powered by these alternative fuels to be certified for evaporative emission credits.

Rationale. This change is necessary to incentivize the manufacture of low-emission engines as the market for ZEE continues to develop further. Current regulations do not require manufacturers to certify the evaporative emission control system of engines powered by alternative fuels because the alternative fuels are contained in sealed, pressurized tanks that prevent evaporative emissions. The proposed change would provide more flexibility in the credit program by allowing manufacturers to certify and generate credits for more engines. This change could provide both public health benefits and economic benefits for manufacturers. Accrual of additional emission reduction credits would lessen the initial cost impacts for manufacturers (and those purchasing equipment) that could result as ZEE increasingly accounts for a greater portion of equipment sales—spread out the cost impact over a longer time—by allowing manufacturers to produce and sell SORE and equipment powered by alternative fuels for longer. At the same time, incentivizing manufacturers to produce more alternative fuel-powered equipment rather than gasoline-powered equipment would enable more rapid reductions in SORE emissions and associated adverse health impacts in California. The credits earned for these alternative fuel-powered engines will allow manufacturers more flexibility in planning engine sales to meet California market demand.

§ 2754.1(b)(5)

Purpose. The current regulations in this section specify: “A Holder shall certify an evaporative family to an EMEL and shall determine an EFELD.” Per § 2752(a)(13) [re-numbered to (15) in Appendix B], the Holder is “the person to whom the Executive Order of Certification is issued.” The EFELD is calculated by a Holder and can be positive or negative subject to the limitations in subsections (b)(6) and (b)(7) of this section, provided the sum of the Holder’s projected balance of credits from all credit transactions for each engine class in a given model year is greater than or equal to zero, as determined under subsection (e)...” The phrase “for each engine class” in the regulations specifies that all evaporative emission credits must be used within the same engine class in which they are generated. The Proposed Amendments remove this requirement by deleting the phrase, “for each engine class,” in order to provide additional flexibility for credit usage. This proposed change would not impact overall

emission reduction benefits (i.e., it would not result in excess emissions) because the proposed change does not alter the current requirement in § 2754.1(e)(2) [§ 2754.1(f)(2) in the Proposed Amendments] that the sum of positive and negative emission credits a manufacturer holds be greater than or equal to zero.

The Proposed Amendments also change the referenced subsection from “subsection (e)” to “subsection (f)” to accommodate the addition of a newly proposed subsection 2754.1(e) and maintain sequential section numbering.

Rationale. This removal of the text “for each engine class” is necessary to incentivize the manufacture of low emission engines and ZEE as the market for ZEE develops further. The flexibility to use evaporative emission credits across all engine classes will allow manufacturers more flexibility in planning engine sales to meet California market demand, while also meeting the applicable evaporative emission standards for SORE equipment. The total emissions from credit usage would remain the same, but manufacturers would be able to use the credits generated by one engine class for engines in other classes without the requirement to maintain a balance of credits that is greater than or equal to zero in each engine class. This flexibility would facilitate compliance with the averaging, banking, and trading provisions when the emission standards are zero for most SORE and more stringent for generator engines for MY 2024. The current diurnal emission standards depend on the fuel tank nominal capacity (the volume of fuel indicated by the manufacturer that represents the maximum recommended fill level, as defined in § 2752). This results in the diurnal emission standard for an engine with greater fuel tank nominal capacity being higher than for an engine with smaller fuel tank nominal capacity. For example, a model using an engine with displacement greater than or equal to 225 cc (Class II) with a 120-liter (32-gallon) nominal capacity would have a diurnal emission standard of approximately 8 grams per day. Such a model could have an EMEL of 24 grams per day, which is 24 times the diurnal emission standard for a walk-behind lawn mower with a Class I engine. Requiring the balance of credits from all credit transactions for each engine class in a given model year to be greater than or equal to zero has been important to ensure that emission reductions of one class of engine do not result in overall higher emissions of engines in other classes. For example, if Class I walk-behind lawn mower engines had emissions below the emission standards and the credits generated by those engines were used to offset higher emissions from Class II generator engines, consumers might be unable to find low-emitting generators. Such potential problems would be mitigated under the Proposed Amendments by the increased availability of ZEE, the reduction in the maximum EMELs in §§ 2754.1(b)(6) and (7), and the implementation of more stringent emission standards. The more stringent emission standards in the Proposed Amendments would reduce the possibility of extremely high-emitting engines being introduced into California commerce. The proposed emission standards also may result in manufacturers deciding to phase out high-emitting models or entire classes of engines if it is less profitable to produce such engines than to produce different models or classes of engines. For example, a manufacturer could determine that using credits to offset emissions from a high-

emitting handheld engine that would be installed in a low-cost piece of equipment (e.g., a string trimmer with a retail price of \$70) would be less profitable than using those credits to offset emissions from an engine that would be installed in a riding lawn mower with a retail price of \$15,000.

Changing the letter of the subsection reference is necessary to provide consistent lettering and to prevent confusion for the reader.

§§ 2754.1(b)(6) and (b)(7)

Purpose. The Proposed Amendments would establish new EMELs for all SORE equipment beginning with MY 2024. As defined by § 2752(a)(9) [§ 2752(a)(11) in the Proposed Amendments], an EMEL is the evaporative emission rate declared by the manufacturer for a model within an evaporative family. The declared rate must be based on evaporative emissions test results for the model of engine or equipment within the evaporative family that is expected to exhibit the highest diurnal evaporative emission rate relative to the applicable diurnal or hot soak plus diurnal emission standard, obtained by following TP-902. The current regulations in §§ 2754.1(b)(6) and (b)(7) set EMELs that are a multiple of the current emission standard: 1.5 times the emission standard for walk-behind mowers and 3 times the emission standard for other equipment. The Proposed Amendments set EMELs for MY 2024 and subsequent model years equal to 1.5 grams organic material hydrocarbon equivalent per test for walk-behind mowers, and 2.1 grams organic material hydrocarbon equivalent per test for other equipment.

Rationale. This change is necessary because the Proposed Amendments set emission standards to zero for all equipment beginning with MY 2024, which would result in an EMEL of zero if the regulations are not changed. An EMEL of zero would prevent manufacturers from being allowed to use the credits they have generated, which would defeat the purpose of the emission reduction credit program. Establishing more stringent EMELs is necessary to accelerate evaporative emission reductions in order to achieve the necessary SORE emission reductions by 2031 as expected under the 2016 State SIP Strategy. The proposed maximum EMEL for MY 2024 and subsequent model year walk-behind lawn mowers is numerically equivalent to the current maximum EMEL for diurnal emissions. However, the proposed maximum EMEL includes hot soak emissions. The proposed maximum EMEL for engines or equipment other than walk-behind lawn mowers is three times the proposed hot soak plus diurnal emission standard for generator engines with displacement greater than or equal to 225 cc. This would allow for evaporative emissions from generator engines with displacement greater than or equal to 225 cc to be up to three times the applicable emission standard, comparable to the current requirements. Engines that are currently certified to EMELs higher than the proposed maximum EMELs could not be certified for introduction into California commerce for MY 2024 or subsequent model years unless their emissions were reduced. This will ensure the highest-emitting engines, which have the greatest impact on air quality and expose operators to the greatest amounts

of pollutants, are the first to have their emission levels reduced or be replaced with lower-emitting engines or ZEE. These EMELs will allow manufacturers to use the credits they have generated, while preventing the introduction for sale or lease for use in California of new SORE with excessive evaporative emissions.

§§ 2754.1(c) and (d)

Purpose. Section 2754.1(c) specifies provisions for averaging of credits, and § 2754.1(d) specifies provisions for banking of credits. The Proposed Amendments include two types of changes to provide consistency with the addition of a newly proposed subsection 2754.1(e) for trading provisions:

- The Proposed Amendments change the reference to “subsection (e)(2)” in § 2754.1(c)(1) to “subsection (f)(2),” and change the reference to “subsection (e)(1)” in § 2754.1(d)(1) to “subsection (f)(1),” to accommodate the addition of a newly proposed subsection 2754.1(e) for trading provisions and maintain sequential section numbering.
- The Proposed Amendments add text to §§ 2754.1(c)(2), (d)(1), (d)(2), and (d)(3) to allow the use of credits obtained through trading to reflect the proposed addition of trading to the credit provisions specified in the newly proposed subsection 2754.1(e).

Rationale. The first type of change, changing the letter of the subsection references, is necessary to provide consistent lettering and to prevent confusion for the reader. The second type of change is necessary to enable manufacturers to use credits obtained through trading per the proposed provisions specified in the newly proposed subsection 2754.1(e).

§ 2754.1(e) [newly proposed subsection]

Purpose. The current evaporative emission regulations contained in § 2754.1 allow only averaging and banking of evaporative emission credits. The Proposed Amendments add a new subsection 2754.1(e) that expands the credit program to allow trading of evaporative emission credits. The newly proposed subsection 2754.1(e) provides requirements for the exchange of evaporative emission credits between engine manufacturers and the use of traded credits for averaging and banking. The proposed trading requirements align with existing trading requirements in the exhaust regulations, which are designed to prevent potential excess emissions that could result from inappropriate use of credits.

Rationale. This change is necessary to further incentivize the manufacture of low-emission engines and ZEE and to provide consistency with the exhaust emission regulations. This change will allow more flexibility in the emission reduction credit program and enable manufacturers who are able to earn evaporative emission credits to trade them to manufacturers who cannot, encouraging them to make the lowest-emitting engines possible. This change could provide both public health benefits and economic benefits for manufacturers. Accrual of additional emission reduction credits

would lessen the initial cost impacts for manufacturers (and those purchasing equipment) that could result as ZEE increasingly accounts for a greater portion of equipment sales—spread out the cost impact over a longer time—by allowing manufacturers to produce and sell SORE and low-emission engines for longer. At the same time, incentivizing manufacturers to produce more low-emission engines and ZEE that could generate evaporative emission credits that could in turn be traded to other manufacturers would enable more rapid reductions in SORE emissions and associated adverse health impacts in California. Furthermore, aligning the proposed trading requirements for evaporative emission credits with the existing requirements for exhaust emission credit trading makes them more easily understood by participants in the credit market, and better ensures their effectiveness in preventing any excess emissions to result from evaporative emission credit trading.

§ 2754.1(e)(1) [re-lettered to (f)(1)]

Purpose. The Proposed Amendments change the subsection list lettering of the current subsection (e) to (f) to provide sequential lettering of the subsections, and change the reference for the definition of Production Volume from § 2752(a)(21) to § 2752(a)(25). In addition, the Proposed Amendments delete the requirement for emission credit calculation results to be rounded to the nearest tenth of a gram.

Rationale. The first two changes are necessary because the Proposed Amendments add a new subsection 2754.1(e), and new definitions in § 2752(a), which result in the need to update subsection lettering and references. The third change is necessary to provide consistency with the Proposed Amendments to § 2754(a). The current requirement to round credit calculation results to the nearest tenth of a gram will not provide an adequate number of significant digits to comply with the second requirement in this subsection, “Consistent units with two significant digits are to be used throughout the equations,” once the proposed evaporative emission standard of 0.00 grams of organic material hydrocarbon equivalent per test becomes effective.

§ 2754.1(f) [re-lettered to (g)]

Purpose. The Proposed Amendments change the subsection list lettering of the current subsection (f) to (g) to provide sequential lettering of the subsections. The Proposed Amendments also change references to § 2754.1(e) and § 2754.1(f) within the subsection to § 2754.1(f) and § 2754.1(g) to reflect the updated lettering in the Proposed Amendments.

Rationale. These changes are necessary because the Proposed Amendments add a new subsection 2754.1(e).

§ 2754.1(g) [re-lettered to (h)]

Purpose. The current regulations in § 2754(g) describe requirements for records maintenance by Holders of Executive Orders of Certification (Holders). The Proposed Amendments change the subsection list lettering of the current subsection (g) to (h) to

provide sequential lettering of the subsections. The Proposed Amendments also add requirements for the maintenance of records for Holders participating in credit trading as a newly proposed subsection 2754.1(h)(2). The proposed records maintenance requirements align with existing trading records maintenance requirements in the exhaust regulations. The Proposed Amendments change the subsection list numbering for the current subsections (2) through (5), to (3) through (6), respectively, to provide sequential numbering.

Rationale. The changes to subsection lettering and numbering are necessary because the Proposed Amendments add new subsections as § 2754.1(e) and § 2754.1(h)(2). The addition of records maintenance requirements for credit trading is necessary for CARB to be able to verify credit balances for participants and ensure no excess emissions result from credit trading, and to provide consistency with the exhaust emission regulations. Aligning the proposed evaporative emission credit trading record maintenance requirements with the existing requirements for exhaust emission credit trading makes them more easily understood by participants in the credit market, and better ensures their effectiveness in preventing any excess emissions to result from evaporative emission credit trading.

§ 2754.1(h)

Purpose. The current regulations in § 2754.1(h) describe requirements for participants in the credit program for end-of-year and final reports. There are seven proposed amendments to this section that were not already described in the “Global Amendments” section of this chapter:

- The first changes the subsection list lettering of the current subsection (h) to (i) to provide sequential lettering of the subsections (the remainder of this summary uses the updated lettering);
- The second changes the reference to subsection (e) to subsection (f) in § 2754.1(i)(1);
- The third adds newly proposed text to § 2754.1(i)(1) that requires copies of contracts related to credit trading to be included or supplied by the broker, if applicable;
- The fourth deletes from § 2754.1(i)(1) the requirement that the report show that the credit summation for each class of engines or equipment is equal to or greater than zero;
- The fifth changes the reference for the definition of Production Volume in § 2754.1(i)(2) from § 2752(a)(21) to § 2752(a)(25); and
- The sixth corrects a mistake made when the credit program requirements were adopted, where the text in § 2754.1(i)(6) mistakenly states that errors in previously submitted reports “may” be corrected in the final report, by changing “may” to “must.”

- The seventh corrects a second mistake, where the text in § 2754.1(h)(7) (re-lettered to (i)(7)) mistakenly states that erroneous positive credits will be void except as provided in “subsection (h)” of this section instead of in “subsection (f).” Subsection (f) (re-lettered to (g) by the Proposed Amendments) specifies the provisions for certification using credits. To fix this error, the Proposed Amendments change the exception reference to “except as provided in subsection (g) of this section.”

Rationale. The rationales for the Proposed Amendments to § 2754.1(i) are as follows:

- The first, second, and fifth changes are necessary because the Proposed Amendments add a new subsection 2754.1(e), and new definitions in § 2752(a), which result in the need to update subsequent subsection lettering and references.
- The third change, to require copies of contracts related to credit trading, is necessary for CARB to be able to verify compliance with all credit trading provisions and provides consistency with reporting requirements in the exhaust emission regulations. Compliance with all provisions is necessary to ensure no excess emissions result from implementation of the credit program.
- The fourth change, to delete the requirement that the credit summation for each class be equal to or greater than zero, is necessary for consistency with the proposed change to § 2754.1(b)(5), which removes the requirement for evaporative emission credits to be used within the same engine class in which they are generated. Under the Proposed Amendments, there is no longer a regulatory need for credit program participants to provide the summations by class.
- The sixth change, to change “may” to “must,” is necessary to ensure correct reporting, which in turn is necessary to ensure no excess emissions result from implementation of the credit program.
- The seventh change, to change the exception reference from subsection (h) to (g), is necessary to provide clarity necessary to help ensure the correct regulation is referenced by manufacturers.

§ 2754.3. Evaporative Emission Reduction Credits – Zero-Emission Generator Credits Averaging, Banking, and Trading Provisions [newly proposed section]

Purpose. The Proposed Amendments add a new subsection 2754.3 to establish a new, generator-specific evaporative emission reduction credit program. This voluntary program would allow manufacturers to offset emissions from generators with emission levels above the proposed evaporative emission standards by using credits earned by zero-emission generators. All SORE, including generator engines, may be included in engine families participating in the certification averaging, banking and trading program described in § 2754.1. The evaporative emission regulations, however, do

not include a zero-emission equipment credits averaging, banking and trading program. The emission inventory calculated with SORE2020 indicates that generators produce the highest statewide emissions of any small off-road equipment type. In 2020, generators accounted for approximately 14 percent of the total population of SORE equipment, and 19 percent of all ROG and NO_x emissions from SORE (CARB, 2020).

The Proposed Amendments add a new emission reduction credit program for zero-emission generators to incentivize further development of the market. The program is tiered, granting more emission reduction credits for zero-emission generators with greater energy storage and power delivery than for those with less energy storage and power delivery. The purpose of the tier system is to provide the greatest credit benefits to manufacturers who develop zero-emission generators in the least developed sector of the market (i.e., zero-emission generators with the greatest energy storage and highest power output). The proposed zero-emission generator credits would be subject to similar provisions to those in the existing emission reduction credit programs, including a five-year limit on banking credits.

Rationale. This change is necessary to incentivize manufacturers to increase development and production of zero-emission generators, particularly zero-emission generators with the greatest energy storage and highest power output. Currently, the availability of zero-emission generators is limited and their price is often more than that of a comparable SORE generator. This credit program aims to decrease the price of zero-emission generators while allowing increased flexibility for manufacturers of SORE generators as more models of zero-emission generators enter the market.

§ 2754.3(a)

Purpose. The Proposed Amendments define the applicability of the zero-emission generator evaporative credit program. The Proposed Amendments specify the program requirements are applicable to all zero-emission generators as defined in § 2408.2 produced in MYs 2022 through 2026. The Proposed Amendments establish that participation is voluntary, but if a manufacturer elects to participate, it must follow all provisions set forth in § 2754.3.

Rationale. This section is necessary to define which manufacturers are eligible to participate in the program to prevent confusion. Including a reference to § 2408.2(a), rather than restating its contents, prevents unnecessary redundancy in the regulations. The Proposed Amendments add a new subsection 2408.2, "Exhaust Emission Reduction Credits – Zero-Emission Generator Credits Averaging, Banking, and Trading Provisions", with applicability defined in § 2408.2(a). Similar to § 2754.3(a), § 2408.2(a) specifies the credit program applies to zero-emission generators produced in MYs 2022 through 2026. The rationale for § 2754.3(a) is the same as the rationale for § 2408.2, provided in section A of this chapter. The ability to earn zero-emission generator credits extends through MY 2026 to incentivize further development of the zero-emission generator market sooner. No zero-emission generator credits may be

earned for MY 2027 to ensure that manufacturers introduce new models of zero-emission generators with greater energy storage and higher power output earlier. This limitation on earning zero-emission generator credits will also ensure that banked zero-emission generator credits are used by the end of MY 2031 thereby providing a known timeline for the use of credits.

§§ 2754.3(b)(1) through (b)(3)

Purpose. The Proposed Amendments establish two general provisions for the generation and use of zero-emission generator credits:

- The first specifies that zero-emission generator evaporative credits may be used to offset emissions for an evaporative family used exclusively in generators.
- The second explicitly states that a manufacturer of engine families certified for zero-emission generator credits under § 2408.2 may generate zero-emission generator evaporative credits. Subsections of this provision also establish requirements for credit generation:
 - The first subsection specifies that a manufacturer of zero-emission generator engine families certified for zero-emission generator credits under § 2408.2 shall earn zero-emission generator evaporative credits in accordance with the proposed Table 1 in this § 2754.3 for averaging, banking, or trading, or a combination thereof. Table 1 establishes zero-emission generator energy, power and useful life requirements for different levels (aka “tiers”) of credit eligibility, that grants more emission reduction credits for larger zero-emission generators (those with greater energy storage and higher power output).
 - The second subsection specifies that manufacturers must demonstrate compliance under the averaging, banking, and trading provisions of this § 2754.3 for a particular model year within 270 days after the end of the model year.

Rationale. These provisions are necessary to ensure no excess emissions result from implementation of the credit program and to ensure the credit program accomplishes the goals specific to generators. The first provision specifies zero-emission generator evaporative credits may be used to offset emissions for an evaporative family used exclusively in generators in order to further incentivize development of the zero-emission generator market. As described in section D.2 of Chapter I, there is still a need for innovation and growth in the zero-emission generator market, particularly for zero-emission generators with the greatest energy storage and highest power output. Implementation of zero-emission standards for generators sooner than MY 2028 could have unintended negative impacts on power supply in some regions of California. The Proposed Amendments add a generator-specific credit program to increase flexibility for manufacturers and reduce cost impacts of the proposed requirements to accelerate the deployment of ZEE. Limiting credit use to offsetting emissions from generator engines is necessary to help ensure those benefits for manufacturers also

work towards addressing the public's need for reliable and affordable power supply. Using credits earned by zero-emission generators to offset emissions from generator engines will ensure that the benefits of the credits are used toward the continued availability of SORE generators as the market for zero-emission generators continues to mature. Use of zero-emission generator credits for other equipment types could limit options for California consumers to use SORE generators in situations where an appropriate zero-emission generator may not yet be available or cost-effective as the market matures.

The proposed Table 1 establishes a tiered credit eligibility approach that is necessary to incentivize manufacturers to develop additional zero-emission generators in the least developed sector of the market: zero-emission generators with the greatest energy storage and highest power output. The program would award a greater amount of credits to zero-emission generators that store more energy or produce more power. The credit eligibility ranges from 0.5 g organic material hydrocarbon equivalent·day⁻¹ or 0.5 g organic material hydrocarbon equivalent·test⁻¹ credits for a Level 1 or 2 zero-emission generator to 0.6 g organic material hydrocarbon equivalent·day⁻¹ or 0.5 g organic material hydrocarbon equivalent·test⁻¹ credits for a Level 3 or 4 zero-emission generator. The credits generated by a zero-emission generator could offset either a portion or all of the emissions from a generator engine, depending on the emission level and displacement of the generator engine. The power requirements for Levels 1 through 4 in Table 1 are the same as proposed for exhaust credit eligibility in § 2408.2(b). This consistency is necessary to make the requirements easier to understand and prevent confusion and additional administrative work for manufacturers, which in turn helps facilitate participation in the credit program and accelerate the further development of the zero-emission generator market.

The proposed Table 1 specifies a minimum requirement for generator "useful life" of 5 years to be eligible for credit generation, whereas § 2408.2(b) specifies a minimum requirement for "durability period" of 500 hours. Both requirements are necessary for the same reason: to incentivize manufacturers to develop zero-emission generators that address the public's need for reliable power supply. The requirement for evaporative credit generation is in terms of useful life and years for consistency with the existing useful life requirements for evaporative emissions for engines in § 1054.110 and § 1054.112. Zero-emission generators certified to earn both exhaust and evaporative credits would therefore be required to meet the applicable requirements for 500 hours of operation and 5 years.

The requirement for manufacturers to demonstrate compliance under the averaging, banking, and trading provisions of this § 2754.3 for a particular model year within 270 days after the end of the model year is consistent with requirements for existing credit programs and the proposed generator-specific exhaust credit program. This requirement is necessary for CARB to be able to verify compliance with program

requirements, which is necessary to prevent potential inappropriate accrual and subsequent use of credits that could lead to excess emissions.

§ 2754.3(c)

Purpose. The Proposed Amendments establish averaging requirements that:

- Allow 100 percent of negative credits from engine families with EMELs above the applicable emission standard to be offset by positive zero-emission generator credits; and
- Allow zero-emission generator credits used in averaging for a given model year to be obtained from zero-emission generator evaporative credits banked in previous model years, or zero-emission generator evaporative credits of previous model years obtained through trading.

Rationale. These averaging requirements are necessary to support the key goals of the zero-emission generator credit program: allow manufacturers flexibility, while reducing emissions from generators and accelerating market development of zero-emission generator options in advance of emission standards of zero for all generators for MY 2028 and subsequent model years. Allowing all excess emissions to be offset by zero-emission generator credits is necessary to provide manufacturers flexibility to produce SORE generators that may emit at levels higher than the more stringent MY 2024-2027 emission standards as the market for zero-emission generators develops further. This flexibility is warranted as it supports the goal of encouraging manufacturers to produce more zero-emission generators. These proposed averaging requirements are consistent with existing requirements and proposed amendments for existing credit programs.

§ 2754.3(d)

Purpose. The Proposed Amendments establish provisions for banking that:

- Beginning with MY 2022, allow manufacturers to bank zero-emission generator evaporative credits for use in subsequent model years for the purposes of averaging and trading;
- Allow manufacturers to bank credits only after submission of all final reports and verification of the reporting by CARB;
- Require that, during the model year, and before submittal of the end-of-year report, credits originally designated in the certification process for banking will be considered reserved, and may be re-designated for trading in the end-of-year report and final report;
- Allow zero-emission generator credits to be banked for up to five years;
- Require zero-emission generator credits that are unused after five years to expire, and no longer allow these expired credits to be used toward offsetting negative evaporative emission credits from other eligible evaporative families.

Rationale. These provisions are necessary to ensure that any banked credits are calculated correctly and use of banked credits in future years does not result in excess emissions. The five-year expiration date for credits prevents credits from being banked indefinitely and provides a known timeline for all new generators sold or leased for use in California to be zero-emission generators. These proposed banking requirements are consistent with requirements for existing credit programs and the proposed generator-specific exhaust emissions credit program.

§ 2754.3(e)

Purpose. The Proposed Amendments establish provisions for trading that:

- Allow a Holder to exchange zero-emission generator credits with other Holders in trading;
- Allow zero-emission generator credits banked in previous years to be used for trading; and
- Allow traded zero-emission generator credits to be used for averaging or banking for up to five years from the time of zero-emission generator credit generation.

Rationale. The first two provisions are necessary to enable flexibility for manufacturers, which supports one of the goals of this credit program: lessen the initial cost impacts for manufacturers (and those purchasing equipment) that could result while the zero-emission generators market develops further. The five-year expiration date from the time of credit generation is necessary to prevent credits from being traded and banked indefinitely, which is necessary to prevent excess emissions, and to provide a known timeline for all new generators sold or leased for use in California to be zero-emission generators. These proposed trading requirements are consistent with requirements for existing credit programs and the proposed generator-specific exhaust emissions credit program. This consistency is necessary to prevent confusion, calculation errors, and costs of additional manufacturer time spent on learning and maintaining different methods and resolving errors.

§ 2754.3(f)

Purpose. The Proposed Amendments provide an equation, steps, and definitions required to calculate zero-emission generator evaporative credits and assess manufacturer compliance with emission standards. For calculating the total credits earned for a zero-emission generator evaporative family, the credits indicated in Table 1 in subsection (b) are multiplied by the sales of that family. The Proposed Amendments reference the proposed § 2408.2 for the definition of "sales," and § 2408.2(f) references the existing definition of sales provided in § 2401. Section 2401(a)(37) [to be amended to (42)] defines sales as follows:

""Sales" or "Eligible sales" means the actual or calculated sales of an engine family in California for the purposes of averaging, banking or trading. Upon Executive Officer approval, an engine manufacturer may calculate its eligible

sales through market analysis of actual federal production or sales volume. ... Actual sales are sales calculated at the end of a model year based on that model year's production, rather than on estimates of production."

Section 2408.2(f) also specifies that annual sales projections are used to project credit availability for initial certification, and actual sales volume is used in determining actual credits for end-of-year compliance determination.

Rationale. An equation with detailed steps and definitions is necessary to ensure consistency and provide a fair and equitable process for all manufacturers that choose to participate in the credit program. In addition, such consistency is necessary to ensure use of credits does not result in excess emissions. The proposed equation and steps are consistent with requirements for existing credit programs and the proposed generator-specific exhaust emissions credit program. This consistency is necessary to prevent confusion, calculation errors, and costs of additional manufacturer time spent on learning and maintaining different methods and resolving errors.

§ 2754.3(g)

The Proposed Amendments specify requirements for certification using zero-emission generator evaporative credits that:

- Identify the specific materials that must be submitted in the certification application by a manufacturer using zero-emission generator evaporative credits, and allows information required by §§ 2754.3(g)(1)(B), 2754.3(g)(1)(C), and 2754.3(g)(1)(D) to be supplied in an electronic spreadsheet;
- Establish all Executive Orders of Certification issued are conditional upon manufacturer compliance with the provisions of this § 2754.3 both during and after the model year of production, and failure to comply with all provisions of this section will be considered to be a failure to satisfy the conditions upon which the Executive Order of Certification was issued; and
- Require the manufacturer to bear the burden of establishing to the satisfaction of the Executive Officer that the conditions upon which the Executive Order of Certification was issued were satisfied or waived.

Rationale. These requirements are necessary to ensure proper documentation of zero-emission generator evaporative credit use in certification applications, which is necessary for CARB to ensure compliance with program requirements and to prevent excess emissions from the improper use of credits. The proposed requirements are consistent with requirements for existing credit programs and the proposed zero-emission generator exhaust emission reduction credit program. This consistency is necessary to prevent confusion, errors, and costs of additional manufacturer time spent on learning and maintaining different methods and resolving errors.

§§ 2754.3(h) and (i)

Purpose. The Proposed Amendments specify detailed records maintenance requirements in § 2754.3(h) and requirements for end-of-year and final reports in § 2754.3(i). The actions required in these subsections for the proposed zero-emission generator evaporative emission reduction credit program are identical to actions required by existing credit programs.

Rationale. The addition of records maintenance and reporting requirements is necessary for CARB to be able to verify credit balances for participants and their compliance with emission standards, and to ensure no excess emissions result from credit use. Aligning the proposed records maintenance and reporting requirements with the requirements for other credit programs makes them more easily understood by participants in the credit market, and better ensures their effectiveness in preventing any excess emissions resulting from credit use.

§ 2755. Permeation Emission Standards

Purpose. The current regulations in § 2755 establish permeation emission standards for fuel tanks and fuel lines in SORE with displacement less than or equal to 80 cc. These emission standards are referenced by § 2753(c) as one of two options for certification of an evaporative emission control system in SORE with displacement less than or equal to 80 cc. The current regulations do not specify an end date for the applicability of the emission standards, and therefore the requirements currently apply to all model years subsequent to the “effective date model year” specified in Table 1 in § 2755. The Proposed Amendments add text that specifies the requirements will apply only through MY 2023 for consistency with Proposed Amendments to other sections. This text provides consistency with proposed revisions to § 2753(c), and the proposed new subsection 2753(d), that require all engines in MY 2024 and subsequent model years to obtain certification of a complete evaporative emission control system, and to use the same test and certification procedures, regardless of their displacement category. Under the Proposed Amendments, the separate certification procedure for engines less than 80 cc—and associated permeation emission standards—will not apply after MY 2023.

Rationale. As described in the purpose and rationale for § 2754(a) in this section B of this chapter, the Proposed Amendments set the evaporative emission standards for all SORE except generator engines to zero, and set more stringent emission standards for generator engines, beginning in MY 2024. The proposed changes to this section (§ 2755) are necessary to implement the new emission standards and test procedures for MY 2024 and subsequent model years, while at the same time continuing to allow flexibility for earlier model years, and are necessary to provide consistency with the Proposed Amendments to § 2753(c). Under the Proposed Amendments to § 2753(c) and (d), beginning with MY 2024, all SORE equipment must use evaporative emission testing using TP-902 for certification, including engines with displacement less than

80 cc. This change obviates the need for the permeation emission standards for any SORE in MY 2024 and subsequent model years.

§ 2756. Fuel Cap Performance Standard

Purpose. The current regulations establish three fuel cap performance standards for SORE with engine displacement greater than 80 cc. The Proposed Amendments make three changes to this section:

- The first deletes the text, “or equipment that use small off-road engines with displacements > 80 cc”, to expand the applicability of the fuel cap standards to SORE with small displacement volumes.
- The second adds new text, “Fuel cap tether must meet the durability requirements in TP-902.” This text establishes a fourth performance standard.
- The third adds a fourth row to the standards table in § 2756 that establishes the applicability of the existing three performance standards to all SORE, and the proposed fourth standard, to begin in MY 2024.

Rationale. The rationales for the Proposed Amendments to § 2756 are as follows:

- The first and third changes are necessary to provide consistency with other Proposed Amendments to the evaporative emission regulations. As described in the purpose and rationale for § 2754(a) in this section B of this chapter, the Proposed Amendments provide text in a newly proposed subsection 2753(d) that requires all engines in MY 2024 and subsequent model years to obtain certification of a complete evaporative emission control system, and to use the same test and certification procedures, regardless of their displacement category. Under the Proposed Amendments, the separate certification procedure for engines less than 80 cc will not apply after MY 2023.
- The second change is necessary to remedy a problem found with some types of fuel caps and tethers. As described in section D in Chapter II of this Staff Report, some fuel caps incorporate fuel gauges that extend into the fuel in the fuel tank or otherwise come into contact with liquid fuel inside the fuel tank. These tethers and fuel caps can cause fuel to spill or drip when removing a cap from the fuel tank. During evaporative emissions compliance testing and other observations of engines, CARB staff have observed fuel spilling or dripping from several pieces of equipment when the fuel cap was removed. The current test procedures do not assess this spillage, which could result in excess emissions. This spillage should be assessed to ensure that engines determined to be in compliance with emission standards do not result in excess emissions. Consequently, the Proposed Amendments add a new “Fuel Cap and Tether Spill Test” as § 2.1(f) in TP-902 (see the purpose and rationale for § 2.1(f) in section D of this chapter), and add a new performance standard in § 2756 that references that test.

§ 2757. Optional Evaporative Emission Standards

Purpose. The current regulations in this section establish optional permeation and diurnal emission standards for advanced fuel system designs that reduce or eliminate carburetor and permeation emissions. These optional evaporative emission standards are emission targets that are more stringent than the evaporative emission standards set out in §§ 2754 and 2755. These emission standards are often referred to as the “Blue Sky Standards” because a manufacturer certifying to an optional evaporative emission standard would be allowed to affix a “Blue Sky Label” on their equipment. The Blue Sky Standards were developed to allow manufacturers to receive recognition for certifying to lower emission standards, but CARB has no record of any manufacturer taking advantage of the program for spark-ignition engines. These standards are referenced by § 2753(c) as one of two options for certification of an evaporative emission control system in SORE with displacement less than or equal to 80 cc.

The Proposed Amendments add text that specifies the Blue Sky Standards will apply only through MY 2023 for consistency with Proposed Amendments to other sections. This text provides consistency with proposed revisions to § 2753(c), and the newly proposed subsection 2753(d), that require all engines in MY 2024 and subsequent model years to obtain certification of a complete evaporative emission control system, and to use the same test and certification procedures, regardless of their displacement category. Under the Proposed Amendments, the separate certification procedure for engines less than 80 cc—and referenced Blue Sky Standards—will not apply after MY 2023.

Rationale. As described in the purpose and rationale section for § 2754(a) in this section B of this chapter, beginning with MY 2024, the Proposed Amendments set the evaporative emission standards for all SORE except generator engines to zero, and set more stringent emission standards for generator engines. The Proposed Amendments set the evaporative emission standards for generator engines to zero for MY 2028 and subsequent model years. The proposed changes to this section (§ 2757) are necessary to implement the proposed new emission standards and test procedures for MY 2024 and subsequent model years, while at the same time continuing to allow flexibility for earlier model years, and are necessary to provide consistency with the Proposed Amendments to § 2753(c). Under the Proposed Amendments to § 2753(c) and (d), beginning with MY 2024, all SORE equipment must use evaporative emission testing using TP-902 for certification, including engines with displacement less than 80 cc. In addition, the Blue Sky Standards do not include hot soak emissions and will no longer be lower than the evaporative emission standards in § 2754 once the emission standards of zero become effective. These changes obviate the need to certify any SORE to the permeation emission standards or Blue Sky Standards beginning in MY 2024.

§ 2758. Test Procedures

§ 2758(a)

Purpose. The current regulations in § 2758(a) specify which version of TP-902 manufacturers must follow to determine compliance with § 2754. The required TP-902 version vary by SORE model year and by which CP-902 version is followed. There are three Proposed Amendments to this section:

- The first changes text in § 2758(a)(3) to limit the applicability of the TP-902 version amended May 6, 2019, to MYs 2020 and 2021;
- The second adds a new subsection 2758(a)(4) that allows manufacturers for MYs 2022 and 2023 to have the option to use the current versions of CP-902 (last amended September 18, 2017), and TP-902 (last amended May 6, 2019), or the proposed versions of CP-902 and TP-902 included in the Proposed Amendments; and
- The third adds a new subsection 2758(a)(5) that requires manufacturers for MY 2024 and subsequent model years to follow the proposed version of TP-902 included in the Proposed Amendments.

Rationale. The proposed changes to this section § 2758(a) are necessary to implement the proposed changes to TP-902. (Section D in this chapter describes the Proposed Amendments for TP-902.) The addition of text to allow applicants the option to follow either the current or proposed versions is necessary to allow flexibility and prevent unnecessary confusion and costs for manufacturers that could result from changing the reference document editions for MYs 2022 and 2023 with design and testing already underway.

§§ 2758(b) and (c)

Purpose. The current regulations in §§ 2758(b) and (c) specify which test procedures manufacturers must follow to determine compliance with §§ 2755 and 2757, respectively. The requirements vary by model year. Subsections 2758(b)(3) and (c)(3) specify the test procedures for MY 2020 and subsequent model years without an end date. The Proposed Amendments add text that specifies the test procedure requirements will apply only through MY 2021 and add new subsections 2758(b)(4) and (c)(4) that provide test procedure requirements for MYs 2022 and 2023 for consistency with Proposed Amendments to other sections. The newly proposed subsections 2758(b)(4) and (c)(4) retain the existing test procedure options and add the proposed version of TP-901 included in the Proposed Amendments as an optional test procedure for determining fuel line permeation emissions. This text provides consistency with proposed revisions to § 2753(c), and the newly proposed § 2753(d), that require all engines in MY 2024 and subsequent model years to obtain certification of a complete evaporative emission control system, and to use the same test and certification procedures, regardless of their displacement category. Under the Proposed Amendments, the separate certification procedure for engines with

displacement less than or equal to 80 cc—and associated standards specified in § 2755 and § 2757 and test procedures specified in §§ 2758(b) and (c)—will not apply after MY 2023.

Rationale. As described in the purpose and rationale for § 2754(a) in this section B of this chapter, the Proposed Amendments set the evaporative emission standards for all SORE except generator engines to zero, and set more stringent emission standards for generator engines, beginning in MY 2024. The Proposed Amendments set the evaporative emission standards for generator engines to zero beginning in MY 2024. The proposed changes to these sections (§§ 2758(b) and (c)) are necessary to implement the newly proposed emission standards and test procedures for MY 2024 and subsequent model years, and are necessary to provide consistency with the Proposed Amendments to § 2753. For MYs 2022 and 2023, manufacturers may choose to use the proposed version of TP-901 included in the Proposed Amendments to better ensure their fuel tanks meet the permeation emission standards. Under the Proposed Amendments to § 2753(c) and (d), beginning with MY 2024, all SORE equipment must use evaporative emission testing using TP-902 for certification, including engines with displacement less than or equal to 80 cc. This change obviates the need for the standards specified in § 2755 and § 2757 and associated test procedure requirements specified in §§ 2758(b) and (c) for any SORE in MY 2024 and subsequent model years.

§ 2759. Equipment and Component Labeling

§ 2759(c)(4)

Purpose. The current regulations in § 2759 specify equipment and component labeling requirements to identify equipment that meets applicable evaporative emission standards. Section 2759(c)(4) specifies the information a certification label must contain and its formatting. There are four Proposed Amendments to this section:

- The first changes the capitalization of the text “IMPORTANT EMISSIONS INFORMATION” to “Important Emissions Information” in § 2759(c)(4)(A) to aid in making the text accessible to everyone, including people with visual impairments and assistive technology users.
- The second deletes the text “revised October 2008” that follows SAE J1930 in § 2759(c)(4)(C) to provide consistency with the proposed definition included as § 2752(a)(31), which incorporates by reference the most recent version available (March 2017).
- The third changes the capitalization of the text “THIS ENGINE MEETS 2006 CALIFORNIA EVP EMISSION REGULATIONS FOR SMALL OFF-ROAD ENGINES” to “This engine meets 2006 California evp emission regulations for small off-road engines” in § 2759(c)(4)(E) to aid in making the text accessible to everyone, including people with visual impairments and assistive technology users.

- The fourth updates the text in § 2759(c)(4)(F), which lists the different versions of Attachment 1 of CP-902 that contain the classification criteria for determining an evaporative family, to include a reference to the Attachment 1 version that is amended by the Proposed Amendments.

Rationale. The rationales for the Proposed Amendments to § 2759 are as follows:

- The first and third changes are necessary to make label text easier to read and consistent with current accessibility guidelines.
- The second change is necessary to provide consistency with the proposed definition included as § 2752(a)(31) and prevent confusion and regulatory uncertainty for manufacturers that create the labels.
- The fourth change is necessary to provide consistency with other Proposed Amendments to the evaporative emission regulations. Section E of this chapter summarizes the Proposed Amendments to Attachment 1 of CP-902 and Appendix E provides Attachment 1 in its entirety with underline/strikeout text to illustrate the specific Proposed Amendments.

§ 2761. Emission-Related Defect and Production Volume Reporting Requirements

§ 2761(f)(6)

Purpose. The current regulations in § 2761 specify requirements to report emission-related defects affecting a given evaporative family of 2007 model year and later SORE. Section 2761(f) specifies the requirements for end-of-year and final production volume reports, and subsection 2761(f)(6) allows a report submitted to CARB to meet the requirements of section 1054.250 of the "California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1054)," ["Part 1054"] adopted October 25, 2012, for an engine family to be used to meet the requirements of this section for an evaporative family that is equivalent to the engine family. The Proposed Amendments add text to update the reference to the Part 1054 version that is amended by the Proposed Amendments.

Rationale. This change is necessary to provide consistency with other Proposed Amendments to the SORE regulations. Section F of this chapter summarizes the Proposed Amendments to Part 1054 and Appendix F provides Part 1054 in its entirety with underline/strikeout text to identify the specific Proposed Amendments.

§ 2764. Evaporative Emission Control System Warranty Statement

§ 2764(b)

Purpose. The current regulations in § 2764 specify requirements for manufacturers to provide a California Evaporative Emission Control System Warranty, a copy of which must be included with any application for an evaporative emission control system

certification. The Proposed Amendments add new text to the required first paragraph of the “Owner’s Warranty Responsibilities” portion of the statement, as indicated by underline formatting in the following:

“As the (equipment type) owner, you are responsible for performance of the required maintenance listed in your owner’s manual. (Holder’s name) recommends that you retain all receipts covering maintenance on your (equipment type), but (Holder’s name) cannot deny warranty coverage solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.”

Rationale. This change is necessary to ensure ultimate purchasers know their warranty claims cannot be denied solely for failure to ensure the performance of all scheduled maintenance. If manufacturers improperly deny warranty claims, equipment owners may forego repairs at their own expense that should have been repaired at no cost under warranty, and instead continue to use defective equipment that exhibit excess emissions. This change corrects an oversight at the time the evaporative emission regulations were adopted and provides consistency with comparable provisions in the SORE exhaust emissions regulations in Title 13, CCR, § 2406(a).

§ 2765. New Equipment Compliance Testing

§ 2765(a)(7)

Purpose. The current regulations in § 2765 establish the requirements for new equipment compliance testing. As described in § 2765(a)(1), the regulations specify that the Executive Officer may order a manufacturer to make available for compliance testing and/or inspection five or more fuel lines, carbon canisters, or fuel tanks, or one or more engines or equipment units with complete evaporative emission control systems. Section 2765(a)(1) further specifies that the equipment to be tested “...must be selected at random from sources specified by the Executive Officer according to a method approved by the Executive Officer...” Sections 2765(a)(2) through (10) list specific additional selection and testing requirements. Section 2765(a)(7) states “Engines or equipment must be randomly chosen from the selected evaporative family or subgroup.” The Proposed Amendments adds the text “, as designated by the Executive Officer” to the end of this sentence to provide clarity and consistency with the requirement in § 2765(a)(1).

Rationale. This change is necessary to provide clarity and improve regulatory certainty by fixing an oversight in § 2765(a)(7) that occurred at the time the regulations were adopted. The current text of § 2765(a)(7) does not specify the method for making the random selection of equipment for testing. As evidenced by the adopted text in § 2765(a)(1), the intent of the regulations is for the Executive Officer to be the entity responsible for specifying sources of equipment to be tested and methods for the random selection of the equipment. The Proposed Amendments to § 2765(a)(7) are consistent with that intent.

§ 2766. Exemptions

§ 2766(b)

Purpose. The current regulations in § 2766(b) describe the small production volume tank exemption for engines or equipment that qualify under § 2752(a)(30). The current regulations in § 2752(a)(30) provide a definition of “small production volume tank” for application of the exemption. The Proposed Amendments change the definition’s reference from § 2752(a)(30) to § 2752(a)(34) to accommodate the Proposed Amendments’ addition of new definitions in § 2752(a).

Rationale. This change is necessary to help ensure manufacturers reference the correct regulation subsection.

§ 2768. Variances

Purpose. The current regulations in § 2768 establish the requirements that must be met for a SORE manufacturer to obtain a variance if the manufacturer cannot meet the requirements set forth in §§ 2754 through 2757 due to extraordinary reasons beyond the manufacturer’s reasonable control. The Proposed Amendments repeal this entire section on variances for consistency with other Proposed Amendments to the evaporative emission regulations.

Rationale. This change is necessary to achieve the broader goal of this rulemaking: accelerate the manufacture and sale of ZEE in place of SORE equipment to achieve the SORE emission reductions expected under the 2016 State SIP Strategy and EO N-79-20. When the variance provision is invoked, excess evaporative emissions can occur. As conditions of variances that have been granted, manufacturers have used banked evaporative emissions credits or set a higher EMEL to offset those excess emissions. Once the proposed emission standards of zero are effective for SORE—MY 2024 for all SORE except generator engines, and MY 2028 for generator engines—having sufficient credits to offset excess emissions will become increasingly more difficult. Allowing excess emissions to occur without adequate offset would conflict with, and increase the burden of, already challenging efforts to comply with the 2016 State SIP Strategy and EO E-79-20. Furthermore, ZEE are now available for all small off-road equipment categories, and the number and breadth of models is expected to continue increasing as it has in recent years. In addition, while the current availability of zero-emission generators is limited, the Proposed Amendments allow more time for generators to meet emission standards of zero to provide more time for innovation and growth in the zero-emission generator market. The improvement in ZEE availability since the time § 2768 was established, and the schedule for implementation of the proposed emission standards of zero, obviate the need for the variance provisions in the evaporative emission regulations.

Repealing the variance provision would ensure equity for all manufacturers, because all manufacturers would be required to comply with emission standards as set forth in the

regulations. The addition of evaporative emission credit trading in the proposed § 2754.1(e) would also alleviate the need for variances, which would enable all manufacturers to certify their engines in a manner consistent with the SORE evaporative emission standards; manufacturers who could not meet the emission standards could acquire credits to offset emissions above the emission standards. As discussed in the SRIA in Appendix I, repealing the variance section is not expected to have an economic impact.

C. TP-901, Test Procedure for Determining Permeation Emissions from Small Off-Road Engine Fuel Tanks

This section provides a summary, purpose, and rationale for each Proposed Amendment to “Small Off-Road Engine Evaporative Emissions Test Procedure, TP-901, Test Procedure for Determining Permeation Emissions from Small Off-Road Engine Fuel Tanks” (TP-901). The SORE evaporative emission regulations require the use of TP-901 to determine the permeation rate from fuel tanks of spark-ignition small off-road engines and equipment. This test procedure is incorporated by reference in Title 13, CCR, §§ 2755 and 2758. Appendix C of this Staff Report provides the full language of this test procedure with Proposed Amendments shown in strikeout and underline formatting.

Global Amendments throughout TP-901

The following proposed global changes provide updated and clarifying text that does not alter current requirements for SORE equipment.

Acronym Change

Purpose. The Proposed Amendments change “ARB” and “the ARB” to “CARB,” and add “California” before “Air Resources Board,” for consistency with recent CARB document style practices designed to improve clarity.

Rationale. This change reflects the California Air Resources Board’s recent change to, and preferred use of, the acronym “CARB” versus the prior acronym, “ARB,” and the entire agency title, “California Air Resources Board.”

Capitalization Change

Purpose. The Proposed Amendments change the formatting of text in all capital letters to mixed case to aid in making documents accessible to everyone, including people with visual impairments and assistive technology users.

Rationale. Mixed case words and sentences are easier to read and consistent with current accessibility guidelines.

Table of Contents Change

Purpose. The Proposed Amendments change the formatting of section titles and text in all capital letters to mixed case to aid in making documents accessible to everyone, including people with visual impairments and assistive technology users. In addition, the Proposed Amendments adjust page numbers to accommodate added or removed text throughout TP-901. Amendments to the Table of Contents reflect these changes.

Rationale. Mixed case words and sentences are easier to read and consistent with current accessibility guidelines. Amending the page numbers is necessary for accuracy and to prevent confusion for the reader.

Definition of Terms

Purpose. The Proposed Amendments change “authorized representative or designate” to “authorized representative or designee” to correct a spelling mistake in the definition of the term “Executive Officer.”

Rationale. California Administrative Law (Title 1, CCR, § 16(a)(4)) requires that California regulations be free of spelling errors. The change to correct the spelling of designee is necessary to provide clarity for readers and does not affect any requirements for SORE certification and testing.

§ 2. Principle and Summary of Test Procedure

Purpose. The current regulations specify: “Prior to permeation testing of the fuel tanks, durability testing and preconditioning are performed. Durability testing exposes the fuel tanks to pressure and vacuum extremes, ultraviolet radiation, fuel sloshing, and fuel cap installation cycles. After durability testing, the fuel tanks are filled with fuel and allowed to precondition to maximize the permeation emissions.” The Proposed Amendments add the text “to nominal capacity” after the current text “are filled with fuel,” to specify fuel tanks must be filled to nominal capacity after durability testing, which adds clarity and ensures fuel tanks remain at true nominal capacity for the duration of preconditioning. The definition of “nominal capacity” is specified in the SORE evaporative emission regulations. Per Title 13, CCR, § 2752, “nominal capacity” means the volume of fuel indicated by the manufacturer that represents the maximum recommended fill level.

Rationale. This change is necessary for clarification because fuel tank material may expand during durability testing or fuel may evaporate. Additional fuel must be added so that fuel tanks remain at nominal capacity. Filling the fuel tank to nominal capacity before preconditioning ensures the maximum nominal surface area is saturated and therefore produces more accurate permeation test emission rates.

§ 5. Equipment

Purpose. There are four Proposed Amendments to this section:

- The first removes the entirety of § 5(a), which currently describes materials that may be used to seal the fuel tank: "A handheld, thermostatically controlled, Teflon coated aluminum hot plate (handheld fusion welder) and coupons of the same material as the tank. Both the handheld fusion welder and coupons must be of sufficient diameter to completely cover the opening(s) of the tank (optional)."
- The second re-letters subsections (b) through (g) to (a) through (f), respectively, to accommodate the proposed removal of subsection (a) and maintain sequential subsection lettering.
- The third removes "optional" from the end of § 5(f) [re-lettered to 5(e)], which describes the relative humidity measuring instrument.
- The fourth removes the specified adoption and amendment dates in the reference to TP-902 in § 5(g) [re-lettered to 5(f)], as indicated by strikeout in this sentence: "Instrumentation meeting the requirements of section 4 of TP-902, ~~adopted July 26, 2004, and last amended May 6, 2019,~~ (if permeation testing will be performed according to section 12 of this test procedure)."

Rationale. The rationales for the Proposed Amendments to § 5 are as follows:

- Removal of materials that may be used to seal the fuel tank from the equipment list is necessary to provide consistency with the Proposed Amendment to § 10(a) to require the production volume fuel cap to be used, rather than allow the option to seal a tank by fusion welding a coupon over the fuel fill neck opening to make a seal.
- The change in subsection lettering is necessary to provide consistent lettering and to prevent confusion for the reader.
- Removal of the word "optional" for the relative humidity measuring instrument is necessary to provide consistency with the Proposed Amendment to §§ 11(a)(2) and (8) that would require relative humidity to be measured and recorded.
- Removal of the specific adoption and amendment dates in the reference to TP-902 is necessary to ensure instrumentation meets requirements set forth in the most current TP-902 test procedure available.

§ 6. Certification Test Fuel

Purpose. The current regulations in § 6 provide:

"The fuel specified in part II, section A.100.3.1.1 of the California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust

Emission Standards and Test Procedures for Passenger Cars, Light Duty Trucks, and Medium-Duty Vehicles, as last amended September 2, 2015, may be used as an alternative test fuel to certify fuel tanks for use on engines and equipment through model year 2019.”

The Proposed Amendments remove this entire paragraph to provide consistency with current regulatory requirements.

Rationale. This change is necessary to prevent confusion because the alternative test fuel specified above was allowed only through MY 2019, so is no longer applicable.

§ 7. Calibration Procedure

Purpose. The current regulations in § 7 specify: “All instruments and equipment used in this procedure shall be calibrated at the interval specified by the manufacturer. The balance listed in section 5(b) shall be calibrated annually per the balance manufacturer’s instructions using National Institute of Standards and Technology (NIST)-traceable mass standards. The NIST-traceable mass standards shall be calibrated annually by an independent organization.” The Proposed Amendments change “interval” to “time interval” and add language specifying that instruments and equipment shall be calibrated more often as needed per manufacturer instructions, for example, when equipment is moved or repaired. The Proposed Amendments also change the reference to § 5(b), from (b) to (a), in order to refer to the correct subsection, given the proposed removal of the current § 5(a) and re-lettering of § 5(b) and subsequent subsections. In addition, the Proposed Amendments change the requirement to use NIST-traceable mass standards to instead allow the use of *Système International d’Unités*ⁱⁱ (SI) traceable mass standards through NIST or another member of the Mutual Recognition Arrangement of the *Comité International des Poids et Mesures*^{jj} (CIPM MRA).

Rationale. The change to specify “time interval” is necessary to avoid confusion for a tester. The changes to specify that instruments and equipment shall be calibrated more often as needed per manufacturer instructions are necessary to provide certainty for testers who need to calibrate instruments or equipment more often and to ensure that instruments and equipment are properly calibrated and produce valid data. The change to the reference lettering from (b) to (a) is necessary to provide consistent numbering and to prevent confusion for the reader. Requiring SI-traceable standards is consistent with current industry practice and is necessary to allow flexibility for manufacturers around the world to use other recognized international standards while still maintaining the consistency necessary to ensure test data accuracy, precision, and comparability to the emission standards, as well as a level playing field amongst

ⁱⁱ International System of Units

^{jj} International Committee for Weights and Measures

manufacturers. Accurate and precise data are necessary to ensure that fuel tanks determined to be in compliance with emission standards assessed using TP-901 are indeed compliant and do not result in excess emissions.

§ 8. Durability Demonstration

§ 8.1 Pressure Test

Purpose. The Proposed Amendments to this section include the following changes:

- The first corrects a typographic error by replacing the text “The Pressure test” with “A pressure test” in the first sentence of the first paragraph.
- The second divides the first paragraph into three paragraphs, with the second and third paragraphs inset and labeled as subsections (a) and (b) to better delineate the different steps of the pressure test.
- The third modifies text to specify the pressure test shall be performed on fuel tanks without fuel and prior to any other durability testing or preconditioning. The current regulations specify that the pressure test shall be performed prior to any preconditioning of the fuel tank.
- The fourth provides additional instructions to meet an existing requirement to determine a fuel tank system’s pressure and vacuum limits. The current regulations require a manufacturer to: “Determine the fuel tank system’s design pressure and vacuum limits under normal operating and storage conditions considering the influence of any associated pressure/vacuum relief components.” However, the current regulations do not specify how to make this determination. The Proposed Amendments add the following text to describe the procedural steps and equipment to be used, including steps to measure and record the maximum and minimum pressure limits of the test fuel tank, which is necessary to determine the pressure and vacuum limits required for the next Proposed Amendment.

“To do this, measure the pressure limits using a fuel tank from an evaporative emission control system that is not used for any other portion of this test procedure by installing a pressure transducer in the fuel tank. With the exception of the use of the pressure transducer and connection to a carbon canister, as applicable, the fuel tank and fuel tank configuration used for these pressure measurements shall be identical to those used in the remainder of this test procedure. Using compressed air of no less than 21 °C, pressurize the fuel tank with compressed air, seal the fuel tank, and measure the pressure every second for 5 minutes. Use a vacuum pump to draw a vacuum in the fuel tank, seal the fuel tank, and measure the pressure every second for 5 minutes. Record the maximum and minimum pressure measurements on the test report.”

- The fifth adds a new provision to the newly labeled subsection (a):
“Subsection (b) of this test is not required if the fuel tank pressure does not

exceed a gauge pressure of + 1.0 kPa for at least one minute when pressurized and the fuel tank vacuum does not exceed a gauge pressure of – 1.0 kPa for at least one minute when a vacuum is drawn in the fuel tank.”

- The sixth removes this current provision from the newly labeled subsection (b): “If the fuel tanks have no features that would cause positive or negative pressure to accumulate during normal operation or storage, then a pressure test is not required.”
- The seventh removes this current provision at the end of § 8.1: “Tanks that have a secondary operation for drilling holes for insertion of fuel line and grommet system may have these eliminated for purposes of durability and permeation testing.”

Rationale. The rationales for the Proposed Amendments to § 8.1 are as follows:

- The first and second Proposed Amendments are necessary to improve clarity and prevent confusion for testers, better ensuring correct completion of the procedural steps.
- The third change, to require performance of a pressure test without fuel and prior to any other portion of the durability demonstration or preconditioning of the fuel tank, is necessary to further clarify the existing requirement to perform a pressure test prior to any preconditioning of the fuel tank. Preconditioning starts to occur when fuel is introduced into the fuel tank, so the existing requirement would preclude performance of a pressure test if fuel were in the fuel tank. However, some manufacturers have submitted test reports that indicated a pressure test was performed during preconditioning, which indicates that those pressure tests were conducted inconsistent with the necessary procedures that ensure accurate pressure test readings. Thus, this change is also necessary because the presence of fuel in the fuel tank could interfere with the pressure test. Performing a pressure test with fuel in the fuel tank would also result in the repeated introduction of air into the fuel tank and removal of fuel vapors from the fuel tank. Over the course of the 10,000 cycles required for the test, a significant amount of fuel vapors could be removed from the fuel tank, degrading the fuel and resulting in test results that would not represent real-world permeation emissions from fuel tanks.
- The fourth change, to provide additional instructions, is necessary to provide the clarity and consistency necessary to ensure different testers use a consistent approach known to provide accurate test results, which is necessary to ensure that fuel tanks determined to be in compliance with emission standards assessed using TP-901 are indeed compliant and do not result in excess emissions. In addition, adding explicit instructions to measure and record the pressure limits is necessary to provide the information needed to determine whether the pressure test may be omitted, per the Proposed Amendment described next.

- The fifth change is necessary because it improves the reliability of the determination that a pressure test may be omitted by providing explicit, measurable criteria for determining whether a pressure test may be omitted, rather than relying on a subjective assessment, which in turn improves safety and the certainty of later test results. If a pressure test is omitted inappropriately (e.g., the visual assessment of the physical fuel tank and its design schematics does not detect that a fuel tank indeed has features that would cause positive or negative pressure to accumulate), then two negative consequences could occur. First, excess pressurization or vacuum could result in unsafe conditions for testers, and second, permeation test results may not be valid. Fuel tanks that pressurize to a greater extent in real-world use than in certification tests could have higher permeation or venting emissions. The result could be higher emissions from SORE than are expected based on certification test results. The Proposed Amendments would allow testers to omit the pressure test if the fuel tank pressure measurements are not higher or lower than the gauge pressure range of + 1.0 to – 1.0 kPa for more than one minute. This pressure range is based on discussions with manufacturers, who have indicated that fuel tanks that are connected to carbon canisters often experience minimal pressure changes. The pressure range of + 1.0 to – 1.0 kPa would ensure that small fluctuations that naturally occur when measuring pressure are not interpreted to be accumulation of pressure or vacuum. Using these criteria would enable testers to determine based on pressure measurements whether a fuel tank has any features that would cause positive or negative pressure to accumulate during normal storage and operation, rather than rely on a subjective visual assessment.
- The sixth change, to remove the provision “If the fuel tanks have no features that would cause positive or negative pressure to accumulate during normal operation or storage, then a pressure test is not required,” is necessary to avoid unnecessary and redundant effort, and prevent confusion. The fifth change described above provides an improved method for determining whether fuel tanks have features that would cause positive or negative pressure to accumulate during normal operation or storage.
- The seventh change, to remove the provision that allows the elimination of holes in the tank before testing, is necessary to provide a tank configuration closer to production tanks (i.e., one that better simulates real-world operating and storage conditions), and therefore provide more accurate permeation test emission rates, which is necessary to ensure certified equipment does not produce excess emissions.

§ 8.3. Ultraviolet Radiation Exposure

Purpose. The current regulations specify: “A sunlight exposure test shall be performed by exposing each fuel tank to an ultraviolet light of at least $24 \text{ W}\cdot\text{m}^{-2}$ ($0.40 \text{ W}\cdot\text{hr}\cdot\text{m}^{-2}\cdot\text{min}^{-1}$) on the tank surface for at least 450 hours. Alternatively, each fuel tank may be exposed to direct natural sunlight for at least 450 daylight hours.” The

Proposed Amendments add language that specifies a tester must measure and record ultraviolet (UV) light intensity at least every hour.

Rationale. This change is necessary because temperature changes in the test area throughout the day may cause the UV light intensity to vary. Measuring and recording hourly UV intensity values provides documentation of compliance with the existing testing requirement for at least 450 hours of UV light exposure above the required intensity. In addition, such hourly tracking will better enable testers to make timely adjustments as needed to ensure UV light intensity remains at the appropriate intensity throughout each day. This change requires testers to verify they are complying with the existing requirement for UV light intensity. Exposure to sunlight or other sources of UV light can degrade materials in the evaporative emission control system, reducing their ability to resist permeation. If the intensity of the UV light does not meet the minimum requirement, the effect of the exposure on permeation emissions would be reduced and certification test results would not represent real-world emissions.

§ 8.4. Fuel Cap Installation Cycles

Purpose. The current regulations specify: “The following test is optional: Installation cycles shall be performed with fuel caps intended for use with the fuel tanks by putting each fuel cap on and taking it off 300 times. Tighten the fuel cap each time in a way that represents typical usage.” The Proposed Amendments remove the text, “The following test is optional,” to require the fuel cap installation cycles.

Rationale. This change is necessary for two reasons. First, it would ensure all testers perform the same steps during TP-901 to confirm durability of the fuel cap and its ability to maintain a seal under normal operating and storage conditions. For example, if only those manufacturers whose fuel caps were designed to be sufficiently durable to maintain an adequate seal for at least 300 installation cycles performed the test in this § 8.4, the results would not be equitable for the manufacturers performing the fuel cap installation cycles. Second, if the fuel cap installation cycles were not performed, poorly-designed fuel caps may not maintain an adequate seal, which could result in excess emissions and confound efforts to achieve emission reductions expected under the 2016 State SIP Strategy. Installing and removing the fuel tank cap simulates typical usage and ensures the tank remains sealed throughout storage and normal operation. Ensuring fuel caps are capable of maintaining a seal throughout storage and normal operation ensures there are no excess evaporative emissions leaking from the fuel cap.

§ 8.5. Fuel Cap and Tether Spill Test

Purpose. The Proposed Amendments add a new subsection 8.5 to set requirements for a new fuel cap and tether spill test with specific instructions for filling the fuel tank, installing and loosening the cap, fully extending the tether within a specified

timeframe, and reporting any dripping, spraying or leaking of fuel from any part of the fuel cap or tether.

Rationale. This change is necessary to ensure tether and fuel cap designs do not cause excess evaporative emissions. The evaporative emission regulations in Title 13, CCR, § 2756 require fuel caps for fuel tanks used on engines with displacement greater than 80 cc to be secured to the fuel tank, equipment or engine with a tether. This prevents fuel caps from falling and becoming damaged or dirty. It also prevents them from being lost, which could lead to excess emissions from the fuel tank if the cap is not replaced. Some fuel caps are equipped with internal tethers, i.e., with tethers that are attached to a location inside the fuel tanks. Other fuel caps incorporate fuel gauges that extend into the fuel in the fuel tank or otherwise come into contact with liquid fuel inside the fuel tank. During evaporative emissions compliance testing and other observations of engines, CARB staff have observed fuel spilling or dripping from several pieces of equipment when the fuel cap was removed. Based on these observations, CARB staff concludes that there is greater likelihood that these tethers and fuel caps may cause users of SORE equipment to spill or drip fuel when removing a cap from the fuel tank, thereby creating excess emissions neither captured in current test procedures nor reflected in CARB's emissions inventory. Emissions from spillage are difficult to quantify and are not measured in the test procedures because no spillage is permitted by the regulations. Spilled fuel often evaporates quickly, but it can also pollute soil or water, where it may not evaporate entirely. Once spilled fuel has evaporated, it can negatively impact air quality. Therefore, it is necessary to amend the test procedures to ensure that fuel caps and tethers are designed to prevent fuel spillage. It is also necessary for certification applicants to include information in their applications to show that their engines meet relevant standards.

This test simulates an equipment user removing the fuel cap to check the fill level or add fuel. Some users might drop the fuel cap after removing it, allowing it to hang from the tether. Others may hold the fuel cap after removing it. However, the proposed instructions for this test will ensure a uniform procedure for the varying designs of fuel caps and tethers used on SORE fuel tanks.

§ 9. Preconditioning Procedure

Purpose. The current regulations in this section specify the steps for preconditioning the five fuel tanks that are subject to permeation testing. The current regulations include these procedural requirements:

"After performing the durability tests, fill each tank to its nominal capacity with the fuel specified in section 6 of this procedure and install a production fuel cap expected to have permeation emissions at least as high as the highest emitting fuel cap that will be used with fuel tanks from the evaporative family. Place the tanks in a suitable vented enclosure. Record the preconditioning start date on the data sheet. Soak the tanks at a temperature that never falls below 38 °C for not less than 140 days. Accelerated preconditioning of the tanks can be

accomplished by soaking the tanks at an elevated temperature. Data documenting that permeation emissions from the fuel tanks will not increase with further preconditioning must be provided for tanks soaked less than 140 days. The time of the durability demonstration in section 8 of this procedure may be counted as part of the preconditioning procedure if the ambient temperature remains within the specified temperature range, the same fuel cap is used throughout the durability demonstration and preconditioning period, and each fuel tank is at least 50 percent full; fuel may be added or replaced as needed to conduct the specified durability tests.”

The Proposed Amendments detailed in Appendix C include eight changes in this section:

- The first requires the tester to measure and record the preconditioning temperature at least every five minutes to ensure fuel tanks are soaked at the appropriate temperature throughout preconditioning.
- The second requires the tester to take steps during preconditioning to ensure fuel remains at nominal capacity to ensure fuel tanks are soaking at their true nominal capacity throughout preconditioning.
- The third requires accelerated preconditioning to be conducted a minimum of 70 days to ensure tank walls are saturated with fuel.
- The fourth adds instructions necessary to produce acceptable permeation data that would demonstrate permeation emissions would not increase with further preconditioning, which may be collected gravimetrically or using a flame ionization detector (FID).
- The fifth makes more specific the reference to § 8 for the time of durability demonstration, by providing the specific sections that are relevant, “section 8.2 through 8.5”, to clarify applicable subsections of durability testing that may be counted as preconditioning.
- The sixth deletes one of the requirements for counting durability testing time as preconditioning, “the same fuel cap is used throughout the durability demonstration and preconditioning period,” because its inclusion could create confusion given the production fuel cap must be used throughout testing according to TP-901.
- The seventh adds the following instructions to provide procedural consistency: “Record the fuel fill amount and dates on the test report if fuel is added or replaced.”
- The eighth adds the following instructions to ensure fuel tank walls are fully saturated with fresh fuel: “Drain the fuel tank and refill with fresh fuel to nominal capacity 15 days prior to ending preconditioning. The fuel tank must not be empty for more than 15 minutes. Record the date and time the fuel tank is drained and refilled with fresh fuel, and record the fuel fill amount on the test report.”

Rationale. These changes are necessary to ensure permeation testing produces the accurate results necessary to prevent an incorrect determination of compliance with the evaporative emission standards. An incorrect compliance determination could lead to excess emissions. The specific rationales for each of the Proposed Amendments to § 9 are as follows:

- Requiring temperature measurements every five minutes during preconditioning is necessary to ensure temperatures do not fall below required thresholds, and is consistent with requirements for permeation testing in § 11(a)(7). Temperature influences evaporation and therefore permeation test rates, so in order to verify fuel tanks are soaking at the appropriate temperature for the duration of preconditioning, temperature must be measured and recorded frequently. Per § 11(a)(7), current regulations require temperature to be measured and recorded every five minutes during permeation testing, which indicates it is feasible and necessary to measure and record temperature every five minutes during preconditioning as well.
- Requiring the tester to take steps during preconditioning to ensure fuel remains at nominal capacity is necessary because fuel tank material may expand during preconditioning or fuel may evaporate, so additional fuel may need to be added to ensure fuel tanks remain at true nominal capacity for the duration of preconditioning. This could involve testing staff checking the fill level of fuel tanks on a periodic basis.
- Requiring a minimum soak requirement of 70 days for accelerated preconditioning is necessary to better ensure preconditioning of the fuel tanks will not be stopped prematurely (i.e., before the permeation rate stops increasing). Many manufacturers attempt to accomplish accelerated preconditioning of their fuel tanks to finish testing sooner. Often, this involves measuring the mass loss of the fuel tanks every day, beginning the day that preconditioning starts. Their goal is to end preconditioning as soon as possible. Requiring a minimum of 70 days of preconditioning will continue to allow accelerated preconditioning while decreasing the likelihood that a tester will improperly determine the permeation rate has stopped increasing. U.S. EPA requires a minimum preconditioning period of 70 days for SORE fuel tanks, as described in 40 CFR § 1060.520. CARB requires a minimum preconditioning period of 70 days for PFCs, as described in TP-502. The proposed minimum preconditioning period for SORE fuel tanks would therefore be consistent with the minimum used for testing the same fuel tanks for U.S. EPA and with CARB's requirements for PFCs, which are often made of similar materials to those used to manufacture SORE fuel tanks.
- Specific instructions for how to produce acceptable permeation data that would demonstrate permeation emissions would not increase with further preconditioning is necessary to improve consistency for those implementing the procedure, which better ensures adequate preconditioning time is accomplished, increases clarity for those reviewing the data, better ensures

accurate evaporative emission compliance determinations, and better maintains a level playing field amongst manufacturers. CARB staff developed the instructions based on data that have been provided by manufacturers to document that permeation emissions from the fuel tanks will not increase with further preconditioning. To allow flexibility for manufacturers, the proposed instructions provide two options for data that may be provided to document that permeation emissions from the fuel tanks will not increase with further preconditioning: one to be used when conducting a permeation test by the gravimetric method described in § 11 and one to be used when conducting a permeation test by the flame ionization detector method in § 12 of TP-901.

- A more specific reference to § 8 for the time of the durability demonstration is necessary to clarify applicable subsections of durability testing that may be counted as preconditioning, which prevents confusion and saves time for testers. The time of the pressure test could not be counted as part of the preconditioning procedure because the pressure test must be performed before any preconditioning and the fuel tanks would not be at least 50 percent full.
- Removing one of the requirements for counting durability testing time as part of the preconditioning procedure, “the same fuel cap is used throughout the durability demonstration and preconditioning period,” is necessary to prevent confusion given a production fuel cap would be used throughout testing according to TP-901 under the Proposed Amendments. Using the production fuel cap throughout the duration of the test procedure ensures real-world storage and operation conditions, which enables test emission rates that better reflect real-world emissions and therefore helps prevent the certification of fuel tanks that could produce excess emissions.
- Adding a requirement to record the fuel fill amount and dates during preconditioning is necessary for reviewers to verify the procedure is followed correctly and consistently by different testers.
- Adding a requirement to refill tanks with fresh fuel 15 days prior to ending preconditioning is necessary to ensure permeation rates are not suppressed by conditions that do not reflect real-world conditions. As fuel soaks in the tanks, the more volatile constituents evaporate more quickly, and therefore the fuel level and permeation rate change over time. To ensure fully saturated fuel tank walls and emission rates comparable to real-world conditions, fuel should be replaced before ending preconditioning. CARB staff proposes refilling the tank 15 days before the end of preconditioning for two reasons. The first is that it represents a periodic replacement of fuel in equipment that would occur as fuel is consumed due to its use. The second is that testers attempting to accomplish accelerated preconditioning could conduct two permeation tests separated by 15 days according to the procedure in § 12 of TP-901 when attempting to accomplish accelerated preconditioning. The proposed requirement, “The fuel tank must not be empty for more than 15 minutes” during the refueling

process, is necessary to ensure fuel tank walls remain fully saturated. The proposed 15-minute maximum time the fuel tank is allowed to be empty is consistent with the 15-minute maximum time allowed by the current requirements in § 10(a).

§ 10. Sealing Procedure

Purpose. The Proposed Amendments detailed in Appendix C include six changes in this section:

- The first removes the requirement for tanks to be equilibrated to 40 ± 2 °C for a minimum of two hours before being sealed. This change would result in tanks being tested immediately after sealing.
- The second adds the text “(except section 8.1(a))” to the requirement to seal each tank with the same fuel cap used for the durability demonstration and preconditioning procedure.
- The third removes the option for testers to seal a test fuel tank “by fusion welding a coupon over the fuel fill neck opening to make a seal.” This change would result in only one option for sealing a test fuel tank: use of the same fuel cap used for the durability demonstration and preconditioning procedure.
- The fourth removes the text describing methods for sealing fuel tanks other than with the fuel cap, to ensure a consistent procedure for sealing all fuel tanks for permeation testing. This will also ensure emissions measured in certification tests better represent real-world fuel tank permeation emissions.
- The fifth makes more specific the existing procedure to prepare a reference tank, as indicated by strikeout and underline in the following text in § 10(b)(2): “Fill the reference tank with enough glass beads (or other inert material) so the mass of the reference tank is approximately the same as the test fuel tanks greater than the mass of the lightest test fuel tank and less than the mass of the heaviest test fuel tank when filled with fuel. ~~Considering the performance characteristics of the balance to be used, use good engineering judgment as defined in 40 CFR Part 1060.801 to determine how similar the mass of the reference tank needs to be to the mass of the test tank.~~”
- The sixth modifies the instructions for sealing the reference tank to require use of a production fuel cap identical to the fuel caps used to seal the test fuel tanks.

Rationale. These changes are necessary to ensure permeation testing produces the accurate results necessary to prevent an incorrect determination of compliance with the evaporative emission standards. An incorrect compliance determination could lead to excess emissions from certified engines. The specific rationales for each of the Proposed Amendments to § 10 are as follows:

- The first proposed change, removing the requirement for tanks to be equilibrated for two hours, is necessary to prevent inaccurate permeation test

rates. Allowing unsealed tanks filled with fuel to sit at elevated temperature for an extended time allows evaporation of the fuel to occur, which may result in an inaccurate, lower permeation test emission rate that does not reflect real-world conditions.

- The second, third, and fourth proposed changes, which result in only one option for sealing the tanks (use of the production fuel cap used for the durability demonstration (except section 8.1(a)) and preconditioning procedure), are necessary to ensure more accurate test emission rates. Using the production volume fuel cap on the fuel tank for the duration of the test simplifies the procedure and provides testing that better reflects real-world storage and operation conditions, and therefore produces more accurate test emission rates, which is necessary to ensure certified equipment does not result in excess emissions. Testing fuel tanks in a configuration that more closely matches the configuration on a piece of equipment may improve compliance rates of engines with existing diurnal emission standards. Sealing fuel tanks with a coupon of fuel tank material and a fusion welder or another method results in liquid or vapor leaks in some cases. Sealing with a fuel cap would prevent such problems and enable testing to be completed more quickly.
- The fifth proposed change, to provide specific constraints for the reference fuel tank mass, is necessary to improve clarity and consistency for those implementing the procedure, which increases clarity for those reviewing the data, and better ensures accurate test emission rates and evaporative emission compliance determinations.
- The sixth proposed change, to require a tester to seal the reference tank with a production fuel cap identical to the fuel caps used to seal the test fuel tanks, is necessary for consistency with the requirement to require all fuel tanks to be sealed with production fuel caps used for the durability demonstration (except section 8.1(a)) and preconditioning procedure.

§ 11. Gravimetric Permeation Test

Purpose. The Proposed Amendments detailed in Appendix C include four types of changes in this section:

- The first removes the word “optional” in § 11(a)(2) and (8) as it pertains to recording relative humidity before weighing each seal test fuel tank. The change would make it a requirement for testers to measure and record relative humidity.
- The second modifies the text in §§ 11(a)(2) and (8) regarding how to measure and record the mass of the reference tank and each of the test tanks, so that the mass of every fuel tank is measured and recorded (rather than differences between the reference tank and test tanks).

- The third adds text to § 11(a)(2) to require the tanks to be weighed within 15 minutes of sealing, compared to the current requirement, “directly after sealing.”
- The fourth replaces the word “Record” with “Calculate” in the first sentence of § 11(a)(9), “Record the difference in mass between the reference tank and each test fuel tank for each daily measurement.”

Rationale. These changes are necessary to improve the test procedure to better ensure the accuracy of permeation test results, which is necessary to prevent an incorrect determination of compliance with the evaporative emission standards and prevent excess emissions from certified engines. The specific rationales for each of the Proposed Amendments to § 10 are as follows:

- Because natural moisture in the air can be absorbed and desorbed from fuel tank walls, it is necessary to require that relative humidity data be recorded to enable the tester and data reviewer to consider all elements that may affect results.
- Measuring and recording the reference fuel tank and test fuel tank mass (rather than differences between the reference tank and test tanks) is necessary to simplify the method, improve clarity and accuracy, and provide information necessary for review of the data. For example, it is necessary to record the mass of each test fuel tank and the reference tank to confirm the mass of the reference tank is greater than the mass of the lightest test fuel tank and less than the mass of the heaviest test fuel tank.
- Providing a specific 15-minute maximum time for weighing the fuel tanks after sealing them is necessary to ensure no excessive delay occurs between sealing the fuel tanks and weighing them. If an excessive delay were to occur, the mass measurements could be biased low, which would result in permeation test rates that were biased low and certification of engines with emissions that exceed the evaporative emission standards. The proposed 15-minute maximum time allowed to weigh the fuel tanks is consistent with the 15-minute maximum time allowed by the current requirements in § 10(a) and proposed for § 9, and allows a reasonable amount of time for completing procedural tasks without introducing an unreasonable amount of uncertainty in the test calculations.
- Replacing the word “Record” with “Calculate” in the first sentence of § 11(a)(9) is necessary to improve the accuracy and clarity of the description of the action that must be performed. The difference in mass between the reference tank and each test fuel tank for each daily measurement must be calculated rather than only recorded, given how the Proposed Amendments modify the weighing procedure in §§ 11(a)(2) and (8). Under the Proposed Amendments to §§ 11(a)(2) and (8), the reference tank and test tanks would be weighed each day—the balance would not be tared with the reference container on it—and the difference in mass between the reference tank and each test tank would be calculated each day.

§ 12. Permeation Test with Flame Ionization Detector

Purpose. The Proposed Amendments add language to § 12(a)(2), as indicated by underlined text in the following sentence, to specify that the fuel tank must be placed in the enclosure within 15 minutes of sealing:

“Place the fuel tank in an enclosure meeting the requirements of section 4 of TP-902 that is equilibrated to 40 ± 2 °C, and close the enclosure within 15 minutes of sealing the fuel tank as specified in section 10 of this procedure.”

Rationale. This change is necessary to ensure no excessive delay occurs between sealing the fuel tanks and placing them in the test enclosure to begin the permeation test. If an excessive delay were to occur, the measurements of reactive organic gas emissions from the fuel tank using the flame ionization detector could be biased low, which would result in permeation test rates that were biased low and certification of engines with emissions that exceed the evaporative emission standards. The proposed 15-minute maximum time allowed to enclose fuel tanks is consistent with the 15-minute maximum time allowed by the current requirements in § 10(a) and proposed for §§ 9 and 11, and allows a reasonable amount of time for completing procedural tasks without introducing an unreasonable amount of uncertainty in the test calculations.

§ 16. Figures

Purpose. The Proposed Amendments include the following four changes to “Figure 1. Data Sheet.”

- The first removes the text “Water Bath Test (pass/fail):”
- The second replaces “weight” with “mass” in the “Full Tank Data” and “Reference Tank” table column headings
- The third removes the weight symbols from the column headings of both tables
- The fourth removes the equation for weight loss at the bottom of the “Full Tank Data” table

Rationale. These changes are necessary to provide consistency with regulatory amendments approved in 2016 and to improve accuracy. The Proposed Amendments remove the text “Water Bath Test (pass/fail):” because the water bath test requirement was removed from the test procedure by amendments approved in 2016. Using the term “mass” is more accurate than “weight” and provides consistency with the Proposed Amendments to earlier sections of this test procedure and other CARB procedures. Due to amendments made in 2016, the equation on the data sheet to determine weight loss is obsolete as are the weight symbols used in the equation and table column headings.

D. TP-902, Test Procedure for Determining Diurnal Emissions from Small Off-Road Engines

This section provides a summary, purpose, and rationale for each Proposed Amendment to “Small Off-Road Engine Evaporative Emissions Test Procedure, TP-902, Test Procedure for Determining Diurnal Emissions from Small Off-Road Engine Fuel Tanks” (TP-902). The SORE evaporative emission regulations require the use of TP-902 to determine the diurnal and resting loss evaporative emissions from small off-road engines. This test procedure is incorporated by reference in Title 13, CCR, § 2758. Appendix D of this Staff Report provides the full language of this test procedure with Proposed Amendments shown in strikeout and underline formatting.

Global Amendments throughout TP-902

Acronym Change

Purpose. The Proposed Amendments change “ARB” and “the ARB” to “CARB,” and add “California” before “Air Resources Board,” for consistency with recent CARB document style practices designed to improve clarity.

Rationale. This change reflects the California Air Resources Board’s recent change to, and preferred use of, the acronym “CARB” versus the prior acronym, “ARB,” and the entire agency title, “California Air Resources Board.”

Capitalization Change

Purpose. The Proposed Amendments change the formatting of text in all capital letters to mixed case to aid in making documents accessible to everyone, including people with visual impairments and assistive technology users.

Rationale. Mixed case words and sentences are easier to read and consistent with current accessibility guidelines.

Table of Contents Change

Purpose. The Proposed Amendments change the formatting of section titles and text in all capital letters to mixed case to aid in making documents accessible for everyone, including people with visual impairments and assistive technology users. In addition, the Proposed Amendments adjust page numbers to accommodate added or removed text throughout TP-902. Amendments to the Table of Contents reflect these changes. The Proposed Amendments also change “List of Tables and Figures” to “List of Tables, Figures, and Attachments” for accuracy because there is one of each in the list and the list includes an attachment.

Rationale. Mixed case words and sentences are easier to read and consistent with current accessibility guidelines. Amending the page numbers and Table of Contents list title is necessary for accuracy and to prevent confusion for the reader.

"Diurnal" Phrase Changes to Incorporate "Hot Soak" Emissions

Purpose. As described in Chapter II of this Staff Report and detailed in the following sections, the Proposed Amendments incorporate "hot soak" emissions into the evaporative emission standards for SORE. To support the inclusion of the "hot soak" emissions, the Proposed Amendments make these phrasing changes throughout the regulations:

- Change "Diurnal" to "Evaporative" in the title of TP-902, as identified with the strikeout and underline text:

"Test Procedure for Determining Evaporative ~~Diurnal~~ Emissions from Small Off-Road Engines"

- Change "diurnal and resting loss evaporative emissions" to "hot soak, diurnal, and resting loss evaporative emissions;"
- Change "diurnal emission standard" to "hot soak plus diurnal emission standard;"
- Change "24-hour diurnal" to "hot soak and 24-hour diurnal;"
- Change "diurnal emission test" to "evaporative emission test;" and
- Change "diurnal emissions" to "hot soak and diurnal emissions," or "evaporative emissions," depending on the context of a particular sentence.

Rationale. This change is necessary to provide consistency with the Proposed Amendments to the evaporative emission standards specified in § 2754. Currently, the evaporative emission standards only apply to the 24-hour diurnal cycle. However, some engines tested by CARB have met the 24-hour diurnal emission standard, but had hot soak emissions several times higher than the diurnal emission standards. In order to control these emissions that reduce the expected benefits of the emission standards, it is necessary to change § 2754 to incorporate hot soak emissions into the evaporative emission standards. The Proposed Amendments update text throughout the regulations, including TP-902, to reflect this change. The purpose and rationale section for § 2754(a) in section B of this chapter provide additional information about hot soak emissions and the need for the amendments to the evaporative emission regulations.

Temperature Change

Purpose. The Proposed Amendments add temperature "40.6 °C" to references of the one-hour hot soak in §§ 3, 5, and 5.2 because it may optionally be performed at 40.6°C to match the maximum temperature of the diurnal profile and to provide greater purging of passively-purged carbon canisters.

Rationale. This change is necessary because the alternative higher hot soak temperature enables passively-purged carbon canisters to experience a greater amount of purging during the forced cooling. References to the one-hour hot soak

include the alternate temperature to be consistent with the procedure. The optional temperature of 40.6 °C for the hot soak test is also consistent with the required temperature for the hot soak test for motor vehicles in the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles."

Definition of Terms

Purpose. The Proposed Amendments change "authorized representative or designate" to "authorized representative or designee" to correct a spelling mistake in the definition of the term "Executive Officer."

Rationale. California Administrative Law (Title 1, CCR, § 16(a)(4)) requires that California regulations be free of spelling errors. The change to correct the spelling of designee is necessary to provide clarity for readers and does not affect any requirements for SORE certification and testing.

§ 2. Pre-Certification Requirements

§ 2.1(b). Pressure Test

Purpose. The Proposed Amendments to this section include the following changes:

- The first corrects a typographic error by replacing the text "The Pressure test" with "A pressure test" in the first sentence of the first paragraph.
- The second divides the first paragraph into three paragraphs, with the second and third paragraphs inset and labeled as subsections (1) and (2) to better delineate the different steps of the pressure test.
- The third modifies text to specify the pressure test shall be performed on fuel tanks without fuel and prior to any other durability testing or preconditioning. The current regulations specify that the pressure test shall be performed prior to any preconditioning of the fuel tank.
- The fourth provides additional instructions to meet an existing requirement to determine a fuel tank system's pressure and vacuum limits. The current regulations require a manufacturer to: "Determine the fuel tank system's design pressure and vacuum limits under normal operating and storage conditions considering the influence of any associated pressure/vacuum relief components." However, the current regulations do not specify how to make this determination. The Proposed Amendments add the following text to describe the procedural steps and equipment to be used, including steps to measure and record the maximum and minimum pressure limits of the test fuel tank, which is necessary to determine the pressure and vacuum limits required for the next Proposed Amendment.
 - "To do this, measure the pressure limits using a fuel tank from an evaporative emission control system that is not used for any other

portion of this test procedure by installing a pressure transducer in the fuel tank. With the exception of the use of the pressure transducer and connection to a carbon canister, as applicable, the fuel tank and fuel tank configuration used for these pressure measurements and the evaporative emission control system in which it is used shall be identical to those used on the engine tested in the remainder of this test procedure. Using compressed air of no less than 21 °C, pressurize the fuel tank with compressed air, seal the fuel tank, and measure the pressure every second for 5 minutes. Use a vacuum pump to draw a vacuum in the fuel tank, seal the fuel tank, and measure the pressure every second for 5 minutes. Record the maximum and minimum pressure measurements on the test report.”

- The fifth adds a new provision to the newly labeled subsection (1): “Subsection (2) of this test is not required if the fuel tank pressure does not exceed a gauge pressure of + 1.0 kPa for at least one minute when pressurized and the fuel tank vacuum does not exceed a gauge pressure of – 1.0 kPa for at least one minute when a vacuum is drawn in the fuel tank.”
- The sixth removes this current provision from the newly labeled subsection (2): “If the fuel tank has no features that would cause positive or negative pressure to accumulate during normal operation or storage, then a pressure test is not required.”

Rationale. The rationales for the Proposed Amendments to § 2.1(b) are as follows:

- The first and second Proposed Amendments are necessary to improve clarity and prevent confusion for testers, better ensuring correct completion of the procedural steps.
- The third change, to require performance of a pressure test without fuel and prior to any other portion of the durability demonstration or preconditioning of the fuel tank, is necessary to further clarify the existing requirement to perform a pressure test prior to any preconditioning of the fuel tank. Preconditioning starts to occur when fuel is introduced into the fuel tank, so the existing requirement would preclude performance of a pressure test if fuel were in the fuel tank. However, some manufacturers have submitted test reports that indicated a pressure test was performed during preconditioning, which indicates that those pressure tests were conducted inconsistent with the necessary procedures that ensure accurate pressure test readings. Thus, this change is also necessary because the presence of fuel in the fuel tank could interfere with the pressure test. Performing a pressure test with fuel in the fuel tank would also result in the repeated introduction of air into the fuel tank and removal of fuel vapors from the fuel tank. Over the course of the 10,000 cycles required for the test, a significant amount of fuel vapors could be removed from the fuel tank, degrading the fuel and resulting in test results that would not represent real-world permeation emissions from fuel tanks.

- The fourth change, to provide additional instructions, is necessary to provide the clarity and consistency necessary to ensure different testers use a consistent approach known to provide accurate test results, which is necessary to ensure that engines determined to be in compliance with emission standards assessed using TP-902 are indeed compliant and do not result in excess emissions. In addition, adding explicit instructions to measure and record the pressure limits is necessary to provide the information needed to determine whether the pressure test may be omitted, per the Proposed Amendment described next.
- The fifth change is necessary because it improves the reliability of the determination that a pressure test may be omitted by providing explicit, measurable criteria for determining whether a pressure test may be omitted, rather than relying on a subjective assessment, which in turn improves safety and the certainty of later test results. If a pressure test is omitted inappropriately (e.g., the visual assessment of the physical fuel tank and its design schematics does not detect that a fuel tank indeed has features that would cause positive or negative pressure to accumulate), then two negative consequences could occur. First, excess pressurization or vacuum could result in unsafe conditions for testers, and second, hot soak and diurnal emission test results may not be valid. Fuel tanks that pressurize to a greater extent in real-world use than in certification tests could have higher permeation or venting emissions. The result could be higher emissions from SORE than are expected based on certification test results. The Proposed Amendments would allow testers to omit the pressure test if the fuel tank pressure measurements are not higher or lower than the gauge pressure range of + 1.0 to – 1.0 kPa for more than one minute. This pressure range is based on discussions with manufacturers, who have indicated that fuel tanks that are connected to carbon canisters often experience minimal pressure changes. Using these criteria would enable testers to determine based on pressure measurements whether a fuel tank has any features that would cause positive or negative pressure to accumulate during normal storage and operation, rather than rely on a subjective visual assessment.
- The sixth change, remove the provision “If the fuel tank has no features that would cause positive or negative pressure to accumulate during normal operation or storage, then a pressure test is not required,” is necessary to avoid unnecessary and redundant effort, and prevent confusion. The fifth change described above provides an improved method for determining whether a fuel tank has features that would cause positive or negative pressure to accumulate during normal operation or storage.

§ 2.1(e). Ultraviolet Radiation Exposure

Purpose. The current regulations specify: “A sunlight-exposure test shall be performed by exposing each test engine or equipment unit to an ultraviolet light of at least $24 \text{ W}\cdot\text{m}^{-2}$ ($0.40 \text{ W}\cdot\text{hr}\cdot\text{m}^{-2}\cdot\text{min}^{-1}$) for at least 450 hours. Alternatively, each test engine or equipment unit may be exposed to direct natural sunlight for at least 450 daylight

hours.” The Proposed Amendments add language that specifies a tester must measure and record ultraviolet (UV) light intensity at least every hour.

Rationale. This change is necessary because temperature changes in the test area throughout the day may cause the UV light intensity to vary. Measuring and recording hourly UV intensity values provides documentation of compliance with the testing requirement for at least 450 hours of UV light exposure above the required intensity. In addition, such hourly tracking will better enable testers to make timely adjustments as needed to ensure UV light intensity remains at the appropriate intensity throughout each day. This change requires testers to verify they are complying with the existing requirement for UV light intensity. Exposure to sunlight or other sources of UV light can degrade materials in the evaporative emission control system, reducing their ability to resist permeation. If the intensity of the UV light does not meet the minimum requirement, the effect of the exposure on permeation emissions would be reduced and certification test results would not represent real-world emissions.

§ 2.1(f). Fuel Cap and Tether Spill Test

Purpose. The Proposed Amendments add a new subsection 2.1(f) to set requirements for a new fuel cap and tether spill test with specific instructions for filling the fuel tank, installing and loosening the cap, fully extending the tether within a specified timeframe, and reporting any dripping, spraying or leaking of fuel from any part of the fuel cap or tether.

Rationale. This change is necessary to ensure tether and fuel cap designs do not cause excess evaporative emissions. The evaporative emission regulations in Title 13, CCR, § 2756 require fuel caps for fuel tanks used on engines with displacement greater than 80 cc to be secured to the fuel tank, equipment or engine with a tether. This prevents fuel caps from falling and becoming damaged or dirty. It also prevents them from being lost, which could lead to excess emissions from the fuel tank if the cap is not replaced. Some fuel caps are equipped with internal tethers, i.e., with tethers that are attached to a location inside the fuel tanks. Other fuel caps incorporate fuel gauges that extend into the fuel in the fuel tank or otherwise come into contact with liquid fuel inside the fuel tank. During evaporative emissions compliance testing and other observations of engines, CARB staff have observed fuel spilling or dripping from several pieces of equipment when the fuel cap was removed. Based on these observations, CARB staff concludes that there is greater likelihood that these tethers and fuel caps may cause users of SORE equipment to spill or drip fuel when removing a cap from the fuel tank, thereby creating excess emissions neither captured in current test procedures nor reflected in CARB’s emissions inventory. Emissions from spillage are not measured in the test procedures because no spillage is permitted by the regulations. Spilled fuel often evaporates quickly, but it can also pollute soil or water, where it may not evaporate entirely. Once spilled fuel has evaporated, it can negatively impact air quality. Therefore, it is necessary to amend the test procedures to ensure that fuel caps and tethers are designed to prevent fuel spillage. It is also

necessary for certification applicants to include information in their applications to show that their engines meet relevant standards.

This test simulates an equipment user removing the fuel cap to check the fill level or add fuel. Some users might drop the fuel cap after removing it, allowing it to hang from the tether. Others may hold the fuel cap after removing it. However, the proposed instructions for this test will ensure a uniform procedure for the varying designs of fuel caps and tethers used on SORE fuel tanks.

§ 2.2. Canister Working Capacity

Purpose. The current regulations specify: “For evaporative emission control systems that use a carbon canister and do not pressurize the fuel tank, the carbon canister must have a working capacity of at least 1.4 grams of vapor storage capacity per liter of fuel tank nominal capacity for tanks greater than or equal to 3.78 liters, and 1.0 grams of vapor storage capacity per liter of fuel tank nominal capacity for tanks less than 3.78 liters.”

The Proposed Amendments change “nominal capacity” to “total capacity” to require that the total capacity of the fuel tank must be used for calculating carbon canister working capacity for these types of evaporative emission control systems. Per Title 13, CCR, § 2752, “nominal capacity” means the volume of fuel indicated by the manufacturer that represents the maximum recommended fill level. In contrast, total capacity is the total internal volume of the fuel tank, which includes space occupied by fuel vapor.

Rationale. This change is necessary to ensure carbon canisters are sized properly to account for the total vapor space in the fuel tanks, particularly in cases where the total capacity of the fuel tank is significantly larger than the nominal capacity. An insufficiently-sized carbon canister may not control venting emissions from a fuel tank effectively. CARB staff demonstrated the effective control of venting emissions using carbon canisters with 2.0 grams of vapor storage capacity per liter of fuel tank total capacity, as described in the 2003 Staff Report for the adoption of the current SORE emission standards (CARB, 2003). The working capacity requirements proposed in 2003 were modified based on input from manufacturers. Those modifications resulted in the current working capacity requirements. The nominal capacity and total capacity of a fuel tank are often equivalent or nearly equivalent. However, in some cases, the total capacity is significantly greater than the nominal capacity. In such a case, the carbon canister may not sufficiently control venting emissions. CARB staff have found that the nominal capacity indicated by manufacturers in a certification application often does not match the recommended fill level in the user’s manual for the engine, which can increase the likelihood that the carbon canister will not effectively control venting emissions.

§ 2.4. Running Loss Emission Control Test [newly proposed section]

Purpose. The Proposed Amendments add a new subsection, "2.4 Running Loss Emission Control Test," to specify instructions for the existing requirement for certification applicants to demonstrate that running loss emissions are controlled from being emitted into the atmosphere. Per Title 13, CCR, § 2752(a)(27), "running loss emissions" means evaporative emissions from a small off-road engine that occur while it is being operated. The Proposed Amendments would allow certification applicants to select one of two methods to demonstrate that running loss emissions are controlled from being emitted into the atmosphere.

Rationale. This change is necessary to provide clear and consistent directions for applicants for how to demonstrate control of running loss emissions, and to simplify CARB review of applications. The SORE evaporative emission regulations in § 2754(b)(1) already require applicants certifying engines or equipment to comply with the diurnal emission standards to submit a determination in the certification application that running loss emissions are controlled from being emitted into the atmosphere, but do not specify a test procedure. In addition, the current version of TP-902 does not provide a test sequence for demonstrating control of running loss emissions. The Proposed Amendments to § 2754 would require applicants to follow one of the two methods in this newly proposed procedure in § 2.4 for their demonstration. The two methods in this procedure are based on methods manufacturers have used to demonstrate running loss emission control.

§ 3. General Summary of Test Procedure

Purpose. The current regulations in § 3 refer to Title 13, CCR, "section 2752 (a)(7)" for the definition of "evaporative emission control system." The Proposed Amendments change the subsection reference number from (7) to (9) so that the text continues to refer to the definition of "evaporative emission control system."

Rationale. This change is necessary to provide consistency with the Proposed Amendments to § 2752(a)(7), which change the subsection number of the "evaporative emission control system" definition from (7) to (9) to accommodate the proposed addition of two new definitions earlier in § 2752(a).

§ 4. Instrumentation

Purpose. The Proposed Amendments to this section include the following changes:

- Add "Title 40 of the Code of Federal Regulations" to define the acronym "CFR" in the first paragraph of § 4.
- Add "40 CFR" before the text "§86.117-90(a)(1) through (a)(6)" in § 4.2.1.
- Add a space between each temperature value and "°F" where currently there is no space in the second, third, and fifth paragraphs in § 4.1.

- Add a space between “±” and “2.0 inches” at the end of the sixth paragraph in § 4.1.
- Add a new subsection, “4.3 Other Instruments and Equipment,” to establish requirements for equipment calibration frequency and minimum balance sensitivity, specified by the following text:

“All instruments and equipment used in this Test Procedure, TP-902, shall be calibrated at the time interval specified by the manufacturer or more often as needed per manufacturer instructions (e.g., if equipment undergoes repair).

For mass measurements more than 6,200 grams, the minimum sensitivity of the balance must be 0.1 grams. For mass measurement between 1,000 and 6,200 grams, the minimum sensitivity of the balance must be 0.01 grams. For mass measurements less than 1,000 grams, the minimum sensitivity of the balance must be 0.001 grams.

The balance shall be calibrated annually per the balance manufacturer’s instructions, or more often as needed per the manufacturer instructions (e.g., if the balance is moved), using *Système International d’Unités* (SI)-traceable mass standards through National Institute of Standards and Technology (NIST) or another member of the Mutual Recognition Arrangement of the *Comité International des Poids et Mesures* (CIPM MRA). The SI-traceable mass standards shall be calibrated annually by an independent organization or more often as needed.”

Rationale. The rationales for the Proposed Amendments to § 2.1(b) are as follows:

- Addition of the definition of “Title 40 of the Code of Federal Regulations” at the beginning of § 4, and “40 CFR” before the section number in § 4.21, is necessary to provide the full reference information needed by testers and to provide consistency with reference formatting elsewhere in the test procedure.
- Addition of a space between “±” and “2.0 inches” in § 4.1 is necessary to provide consistent formatting throughout the procedure, which improves readability for testers.
- Addition of requirements for equipment calibration frequency and minimum balance sensitivity is necessary to ensure test data accuracy and precision. Specifying that instruments and equipment shall be calibrated more often as needed per manufacturer instructions is necessary to provide certainty for testers who need to calibrate instruments or equipment more often and to ensure that instruments and equipment are properly calibrated and produce valid data. Accurate and precise data are necessary to ensure that engines determined to be in compliance with emission standards assessed using TP-902 are indeed compliant and do not result in excess emissions. Calibration and sensitivity requirements specific to balances are necessary because the Proposed Amendments that add instructions for applicants to demonstrate

control of running loss emissions (in a newly proposed section 2.4) require the use of a balance with sensitivity adequate to determine whether the mass of a carbon canister increases during the running loss test. Including SI-traceable standards provides consistency with current practice. The requirements to use SI-traceable mass standards, and for annual calibration of those standards by an independent organization, is consistent with current industry practice and is necessary to allow flexibility for manufacturers around the world to use other recognized international standards while still maintaining the consistency necessary to ensure test data accuracy, precision, and comparability to the emission standards, as well as a level playing field amongst manufacturers. These instructions are based on those in TP-901 and Attachment 1 to TP-902 and are consistent with standard laboratory practices to ensure collection of valid data.

§ 5. Test Procedure

Purpose. The Proposed Amendments remove the following sentence from the first paragraph of § 5: “The equipment shall be approximately level during all phases of the test sequence to prevent abnormal fuel distribution.”

Rationale. This change is necessary to avoid confusion for testers and to provide consistency with the Proposed Amendments to § 5.2 that would require a tilt test. A slosh test involves rocking the engine 15 degrees back and forth, so equipment will not remain level throughout testing. The proposed tilt test involves tilting the test unit 90 degrees in each of three directions.

§ 5.1. Evaporative Emission Control System Preconditioning

Purpose. The current regulations in this section specify the steps for preconditioning the evaporative emission control system prior to the hot soak and diurnal emission tests. The current regulations include these procedural requirements:

“The purpose of the preconditioning period is to introduce gasoline into the evaporative emission control system and precondition all evaporative emission control system components. Precondition the evaporative emission control system by filling the fuel tank to its nominal capacity with fresh test fuel as specified in Section 6 of this procedure. After filling the tank, start the engine and allow it to run at maximum governed speed (unloaded or blade load) for approximately five minutes. Stop the engine and add fuel to fill the fuel tank to its nominal capacity. Soak the evaporative emission control system at $30 \pm 10^{\circ}\text{C}$ for not less than 140 days. As an alternative, accelerated preconditioning of the evaporative emission control system can be accomplished by soaking at an elevated temperature. Data documenting that the diurnal emissions will not increase with further preconditioning must be provided for tanks soaked less than 140 days. The period of slosh testing and ultraviolet radiation exposure may be considered part of the preconditioning period provided the ambient temperature remains within the specified

temperature range and each fuel tank is at least 50 percent full; fuel may be added or replaced as needed to conduct the specified durability tests.”

The Proposed Amendments detailed in Appendix D include six changes in this section:

- The first requires the tester to measure and record the preconditioning temperature at least every five minutes to ensure test units are soaked at the appropriate temperature throughout preconditioning.
- The second requires the tester to take steps during preconditioning to ensure fuel remains at nominal capacity to ensure test units are soaking at their true nominal capacity throughout preconditioning.
- The third requires accelerated preconditioning to be conducted a minimum of 70 days to ensure evaporative emission control system components are saturated with fuel.
- The fourth adds instructions necessary to produce acceptable emission data that would demonstrate emissions would not increase with further preconditioning, which may be accomplished by performing two hot soak and diurnal tests with hot soak and diurnal emissions measured in the second test no higher than in the first test.
- The fifth adds the following instructions to provide procedural consistency: “Record the fuel fill amount and dates on the test report if fuel is added or replaced.”
- The sixth adds the following instructions to ensure fuel tank walls are fully saturated with fresh fuel: “Drain the fuel tank and refill with fresh fuel to nominal capacity 15 days prior to ending preconditioning. The fuel tank must not be empty for more than 15 minutes. Record the date and time the fuel tank is drained and refilled with fresh fuel, and record the fuel fill amount on the test report.”

Rationale. These changes are necessary to ensure hot soak and diurnal emission testing produce the accurate results necessary to prevent an incorrect determination of compliance with the evaporative emission standards. An incorrect compliance determination could lead to excess emissions. The specific rationales for each of the Proposed Amendments to § 5.1 are as follows:

- Requiring temperature measurements every five minutes during preconditioning is necessary to ensure temperatures do not fall below required thresholds, and is similar to current requirements for the SHED used in hot soak and diurnal emission testing, as described in § 4.1. Temperature influences evaporation and therefore evaporative emissions, so in order to verify test units are soaking at the appropriate temperature for the duration of preconditioning, temperature must be measured and recorded frequently. Per TP-902 § 4.1, current regulations require temperature to be measured and recorded every 30 seconds during hot soak and diurnal emission testing, which indicates it is

feasible and necessary to measure and record temperature every five minutes during preconditioning as well. CARB staff also expect testers measure and record temperature during preconditioning when testing according to the current version of TP-902.

- Requiring the tester to take steps during preconditioning to ensure fuel remains at nominal capacity is necessary because fuel tank material may expand during preconditioning or fuel may evaporate, so additional fuel may need to be added to ensure fuel tanks remain at true nominal capacity for the duration of preconditioning. This could involve testing staff checking the fill level of fuel tanks on a periodic basis.
- Requiring a minimum soak requirement of 70 days for accelerated preconditioning is necessary to better ensure preconditioning of the test units will not be stopped prematurely (i.e., before hot soak and diurnal emissions stop increasing). Many manufacturers attempt to accomplish accelerated preconditioning of their test units to finish testing sooner. Often, this involves performing hot soak and diurnal emission tests beginning within one month of the day that preconditioning starts. Their goal is to end preconditioning as soon as possible. Requiring a minimum of 70 days of preconditioning will continue to allow accelerated preconditioning while decreasing the likelihood that a tester will improperly determine hot soak and diurnal emissions have stopped increasing. U.S. EPA requires a minimum preconditioning period of 70 days for SORE fuel tanks, as described in 40 CFR § 1060.520. CARB requires a minimum preconditioning period of 70 days for PFCs, as described in TP-502. The proposed minimum preconditioning period for SORE would therefore be consistent with the minimum used for testing fuel tanks for U.S. EPA, with CARB's requirements for PFCs, and with the Proposed Amendments to TP-901.
- Specific instructions for how to produce acceptable test data that would demonstrate hot soak and diurnal emissions would not increase with further preconditioning is necessary to improve consistency for those implementing the procedure, which better ensures adequate preconditioning time is accomplished, increases clarity for those reviewing the data, better ensures accurate emission standards compliance determinations, and better maintains a level playing field amongst manufacturers. CARB staff developed the instructions based on data that have been provided by manufacturers to document that diurnal emissions from the engines will not increase with further preconditioning.
- Adding a requirement to record the fuel fill amount dates during preconditioning is necessary for reviewers to verify the procedure is followed correctly and consistently by different testers.
- Adding a requirement to refill tanks with fresh fuel 15 days prior to ending preconditioning is necessary to ensure hot soak and diurnal emission rates are not suppressed by conditions that do not reflect real-world conditions. As fuel soaks in the test units, the more volatile constituents evaporate more quickly,

and therefore the fuel level and emission rates change over time. To ensure fully saturated evaporative emission control system components and emission rates comparable to real-world conditions, fuel should be replaced before ending preconditioning. CARB staff proposes refilling the tank 15 days before the end of preconditioning for two reasons. The first is that it represents a periodic replacement of fuel in equipment that would occur as fuel is consumed due to its use. The second is that testers attempting to accomplish accelerated preconditioning could conduct two test sequences separated by 15 days according to the procedure in TP-902 § 5.2 through § 5.4 when attempting to accomplish accelerated preconditioning. The proposed requirement, "The fuel tank must not be empty for more than 15 minutes" during the refueling process, is necessary to ensure evaporative emission control system components remain fully saturated. The proposed 15-minute maximum time the fuel tank is allowed to be empty is consistent with the 15-minute maximum time allowed by the current requirements in TP-901 § 10(a).

§ 5.2. Refueling and Hot Soak

Purpose. The current regulations in this section specify refueling and hot soak test steps. As defined by Title 13, CCR, § 2752(a), "hot soak emissions" are evaporative emissions that occur for the one-hour period following the termination of engine operation. The current regulations include these procedural requirements:

"Following the preconditioning period, drain the fuel tank and refill to 50 percent of its nominal capacity with test fuel. For evaporative emission control systems that use a carbon canister, the canister must be purged following the preconditioning period but prior to initiating the hot soak test. Purging consists of drawing 400 bed volumes of nitrogen or dry air through the canister at the canister manufacturer's recommended purge rate. Operate the engine at its maximum governed speed for fifteen minutes. Immediately place the engine in the SHED enclosure preheated to 35 °C. Perform a one-hour hot soak at a constant 35 °C."

The Proposed Amendments detailed in Appendix D include six changes in this section:

- Add language to specify the timing for refilling the fuel tank and require the tester to record the fuel fill amount, date and time on the test report.
- Add language to specify different steps for the purging procedure for actively- and passively-purged carbon canisters. Actively-purged carbon canisters would be purged with 400 bed volumes of air. Passively-purged carbon canisters would not be manually purged before testing. Instead, passively-purged carbon canisters would be purged due to vacuum created in the fuel tank when the engine is run in § 5.2 and during forced cooling in § 5.3 of TP-902. Carbon canisters would be weighed before and after purging.
- Add requirements that establish a new tilt test. The tilt test consists of tipping a piece of equipment 90 degrees in three directions, without tilting toward the

carburetor, and monitoring for leaking fuel. The Proposed Amendments specify that the tilt test may be omitted for a test unit with displacement greater than or equal to 225 cc if engines from the evaporative family will not be used in equipment that is designed to be tilted during operation, transport, maintenance, or storage. Any fuel leaking from any part of the engine or evaporative emission control system would constitute a test failure.

- Add instructions for what to do if engines run out of fuel while running at maximum governed speed for 15 minutes. The instructions specify the tester must restart the test procedure with the fuel tank filled to nominal capacity rather than 50 percent of nominal capacity.
- Add temperature specifications for the SHED enclosure during the hot soak to further specify allowable range for temperature variability.
- Add a requirement to place the equipment in the enclosure within 180 seconds (3 minutes) of engine shutdown to ensure all evaporative emissions are captured by the enclosure.

Rationale. These changes are necessary to ensure testing produces the accurate results necessary to prevent an incorrect determination of compliance with the evaporative emission standards. An incorrect compliance determination could lead to excess emissions. In addition, some of these changes are necessary to eliminate excess emissions that come from fuel leaks than can occur when some engines are tilted. The specific rationales for each of the Proposed Amendments to § 5.2 are as follows:

- The proposed requirement, “The fuel tank must not be empty for more than 15 minutes” during the refueling process, is necessary to ensure evaporative emission control system components remain fully saturated. The proposed 15 minute maximum time the fuel tank is allowed to be empty is consistent with the 15-minute maximum time allowed by the current requirements in TP-901 § 10(a). Adding a requirement to record the fuel fill amount, date and time when the fuel tank is drained and refilled is necessary for reviewers to verify the procedure is followed correctly and consistently by different testers.
- Having different steps for purging actively- and passively-purged carbon canisters is necessary to produce accurate test results given the different characteristics of actively- and passively-purged carbon canisters. The change to specify that actively-purged carbon canisters would be purged with “air” rather than “nitrogen or dry air” is necessary to account for different canister designs and ensure the test procedure allows for purging canisters by drawing ambient air into the purge port, as engines do when carbon canisters are installed. Passively-purged canisters are designed to purge during normal operation and during cooling of the engine. The Proposed Amendments to § 5 of TP-902 would result in purging passively-purged carbon canisters in the way that is consistent with their design during the test. Measuring the carbon canister mass before and after purging is necessary to provide information regarding the

ability of carbon canisters to capture and store venting emissions until they are purged.

- The addition of a tilt test is necessary to eliminate excess emissions that come from fuel leaks when equipment is turned on its side for cleaning, transportation, or storage. CARB staff have observed during testing that fuel can spill when equipment is tilted during typical activities, and found that, when equipment is tilted, fuel can contact the carbon canister, which must be prevented. Owner's manuals for some equipment direct users to tilt equipment or turn it on its side for certain activities. For example, for a Honda HRC216HXA lawn mower, the owner's manual directs a user to tilt the mower to the right side for various activities, including blade inspection, oil changes, and cleaning, and indicates a loading ramp may be used to load the mower on a transport vehicle (Honda, 2021). Ramps are often used by landscapers to load lawn mowers into the beds of pickup trucks. Because it is not practical to store loading ramps that are longer than the bed of a pickup truck, the angle of ramps used by landscapers when leaned against the tailgate is often steep, resulting in significant tilting of the mower as it is pushed up the ramp.

Other products, such as portable generators and pressure washers, are designed to be tilted for transport. A user may determine that it is easier or more secure to tilt a pressure washer on its side, front, or back when securing it in a vehicle. This could result in prolonged tilting of a piece of equipment without any fuel spillage. However, the carbon canister may be exposed to liquid fuel, or evaporative emissions could otherwise increase without a user having an indication other than the unpleasant odor of gasoline. Some equipment, including some models of lawn mowers, are designed to be tilted for storage to save space in a storage area. Handheld equipment is often designed to function in a range of orientations, including upside down.

Aside from these examples of tilting that is intended by manufacturers, users are likely to tilt their equipment for other reasons, intentionally or unintentionally, during operation, transport, maintenance, or storage. By its nature, handheld equipment is unlikely to be affected by the tilt test. The tilt test may increase evaporative emissions of nonhandheld equipment that is not properly designed to meet the existing requirement in § 2754(d) [re-lettered to (e) in the Proposed Amendments] of the evaporative emission regulations to install carbon canisters in a way that prevents exposing the carbon to water or liquid fuel. The proposed tilt test steps simulate momentary tilting of equipment that a user might perform when operating, transporting, maintaining, or storing equipment, and incorporate feedback from manufacturers. Leaving the test unit in each position for five minutes would ensure momentary tilting would not cause fuel to spill or result in evaporative emissions that exceed the applicable emission standard. The Proposed Amendments do not require the tester to tilt the engine in the direction which results in the air inlet of the engine pointing downward, because rotating in this direction is known to result in extensive fuel leakage for engines that use

float-type carburetors. The Proposed Amendments would require this new tilt test for evaporative families that include models that may be tilted during typical activities, as specified by the proposed addition of this sentence: "This tilt sequence may be omitted for a test unit with displacement greater than or equal to 225 cc if engines from the evaporative family will not be used in equipment that is designed to be tilted during operation, transport, maintenance, or storage." This text is carefully worded to account for the existence of equipment using engines with displacement greater than or equal to 225 cc that may be operated at an angle, such as mowing grass on a slope, or may otherwise be tilted. For example, Figure II-4 in Chapter II of this Staff Report shows an individual cleaning under a riding mower that has been tilted using a hydraulic jack.

The current regulations include requirements that are expected to ensure emission control systems would not be negatively affected by momentary tilting of the engine. An example is the requirement in § 2754(d) [re-lettered to (e) in the Proposed Amendments] of the evaporative emission regulations to install carbon canisters in a way that prevents exposing the carbon to water or liquid fuel.

- The instructions for what to do if engines run out of fuel when preparing for the hot soak test are necessary to account for engines with small fuel tanks that may have run times of less than 15 minutes at maximum governed speed.
- The addition of temperature range specifications for the SHED enclosure during the hot soak is necessary to correct an oversight that occurred when TP-902 was adopted. TP-902 includes temperature range specifications for all testing. However, the hot soak test is performed at a higher temperature than typical room temperature. When the SHED door is opened to place the test unit inside, the temperature inside the SHED can drop. The proposed hot soak temperature specifications match those for the hot soak test for motor vehicles. The tolerance for temperature is higher for a hot soak test than for a diurnal emission test because of the elevated temperature. The tolerance is highest for the first five minutes after the SHED is sealed because the temperature inside the SHED typically decreases after the door is opened.
- The addition of a specified maximum time allowed to place the equipment in the SHED enclosure after engine shutdown is necessary to ensure all evaporative emissions during the hot soak period are captured by the enclosure. This change is necessary because the Proposed Amendments to § 2754 include hot soak emissions along with diurnal emissions when assessing compliance with the evaporative emission standards.

§ 5.4. 24-Hour Diurnal Test

Purpose. The Proposed Amendments add a sentence to the tester to: "Measure and record the carbon canister mass after the diurnal test on the test report."

Rationale. This change is necessary to provide information regarding the ability of carbon canisters to capture and store venting emissions until they are purged. A carbon canister that does not gain significant mass during the diurnal emission test may not be functioning properly. That could, for example, be due to exposure of the carbon to liquid fuel. If the carbon canister were not weighed after the diurnal emission test, a tester would not have potentially useful information on the performance of the carbon canister.

§ 6. Test Fuel

Purpose. The current regulations in § 6 provide:

“Testing according to this procedure shall be conducted using 1) LEV III Certification Gasoline as defined in part II, section A.100.3.1.2 of the *California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures* and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light Duty Trucks, and Medium-Duty Vehicles, as last amended September 2, 2015, or 2) the fuel defined in 40 CFR Part 1065.710(b) for general testing.

The fuel specified in part II, section A.100.3.1.1 of the California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light Duty Trucks, and Medium-Duty Vehicles, as last amended September 2, 2015, may be used as an alternative test fuel to certify fuel tanks for use on engines and equipment through model year 2019.”

The Proposed Amendments include two changes to § 6 as follows:

- Delete the entire second paragraph to provide consistency with current regulatory requirements.
- Add a new unnumbered paragraph with the following text:

“For engines that are not gasoline-fueled and that are powered with compressed natural gas (CNG), propane, liquefied petroleum gas (LPG), or liquefied natural gas (LNG), testing according to this procedure shall be conducted using a fuel meeting the requirements of section 1065.701 of the “California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1065),” adopted October 25, 2012, and amended [insert amended date].”

Rationale. The rationales for the Proposed Amendments to § 6 are as follows:

- The first change is necessary to prevent confusion because the alternative test fuel specified in the current regulations was allowed only through MY 2019, so is no longer applicable.

- The second change is necessary to specify test fuels for engines that are not gasoline-fueled and that are powered with CNG, propane, LPG, or LNG because the Proposed Amendments to § 2754.1(b)(3) allow such engines to be certified to earn evaporative emission credits. Those engines must be tested according to TP-902 to be eligible to earn evaporative emission credits, and TP-902 does not currently include a fuel option to test them. This change will ensure proper selection of test fuels for all engines that are tested according to TP-902.

Attachment 1. Procedure for Determining Carbon Canister Performance: Durability Demonstration and Working Capacity

The test procedure specified by Attachment 1 is used to evaluate the durability and working capacity of carbon canisters used to control evaporative emissions from SORE. Working capacity is a defining parameter expressing the mass of organic material hydrocarbon equivalent that can be stored in the canister under controlled conditions.

§ 5. Equipment Calibrations

Purpose. There are three Proposed Amendments to this section:

- Change the coefficient of determination notation from " R^2 " to " r^2 " in the first paragraph of the section.
- Change the requirement to calibrate the balance using NIST-traceable standards to using SI-traceable standards in the second paragraph of this section.
- Remove the percent symbols (%) from this sentence in the second paragraph: "At minimum, the accuracy shall be checked at approximately 80% percent, 100% percent, and 120% percent of the canister's expected test mass."

Rationale. The rationales for the Proposed Amendments to § 5 in Attachment 1 are as follows:

- Changing the notation from " R^2 " to " r^2 " is necessary to reflect common convention for describing the coefficient of determination and to provide consistency with other CARB test procedures, which helps prevent confusion for testers. This change does not affect the current calibration requirements.
- Requiring SI-traceable standards (which include NIST-traceable standards) is consistent with current industry practice and is necessary to allow flexibility for manufacturers around the world to use other recognized international standards while still maintaining the consistency necessary to ensure test data accuracy, precision, and comparability to the emission standards, as well as a level playing field amongst manufacturers. Accurate and precise data are necessary to ensure that engines determined to be in compliance with emission standards assessed using TP-902 are indeed compliant and do not result in excess emissions.

- Removing the percent symbols is necessary to improve readability because each percent symbol is followed by the word “percent,” and is therefore redundant and not necessary. Using the word “percent” rather than the symbol provides consistency with recent CARB document style practices designed to improve clarity.

§ 6. Carbon Canister Working Capacity Determination

Purpose. Section 6 specifies the testing steps to establish the canister’s working capacity by repeated canister loading and purging. This procedure involves multiple cycles that each include a 400 bed volume purge (specified in § 6.2), a five minute pause (specified in § 6.3), weighing the canister (specified in § 6.4), and then loading the canister with butane mixed 50/50 by volume with air or nitrogen to a measured breakthrough (specified in § 6.5). There are two types of proposed changes to this section, and both are for specifications in § 6.5. The current regulations in § 6.5 specify:

“Load the test canister with butane mixed 50/50 by volume with air or nitrogen until the specified breakthrough criterion has been met. The canister load is accomplished by flowing the butane mixture into the canister via the tank fitting. The butane load rates and breakthrough criteria are determined by canister’s bed volume. In order to accommodate the expected wide range of canister bed volumes expected in small off-road engines, four ranges of canister loading and breakthrough criteria are defined: small (< 99cc), medium (100 to 249cc) large (249 to 550cc) and extra large (> 550cc). The load and breakthrough criteria are defined as follows:

| Carbon Canister Bed Volume | Small < 99cc | Medium 100 to 249cc | Large 249cc to 550 | Extra Large >550 |
|--|-----------------|---------------------------|--------------------------|---------------------|
| Butane Load Rate [grams C ₄ H ₁₀ / hour] | 5.0 | 10.0 | 15.0 | 15.0 |
| Breakthrough limit [grams](*) | 2.0 | 2.0 | 2.0 | 2.0 |

(*) If the canister shows mass loss prior to the 2.0 grams breakthrough then an alternate lower breakthrough limit can be used.”

The Proposed Amendments detailed in Appendix D include the following changes to § 6.5 in Attachment 1:

- Add the following sentence to specify a tolerance (i.e., allowable range or margin of error) for butane load rate of 10 percent of the specified load rate in the above table provided in § 6.5: “The butane load rate must be within ± 10 percent of the specified load rate below.”
- Improve the notation and spacing in the carbon canister bed volume categories in the paragraph text and table in § 6.5 by changing the small category from

"< 99cc" to "< 100 cc," the medium category from "100 to 249cc" to "≥ 100 cc and < 250 cc," the large category from "249 to 550cc" [in the paragraph text] and "249cc to 550" [in the table] to "≥ 250 cc and ≤ 550cc," and the extra large category from "> 550cc" [in the paragraph text] and ">550cc" [in the table] to "> 550 cc."

- Improve the grammar of the list of carbon canister bed volume categories in the paragraph text by adding a comma after the medium and large categories.

Rationale. The specific rationales for each of the Proposed Amendments to § 6.5 in Attachment 1 are as follows:

- Specifying a butane load rate tolerance is necessary to minimize the error in the calculation of the canister's working capacity and to ensure the specified load rates can be achieved consistently. Attachment 1 was proposed by industry to replace the procedure proposed by CARB staff in 2003 for determining carbon canister working capacity. Unlike other procedures for determining carbon canister working capacity, Attachment 1 does not specify a tolerance for load rate. Manufacturers have requested the addition of butane load rate tolerance. Test reports indicate manufacturers are able to meet the required load rates. However, some manufacturers have indicated difficulty in meeting the load rates. The proposed tolerance would enable testers to consistently meet the required load rates, while minimizing error.
- Improving the notation and spacing of the carbon canister bed volume categories in the paragraph text and table, and improving the grammar of the category list in the paragraph text, are necessary to better delineate each category, eliminate ambiguity, and improve readability.

§ 7. Calculating Results

Purpose. Section 7 contains only two sentences. The current regulations in § 7 specify: "The working capacity is the lower test canister weight gain in grams determined from the last two load cycles. The resultant working capacity is expressed in grams of C₄H₁₀." The Proposed Amendments add the following new sentence, equation, and definitions of the equation variables, before the existing sentences to specify how to calculate the butane load rate:

"The following equation shall be used to calculate butane load rate:

$$Q_b = 3,600 \times \frac{(m_f - m_i) + m_b}{t}$$

where:

Q_b = butane load rate (grams C₄H₁₀ per hour)

3,600 = the number of seconds in one hour

m_f = final carbon canister mass (grams)

m_i = initial carbon canister mass (grams)

m_b = breakthrough mass (grams)
 t = duration of load cycle (seconds)"

Rationale. This change is necessary to provide specificity, ensure consistency, and prevent calculation errors. The proposed equation is based on basic physical principles and algebra, along with a conversion factor (3600 seconds per hour) to convert flow rate in grams per second to grams per hour. The symbols used in the proposed equation are those used in Figure 1, the Canister Data Sheet, of Attachment 1. This change does not affect the calculation of butane load rate, because the method specified in the proposed equation is used by testers when determining carbon canister working capacity according to Attachment 1.

§ 9. Figures

Purpose. Section 9 contains Figure 1, the Canister Data Sheet. The Proposed Amendments add the symbol "t" for the column "Duration [seconds]" in the Canister Purge Data and Canister Load Data tables and change a column heading from "Butane Rate Q_b [g/hr]" to "Butane Load Rate Q_b [g/hr]."

Rationale. These changes are necessary to provide specificity, ensure consistency, and prevent calculation errors. The symbol "t" is used in the equation included in the Proposed Amendments to § 7 of Attachment 1. The rate specified in the table in § 6.5 and calculated in § 7 of Attachment 1 is butane load rate.

E. CP-902, Certification Procedure for Evaporative Emission Control Systems on Small Off-Road Engines

This section provides a summary, purpose, and rationale for each Proposed Amendment to "Small Off-Road Engine Evaporative Emission Control System Certification Procedure, CP-902, Certification Procedure for Evaporative Emission Control Systems on Engines With Displacement Greater Than 80 Cubic Centimeters" (CP-902). The SORE evaporative emission regulations require the use of CP-902 to evaluate and certify evaporative emission control systems on SORE to evaporative emission standards. This certification procedure is incorporated by reference in Title 13, CCR, § 2753. Appendix E of this Staff Report provides the full language of this certification procedure with Proposed Amendments shown in strikeout and underline formatting.

Global Amendments throughout CP-902

Acronym Change

Purpose. The Proposed Amendments change "ARB" and "the ARB" to "CARB," and add "California" before "Air Resources Board," for consistency with recent CARB document style practices designed to improve clarity.

Rationale. This change reflects the California Air Resources Board's recent change to, and preferred use of, the acronym "CARB" versus the prior acronym, "ARB," and the entire agency title, "California Air Resources Board."

"Engine" Phrase Change to Incorporate "Small Off-Road"

Purpose. The Proposed Amendments add "small off-road" before "engines" in the title to ensure the title accurately represents the procedure.

Rationale. This change is necessary because adding "small off-road" before "engines" clarifies that the procedure is for small off-road engines.

Applicability Change

Purpose. The current title and text of CP-902 reference engines "with displacement greater than 80 cubic centimeters" to differentiate between the applicability of CP-901 and CP-902. The Proposed Amendments remove this reference throughout CP-902, and add a fourth displacement category to § 4.1 in CP-902 for engines with displacement less than or equal to 80 cc, to include all SORE displacements.

Rationale. This change is necessary to provide consistency with Proposed Amendments to Title 13, CCR, § 2753. Under the Proposed Amendments to § 2753, CP-902 would apply to all SORE for MY 2024 and subsequent model years, including SORE with displacement less than or equal to 80 cc.

Capitalization Change

Purpose. The Proposed Amendments change the formatting of text in all capital letters to mixed case to aid in making documents accessible to everyone, including people with visual impairments and assistive technology users.

Rationale. Mixed case words and sentences are easier to read and consistent with current accessibility guidelines.

Table of Contents Change

Purpose. The Proposed Amendments change the formatting of section titles and text in all capital letters to mixed case to aid in making documents accessible to everyone, including people with visual impairments and assistive technology users. In addition, the Proposed Amendments adjust page numbers to accommodate added or removed text throughout TP-902. Amendments to the Table of Contents reflect these changes.

Rationale. Mixed case words and sentences are easier to read and consistent with current accessibility guidelines. Amending the page numbers is necessary for accuracy and to avoid confusion for the reader.

"Diurnal" Phrase Changes to Incorporate "Hot Soak" Emissions

Purpose. As described in Chapter II of this Staff Report and detailed in the following sections, the Proposed Amendments incorporate "hot soak" emissions into the evaporative emission standards for SORE. To support the inclusion of the "hot soak" emissions, the Proposed Amendments make these phrasing changes throughout the regulations:

- Change "diurnal emission and design standards" to "evaporative emission standards;"
- Change "diurnal emission rates" to "hot soak and diurnal emission rates" or "hot soak plus diurnal emission rates," depending on the context of a particular sentence;
- Change "diurnal emission rate" to "hot soak plus diurnal emission rate;"
- Change "diurnal emission standard" to "hot soak plus diurnal emission standard;"
- Change "diurnal emission standards" to "hot soak plus diurnal emission standards" or "evaporative emission standards," depending on the context of a particular sentence; and
- Change "diurnal emission testing" to "hot soak and diurnal emission testing."

Rationale. This change is necessary to provide consistency with the Proposed Amendments to the evaporative emission standards specified in § 2753. Currently, the evaporative emission standards only apply to the 24-hour diurnal cycle. However, some engines tested by CARB have met the 24-hour diurnal emission standard, but had hot soak emissions several times higher than the diurnal emission standards. In order to control these emissions that reduce the expected benefits of the emission standards, it is necessary to change § 2753 to incorporate hot soak emissions into the evaporative emission standards. The Proposed Amendments update text throughout the regulations, including CP-902, to reflect this change. Section B in this chapter provides additional information about hot soak emissions and the need for the amendments to the evaporative emission regulations.

Design Certification Option Removed

Purpose. The current regulations in Title 13, CCR, § 2750(b) require manufacturers to select one of two allowable options for certification of engines and state that the options are identified in § 2754(a) and in § 2754(b). Those options are referred to as "performance certification" and "design certification." Both options require running loss emissions to be controlled during engine operation, which results in greater evaporative emission reductions. Section 2754(a) specifies the diurnal emission and design standards for SORE with displacements greater than 80 cc in Table 1 and requires that diurnal emissions from any SORE with displacement greater than 80 cc must not exceed those standards. Section 2754(b) requires an applicant to submit in

the certification application: (1) a determination that running loss emissions are controlled from being emitted into the atmosphere; and (2) either the Executive Order of Certification number approving the fuel lines pursuant to § 2767.1, or test data showing that all fuel lines meet the permeation requirement of 15 grams of ROG per square meter of surface area of the surface in contact with fuel per day when tested in accordance with one of the procedures specified in § 2754(b). The current regulations in § 2754(c) require a manufacturer to choose (1) "performance certification," and provide diurnal emission test data for the engine or equipment model in the evaporative family that is expected to exhibit the highest diurnal emission rate relative to the applicable diurnal emission standard, in accordance with TP-902; or (2) "design certification," and provide information in the certification application showing that the fuel tank and carbon canister meet the applicable design standards listed in Table 1 of § 2754.

Under the Proposed Amendments, design certification would not be an allowable option for MY 2024 and subsequent model years because no design standards are proposed for MY 2024 and subsequent model years. Consequently, for consistency with these proposed changes, the Proposed Amendments remove language throughout CP-902 that is specific to the "design certification" option. As detailed in Appendix E, the Proposed Amendments make the following changes:

- Remove text from § 4.1 and § 6 that specifies applicants must submit test results (whether or not they were collected according to TP-901, SAE J1737 (Stabilized May 2013), SAE J30, SAE J1527, and SAE J2996) or Executive Order of Certification numbers for fuel tanks, fuel lines, and carbon canisters.
- Remove text from § 5.6 that specifies the following are among test procedures used to determine compliance with the evaporative emission standards: SAE J1737 (Stabilized May 2013), SAE J30, SAE J1527, or, only for fuel lines with inner diameter 4.75 mm or less, SAE J2996, and TP-901.
- Remove text from § 6 that specifies applicants must include Executive Order of Certification numbers applicable to fuel tank models, fuel line models, and carbon canister models in the evaporative family descriptions required to be included in certification applications, and move text that requires the following information about each component model:

For each fuel tank model:

- Tank materials, including pigments, plasticizers, UV inhibitors, or other additives that are expected to affect control of emissions
- Gasket material
- Production method
- Permeation barrier
- Engineering drawings

For each fuel line model:

- Materials and methods used to construct the line
- Permeation barrier
- Engineering drawings

The § 6 list of information required for carbon canisters does not need amendment because it is configured in a way that list the necessary information even when the Executive Order of Certification number option is removed.

- Remove the word “certified” from the following text included in the § 7 list of items required in the Executive Order of Certification: “A list of components ~~certified~~ for use with the evaporative family including component specifications.”
- Remove these three items included in the § 7 list of items required in the Executive Order of Certification:
 - Highest tested final permeation rate ($\text{g ROG} \cdot \text{m}^{-2} \cdot \text{day}^{-1}$) of the fuel tank samples tested for certification, as calculated in section 14 of TP-901, if applicable.
 - Highest tested permeation rate ($\text{g ROG} \cdot \text{m}^{-2} \cdot \text{day}^{-1}$) of the fuel line samples tested for certification, as calculated in SAE J1737 (Stabilized May 2013), SAE J30, SAE J1527, or SAE J2996, if applicable.
 - Working capacity (g organic material hydrocarbon equivalent) of the carbon canister as measured in Attachment 1 to TP-902.

Rationale. The proposed changes are necessary to provide consistency with the Proposed Amendments to § 2750(b), which are necessary to support the effective inclusion of hot soak emissions in the emission standards. The Proposed Amendments specify revisions to § 2754(a) and add a new subsection 2754(d) that, beginning with MY 2024, would require manufacturers to demonstrate compliance with evaporative emission standards that incorporate hot soak emissions and to submit data showing that hot soak plus diurnal emissions will not exceed the new standards prior to certification. However, the existing design standards in Table 1 of § 2754 have not been demonstrated to ensure that hot soak plus diurnal emissions would not exceed the newly proposed emission standards. CARB staff solicited information during public workshops and other stakeholder meetings regarding design standards that would enable engines to meet the proposed emission standards in a way that would make design certification effective. CARB staff did not receive such information, but did receive comments indicating that manufacturers believed design certification was a valuable option. The perceived value of design certification for manufacturers did not suggest that certifying to design standards would provide sufficient evidence for CARB to determine that engines meet the proposed hot soak plus diurnal emission standards. Consequently, the Proposed Amendments to § 2750 require manufacturers to use performance certification to certify each evaporative family to meet the hot soak plus diurnal emission standards for MY 2024 and subsequent model years, and

the Proposed Amendments to CP-902 remove requirements specific to the design certification option. Under the Proposed Amendments to § 2753 Certification Requirements, manufacturers may continue to follow the current regulations as specified in CP-902, amended September 18, 2017, or earlier editions, as applicable, for MY 2023 and earlier model years.

Definition of Terms

Purpose. The Proposed Amendments change “authorized representative or designate” to “authorized representative or designee” to correct a spelling error in the definition of the term “Executive Officer.”

Rationale. California Administrative Law (Title 1, CCR, § 16(a)(4)) requires that California regulations be free of spelling errors. The change to correct the spelling of designee is necessary to provide clarity for readers and does not affect any requirements for SORE certification and testing.

§ 1. General Information and Applicability

Purpose. The Proposed Amendments change “a” to “an” in the beginning of the first sentence of § 1.1, “Certification of a evaporative emission control system...,” to improve grammar.

Rationale. This change is necessary to correct nonstandard grammar in the previously adopted text. California Administrative Law (Title 1, CCR, § 16(a)(4)) requires that California regulations be free of grammatical errors. The correction is necessary to provide clarity for readers and does not affect any requirements for SORE certification and testing.

§ 3. Optional Evaporative Emission Standards

Purpose. The Proposed Amendments add “through Model Year 2023” to the title of this section to specify optional evaporative emission standards would be available only through MY 2023.

Rationale. This change is necessary to provide consistency with proposed revisions to Title 13, CCR, § 2757, which specify the optional evaporative emission standards will apply only through MY 2023 for consistency with Proposed Amendments to other sections. As described in the purpose and rationale for § 2754(a) in section B of this chapter, the Proposed Amendments set the evaporative emission standards for all SORE except generator engines to zero for MY 2024 and subsequent model years, and set more stringent emission standards for generator engines. The Proposed Amendments set the evaporative emission standards for generator engines to zero for MY 2028 and subsequent model years. The proposed changes to this section of CP-902 and to Title 13, CCR, § 2757 are necessary to implement the newly proposed emission standards and test procedures for MY 2024 and subsequent model years, while at the same time continuing to allow flexibility for earlier model years, and are

necessary to provide consistency with the Proposed Amendments to § 2753(c). Under the Proposed Amendments to § 2753(c) and (d), beginning with MY 2024, all evaporative families must be tested in accordance with TP-902 for certification. In addition, the optional evaporative emission standards will no longer be more stringent than the evaporative emission standards once the emission standards of zero become effective. These changes obviate the need to certify any SORE to the optional evaporative emission standards beginning in MY 2024.

§ 5. General Instructions – Evaporative Emission Control System Certification

§ 5.1. Where to Submit Applications for Certification

Purpose. The Proposed Amendments change the “Emissions Compliance, Automotive Regulations and Science Division” to the “Emissions Certification and Compliance Division” because of reorganization of divisions within CARB. In addition, the Proposed Amendments change “9528 Telstar Avenue, El Monte, California 91731” to “4001 Iowa Street, Riverside, CA 92507” to reflect the address of CARB’s new Southern California headquarters.

Rationale. These changes are necessary because CARB divisions have been reorganized and renamed, and construction of the new Southern California headquarters has been completed. The Emissions Certification and Compliance Division now has responsibility for reviewing certification applications, so the division name has been updated. Division staff and the vehicle emissions testing laboratories will be housed at the new headquarters.

§ 5.2. Letter of Intent

Purpose. The Proposed Amendments add the text, “, and amended [insert amended date]” to the reference for “California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1054).” The Proposed Amendments include a placeholder for the amended date, “[insert amended date]”, that will be updated to reflect the CARB adoption date of the Proposed Amendments to these procedures described in sections F and G later in this chapter, and provided in their entirety in Appendices F and G.

Rationale. This change is necessary to ensure manufacturers follow the most up-to-date testing procedures for SORE. Adding the amendment date for the test procedures clarifies the versions of the test procedures that must be used. Most proposed updates to the test procedures would further harmonize CARB’s test procedures with federal Part 1054 test procedures and incorporate updates made to federal Part 1054 since CARB’s test procedures were adopted. Section F later in this chapter describes the purpose and rationale for the Proposed Amendments for Part 1054, and Appendix F provides the Proposed Amendments in their entirety. Combining letters of intent for exhaust and evaporative emission certification may be

convenient for manufacturers. In order to enable manufacturers to continue combining their letters of intent, it is necessary to specify the amended exhaust test procedures in this section.

§ 6. Application Format Instructions

Purpose. The current regulations in § 6 specify the types of information required to be included in certification applications. The information items are identified in a bulleted list. The Proposed Amendments add a new bulleted item, "List of equipment brands using engines from the evaporative family, if known."

Rationale. This change is necessary to enable CARB staff to identify the Executive Order of Certification Holder of SORE equipment in California commerce. CARB use this information to help verify that products sold in California use certified engines. In addition, information on the brands of equipment using engines from an evaporative family is often requested by CARB when conducting testing. Inclusion of equipment brands using engines from the evaporative family in the certification application will streamline future data requests.

§ 7. Documentation of Certification

Purpose. The current regulations in § 7 specify the items required to be included in Executive Orders of Certification. The items are identified in a bulleted list. Some of the bullets end with a period and others do not. The Proposed Amendments remove all the periods from the bullets.

Rationale. This change is necessary to provide consistency and improve readability.

Attachment 1. SORE Evaporative Family Classification Criteria

Purpose. The Proposed Amendments define the acronym "HDPE" by adding the text, "High-density polyethylene."

Rationale. This change is necessary to provide clarity because the term was not defined in CP-902.

F. California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1054)

This section provides a summary, purpose, and rationale for the Proposed Amendments to the California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1054), referred to herein as "Part 1054". These standards and test procedures are incorporated by reference in Title 13, CCR, § 2403. Appendix F of this Staff Report provides the full proposed regulatory language of these standards and test procedures with Proposed Amendments shown in strikeout and underline formatting.

Global Amendments throughout Part 1054

"ARB" to "CARB" Acronym Change

Purpose. The Proposed Amendments change "ARB" and "the ARB" to "CARB," and add "California" before "Air Resources Board," for consistency with recent CARB document style practices designed to improve clarity.

Rationale. This change reflects the California Air Resources Board's recent change to, and preferred use of, the acronym "CARB" versus the prior acronym, "ARB," and the entire agency title, "California Air Resources Board."

Capitalization Change

Purpose. The Proposed Amendments change the formatting of text in all capital letters to mixed case to aid in making documents accessible to everyone, including people with visual impairments and assistive technology users.

Rationale. Mixed case words and sentences are easier to read and consistent with current accessibility guidelines.

Grammar Change to "Owner's Manual"

Purpose. The Proposed Amendments change the phrase "owners manual" to "owner's manual" by adding an apostrophe in §§ 1054.115(c), 1054.120(e), 1054.125(a)(2), 1054.125(d), 1054.125(h), and 1054.801.

Rationale. This change is necessary to correct nonstandard grammar in the previously adopted text. The term "owner's manual," with the possessive apostrophe, is the correct grammar for referencing the document. California Administrative Law (Title 1, CCR, § 16(a)(4)) requires that California regulations be free of grammatical errors, which may create confusion or ambiguity or undermine the perceived authoritativeness of the regulation text. It is essential to satisfying the purpose of this regulation and addressing the identified problem that there be no such real or perceived ambiguity or error in language use in the regulatory text.

Table of Contents Change

Purpose. The Proposed Amendments adjust page numbers to accommodate added or removed text throughout Part 1054. Amendments to the Table of Contents reflect these changes.

Rationale. Amending the page numbers is necessary for accuracy and to prevent confusion for the reader.

"Reserved" Placeholder Added

Purpose. The Proposed Amendments add the placeholder text "[Reserved]" to the following sections: §§ 1054.1(b), 1054.15(a), 1054.15(c), 1054.101(c-e), 1054.120(d),

1054.145(a-i), 1054.145(k-o), 1054.201(d), 1054.201(h), 1054.205(c), 1054.205(w), 1054.230(d), 1054.230(f), 1054.825(e)(1)(i-iii), 1054.825(e)(1)(v-vi), 1054.825(e)(1)(viii), 1054.825(e)(2), 1054.825(e)(4), and Appendix I. The Proposed Amendments delete the subsection text, “(l) [Reserved]” under § 1054.145. The purpose of these changes is to prevent gaps in the numbering and lettering of provisions while ensuring that provisions within Part 1054 that are similar or analogous to provisions within Title 40, Code of Federal Regulations, Part 1054 (“federal Part 1054” or “federal text”) have the same numbering and lettering.

Rationale. These changes are necessary to maintain sequential section numbering and lettering in order to improve readability and prevent confusion for readers. The incorporation of Part 1054 into the California Code of Regulations in 2012, and the Proposed Amendments, include a number of changes to text in the federal Part 1054 necessary to address California-specific emission standards, production-line testing requirements, credit-generation allowances, and other regulations that support California’s unique air quality programs. Some of these changes involved the deletion of portions of the federal text that contain provisions that are redundant with, or in conflict with, other California SORE regulations. In some cases, the subsection was deleted but subsequent items at the same numbering level were retained. The resulting gaps in numbering of provisions would make the regulation more difficult to follow. Renumbering those provisions adopted or retained to eliminate gaps would result in similar provisions within the federal and California regulations being referred to by different subsection or paragraph numbers. The insertion of the “[Reserved]” placeholder preserves the similar numbering while removing any gaps in sequential numbering of provisions. It is essential to satisfying the purpose of this regulation that it be understandable and accessible to all stakeholders, and that similar designation of similar provisions between California and federal text be preserved to avoid confusion on the part of regulated parties.

Improvements to References to California Code of Regulations

Purpose. The Proposed Amendments make the following changes to references to regulations:

- Change the abbreviation “CCR” to spell out “Title 13, California Code of Regulations” or “California Code of Regulations” in §§ 1054.1(a)(4), 1054.120, 1054.201, 1054.205(p)(1), and 1054.205(u).
- Add the phrase “California Code of Regulations” where previously implied between “Title 13” and a section number in §§ 1054.5, 1054.601(c)(1) and 1054.660.
- Add “Title 13” where previously implied before “California Code of Regulations” and a section number in §§ 1054.1(a)(4), 1054.205(u), and 1054.230.

Rationale. These changes are necessary to better identify the body of regulations to which these subsections refer, to satisfy the clarity requirements under California Administrative Law (Title 1, CCR, § 16), and to better differentiate them from the federal regulations. “CCR” is used in some places within this part, “California Code of Regulations” in others, and “Title 13” without elaboration in others still. Although the existing references are sufficient to identify the regulations, the use of different forms of reference could confuse parties subject to the regulations, as it may create the impression that these are different references. It is essential to satisfying the purpose of the regulations and addressing the identified problem that they be understandable to the regulated parties, including where references are made to other regulations, and that there is no real or perceived ambiguity in such references.

“EPA” to “CARB” Term Change, “Certificate of Conformity” to “Executive Order” Term Change, and Improvements to References to Parts 1054 and 1065

Purpose. The Proposed Amendments make the following changes throughout Part 1054:

- Change “EPA” to “CARB” in §§ 1054.30(d), 1054.205(z), 1054.250 (section title), and 1054.255 (section title).
- Remove the definition and abbreviation entries for “EPA” in §§ 1054.801 and 1054.805.
- Change “certificate of conformity” and “certificate” to “Executive Order” in §§ 1054.10(c), 1054.30(d), 1054.107(b), 1054.201, 1054.225, 1054.250(b)(5), 1054.255, and 1054.640.
- Remove the definition entry for “certificate of conformity” in § 1054.801.
- Change references to “40 CFR 1054” to refer to “this part 1054” in §§ 1054.20(c), 1054.255(a), 1054.255(b), 1054.255(c)(4)(i), 1054.255(c)(7), 1054.255(d), and 1054.645.
- Add the word “section” to the reference to “1054.205(r)” in § 1054.115.
- Change “Part 1065” in § 1054.15(b) to “The “California Exhaust Emission Standards and Test Procedures for New 2013 Small Off Road Engines; Engine-Testing Procedures (Part 1065),” adopted October 25, 2012, and amended [insert amended date].” The Proposed Amendments include a placeholder for the amended date, “[insert amended date]”, that will be updated to reflect the CARB adoption date of the Proposed Amendments to Part 1065, which are described in section G later in this chapter, and provided in their entirety in Appendix G.
- Change references to “Part 1065 of this chapter,” “40 CFR part 1065,” “40 CRF 1065,” and “40 CFR 1065” to refer to “Part 1065” in §§ 1054.15(b), 1054.115(a)(1)(i), 1054.115(c), 1054.125, 1054.140(a), 1054.205(g), 1054.205(p)(1), 1054.230(e), 1054.235, 1054.235(a), 1054.235(f), 1054.235(g),

1054.250(b)(3)(iv), 1054.501(b), 1054.501(b)(1), 1054.501(b)(2), 1054.501(b)(3), 1054.501(b)(3)(i), 1054.501(b)(3)(ii), 1054.501(b)(4), 1054.501(b)(7), 1054.501(b)(8)(ii), 1054.501(b)(8)(iii), 1054.501(b)(10)(ii), 1054.501(c), 1054.501(c)(1), 1054.501(d), 1054.505(a)(1)(i), 1054.505(a)(2), 1054.505(b), 1054.505(b)(1)(iii), 1054.505(b)(2), 1054.505(d)(2), 1054.505(d)(4), 1054.505(e), 1054.650(a), 1054.801, and 1054 Appendix II.

Rationale. These changes are necessary to improve clarity and regulatory certainty. In 2012, CARB modified the SORE regulations to adopt portions of U.S. EPA's Title 40, Code of Federal Regulations, Parts 1054 and 1065 ("federal Part 1054 and Part 1065" or "federal text"), to improve alignment of the certification and testing requirements without any changes in the stringency of the emission standards and associated test procedures, and without any cost impacts. Certain sections, section titles, subsections, or paragraphs, which were adopted without making other changes, contain references to U.S. EPA and certificate of conformity carried over from the original federal text. U.S. EPA uses the term "certificate of conformity," shortened to "certificate." CARB uses the term "Executive Order" to refer to the certification document for an engine family for sale or lease for use in California. In the 2012 adoption this was dealt with by adding definition entries clarifying that the terms "EPA" and "certificate of conformity" or "certificate" should be understood to refer to CARB and Executive Order, respectively, for the purposes of California's Part 1054. However, as much of the document must be reviewed before one reaches these definition entries, a potential for confusion still exists. This proposed amendment ensures that the intended meaning of these references is immediately clear to regulated parties and other stakeholders. Changing "EPA" to "CARB" and removing the definition for U.S. EPA are necessary to provide consistency with the incorporation of federal regulations into California's SORE regulations and to clarify that the California Air Resources Board is the agency having jurisdiction and decision-making authority under these regulations and is the agency to which reports must be submitted. It is essential to satisfying the purpose of the regulations and addressing the identified problem that there be no real or perceived ambiguity regarding the fact that the California Air Resources Board is the agency having jurisdiction and decision-making authority under this part, and the agency to which reports must be submitted. Changing "certificate of conformity" and "certificate" to "Executive Order" and removing the definition for "certificate of conformity" would provide consistent use of California-specific terminology throughout the regulations, which better distinguishes them from the federal regulations and prevents confusion for manufacturers and other readers. These Proposed Amendments do not change any of the standards and test procedures.

In addition, the current regulations in California's Part 1054 refer to the federal Part 1054 and Part 1065 in some places, and to Part 1054 and Part 1065 as adopted by CARB in others, due to text carried over from the federal regulations during the 2012 adoption process. This may create confusion and the potential for apparently conflicting instructions, where differences between California's Part 1054 and Part 1065, and the federal Part 1054 and Part 1065 exist. There is an additional potential

for conflict if the federal Part 1054 or Part 1065 is revised subsequent to the adoption of its text by CARB. The Proposed Amendments clarify that the referenced test procedures and other requirements are those specified in California's Part 1054 and Part 1065, rather than the same-numbered paragraphs in the similar federal procedures. The test procedures and other requirements in California's Part 1054 and Part 1065 are the ones that properly apply to testing to address California requirements. Providing explicit references to the California SORE regulations in all places where the test procedures and other requirements contained therein are referenced prevents ambiguity and potential conflict. It is essential to satisfying the purpose of the regulations and addressing the identified problem that the test procedures and other requirements referenced here be consistent and understandable to the regulated parties, including where references are made to other regulation, and that there is no real or perceived ambiguity or conflict in regulatory instructions to regulated parties.

Furthermore, the change to "Part 1065" the first place it is specified is necessary to ensure the amended test procedures are used for certification and compliance testing once they become effective. The most up-to-date test procedures must be followed by all manufacturers of MY 2013 and subsequent model year engines to ensure SORE meet the emission standards. Adding the amendment dates for the test procedures clarifies the versions of the test procedures that must be used.

"Family Emission Limit" to "Family Emission Level" Term Change

Purpose. The Proposed Amendments change the term "family emission limit" to "family emission level" to provide consistency of term usage throughout the SORE regulations. The Proposed Amendments include this change in §§ 1054.230(b)(9), 1054.801, and 1054.805.

The Proposed Amendments also change the definition in § 1054.801 to direct the reader to the California-specific regulations, as indicated by strikeout and underline formatting in the following:

Family emission-limit level (FEL) has the meaning given in Title 13, California Code of Regulations, Section 2401. ~~means an emission level declared by the manufacturer that will be used in the ABT program. The family emission level will take the place of an otherwise applicable emission standard. The family emission limit must be expressed to the same number of decimal places as the emission standard it replaces. The family emission limit serves as the emission standard for the engine family (exhaust) or emission family (evaporative) with respect to all required testing.~~

Rationale. These proposed changes are necessary to prevent confusion for manufacturers and other readers and do not affect SORE emission standards nor testing requirements. The California SORE regulations traditionally use the term "Family Emission Level" while the federal regulations for small nonroad spark-ignition

engines use the term “Family Emission Limit.” The California and federal definitions are virtually identical:

- Per Title 13, California Code of Regulations, § 2401(a): ““Family emission level” or “FEL” means an emission level that is declared by the manufacturer to serve for the averaging, banking, and trading program and in lieu of an emission standard for certification. The FEL serves as the engine family’s emission standard for emissions compliance efforts. If the manufacturer does not declare an FEL for an engine family, the applicable emissions standard must be treated as that engine family’s FEL for the purposes of any provision of this Article.”
- Per federal Part 1054.801: “*Family emission limit (FEL)* means an emission level declared by the manufacturer to serve in place of an otherwise applicable emission standard under the ABT program in subpart H of this part. The family emission limit must be expressed to the same number of decimal places as the emission standard it replaces. The family emission limit serves as the emission standard for the engine family (exhaust) or emission family (evaporative) with respect to all required testing.”

In addition, California Part 1054 Subpart H already references California regulations for ABT program requirements, as follows:

Subpart H – Averaging, Banking, and Trading for Certification

§ 1054.701 General provisions.

“Each manufacturer must comply with all provisions of the averaging, banking, and trading program outlined in Title 13, California Code of Regulations, Sections 2408-2409, for each engine family participating in that program.”

However, as much of the document must be reviewed before one reaches §§ 1054.701 and 1054.801, a potential for confusion still exists. The proposed changes to provide consistent use of the term “Family Emission Level” satisfy clarity requirements under California regulations (Title 1, CCR, § 16(a)(4)).

Updates to Harmonize with Amended Federal Text

Purpose. Subsequent to CARB’s adoption of Part 1054 into the California Code of Regulations, U.S. EPA has made a number of terminology changes and other amendments to the federal Part 1054. The Proposed Amendments revise portions of California’s Part 1054 to provide consistency with (i.e., “harmonize”) these recent changes made to the wording of corresponding provisions in the federal Part 1054. These proposed harmonization amendments reflect changes U.S. EPA made to the

federal regulations after November 8, 2010,^{kk} up to and including U.S. EPA's final regulatory amendments, "Improvements for Heavy-Duty Engine and Vehicle Test Procedures, and Other Technical Amendments," published in the Federal Register on June 29, 2021.^{ll}

There are two types of proposed harmonization amendments to California's Part 1054: (1) Amendments that provide the exact same words and organizational changes as U.S. EPA's recent amendments to the federal Part 1054; and (2) Amendments that provide U.S. EPA's recent amendments with one or more modifications to incorporate California-specific changes necessary to maintain the stringency of California emission standards, provide consistency with existing California SORE regulations or other Proposed Amendments described in this staff report, or prevent confusion. The proposed harmonization amendments that include one or more California-specific modifications each have their own separate purpose and rationale descriptions that, along with the purpose and rationale descriptions for other Proposed Amendments to California's Part 1054, follow the "Global Amendments" subsection of this section F in the order in which they occur in the regulations. The following list identifies the sections, subsections, and paragraphs of California's Part 1054 with proposed harmonization amendments that provide the exact same words and organizational changes as U.S. EPA's recent amendments to the federal Part 1054.

- Divide § 1054.2 into subsections 1054.2(a) and 1054.2(b).
- Add to § 1054.125(c) a provision that allows maintenance of low-use engines to be specified in terms of calendar month intervals as well as in terms of operating life, and an example clarifying that engines may not be designed to require special maintenance for specific types of expected operation.
- In § 1054.130(b)(5), change the text "Describe any limits on the range of applications needed to ensure that the engine remains in its certified configuration after installation." **to** "Describe how your certification is limited for any type of application." Add the text "in this subpart" as indicated by underline in the following: "Also, if your wintertime engines are not certified to the otherwise applicable HC+NO_x standards in this subpart, tell equipment manufacturers that the engines must be installed in equipment that is used only in wintertime."

^{kk} CARB incorporated portions of the federal Part 1054 into the California Code of Regulations in October 2012. The California Part 1054 adopted in 2012 is based on the federal text as of November 8, 2010.

^{ll} U.S. EPA. 2021. Improvements for Heavy-Duty Engine and Vehicle Test Procedures, and Other Technical Amendments (Final Rule). Federal Register, Vol. 86, No. 122, June 29, 2021, pages 34,308-34,590 (to be codified at 40 CFR Parts 9, 59, 60, 85, 86, 88, 89, 90, 91, 92, 94, 1027, 1033, 1036, 1037, 1039, 1042, 1043, 1045, 1048, 1051, 1054, 1060, 1065, 1066, 1068, and 1074).

- In § 1054.145, add the text “interim” to the first sentence as indicated by underline in the following: “The interim provisions in this section apply instead of other provisions in this part. This section describes how and when these interim provisions apply.”
- In § 1054.205(p)(1), change the text “Include test results from invalid tests and from any other tests” **to** “Indicate whether there are test results from invalid tests and or from any other tests of the emission-data engine,” and add a provision indicating that the regulatory agency may require these additional tests to be reported.
- In § 1054.225(b), change the text “send the Designated Compliance Officer the following information” **to** “send the following relevant information to the Designated Compliance Officer.”
- In § 1054.225(b)(2), add the text “in this part” to the end of each of the two sentences in this subsection.
- In § 1054.225(b), add a new subsection, “(4) Include any other information needed to make your application correct and complete.”
- In § 1054.235, change the section title from “What exhaust emission testing must I perform for my application for a certificate of conformity?” **to** “What testing requirements apply for certification?”
- In § 1054.235(a), add the text indicated in underline: “Select a configuration and set adjustable parameters in a way that is most likely to exceed the HC + NO_x standard in subpart B of this part, using good engineering judgment.”
- In § 1054.235(b), change the text “...you may ask us to exclude fuel mixtures that you can show are not likely to occur in use” **to** “...you may ask us to instead perform tests with both fuels separately if you can show that intermediate mixtures are not likely to occur in use.”
- In § 1054.235(d)(1), change the text as indicated in underline and strikeout: “The emission family from the previous model year differs from the current emission family only with respect to model year, items identified in § 1054.225(a), or other characteristics unrelated to emissions. ~~You may also ask to add a configuration subject to §1054.225. We may waive this criterion for differences we determine not to be relevant.~~”
- In § 1054.235(d)(3), add “of this part” to the first sentence, as indicated by underline in the following: “The data show that the emission data engine would meet all the requirements of this part that apply to the emission family covered by the application for certification.” Delete the provision: “For engines originally tested under the provisions of 40 CFR part 90, you may consider those test procedures to be equivalent to the procedures we specify in subpart F of this part.”

- In § 1054.240(a), change the text “This includes all test points over the course of the durability demonstration” **to** “This paragraph (a) also applies for all test points for emission-data engines within the family used to establish deterioration factors.”
- In § 1054.240(b), change the text “...test results showing a deteriorated emission level for any pollutant that is above an applicable emission standard” **to** “...test results showing an official emission result or a deteriorated emission level for any pollutant that is above an applicable emission standard in subpart B of this part.”
- In § 1054.240(b), change the text “This includes all test points over the course of the durability demonstration” **to** “This paragraph (b) also applies for all test points for emission-data engines within the family used to establish deterioration factors.”
- In § 1054.240(c), add the text indicated in underline in the following: “Determine a deterioration factor to compare emission levels from the emission-data engine with the applicable emission standards in subpart B of this part.” At the end of the paragraph, add the sentence: “In the case of dual fuel and flexible fuel engines, apply deterioration factors separately for each fuel type.”
- In § 1054.240(d), change the text “Adjust the official emission results for each tested engine at the low-hour test point by multiplying the measured emissions by the deterioration factor, then rounding the adjusted figure to the same number of decimal places as the emission standard” **to** “Determine the official emission result for each pollutant to at least one more decimal place than the applicable standard in subpart B of this part. Apply the deterioration factor to the official emission result, as described in §1054.245(e), then round the adjusted figure to the same number of decimal places as the emission standard.”
- In § 1054.250(b)(3)(iv), change the text “All your emission tests, including documentation on routine and standard tests, as specified” **to** “All your emission tests (valid and invalid), including the date and purpose of each test and documentation of test parameters as specified,” and delete the text “and the date and purpose of each test” from the end of the paragraph.
- In § 1054.255(e), after the current provision, “We may void your certificate if we find that you intentionally submitted false or incomplete information,” add the sentence, “This includes doing anything after submitting your application that causes the submitted information to be false or incomplete.”
- In § 1054.501(b)(2), change the text “meeting the specifications described in 40 CFR 1065.710” **to** “specified” in the initial paragraph, delete the sentence “You may alternatively use gasoline blended with ethanol as follows:” at the end of the initial paragraph, and delete the numbered paragraphs (i) through (iv).

- In § 1054.505(a)(1), delete the text “In each mode, operate the engine for at least 5 minutes, then sample emissions for at least 1 minute.”
- In § 1054.505(b)(2), make the following changes:
 - Change the text “Control engine speeds and torques during idle mode as specified in paragraph (c) of this section and during full-load operating modes as specified in paragraph (d) of this section. For all other modes, control torque as needed to meet the cycle-validation criteria” **to** “Control engine speeds and torques during idle mode as specified in paragraph (c) of this section. Control engine speed during the full-load operating modes as specified in paragraph (d) of this section. For all other modes, control the engine speed to within 5 percent of the nominal speed specified in paragraph (d) of this section or let the installed governor (in the production configuration) control engine speed. For all modes except idle, control torque as needed to meet the cycle-validation criteria.”
 - Delete the text “control the engine speed to within 5 percent of the nominal speed specified in paragraph (d) of this section or let the installed governor (in the production configuration) control engine speed.”
 - In § 1054.601, add a new subsection: “(d) Subpart C of this part describes how to test and certify dual fuel and flexible fuel engines. Some multi fuel engines may not fit either of those defined terms. For such engines, we will determine whether it is most appropriate to treat them as single fuel engines, dual fuel engines, or flexible fuel engines based on the range of possible and expected fuel mixtures.”
- § In 1054.801, make the following changes:
 - Add to the definition of “Dual-fuel engine” the text” (see §1054.601(d)). For purposes of this part, such an engine remains a dual-fuel engine even if it is designed for operation on three or more different fuels.”
 - In the definition of “Engine configuration,” change the text “differ only with respect to normal production variability” to “differ only with respect to normal production variability or factors unrelated to emissions.
 - Add to the definition of “Flexible-fuel engine” the text “(see §1054.601(d).”
 - In the definition of “Nonmethane hydrocarbon (NMHC),” change the text “means the sum of all hydrocarbon species except methane. Refer to §1065.660 for NMHC determination” **to** “has the meaning given in Part 1065.1001. This generally means the difference between the emitted mass of total hydrocarbon and the emitted mass of methane.”

- In the definition of “Placed into service,” add the text “Engines and equipment do not qualify as being “placed into service” based on incidental use by a manufacturer or dealer.”
- In the definition of “Total hydrocarbon (THC),” change the text “means the combined mass of organic compounds measured by the specified procedure for measuring total hydrocarbon, expressed as a hydrocarbon with a hydrogen-to-carbon mass ratio of 1.85:1” **to** “has the meaning given in Part 1065.1001. This generally means the combined mass of organic compounds measured by the specified procedure for measuring total hydrocarbon, expressed as an atomic hydrocarbon with an atomic hydrogen-to-carbon ratio of 1.85:1.”
- In the definition of “Total hydrocarbon equivalent (THCE),” change the text “means the sum of the carbon mass contributions of non-oxygenated hydrocarbons, alcohols and aldehydes, or other organic compounds that are measured separately as contained in a gas sample, expressed as exhaust hydrocarbon from petroleum-fueled engines. The hydrogen-to-carbon ratio of the equivalent hydrocarbon is 1.85:1” **to** “has the meaning given in Part 1065.1001. This generally means the sum of the carbon mass contributions of non-oxygenated hydrocarbon, alcohols and aldehydes, or other organic compounds that are measured separately as contained in a gas sample, expressed as exhaust hydrocarbon from petroleum-fueled engines. The atomic hydrogen-to-carbon ratio of the equivalent hydrocarbon is 1.85:1.”

Rationale. These changes are necessary to provide consistency with comparable provisions in the federal regulations for small nonroad engines, as applicable. Without such consistency, manufacturers could be required to satisfy additional requirements and/or certify separate engine families in California at considerable extra cost without a corresponding increase in emission benefits. The proposed changes are identical to the changes in the equivalent sections, subsections, and paragraphs of the federal Part 1054 due to amendments adopted by U.S. EPA since the adoption of California’s Part 1054. The Proposed Amendments would result in a more efficient certification process for engine and equipment manufacturers, consistent with the rationale for CARB’s incorporation of the federal regulations into the California Code of Regulations in 2012. These proposed changes would align CCR requirements with federal requirements that manufacturers already must follow, as applicable.

Changes to Provide Consistency with Proposed “Handheld” Definition

Purpose. The Proposed Amendments make the following changes to four sections of California’s Part 1054—§§ 1054.115(c), 1054.205(r), 1054.505(a), and 1054.801—to provide consistency with the newly proposed definition for “handheld” in Title 13 CCR § 2401(a):

- Change the definition of “handheld” in § 1054.801 from “Handheld means equipment that contains an engine with a displacement of less than 80cc” to

"Handheld has the meaning given in Title 13, California Code of Regulations, Section 2401."

- Change the text "engines with displacements ≤ 80 cc" in § 1054.115(c), and the text "engines with a displacement of less than or equal to eighty cubic centimeters" in § 1054.505(a), **to** "handheld engines."
- Change the text "engines with displacements > 80 cc" in § 1054.115(c), the text "engines with a displacement of greater than 80 cc" in §§ 1054.205(r), and the text "engines with a displacement of greater than eighty cubic centimeters" in § 1054.505(a) **to** "nonhandheld engines."

The current regulations in § 1054.115(c) specify requirements for engines that need altitude adjustments and include the following: *"Engines must meet applicable emission standards for valid tests conducted under the ambient conditions specified in 40 CFR <sic> 1065.520. Engines must meet applicable emission standards at all specified atmospheric pressures except: (i) engines with displacements ≤ 80 cc for atmospheric pressures below 96.0 kPa; and, (ii) engines with displacements > 80 cc may rely on an altitude kit for atmospheric pressures below 94.0 kPa if you meet the requirements specified in 1054.205(r)."* The proposed changes to § 1054.115(c) would establish that only handheld engines, and not other engines with displacement less than or equal to 80 cubic centimeters, are exempt from meeting the emission standards at lower atmospheric pressure, as occurs at higher altitudes, and that nonhandheld engines may rely on an altitude kit to meet the standard at reduced atmospheric pressure even if their displacement is 80 cc or less.

The current regulations in § 1054.205 describe the information a manufacturer must include in a certification application, and subsection 1054.205(r) specifies: *"Describe how your engines with a displacement of greater than 80 cc engines comply with emission standards at varying atmospheric pressures. Include a description of altitude kits you designed to comply with the requirements of §1054.115(c)."* The proposed change to § 1054.205(r) would establish that manufacturers of all nonhandheld engines, and not just those with a displacement greater than 80 cubic centimeters, would be required to describe how their engines comply with emission standards at varying atmospheric pressures.

The current regulations in § 1054.505(a) describe requirements for how to test engines under steady-state conditions, and specifies: *"For engines with a displacement of less than or equal to eighty cubic centimeters you must perform tests with discrete-mode sampling. For engines with a displacement of greater than eighty cubic centimeters we allow you to perform tests with either discrete-mode or ramped-modal testing methods."* The proposed change to § 1054.505(a) would allow manufacturers of all nonhandheld engines, and not just those with a displacement greater than 80 cubic centimeters, to perform tests with either discrete mode or ramped modal testing methods.

In addition, the Proposed Amendments add a subsection to § 1054.205 that was not included at the time Part 1054 was adopted in the California Code of Regulations:

“(s) If your engines are subject to any handheld engine provisions on the basis of meeting the definition of “handheld” in Title 13, California Code of Regulations, section 2401, describe your analysis showing that you meet the applicable criteria.”

The proposed addition of § 1054.205(s) would require manufacturers of such engines to include in their certification applications their analyses showing that they meet the applicable criteria of the proposed definition of handheld.

Rationale. The proposed changes are necessary to provide consistency with the newly proposed definition for “handheld” in Title 13 CCR § 2401(a) and to ensure no excess emissions result from improper implementation of the emission standards or credit programs. The definition of “handheld” is currently in § 1054.801. California’s current emission standards do not distinguish between handheld and nonhandheld SORE equipment but rather are based on displacement category. The emission standards and other provisions are generally less stringent for engines with displacement less than or equal to 80 cc, some of which are used in handheld equipment. When CARB adopted Part 1054 into the California Code of Regulations in 2012, CARB did not incorporate the federal definition of “handheld” but instead defined handheld in § 1054.801 as “equipment that contains an engine with a displacement of less than 80 cc.”

However, the emission reduction credit program specified by § 2408.1 currently contains requirements specific to handheld equipment. In addition, use of a definition that classifies all equipment that contains an engine with a displacement of less than 80 cc as “handheld” does not account for the challenges specific to handheld equipment that are not relevant for nonhandheld equipment using engines with displacement \leq 80 cc. The design of some engines with displacement less than or equal to 80 cc used in handheld equipment may not be conducive to adjustments for high altitude. However, staff expects adjustments for high altitude can be made for nonhandheld equipment, such as portable generators, that use engines with displacement less than or equal to 80 cc. Therefore, the broader exemption in § 1054.115(c) adopted in 2012 is not appropriate for nonhandheld engines within this size range, and could prevent the full realization of the expected emission reduction benefits from California’s SORE exhaust standards.

The Proposed Amendments to Part 1054 to provide consistency with the proposed “handheld” definition in § 2401 are not expected to result in cost impacts to manufacturers because the proposed definition and associated changes more closely align CCR requirements with federal requirements for handheld engines that manufacturers already must follow, and available information indicates nonhandheld engines with displacement \leq 80 cc are either preempt from California’s standards (i.e., only subject to federal standards) or are equipment types such as generators that

already have the ability to make use of an altitude kit. Similarly, the federal Part 1054.205(s) contains the following text, which is comparable to the text of the proposed § 1054.205(s): *"(s) If your engines are subject to handheld emission standards on the basis of meeting weight limitations described in the definition of "handheld" in §1054.801, describe your analysis showing that you meet the applicable weight-related restrictions."* Consequently, no cost impacts are expected from the proposed addition of the new subsection 1054.205(s) requirements to the California SORE regulations.

Preface

Purpose. The current regulations include the following preface text before and after the table of contents:

Before the table of contents:

"Note: This appendix shows the entirety of regulatory amendments to the test procedures titled below, which were approved by the Air Resources Board on December 16, 2011, and refined via subsequent conforming modifications authorized under Resolution 11-41. Incorporated by reference into these test procedures are portions of Title 40 of the Code of Federal Regulations (CFR) Part 1054 – Control of Emissions from New, Small Nonroad Spark-Ignition Engines and Equipment, including Subparts A, B, C, D, E, F, G, H and I, as amended November 8, 2010; and, the internally referenced sections of Title 40 CFR, Parts 60, 80, 86, 90, and 1065. Sections that have been included in their entirety are set forth with the section number and title. California provisions that replace specific federal language provisions are denoted by the words "DELETE" for the federal language and "REPLACE WITH" or "ADD" for the California language. The notation [* * * *] or [...] means that the remainder of the CFR text for a specific section is not shown in these procedures but has been incorporated by reference, with only the printed text changed. CFR sections that are not listed are not part of the test procedures. If there is any conflict between the provisions of this document and the California Health and Safety Code, Division 26, or Title 13 of the California Code of Regulations (CCR), the Health and Safety Code and Title 13 apply.

This document is all newly adopted text."

After the table of contents:

"The following provisions of Part 1054, Title 40, Code of Federal Regulations, as proposed by the United States Environmental Protection Agency on the date listed, are adopted and incorporated herein by this reference for 2013 model year and later small off road engines as the California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off Road Engines, except as altered or replaced by the provisions set forth below."

“SOURCE: 75 FR 59259, November 8, 2010, unless otherwise noted”

The Proposed Amendments delete this preface text and add the following updated text before the table of contents:

“Note: This document provides the entirety of the California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1054), as adopted by the California Air Resources Board (CARB) on December 16, 2011, with additional conforming modifications authorized under Resolution 11-41 on October 25, 2012, and amended on [insert amendment date]. These standards and test procedures are incorporated by reference in Title 13, California Code of Regulations, § 2403. The Part 1054 section numbers, titles, and text correspond to same-numbered sections in Title 40 of the Code of Federal Regulations (CFR) Part 1054 – Control of Emissions from New, Small Nonroad Spark-Ignition Engines and Equipment, with California-specific modifications as necessary to maintain the stringency of California emission standards and provide consistency with other California regulations. CFR sections that are not listed herein are not a part of this Part 1054. The 2011/2012 CARB rulemaking incorporated by reference portions of Title 40 CFR Part 1054, including Subparts A through I, as amended November 8, 2010; for clarity, the 2021 CARB rulemaking included the entirety of the language from those portions of Title 40 CFR Part 1054, including Subparts A through I, incorporated by reference in Part 1054 from the 2011/2012 CARB rulemaking into Part 1054. The 2011/2012 CARB rulemaking also incorporated by reference the internally referenced sections in Part 1054 to Title 40 CFR Part 90 as amended October 30, 2009, Title 40 CFR Part 1051 as amended April 30, 2010, Title 40 CFR Part 1060 as amended September 16, 2010, Title 40 CFR Part 1065 as amended November 8, 2010, and Title 40 CFR Part 1068 as amended April 30, 2010. The 2021 CARB rulemaking included those portions of Title 40 CFR Part 1054 Subparts A, B, C, and I, as amended between November 8, 2010, and June 29, 2021, in Part 1054. The 2021 CARB rulemaking incorporated by reference the internally referenced sections in Part 1054 to Title 40 CFR Part 1051 as amended June 29, 2021, and Part 1068 as amended June 29, 2021. The 2021 CARB rulemaking removed the references to 40 CFR Parts 90, 1054, 1060, and 1065, and those CFR Parts are no longer incorporated by reference in this Part 1054. If there is any conflict between the provisions of this document and the California Health and Safety Code, Division 26, or Title 13 of the California Code of Regulations, the Health and Safety Code and Title 13 apply.”

The Proposed Amendments include a placeholder for the amended date, “[insert amended date],” that will be updated to reflect the CARB adoption date of the Proposed Amendments to Part 1054.

Rationale. An updated preface is necessary for accuracy and clarity because, once the Proposed Amendments are approved, California Part 1054 will no longer be comprised of “all newly adopted text.” Instead, California Part 1054 will include text adopted by the 2011/2012 rulemaking as amended by the current rulemaking. The Proposed Amendments also provide an updated date of publication for the federal Part 1054 that is the source material for the Proposed Amendments, and updates the list of other 40 CFR parts internally referenced by the amendments and their associated publication dates. Three CFR parts, CFR Parts 60, 80, and 86, were listed in the 2011/2012 preface but were not cited later in California Part 1054, and therefore need not be incorporated by reference. The updated publication dates are necessary to maintain CARB’s ability to independently implement or enforce its regulations should U.S. EPA make a change that does not support the stringency of California emission standards or is otherwise not consistent with other California SORE regulations. Also, Title 1, California Code of Regulations, § 20(c)(3), generally prohibits the incorporation by reference of material into California regulations without a date of publication or issuance. The 2011/2012 preface text that explains why some federal Part 1054 text is not shown is now not necessary because, for clarity, the document now includes the entirety of the language from those portions of Title 40 CFR Part 1054 incorporated by reference in Part 1054 by the 2011/2012 rulemaking into Part 1054.

Subpart A – Overview and Applicability

§ 1054.2

Purpose. The current regulations specify: “For provisions related to certification with respect to evaporative emissions, this generally means the equipment manufacturer.” The Proposed Amendments add the following text to the end of the sentence: “(i.e., the Executive Order Holder, as defined in Title 13, California Code of Regulations, section 2752).”

Rationale. This change is necessary to clarify that the party who holds the Executive Order of Certification (the Executive Order Holder) certifying a given evaporative family is the party ultimately responsible for that evaporative family’s compliance with these requirements, even if another party is considered the equipment manufacturer. Such clarification is needed because it is common for manufacturers of commercially available equipment powered by SORE to purchase engines, fuel system components, assembled fuel systems, or parts for fuel systems and engines from other companies. The party who is the Executive Order Holder for a given evaporative emission control system or component may not be the party responsible for the ultimate production and assembly of the piece of equipment into which it is incorporated. As the Executive Order Holder for an evaporative family, this party is “the equipment manufacturer” for

compliance purposes, and is responsible for the evaporative emission control system's compliance with the applicable standards and certification levels. The current regulations already contain text that clarifies that engine manufacturers that assemble the engine's complete fuel system are considered to be the equipment manufacturer with respect to evaporative emissions, but other arrangements may exist. This amendment clearly identifies the parties responsible for compliance and ensures that those parties understand their responsibilities under these regulations.

§ 1054.10(f)

Purpose. Subsection 1054.10 describes how Part 1054 is organized into different subparts and identifies the topics of each. The text of § 1054.10(f) states: "Subpart F of this part describes how to test your engines (including references to other parts of the Code of Federal Regulations." The Proposed Amendments add clarifying text, as indicated by underline in the following sentence: "Subpart F of this part describes how to test your engines (including references to other parts of the California Code of Regulations and specific sections, which are incorporated by reference, of the Code of Federal Regulations)."

Rationale. This change is necessary to clarify that references in this part are to other parts of the California Code of Regulations, and that individual sections, not entire parts, of the Code of Federal Regulations are incorporated by reference. These revisions describe the scope of references in the subpart, particularly the provisions that refer to California's specific regulations. The similar provisions in the federal Part 1054 refer to federal regulations.

§ 1054.10(g)

Purpose. The text of § 1054.10(g) states: "Subpart G of this part and 40 CFR part 1068 describe requirements, prohibitions, and other provisions that apply to engine manufacturers, equipment manufacturers, owners, operators, rebuilders, and all others." The Proposed Amendments add clarifying text, as indicated by strikeout and underline in the following sentence: "Subpart G of this part and ~~40 CFR~~ sections of Title 40, Code of Federal Regulations part 1068 as amended October 25th, 2016, which are incorporated by reference, describe requirements..."

Rationale. These changes are necessary to clarify that only sections of Title 40, Code of Federal Regulations Part 1068, are incorporated by reference in Subpart G, and to specify the version of federal regulations being referenced and incorporated. Letting readers know that the entirety of the federal Part 1068 is not incorporated into the California Code of Regulations helps improve regulatory certainty by indicating that manufacturers may need to follow other portions of federal Part 1068 in addition to the portions incorporated into the California Code of Regulations. Specifying the version, by amendment date, of the Part 1068 that is being incorporated is necessary to prevent conflicts with California SORE regulations should U.S. EPA amend Part 1068 in the future.

§ 1054.15

Purpose. Section 1054.15 has the title, “Do any other CFR parts apply to me?” The Proposed Amendments remove “CFR” from the section title to clarify that this section refers to California SORE regulations and not federal regulations.

Rationale. This change is necessary to improve clarity by correcting an oversight that occurred at the time the federal Part 1054 regulations were incorporated into the California Code of Regulations. The original federal regulation’s section title was accidentally included in the California Part 1054 regulations at the time of their adoption in 2012. This change is necessary to prevent confusion for reader regarding the topic of the section and does not affect the applicability of the section’s provisions.

§ 1054.20(d)

Purpose. Section 1054.20 provides an overview of the requirements that apply to SORE equipment. Subsection 1054.20(d) states: “You must certify your equipment or fuel systems as described in Title 13, California Code of Regulations, Chapter 15, Article 1.” The Proposed Amendments change the text “equipment or fuel systems” to “evaporative emission control systems” to provide clarity about the regulatory scope.

Rationale. This change is necessary to improve clarity by correcting an oversight that occurred at the time the federal Part 1054 regulations were incorporated into the California Code of Regulations. The text “equipment or fuel systems” should have been changed to “evaporative emission control systems” in 2012 when the California Part 1054 regulations were adopted in order to accurately reflect the scope of Title 13, California Code of Regulations, Chapter 15, Article 1, which requires any engine introduced into California commerce to have a certified and labeled evaporative emission control system. This change is necessary to prevent confusion about the scope of the current regulations.

Subpart B – Emission Standards and Related Requirements

§ 1054.101(a)(1)

Purpose. The current regulations in § 1054.101(a)(1) specify the exhaust emission standards for SORE, special provisions for wintertime engines, and voluntary Blue Sky Series emission standards, as they were set forth in Title 13, California Code of Regulations, Chapter 9, Article 1 § 2403 at the time CARB incorporated Part 1054 into the California Code of Regulations. The Proposed Amendments replace the text and tables in § 1054.101(a)(1) that describe the emission standards and associated provisions with the sentence, “Exhaust emission standards are specified in Title 13, California Code of Regulations, Chapter 9, Article 1,” so that the exhaust emission standards are not duplicated in § 1054.101(a)(1).

Rationale. This change is necessary to prevent the occurrence of conflicting regulations should, in the future, § 1054.101(a)(1) not be amended at the same time § 2403(b) is amended. Exhaust emissions from SORE manufactured for sale, sold, offered for sale in California, or that are introduced, delivered or imported into California for introduction into commerce, must comply with the standards specified in Title 13, California Code of Regulations, § 2403. Duplicating standards and other provisions already specified in § 2403 creates unnecessary redundancy and complexity when amendments to § 2403 are needed, and adds to the length of § 1054.101(a)(1). Specifying a reference to, "Title 13, California Code of Regulations, Chapter 9, Article 1" ensures that manufacturers and other stakeholders refer to the most recent version of applicable exhaust standards.

§ 1054.107

Purpose. The current regulations in § 1054.107 describe an engine family's useful life, which is the period during which engines are required to comply with all emission standards that apply. The Proposed Amendments delete text from the second sentence of the initial unnumbered paragraph that currently applies a five-year maximum limit to the useful life period, as indicated by strikeout in the following: "The useful life period is ~~five years or~~ a number of hours of operation, ~~whichever comes first~~, as described in this section."

Rationale. These changes are necessary to provide consistency with current SORE exhaust emission regulations in § 2403(b)(1) that specify emissions durability periods, and the Proposed Amendments that would update the required period for MY 2024 and subsequent model year engines. The current § 2403(b)(1) provisions allow applicants for certification to select a durability period for their engines from a range of choices that generally reflect "moderate," "intermediate," or "extended," use. As described in section A of this chapter, the Proposed Amendments for § 2403(b)(1) would lengthen the emissions durability periods for some engines to more accurately reflect the useful lifetime of SORE equipment, and would allow only one durability period option per displacement category: 300, 500, or 1,000 hours, depending on the displacement category. Both the current regulations and the Proposed Amendments to § 2403(b)(1) define durability periods in terms of minimum number of hours of operation, without any maximum period limit in terms of hours or years.

§ 1054.107(a)(1) and (2)

Purpose. The current regulations in § 1054.107(a)(1) specify the useful life periods for meeting exhaust emission standards by referencing "Title 13, California Code of Regulations, Chapter 9, Article 1, Section 2404." The current regulations in § 2404 specify requirements for engine or equipment manufacturers to affix a label (or labels) on each production engine (or equipment, as applicable) to provide:

- The engine or equipment owner and service mechanic with information necessary for the proper maintenance of these parts in customer use; and

- The potential consumers with information regarding relative emissions levels.

The current regulations in § 2404(l) specify requirements for the Air Index label content and locations. For engines certified to emission standards subject to an emissions durability period as set forth in § 2403(b) and for engines used to meet the requirements of §2403(c), each engine manufacturer currently must make Air Index and durability period information available to potential consumers. Section 2404(l)(2) specifies that the emissions durability period must be indicated by the actual hours, by the descriptive terms shown in the table provided in that section, or by both. The table has two sections, one for descriptive terms applicable to MYs 2000 through 2004, and the second for descriptive terms applicable to MY 2005 and subsequent model years. The Proposed Amendments change model year applicability for the second table section from model year “2005 and subsequent,” to “2005 through 2023,” for consistency with other Proposed Amendments to § 2403. The change to the model year applicability is necessary to provide consistency with the Proposed Amendments to emissions durability periods specified in § 2403(b)(1) for MY 2024 and subsequent model years. The proposed emissions durability periods are the same for all engines within a displacement class. Therefore, using a descriptive term on the emission control label to supplement the number of hours in the emissions durability period will no longer be necessary.

To provide consistency with the Proposed Amendments to §§ 2403 and 2404, the Proposed Amendments include two changes to § 1054.107(a):

- Add the text “For model years 2013 through 2023,” to the beginning of § 1054.107(a)(1) to specify that its provisions apply to MYs 2013 through 2022.
- Add a new paragraph 1054.107(a)(2) to specify that for MY 2024 and subsequent model years, the useful life period for exhaust requirements is specified in the table in Title 13, California Code of Regulations, § 2403(b)(1).

Rationale. These changes are necessary because the Proposed Amendments would modify § 2403 such that § 2403(b)(1) specifies new useful life periods (i.e., emissions durability periods) for MY 2024 and subsequent model years. The newly proposed subsection 1054.107(a)(2) is necessary to ensure that regulated parties consulting Part 1054 are aware of these provisions as amended for MY 2024 and subsequent model years and know where to find them.

§ 1054.107(a)(3) [newly proposed paragraph]

Purpose. The Proposed Amendments add a new paragraph 1054.107(a)(3) that specifies:

“You may select a longer useful life than that specified in paragraph (a)(1) or (a)(2) of this section as applicable in 100-hour increments not to exceed 3,000 hours for Class I, III, IV, and V engines, or 5,000 hours for Class II engines. Engine classes are defined in Title 13, California Code of Regulations,

section 2403. For engine families generating emission credits, you may do this only with our approval.”

In this proposed text, “you” means the certifying manufacturers, consistent with the definition in § 1054.2, and “our” means CARB, consistent with the definition in § 1054.801. As currently defined by § 2403(b)(1), SORE engine classes have the following displacement ranges: Class I: 65 cc to < 225 cc; Class II: ≥ 225 cc; Class III: < 20 cc; Class IV: 20 cc to < 50 cc; and Class V: ≥ 50 cc to 65 cc.

Rationale. This change is necessary to allow manufacturers the flexibility to specify a longer useful life period for one or more engine families, while providing CARB discretion to confirm that longer useful lives specified for emission credit-generating engine families are appropriate. The federal Part 1054 contains a similar provision, but it was not adopted into the California Code of Regulations by California in 2012. This provision is intended to allow manufacturers flexibility in design and marketing of SORE equipment, particularly handheld equipment, and encourage manufacturers to design and market more durable, higher-quality products, that reduce lifetime emissions. At the same time, requiring CARB’s approval for specification of longer useful life periods for families that generate emission credits would ensure that manufacturers do not claim unrealistically or inappropriately long useful life periods in order to maximize credit generation without actually realizing the expected emission benefits. Providing this flexibility, subject to specific oversight in the case of emission credit generating families, reduces the burden on manufacturers and facilitates compliance while preserving the intended emission reduction benefits of the emission standards and emission reduction credit programs.

The “not to exceed” values of 3,000 hours for Class I, III, IV, and V engines, and 5,000 hours for Class II engines, are equivalent to those specified for Class I and II engines, respectively, by U.S. EPA in the federal Part 1054.

§ 1054.115(b)

Purpose. The current regulations in § 1054.115 identify additional requirements that apply to engines that are required to meet the emission standards.

Section 1054.115(b) specifies requirements for engines with adjustable parameters and includes the following:

“Engines that have adjustable parameters must meet all the requirements of this part for any adjustment in the physically adjustable range. An operating parameter is not considered adjustable if you permanently seal it or if it is not normally accessible using ordinary tools. ...”

To provide clarification, the Proposed Amendments delete the text “or if it is not normally accessible using ordinary tools” and add a new sentence, “Operating parameters that can be adjusted using tools are considered adjustable.”

Rationale. This change is necessary to remedy unintentional vagueness and confusion caused by the current text “normally accessible using ordinary tools.” Providing clarification is necessary to maintain the stringency of California’s emission standards and to achieve the expected emission benefits of the current regulations. In the present market environment, even specialized tools can be readily obtained by SORE equipment owners to adjust parameters such as high- and low-speed fuel mixtures. Owners may adjust parameters to achieve performance benefits or for personal preference. Therefore, in practice, SORE may operate with any parameter set to any value that can be achieved with the use of tools, and such settings must be reflected in the range of operating parameter settings used during engine emissions testing conducted under this part.

§ 1054.125

Purpose. The current regulations in § 1054.125 specify requirements for maintenance instructions that manufacturers must give to the consumer (i.e., “ultimate purchaser”) of each new engine and include the following text in the initial unnumbered paragraph: *“The maintenance instructions also apply to service accumulation on your emission-data engines as described in §1054.245 and in 40 CFR part 1065. Note that for engines with a displacement of less than or equal to 80 cc you may perform maintenance on emission-data engines during service accumulation provided that exhaust emission tests are performed before and after the maintenance is performed.”*

As described in the “Global Amendments” section, the Proposed Amendments change “40 CFR part 1065” to “Part 1065” in the first sentence. In addition, the Proposed Amendments delete the second sentence, *“Note that for engines with a displacement of less than or equal to 80 cc you may perform maintenance on emission-data engines during service accumulation provided that exhaust emission tests are performed before and after the maintenance is performed.”*

Rationale. The first change is necessary to improve clarity by correcting an oversight that occurred at the time certain federal regulations were incorporated into the California Code of Regulations. Changing “40 CFR part 1065” to “Part 1065” clarifies that the referenced test procedures and other requirements are those specified in California’s Part 1065, rather than the similar federal procedures. See the Global Amendments subsection, ““EPA” to “CARB” Term Change, “Certificate of Conformity” to “Executive Order” Term Change, and Improvements to References to Parts 1054 and 1065,” in this section F for additional explanation.

The second change, to delete the sentence, “Note that for engines with ...,” is necessary to harmonize California’s Part 1054 with recent amendments to the federal Part 1054. In an amendment published at 86 FR 34517, June 29, 2021, the U.S. EPA deleted the equivalent sentence from the federal Part 1054.125, *“Note that for handheld engines subject to Phase 3 standards you may perform maintenance on emission-data engines during service accumulation as described in 40 CFR part 90.”*

§ 1054.125(a)(1)

Purpose. The current regulations in § 1054.125(a) define what is meant by “critical emission-related maintenance” and specify the conditions that must be met for a manufacturer to be allowed to schedule maintenance on critical emission-related components. Section 1054.125(a)(1) specifies the following condition:

“You demonstrate that the maintenance is reasonably likely to be done at the recommended intervals on in-use engines. We will accept scheduled maintenance as reasonably likely to occur if you satisfy any of the following conditions:

(i) You present data showing that any lack of maintenance that increases emissions also unacceptably degrades the engine's performance.

(ii) You present survey data showing that at least 80 percent of engines in the field get the maintenance you specify at the recommended intervals. If the survey data show that 60 to 80 percent of engines in the field get the maintenance you specify at the recommended intervals, you may ask us to consider additional factors such as the effect on performance and emissions. For example, we may allow you to schedule fuel injector replacement as critical emission related maintenance if you have survey data showing this is done at the recommended interval for 65 percent of engines and you demonstrate that performance degradation is roughly proportional to the degradation in emission control for engines that do not have their fuel injectors replaced.

(iii) You provide the maintenance free of charge and clearly say so in your maintenance instructions.

(iv) You otherwise show us that the maintenance is reasonably likely to be done at the recommended intervals.”

The Proposed Amendments change “We will” to “We may” in the second sentence of § 1054.125(a)(1) to enable CARB to have discretion in accepting that scheduled maintenance is reasonably likely to occur.

Rationale. This change is necessary to balance the flexibility that the § 1054.125(a)(1) conditions currently allow for certifying manufacturers to demonstrate that maintenance is reasonably likely to be done at the recommended intervals on in-use engines. CARB must have the discretion to disagree with a manufacturer’s definition of “reasonably likely” when CARB assesses whether data provided in the manufacturer’s demonstration adequately represent real-world SORE maintenance practices in order to ensure emission data produced by the test procedures are representative of real-world emissions. This representativeness is necessary to ensure that engines determined to be in compliance with Part 1054 are indeed compliant and do not result in excess emissions.

§ 1054.125(f)

Purpose. The current regulations in § 1054.125(f) specify requirements for maintenance instructions regarding the source of parts or repairs, and specify conditions for when a manufacturer is allowed to disregard the requirements. The Proposed Amendments add clarifying text, as indicated in the following in underline and strikeout text:

"You may disregard the requirements in this paragraph (f) for a component or service if you do one of two things:

(1) Provide ~~a~~ the component or service without charge under the purchase agreement.

(2) Get us to waive this prohibition in the public's interest by convincing us the engine will work properly only with the identified component or service."

Rationale. This change is necessary to improve clarity and consistency within the text of this section, which eliminates ambiguity and improves readability for manufacturers. The first proposed change § 1054.125(f), addition of the text "for a component or service," provides consistency with the wording of § 1054.125(f)(1), which already specifies that the conditions apply to "component or service." The second proposed change, changing "a" to "the," corrects the grammar for consistency with the first proposed change. These Proposed Amendments do not make a substantive change to any of the current standards and test procedures.

§ 1054.130(b)(4)

Purpose. The Proposed Amendments add "the" to the text in the current regulations, "in accordance with the Executive Order" to correct a grammatical error inadvertently included in 2012 when the federal regulations were adopted into the California Code of Regulations.

Rationale. This change is necessary to correct a grammatical mistake and does not make a substantive change to any of the current standards and test procedures. California Administrative Law (Title 1, CCR, § 16(a)(4)) requires that California regulations be free of grammatical errors, which may create confusion or ambiguity or undermine the perceived authoritativeness of the regulation text. It is essential to satisfying the purpose of this regulation and addressing the identified problem that there be no such real or perceived ambiguity or error in language use in the regulatory text.

Subpart C – Certifying Emission Families

§ 1054.205(t)

Purpose. The current regulations in § 1054.205 describe the information a manufacturer must include in a certification application, and subsection 1054.205(t) specifies:

“(t) State whether your certification is limited for certain engines. If this is the case, describe how you will prevent use of these engines in applications for which they are not certified. This applies for engines such as the following:

(1) Wintertime engines not certified to the specified HC+NO_x standard.

(2) Two-stroke snowthrower engines using the provisions of § 1054.101(d).”

The Proposed Amendments delete the entirety of § 1054.205(t)(2) and revise the remaining text to remove the list format, so that the final sentence of the subsection would be: “This applies for engines such as wintertime engines not certified to the specified HC+NO_x standard.”

Rationale. This change is necessary to prevent confusion for the reader by correcting an oversight that occurred at the time the federal Part 1054 regulations were incorporated into the California Code of Regulations. The current text in § 1054.205(t)(2) refers to “§ 1054.101(d).” However, CARB did not adopt 40 CFR § 1054.101(d) into the California Code of Regulations in 2012, and there is no Title 13 CCR § 1054.101(d).

§ 1054.205(v)

Purpose. The current regulations in § 1054.205(v) require manufacturers to include good-faith estimates of California-directed production volumes in their certification applications, consistent with federal regulations prior to June 2021, as specified by the following:

“(v) Include good-faith estimates of California-directed production volumes. Include a justification for the estimated production volumes if they are substantially different than actual production volumes in earlier years for similar models. Also indicate whether you expect the engine family to contain only off-road engines, only stationary engines, or both.”

Changes made in U.S. EPA’s final regulatory amendments, “Improvements for Heavy-Duty Engine and Vehicle Test Procedures, and Other Technical Amendments,” published in the Federal Register on June 29, 2021, include additional requirements, as indicated by strikeout and underline in the following text for 40 CFR Part 1054.205(v):

“(v) Provide the following information about your plans for producing and selling engines:

(1) Identify the estimated initial and final dates for producing engines from the engine family for the model year.

(2) Identify the estimated date for initially introducing certified engines into U.S. commerce under this certificate.

(3) Include good-faith estimates of U.S.-directed production volumes. Include a justification for the estimated production volumes if they are substantially different than actual production volumes in earlier years for similar models. Also indicate whether you expect the engine family to contain only nonroad engines, only stationary engines, or both.”

The Proposed Amendments would incorporate the above underlined changes into California Part 1052.205(v) to harmonize the California Code of Regulations with the recent federal regulation changes, with two modifications to make the changes specific to California:

- In § 1054.205(v)(2), change the federal version of the text “into U.S. commerce under this certificate” to “into commerce in California under this Executive Order.”
- In § 1054.205(v)(2), add the sentence “If your estimates are based on U.S.-directed production volumes, include U.S.-directed production volumes and information or analysis that provides the basis for determining your estimates of California-directed production volumes.”

Rationale. These changes are necessary to provide consistency with (i.e., “harmonize”) recent changes made to the corresponding provisions in the federal Part 1054. The proposed changes to incorporate the new federal requirements would not result in cost impacts to manufacturers because they align CCR requirements with federal requirements that manufacturers already must follow. The proposed California-specific requirement to provide additional information for California-directed production volumes based on U.S.-directed production volumes is necessary for CARB to assess the accuracy of projected California sales volumes reported by manufacturers. An accurate accounting of projected sales volumes is necessary to ensure no excess emissions result from implementation of the current and proposed credit programs under Title 13 CCR §§ 2408 through 2408.2, § 2754.1, and § 2754.3. This California-specific requirement is not expected to have any cost impact for manufacturers because manufacturers would not be required to create new information. The requirement is merely to provide their existing information or analysis to CARB.

§ 1054.205(z)

Purpose. The Proposed Amendments make corrections as indicated by strikeout and underline in the following:

"Name an agent for service located in the United States. Service on this agent constitutes service on you or any of your officers or employees for any action by EPA, CARB or otherwise by the ~~United States~~ State of California related to the requirements of this part."

Rationale: These changes are necessary to prevent confusion for the reader by correcting an oversight that occurred at the time the federal Part 1054 regulations were incorporated into the California Code of Regulations, and to improve clarity and regulatory certainty.

§ 1054.205(aa)

Purpose. The Proposed Amendments make corrections as indicated by strikeout and underline in the following:

"(aa) For imported engines or equipment, identify the following:

(1) The port(s) at which you have imported your engines (or equipment containing your engines) over the previous 12 months.

(2) The names and addresses of the agents you have authorized to import your engines or equipment.

(3) The location of a test facility in the United States where you can test your engines if we select them for compliance testing ~~under a selective enforcement audit~~, as specified in ~~40 CFR part 1068, subpart E~~ Title 13, California Code of Regulations, § 2407."

Rationale. This change is necessary to prevent confusion for the reader by correcting an oversight that occurred at the time the federal regulations were incorporated into the California Code of Regulations in 2012. Federal regulations use the term "selective enforcement audit" to refer to provisions substantially similar to the provisions that California SORE regulations describe as "compliance testing" for in-use testing and validation of engines in § 2407, "New Engine Compliance and Production Line Testing – New Small Off Road Engine Selection, Evaluation, and Enforcement Action." However, referencing the federal regulations here, rather than the applicable California regulatory provisions, could create regulatory conflicts and confusion. The proposed change to reference § 2407 instead of 40 CFR part 1068 would not result in cost impacts to manufacturers because manufacturers already must follow applicable CCR § 2407 requirements and applicable 40 CFR part 1068 requirements.

§ 1054.220(b)

Purpose. The current regulations in § 1054.220 specify how a manufacturer may amend its emission-related maintenance instructions after submitting a certification application. The Proposed Amendments change the text "anytime" to "at any time" in the current text of § 1054.220(b): "... you may distribute the new maintenance instructions anytime after you send your request."

Rationale. This change is necessary to correct a grammatical error in the federal regulations that CARB inadvertently incorporated into the California Code of Regulations in 2012. The change improves readability and is not a substantive change. California Administrative Law (Title 1, CCR, § 16(a)(4)) requires that California regulations be free of grammatical errors, which may create confusion or ambiguity or undermine the perceived authoritativeness of the regulation text. It is essential to satisfying the purpose of this regulation and addressing the identified problem that there be no such real or perceived ambiguity or error in language use in the regulatory text.

§ 1054.225(e)

Purpose. The current regulations in § 1054.225 specify how a manufacturer may amend a certification application to include new or modified engines or fuel systems or change an FEL. The Proposed Amendments change the text “anytime” to “at any time” in the current text of § 1054.225(e): “... may start producing the new or modified configuration anytime after you send us your amended application.”

Rationale. This change is necessary to correct a grammatical error in the federal regulations that CARB incorporated into the California Code of Regulations in 2012. The change improves readability and is not a substantive change. California Administrative Law (Title 1, CCR, § 16(a)(4)) requires that California regulations be free of grammatical errors, which may create confusion or ambiguity or undermine the perceived authoritativeness of the regulation text. It is essential to satisfying the purpose of this regulation and addressing the identified problem that there be no such real or perceived ambiguity or error in language use in the regulatory text.

§ 1054.230(b)

Purpose. The current regulations in § 1504.230 provide instructions to manufacturers for how to divide their product line into different engine families. Subsection (b) specifies the conditions for grouping engines into the same emission family for exhaust emissions, and subsection (b)(7) specifies the condition: “(7) Engine class, as defined in § 1054.801.” The Proposed Amendments change the text “§ 1054.801” to “Title 13, California Code of Regulations, § 2403.”

Rationale. This change is necessary to prevent confusion for the reader by correcting an oversight that occurred at the time CARB incorporated certain sections of federal Part 1054 into the California Code of Regulations in 2012. CARB incorporated the text of § 1504.230(b)(7) as written in the federal Part 1054 but did not incorporate the federal Part 1054.801 engine class definition. The California SORE regulations define engine class in § 2403(b).

§ 1054.230(d)

Purpose. The current regulations in § 1054.230(d) specify:

“You may group engines that are not identical with respect to the things listed in paragraph (b) of this section into the same emission family, as follows:

(3) The provisions of this paragraph (d) do not exempt any engines from meeting all the applicable standards and requirements in subpart B of this part.”

The Proposed Amendments delete the text of § 1054.230(d), and add the text “[Reserved].”

Rationale. This change is necessary to correct an oversight that occurred at the time CARB incorporated the federal regulations into the California Code of Regulations in 2012. As noted in Appendix H of the 2011 ISOR,^{mm} CARB did not incorporate 40 CFR §1054.230(d)(1) and (d)(2) into the California Code of Regulations. The remaining text in Title 13 CCR § 1054.230(d)(3) is meaningless without any preceding provisions. Consequently, the Proposed Amendments remove the text to prevent confusion for the reader, and add the text “[Reserved]” to maintain the sequential lettering of the provisions in § 1054.230 and ensure that provisions analogous to provisions within federal Part 1054 have the same lettering.

§ 1054.230(f)

Purpose. The current regulations in § 1054.230(f) specify:

“You may combine engines from different classes into a single emission family under paragraph (d)(1) of this section if you certify the emission family to the more stringent set of standards from the two classes in that model year.”

The Proposed Amendments delete the text of § 1054.230(f), and add the text “[Reserved].”

Rationale. This change is necessary to correct an oversight that occurred at the time CARB incorporated the federal regulations into the California Code of Regulations in 2012. As noted in Appendix H of the 2011 ISOR (CARB, 2011b), CARB did not incorporate 40 CFR §1054.230(d)(1). As a result, the provision in § 1054.230(f) is meaningless because it refers to a subsection that does not exist in the California

^{mm} CARB. 2011. Staff Report: Initial Statement of Reasons for Proposed Rulemaking - Adoption of The Proposed Amendments to California’s Small Off-Road Engine and Tier 4 Off-Road Compression-Ignition Engine Regulations and Test Procedures; and, Amendments to The Exhaust Emission Certification Test Fuel for Off-Road Spark-Ignition Engines, Equipment, and Vehicles. Report prepared by staff of the Emission Research and Regulatory Development Branch, Mobile Source Control Division, CARB. October 2011.

Code of Regulations. Consequently, the Proposed Amendments remove the text to prevent confusion for the reader, and add the text “[Reserved]” to maintain the sequential lettering of the provisions in § 1054.230 and ensure that provisions analogous to provisions within federal Part 1054 have the same lettering.

§§ 1054.245(a), (b), (c), (e)(1) and (e)(2)

Purpose. Section 1054.245 specifies the different ways a manufacturer can determine deterioration factors (DF). A deterioration factor is the calculated or assigned number that represents the certification engine’s emissions change over the emissions durability period. Subsection 1054.245(a) specifies that manufacturers may, at their option, use DFs from Tables 1 or 2, which are in §§ 1054.245(b) and 1054.245(c), respectively, or calculate DFs according to the process described in § 1054.245(d), or, for technologies that are not addressed in Table 1 or Table 2, the manufacturer may ask the Executive Officer to assign a DF prior to the time of certification. Subsections 1054.245(a) through (c) are intended to give small-volume engine manufacturers a lower cost option for determining deterioration factors (CARB, 2011). Section 1054.245(d) specifies the formula for calculating DFs for engines with aftertreatment, and § 2054.245(e) specifies additional provisions for the determination of DFs.

The Proposed Amendments include seven types of nonsubstantive changes to improve clarity not already described in the “Global Amendments” section:

- First, in § 1054.245(a), change the text “Table 1 or Table 2 of this paragraph (a)” to “Table 1 or Table 2 of this section.”
- Second, in Table 1 in § 1054.245(b), change the order of the words in the Table 1 title, and add “with displacement” to the title, so that the title text changes from “TABLE 1: ENGINES GREATER THAN 80 CC HC+NO_x (NMHC+NO_x) AND CO ASSIGNED DETERIORATION FACTORS FOR SMALL VOLUME ENGINE MANUFACTURERS” to “Assigned HC+NO_x (NMHC+NO_x) and CO deterioration factors for small volume engine manufacturers for engines with displacement greater than 80 cc.”
- Third, in Table 1 in § 1054.245(b) and Table 2 in § 1054.245(c), correct the capitalization of the heading row text so that all words have the first letter capitalized.
- Fourth, in Table 2 in § 1054.245(c), change the text “MANUFACUTURERS” to “manufacturers” to correct a typographical error.
- Fifth, in § 1054.245(d), change the text “Table 1 or Table 2 of this paragraph” to “Table 1 or Table 2 of this section.”
- Sixth, in § 1054.245(e)(1) change the text “Selective Enforcement Auditing” to “compliance testing.”

- Seventh, in § 1054.245(e)(2), change the text “Table 1 or Table 2 of paragraph (a) of this section” to “Table 1 or Table 2 of this section.”

Rationale. The rationales for the Proposed Amendments to § 1054.245 are as follows:

- The first and seventh changes are necessary to improve clarity and readability by correcting a reference mistake. The current text in §§ 1054.245(a) and (e)(2) states that Tables 1 and 2 are in § 1054.245(a). However, Table 1 and Table 2 are in §§ 1054.245(b) and (c), respectively.
- The second, third, and fourth changes are necessary to improve consistency, clarity, and readability.
- The fifth change is necessary to improve clarity and readability by correcting a reference mistake. The current text in § 1054.245(d) states that Tables 1 and 2 are in § 1054.245(d). However, Table 1 and Table 2 are in §§ 1054.245(b) and (c), respectively.
- The sixth change is necessary to prevent confusion for the reader by correcting an oversight that occurred at the time the federal regulations were incorporated into the California Code of Regulations in 2012. Federal regulations use the term “selective enforcement audit” in 40 CFR Part 1068 to refer to provisions substantially similar to the provisions that California SORE regulations describe as “compliance testing” for in-use testing and validation of engines in § 2407. However, using the federal regulatory phrase here, rather than the California regulatory phrase, could create confusion. The proposed terminology change to § 1054.245(e)(1) would not affect manufacturer actions because manufacturers already must follow applicable CCR § 2407 requirements and applicable 40 CFR part 1068 requirements.

§ 1054.245(e)(3)

Purpose. The Proposed Amendments change the text “CARB may reject a DF if it has evidence that the DF is not appropriate for that engine family within 30 days of receipt from the manufacturer” to “CARB may reject a DF if the DF is not appropriate for that engine family.” The purpose of this change is to remove an arbitrary cutoff period for CARB’s review of deterioration factors.

Rationale. This change is necessary because the cutoff period of 30 days may be inadequate for such a critical component of the certification evaluation. Deterioration factors are used in calculating the lifetime emission impacts of certified engine families. In order to quantify and realize the expected emission benefits of the SORE regulations, the deterioration factors used for these calculations for certification must be accurate, otherwise excess emissions may occur. CARB must have the authority to reject a DF at any time during the certification application review process should information come to light that indicates a DF is not appropriate. A manufacturer may not be forthcoming with information regarding how its DF was determined. It is therefore necessary for CARB to preserve the right to reject a DF based on a lack of

information that suggests a DF is appropriate for the engine family. The proposed change clarifies that the burden is on a manufacturer to demonstrate that a DF is appropriate rather than the burden being on CARB to demonstrate that a DF is not appropriate.

§ 1054.245(e)(4)

Purpose. The Proposed Amendments remove the text “families and” from § 1054.245(e)(4), as indicated by the strikeout text in the following: “(4) Calculated deterioration factors may cover ~~families and~~ model years in addition to the one upon which they were generated if the manufacturer submits a justification acceptable to the Executive Officer in advance of certification that the affected engine families can be reasonably expected to have similar emission deterioration characteristics.”

Rationale. This change is necessary to ensure that a manufacturer’s engines whose emission characteristics are sufficiently similar to share a DF are grouped into one engine family rather than being split into two or more engine families. Deterioration factors are used in calculating the lifetime emission impacts of certified engine families. In order to quantify and realize the expected emission benefits of the SORE regulations, the deterioration factors used for these calculations for certification must be accurate, otherwise excess emissions may occur. Any manufacturer who previously used a DF from one family for another family could combine those families into one family without any significant impact.

§ 1054.250(a)

Purpose. The current regulations in § 1054.250 specify the records a manufacturer must keep and the reports a manufacturer must send to CARB. Subsection (a) specifies the address to which the manufacturer must send information related to its California-directed production volumes and its end-of-year report describing information about engines produced during the model year. The Proposed Amendments change the text “Mobile Source Operations Division” to “Emissions Certification and Compliance Division” because of the reorganization of divisions within CARB. In addition, the Proposed Amendments change “9528 Telstar Avenue, El Monte, California 91731” to “4001 Iowa Street, Riverside, CA 92507” to reflect the address of CARB’s new Southern California headquarters.

Rationale. These changes are necessary because CARB divisions have been reorganized and renamed, and construction of the new Southern California headquarters has been completed. The Emissions Certification and Compliance Division now has responsibility for reviewing certification applications, so the division name has been updated. Division staff and the vehicle emissions testing laboratories will be housed at the new headquarters.

§ 1054.250(c)

Purpose. The current regulations in § 1054.250(c) specify the following, consistent with federal regulations prior to June 2021:

“Keep data from routine emission tests (such as test cell temperatures and relative humidity readings) for one year after we issue the associated certificate of conformity. Keep all other information specified in this section for eight years after we issue your certificate.”

U.S. EPA’s final regulatory amendments, “Improvements for Heavy-Duty Engine and Vehicle Test Procedures, and Other Technical Amendments,” published in the Federal Register on June 29, 2021, includes the following amended text for 40 CFR Part 1054.250(c):

“Keep required data from emission tests and all other information specified in this section for eight years after we issue your certificate. If you use the same emission data or other information for a later model year, the eight-year period restarts with each year that you continue to rely on the information.”

The Proposed Amendments would incorporate the above U.S. EPA amendment into California Part 1054.250(c) to harmonize the California Code of Regulations with the recent federal regulation changes, as indicated by underline and strikeout in the following text:

“Keep required data from routine emission tests (such as test cell temperatures and relative humidity readings) for one year after we issue the associated certificate of conformity. Keep all other information specified in this section for eight years after we issue your certificate and all other information specified in this section for eight years after we issue your Executive Order. If you use the same emission data or other information for a later model year, the eight-year period restarts with each year that you continue to rely on the information.”

The Proposed Amendments include one modification specific to California SORE regulations: change “certificate of conformity” to “Executive Order.”

Rationale. These changes are necessary to provide consistency with (i.e., “harmonize”) recent changes made to the corresponding provisions in the federal Part 1054. The proposed changes would not result in cost impacts to manufacturers because they align CCR requirements with federal requirements that manufacturers already must follow. Changing the text “certificate of conformity” to “Executive Order” is necessary to prevent confusion for the reader. CARB uses the term “Executive Order” to refer to the certification document for an engine family for sale or lease for use in California. U.S. EPA uses the term “certificate of conformity,” shortened to “certificate.” The proposed change ensures consistent use of California-specific terminology throughout the regulations. See the Global Amendments subsection, ““EPA” to “CARB” Term Change, “Certificate of Conformity” to “Executive Order” Term Change, and

Improvements to References to Parts 1054 and 1065,” in this section F for additional explanation.

Subpart I – Definitions and Other Reference Information

§ 1054.820

Purpose. Section 1054.820 provides a reference to Subchapter 1.25, Title 17, California Code of Regulations, §§ 60040, et seq., to inform manufacturers and other interested parties how to request a hearing. The Proposed Amendments delete this reference and add the following reference: “Chapter 15, Title 13, California Code of Regulations, Section 2771.”

Rationale. This change is necessary to help ensure manufacturers reference the current hearing procedures because the referenced provisions in Title 17 have been repealed. The provisions in Title 13 CCR § 2771 and its internal references to the Administrative Hearing Procedures for Petitions for Review of Executive Officer Decisions (Title 17, California Code of Regulations, Division 3, Chapter 1, Article 2, commencing with § 60055.1) provide the current hearing procedures.

§ 1054.825

Purpose. Section 1054.825 in the federal Part 1054 and California’s Part 1054 describe reporting and recordkeeping requirements that apply under this part. Because U.S. EPA’s final regulatory amendments published in June 2021 extensively amended and reformatted the federal § 1065.825, the Proposed Amendments replace the entirety of § 1054.825 with text formatted to mirror the current organization of the federal Part 1054.825. The Proposed Amendments include several modifications to make the recent federal amendments specific to California, as described in the following in strikeout and underline. The Proposed Amendments omit references to federal regulations not adopted by CARB and without a California equivalent, and add “[Reserved]” in their place to preserve the numbering continuity and consistency with the numbering of the federal 1054.825 subsections.

“(a) This part includes various requirements to submit and record data or other information. Unless we specify otherwise, store required records in any format and on any media and keep them readily available for eight years after you send an associated application for certification, or eight years after you generate the data if they do not support an application for certification. We may request these records at any time. You must promptly give us organized, written records in English if we ask for them. This requirement to give us records applies whether or not you rely on someone else to keep records on your behalf. We may require you to submit written records in an electronic format.

(b) The regulations in § 1054.255 and ~~40 CFR 1068.25 and 1068.101~~ and in Title 13, California Code of Regulations, sections 2405-2409, describe your obligation to report truthful and complete information. This includes

information not related to certification. ~~Failing to properly report information and keep the records we specify violates 40 CFR 1068.101(a)(2), which may involve civil or criminal penalties. If you fail to properly report information and keep the records we specify, we may suspend, revoke, or void the executive order for the engine family involved, and you may be subject to civil or criminal penalties.~~

(c) Send all reports and requests for approval to the Designated Compliance Officer (see §1054.801).

(d) Any written information we require you to send to or receive from another company is deemed to be a required record under this section. Such records are also deemed to be submissions to ~~EPA~~ CARB. We may require you to send us these records.

~~(e) Under the Paperwork Reduction Act (44 U.S.C. 3501 et seq.), the Office of Management and Budget approves the reporting and recordkeeping specified in the applicable regulations in this chapter. The following items illustrate the kind of reporting and recordkeeping we require for engines and equipment regulated under this part:~~

(1) We specify the following requirements related to engine and equipment certification in this part 1054:

(i-iii) [Reserved]

~~(i) In § 1054.20 we require equipment manufacturers to label their equipment if they are relying on component certification.~~

~~(ii) In § 1054.135 we require engine manufacturers to keep certain records related to duplicate labels sent to equipment manufacturers.~~

~~(iii) In § 1054.145 we include various reporting and recordkeeping requirements related to interim provisions.~~

(iv) In subpart C of this part we identify a wide range of information required to certify engines.

(v-vi) [Reserved]

~~(v) In §§ 1054.345 and 1054.350 we specify certain records related to production line testing.~~

~~(vi) [Reserved]~~

(vii) In subpart G of this part we identify several reporting and recordkeeping items for making demonstrations and getting approval related to various special compliance provisions.

(viii) [Reserved]

~~(viii) In §§ 1054.725, 1054.730, and 1054.735 we specify certain records related to averaging, banking, and trading.~~

(2) [Reserved]

~~(2) We specify the following requirements related to component and equipment certification in 40 CFR part 1060:~~

~~(i) In 40 CFR 1060.20 we give an overview of principles for reporting information.~~

~~(ii) In 40 CFR part 1060, subpart C, we identify a wide range of information required to certify products.~~

~~(iii) In 40 CFR 1060.301 we require manufacturers to keep records related to evaluation of production samples for verifying that the products are as specified in the certificate of conformity.~~

~~(iv) In 40 CFR 1060.310 we require manufacturers to make components, engines, or equipment available for our testing if we make such a request.~~

~~(v) In 40 CFR 1060.505 we specify information needs for establishing various changes to published test procedures.~~

~~(3) We specify the following requirements related to testing in 40 CFR Part 1065:~~

~~(i) In 40 CFR Part 1065.2 we give an overview of principles for reporting information.~~

~~(ii) In 40 CFR Part 1065.10 and 1065.12 we specify information needs for establishing various changes to published test procedures.~~

~~(iii) In 40 CFR Part 1065.25 we establish basic guidelines for storing test information.~~

~~(iv) In 40 CFR Part 1065.695 we identify the specific information and data items to record when measuring emissions.~~

(4) [Reserved]

~~(4) We specify the following requirements related to the general compliance provisions in 40 CFR part 1068:~~

~~(i) In 40 CFR 1068.5 we establish a process for evaluating good engineering judgment related to testing and certification.~~

~~(ii) In 40 CFR 1068.25 we describe general provisions related to sending and keeping information.~~

~~(iii) In 40 CFR 1068.27 we require manufacturers to make engines available for our testing or inspection if we make such a request.~~

~~(iv) In 40 CFR 1068.105 we require equipment manufacturers to keep certain records related to duplicate labels from engine manufacturers.~~

~~(v) In 40 CFR 1068.120 we specify recordkeeping related to rebuilding engines.~~

~~(vi) In 40 CFR part 1068, subpart C, we identify several reporting and recordkeeping items for making demonstrations and getting approval related to various exemptions.~~

~~(vii) In 40 CFR part 1068, subpart D, we identify several reporting and recordkeeping items for making demonstrations and getting approval related to importing engines.~~

~~(viii) In 40 CFR 1068.450 and 1068.455 we specify certain records related to testing production line engines in a selective enforcement audit.~~

~~(ix) In 40 CFR 1068.501 we specify certain records related to investigating and reporting emission-related defects. (x) In 40 CFR 1068.525 and 1068.530 we specify certain records related to recalling nonconforming engines.~~

~~(xi) In 40 CFR part 1068, subpart G, we specify certain records for requesting a hearing."~~

Rationale. These changes are necessary to harmonize California's Part 1054 with amendments to the federal Part 1054 adopted by U.S. EPA since November 2010,ⁿⁿ with modifications to address California's specific regulations. The changes listed are otherwise identical to the changes in the same-numbered section of the federal Part 1054. These changes are proposed for the reasons described in the Global

ⁿⁿ CARB incorporated portions of the federal Part 1054 into the California Code of Regulations in October 2012. The California Part 1054 adopted in 2012 is based on the federal text as of November 8, 2010.

Amendments subsection, "Updates to Harmonize with Amended Federal Text," in this section F of this chapter.

G. California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1065)

This section provides a summary, purpose, and rationale for each Proposed Amendment to the California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1065), referred to herein as "Part 1065". These standards and test procedures are incorporated by reference in Title 13, CCR, § 2403. Appendix G of this Staff Report provides the full proposed regulatory language of these standards and test procedures with Proposed Amendments shown in strikeout and underline formatting.

Global Amendments throughout Part 1065

"ARB" to "CARB" Acronym Change

Purpose. The Proposed Amendments change "ARB" and "the ARB" to "CARB," and add "California" before "Air Resources Board," for consistency with recent CARB document style practices designed to improve clarity.

Rationale. This change reflects the California Air Resources Board's recent change to, and preferred use of, the acronym "CARB" versus the prior acronym, "ARB," and the entire agency title, "California Air Resources Board."

Capitalization Change

Purpose. The Proposed Amendments change the formatting of text in all capital letters to mixed case to aid in making documents accessible to everyone, including people with visual impairments and assistive technology users.

Rationale. Mixed case words and sentences are easier to read and consistent with current accessibility guidelines.

Grammar Change to "Owner's Manual"

Purpose. The Proposed Amendments change the phrase "owners manual" to "owner's manual" by adding an apostrophe in §§ 1065.525 and 1065.930.

Rationale. This change is necessary to correct nonstandard grammar in the previously adopted text. The term "owner's manual," with the possessive apostrophe, is the correct grammar for referencing the document. California Administrative Law (Title 1, CCR, § 16(a)(4)) requires that California regulations be free of grammatical errors, which may create confusion or ambiguity or undermine the perceived authoritativeness of the regulation text. It is essential to satisfying the purpose of this

regulation and addressing the identified problem that there be no such real or perceived ambiguity or error in language use in the regulatory text.

Table of Contents Change

Purpose. The Proposed Amendments adjust page numbers to accommodate added or removed text throughout Part 1065. Amendments to the Table of Contents reflect these changes.

Rationale. Amending the page numbers is necessary for accuracy and to prevent confusion for the reader.

“Reserved” Placeholder Added

Purpose. The Proposed Amendments add the placeholder text “[Reserved]” to the following sections: 1065.122(b), 1065.130(g), footnote (c) of Table 1 of 1065.303, 1065.307(e)(3)(iv), 1065.307(e)(3)(vi), 1065.320(b), 1065.510(g), 1065.530(i), 1065.602(l)(1), 1065.610(d)(3), 1065.670(a), 1065.1010(b)(1-23), 1065.1010(b)(25-27), 1065.1010(b)(29-32), 1065.1010(b)(34), 1065.1010(b)(37-39), 1065.1010(b)(41-46), 1065.1010(c)(2), 1065.1010(d), 1065.1010(e)(1-14). The purpose of these changes is to prevent gaps in the numbering and lettering of provisions while ensuring that provisions within Part 1065 that are similar or analogous to provisions within U.S. EPA’s Title 40, Code of Federal Regulations, Part 1065 (“federal Part 1065”) have the same numbering and lettering.

Rationale. These changes are necessary to maintain sequential section numbering and lettering in order to improve readability and prevent confusion for readers. The incorporation of Part 1065 into the California Code of Regulations in 2012, and the Proposed Amendments, include a number of changes to text in the federal Part 1065 necessary to address California-specific applicability, emission standards, engine cooling, PM emission calculations, test fuels, lubricants, and definitions that support California’s unique air quality programs. Some of these changes involved the deletion of portions of the federal text that contain provisions that are redundant with, or in conflict with, other California SORE regulations. In some cases, the subsection was deleted but subsequent items at the same numbering level were retained. The resulting gaps in numbering of provisions would make the regulation more difficult to follow. Renumbering those provisions adopted or retained to eliminate gaps would result in similar provisions within the federal and California regulations being referred to by different subsection or paragraph numbers. The insertion of the “[Reserved]” placeholder preserves the similar numbering while removing any gaps in sequential numbering of provisions.

Calibration Requirements Change

Purpose. The Proposed Amendments change the requirement to use National Institute of Standards and Technology (NIST)-traceable mass standards to instead allow the use of *Système International d’Unités* (SI)-traceable mass standards through

NIST or another member of the Mutual Recognition Arrangement of the *Comité International des Poids et Mesures* (CIPM MRA), and add a definition for “SI-traceable” in § 1065.1001.

Rationale. Requiring SI-traceable standards is consistent with current industry practice and is necessary to allow flexibility for manufacturers around the world to use other recognized international standards while still maintaining the consistency necessary to ensure test data accuracy, precision, and comparability to the emission standards, as well as a level playing field amongst manufacturers. Accurate and precise data are necessary to ensure that engines determined to be in compliance with emission standards assessed using Part 1065 are indeed compliant and do not result in excess emissions.

Improvements to References to California Code of Regulations

Purpose. The Proposed Amendments make the following changes to references to regulations:

- Change the abbreviation “13, CCR” to spell out “Title 13, California Code of Regulations” in § 1065.701(a)(2).
- Re-locate “Title 13” to precede “California Code of Regulations” where it currently incorrectly follows that text in § 1065.701(a)(1).
- Add the text “California Code of Regulations” where previously implied between “Title 13” and a section number in § 1065.701(a)(2).
- Remove “of the” where it occurs between “Title 13” and “California Code of Regulations” in § 1065.1001.

Rationale. These changes are necessary to better identify the body of regulations to which these subsections refer, to satisfy the clarity requirements under California Administrative Law (Title 1, CCR, § 16), and to better differentiate them from the federal regulations. “CCR” is used in some places within this part, “California Code of Regulations” in others, and “Title 13” without elaboration in others still. Although the existing references are sufficient to identify the regulations, the use of different forms of reference could confuse parties subject to the regulations, as it may create the impression that these are different references. It is essential to satisfying the purpose of the regulations and addressing the identified problem that they be understandable to the regulated parties, including where references are made to other regulations, and that there is no real or perceived ambiguity in such references.

"EPA" to "CARB" Term Change, "Certificate of Conformity" to "Executive Order" Term Change, and Improvements to References to Part 1054

Purpose. The Proposed Amendments make the following changes throughout Part 1054:

- Change "EPA" to "CARB" in §§ 1065.1(c), 1065.2(a), 1065.2(b), 1065.2(c), and 1065.514(a).
- Remove the definition for EPA in § 1065.1001 Definitions, "EPA means Air Resources Board."
- Change "certificates" to "Executive Orders" in § 1065.2(c).
- Remove the definition entry for "certificate of conformity" in § 1065.1001.
- Change "40 CFR 1054" to "Part 1054" in § 1065.1001.
- Change "§1054.505" to "Part 1054, § 1054.505" in § 1065.1001.
- Change "CFR part 1054" in § 1065.1(d) to "California Exhaust Emission Standards and Test Procedures for New 2013 Small Off-Road Engines; Engine-Testing Procedures (Part 1054)," adopted October 25, 2012, and amended [insert amended date], hereinafter referred to as part 1054." The Proposed Amendments include a placeholder for the amended date, "[insert amended date]", that will be updated to reflect the CARB adoption date of the Proposed Amendments to Part 1054, which are described in section F earlier in this chapter, and provided in their entirety in Appendix F.

Rationale. These changes are necessary to improve clarity and regulatory certainty. In 2012, CARB modified the SORE regulations to adopt portions of the federal Part 1054 and Part 1065, to improve alignment of the certification and testing requirements without any changes in the stringency of the emission standards and associated test procedures, and without any cost impacts. Certain sections, section titles, subsections, or paragraphs, which were adopted without making other changes, contain references to U.S.EPA and certificate of conformity carried over from the original federal text. U.S. EPA uses the term "certificate of conformity," shortened to "certificate." CARB uses the term "Executive Order" to refer to the certification document for an engine family for sale or lease for use in California. In the 2012 adoption this was dealt with by adding definition entries clarifying that the terms "EPA" and "certificate of conformity" or "certificate" should be understood to refer to CARB and Executive Order, respectively, for the purposes of California's Part 1054 and Part 1065. However, as much of the document must be reviewed before one reaches these definition entries, a potential for confusion still exists. This proposed amendment ensures that the intended meaning of these references is immediately clear to regulated parties and other stakeholders. Changing "EPA" to "CARB" and removing the definition for U.S. EPA are necessary to provide consistency with the incorporation of federal regulations into California's SORE regulations and to clarify that the California Air Resources Board is the agency having jurisdiction and decision-making

authority under these regulations and is the agency to which reports must be submitted. It is essential to satisfying the purpose of the regulations and addressing the identified problem that there be no real or perceived ambiguity regarding the fact that the California Air Resources Board is the agency having jurisdiction and decision-making authority under this part, and the agency to which reports must be submitted. Changing “certificate of conformity” and “certificate” to “Executive Order” and removing the definition for “certificate of conformity” would provide consistent use of California-specific terminology throughout the regulations, which better distinguishes them from the federal regulations and prevents confusion for manufacturers and other readers. These Proposed Amendments do not change any of the standards and test procedures.

In addition, the current regulations in California’s Part 1065 refer to Part 1054 in some places. The Proposed Amendments clarify that the referenced test procedures and other requirements are those specified in California’s Part 1054, rather than the same-numbered paragraphs in the similar federal procedures. The test procedures and other requirements in California’s Part 1054 are the ones that properly apply to testing to address California requirements. Providing explicit references to the California SORE regulations in all places where the test procedures and other requirements contained therein are referenced prevents ambiguity and potential conflict. It is essential to satisfying the purpose of the regulations and addressing the identified problem that the test procedures and other requirements referenced here be consistent and understandable to the regulated parties, including where references are made to other regulation, and that there is no real or perceived ambiguity or conflict in regulatory instructions to regulated parties.

Furthermore, the change to “Part 1054” the first place it is specified is necessary to ensure the amended test procedures are used for certification and compliance testing once they become effective. The most up-to-date test procedures must be followed by all manufacturers of MY 2013 and subsequent model year engines to ensure SORE meet the emission standards. Adding the amendment dates for the test procedures clarifies the versions of the test procedures that must be used.

Updates to Harmonize with Amended Federal Text

Purpose. Subsequent to CARB’s adoption of Part 1065 into the California Code of Regulations, U.S. EPA made a number of terminology changes and other amendments to the federal Part 1065. The Proposed Amendments revise portions of California’s Part 1065 to provide consistency with (i.e., “harmonize”) these recent changes made to the wording of corresponding provisions in the federal Part 1065. These proposed harmonization amendments reflect changes made to the federal regulations after

June 28, 2011,^{oo} up to and including U.S. EPA's final regulatory amendments, "Improvements for Heavy-Duty Engine and Vehicle Test Procedures, and Other Technical Amendments," published in the Federal Register on June 29, 2021.

There are two types of proposed harmonization amendments to California's Part 1065: (1) Amendments that provide the exact same words and organizational changes as U.S. EPA's recent amendments to the federal Part 1065; and (2) Amendments that provide U.S. EPA's recent amendments with one or more modifications to incorporate California-specific changes necessary to maintain the stringency of California emission standards, provide consistency with existing California SORE regulations or other Proposed Amendments described in this staff report, or prevent confusion. The proposed harmonization amendments that include one or more California-specific modifications each have their own separate purpose and rationale descriptions that, along with the purpose and rationale descriptions for other Proposed Amendments to California's Part 1065, follow the "Global Amendments" subsection of this section G in the order in which they occur in the regulations. The following "Harmonization with Document-wide or Repeated Federal Changes" and "Harmonization with Section-Specific Federal Changes" subsections identify the sections, subsections, and paragraphs of California's Part 1065 with proposed harmonization amendments that provide the exact same words and organizational changes as U.S. EPA's recent amendments to the federal Part 1065.

Harmonization with Document-wide or Repeated Federal Changes

The Proposed Amendments change the following terms in California Part 1065 where U.S. EPA made such changes in the corresponding federal Part 1065:

- Change "water" to "H₂O" in the following sections: 1065.342 (d)(2), 1065.350(d)(2), 1065.350(d)(4), 1065.355(d)(2), 1065.355(d)(4), 1065.370(e)(5), 1065.375(d)(2), 1065.375(d)(4), 1065.376(b), 1065.376(d)(vi), and 1065.376(d)(viii), 1065.655(c)(3).
- Change "Diluent" to "dilution air" in the following sections: 1065.140(a), 1065.140(b), 1065.140(b)(1), 1065.140(e)(1-3), and 1065.905(d)(2)(i)(A).
- Change "Validate" and its conjugations to "verify" and corresponding conjugations thereof in the following sections: 1065.140(c)(7), 1065.140(d)(3)(v), 1065.170(a)(1), and 1065.546.
- Change "rev/min" to "r/min" in the following sections: 1065.20(a)(1), 1065.650(d)(7), 1065.650(e)(4), and 1065.1005.

^{oo} CARB incorporated portions of the federal Part 1065 into the California Code of Regulations in October 2012. The California Part 1065 adopted in 2012 is based on the federal text as of June 28, 2011.

- Change "Methane" to "CH₄" in the following sections: 1065.365(b), 1065.365(f), 1065.520(f) (1065.520(g) in the previous text), and 1065.750(a)(2)(v).
- Change footnote reference marks of the form "1, 2, 3..." to the form "a, b, c..." in the following tables: Table 1 of 1065.750, Table 1 of 1065.905, Table 1 of 1065.915, 1065.1005(a), and 1065.1005(f)(2).
- Change the text "2-stroke" and "4-stroke" to "two-stroke" and "four-stroke," respectively, and add the text "at or" before "below kW, in the following paragraphs and sections: 1065.145(c)(2)(ii), 1065.145(d)(1)(ii), 1065.145(e)(2)(ii), 1065.145(e)(3)(ii), 1065.230(d)(2), 1065.240(d)(2), and 1065.260(c).
- Delete trailing zeros, and decimal points followed by zeroes, from specified percentages in the following sections: 1065.341(f)(5) [re-lettered to subsection (e) in the Proposed Amendments in Appendix G], Table 2 of 1065.514, and Table 1 of 1065.915.

The Proposed Amendments change the following phrases in the California Part 1065 where U.S. EPA made such changes in the corresponding federal Part 1065:

- Change the text "Linearity checks are required" **to** "Linearity verification is required" in the following sections: 1065.307(e)(7), 1065.307(e)(7)(ii), 1065.307(e)(8), 1065.307(e)(8)(ii). Change the text "linearity checks" **to** "linearity verification" in the following sections: 1065.307(e)(7)(i), 1065.307(e)(8)(i), and 1065.695.
- Change the text "If the sample is [is not] passed through a dryer" **to** "If the sample does [does not] pass through a dryer" in the following sections: 1065.350(d)(2) and 1065.375(d)(2)
- Change references to an H₂O content "greater than or equal to" or "at least as high as" **to** "at or above" a specific level in the following sections: 1065.309(d)(2), 1065.350(d)(2), 1065.370(d)(5), and 1065.375(d)(2).
- Footnote reference marks "1, 2, 3..." **to** "a, b, c..." in Table 1 of §§ 1065.750, 1065.905, 1065.915, and in unnumbered tables in 1065.1005(a) and 1065.1005(f)(2).
- Change instructions to control the vessel temperature to generate an acceptable H₂O level **to** instructions to humidify the test gas to an acceptable H₂O level in the following sections: 1065.309(d)(2), 1065.350(d)(2), 1065.370(e)(5), and 1065.375(d)(2).

The Proposed Amendments also add or delete the following text in multiple sections:

- In § 1065.201(b), add the text "You may generally use instruments with compensation algorithms that are functions of other gaseous measurements and the known or assumed fuel properties for the test fuel. The target value for any compensation algorithm is 0% (that is, no bias high and no bias low), regardless of the uncompensated signal's bias." Delete similar provisions

referring individually to specific analyzer types from the following sections: 1065.250(b), 1065.260(b), 1065.270(b), 1065.272(b), 1065.275(b)(1), 1065.275(b)(2), 1065.375(d)(3) [renumbered to (d)(4)], 1065.280(b), 1065.284(b), and 1065.295(b).

- Add text allowing humidification of a gas flow by using a device that introduces distilled H₂O as vapor into a controlled gas flow, as an alternative to humidification by bubbling gas through distilled H₂O, to the following sections: 1065.309(d)(2), 1065.350(d)(2), 1065.355(d)(2), 1065.370(e)(5), and 1065.375(d)(2).

Harmonization with Section-Specific Federal Changes

Harmonization Updates: Subpart A – Applicability and General Provisions

The Proposed Amendments include the following recent federal Part 1065 amendments to Subpart A:

- In § 1065.1(g), add the text indicated by underline in the following: “For additional information regarding these test procedures in this part, visit our Web site”
- In § 1065.10(a), change the text “certain exceptions listed in this section” **to** “certain exceptions noted in this section.”
- In § 1065.10(c)(6), add the text “This also applies for changes to test procedures specified in the standard-setting part to the extent that these changes do not correspond to new emission standards.”
- In § 1065.10(c)(7), change the text, “allowed” to “specified” and add the sentence, “We may perform tests with your engines using either the approved alternate procedures or the specified procedures.”
- Add “Advance approval” as a paragraph title for 1065.10(d).
- In § 1065.12(a), change the text “based on this information alone, or, as described in this section, we may ask you to submit to us in writing submit supplemental information” **to** “based on this information alone, whether or not it includes all the information specified in this section. Where we determine that your original submission does not include enough information for us to determine that the alternate procedure is equivalent to the specified procedure, we may ask you to submit supplemental information.”
- In § 1065.12(d), add text that states that not all submitted information may be necessary for an alternate procedure approval and an example of such a case is given. In addition, change the text, “we may ask you to send the following information to fully evaluate your request:” **to** “we may ask you to send.”
- In § 1065.12(e), delete the first sentence, “We may give you specific directions regarding methods for statistical analysis, or we may approve other methods that you propose” and add the text “We may give you specific directions regarding methods for statistical analysis, or we may approve other methods

that you propose. Such alternate methods may be more or less stringent than those specified in this paragraph (e). In determining the appropriate statistical criteria, we will consider the repeatability of measurements made with the reference procedure. For example, less stringent statistical criteria may be appropriate for measuring emission levels being so low that they adversely affect the repeatability of reference measurements."

- In §§ 1065.15(a)(2), 1065.15(a)(2)(i) and 1065.15(a)(2)(ii), change "hydrocarbons" to "hydrocarbon" add a new paragraph (iii) relating to nonmethane-nonethane hydrocarbon, and renumber paragraphs (iii) and (iv) as paragraphs (iv) and (v), respectively.
- In § 1065.15(b), add the text, "Note also that the standard-setting part may include standards for pollutants not listed in paragraph (a) of this section."
- In § 1065.15(c)(2)(ii), change the text "HC, CO, and NO_x" to "NO_x, HC, CO, CO₂, CH₄, N₂O, and CH₂O."
- In § 1065.20(a), delete the reference details for NIST Special Publication 811 and the associated web link, and change the text "Note the following exceptions" **to** "The following exceptions apply."
- In § 1065.20(a)(1), change the text "rotational frequency" **to** "angular speed." Change the text "reciprocal seconds" **to** "radians per second (rad/s)." Delete the sentence addressing symbol choice for rotational frequency.
- In § 1065.20(a)(3), add the word "generally" to a statement that temperatures are designated in degrees Celsius.
- In § 1065.20(c), add the text "Always use absolute pressure values for multiplying or dividing by pressure."
- In § 1065.20(e), change the text "Unless the standard-setting part specifies otherwise, round only final values, not intermediate values. Round values to the number of significant digits necessary to match the number of decimal places of the applicable standard or specification. For information not related to standards or specifications, use good engineering judgment to record the appropriate number of significant digits." **to** "You are required to round certain final values, such as final emission values. You may round intermediate values when transferring data as long as you maintain at least six significant digits (which requires more than six decimal places for values less than 0.1), or all significant digits if fewer than six digits are available. Unless the standard-setting part specifies otherwise, do not round other intermediate values. Round values to the number of significant digits necessary to match the number of decimal places of the applicable standard or specification as described in this paragraph (e). Note that specifications expressed as percentages have infinite precision (as described in paragraph (e)(7) of this section). Use the following rounding convention, which is consistent with ASTM E29 and NIST SP 811:."
- In § 1065.20(g), add the parenthetical text "dry-to-wet corrected, if applicable."

- Delete the unnumbered paragraph 1065.25 and add new paragraphs designated (a), (b), and (c), which describe recordkeeping and reporting requirements.

Harmonization Updates: Subpart B – Equipment Specifications

The Proposed Amendments include the following recent federal Part 1065 amendments to Subpart B:

- In § 1065.125(e)(1), change the text, “and completely close all drains before starting a duty cycle. Keep the drains closed during the emission test” **to** “Before starting a duty cycle (or preconditioning for a duty cycle), completely close all drains that would normally be closed during in-use operation. Keep those drains closed during the emission test.”
- In § 1065.130(a), add the text, “We refer to exhaust piping as an exhaust stack; this is equivalent to a tailpipe for vehicle configurations.”
- In paragraph 1065.130(c)(6), add recommendations for configuring exhaust stacks to ensure mixing for raw or dilute partial-flow emission sampling, and a statement that mixing considerations may be disregarded in dilute full-flow sampling.
- In § 1065.130(e), add “in this chapter” to the end of the first sentence. Change the text “a chemical balance of fuel, intake air, and exhaust according to § 1065.655” **to** “carbon balance error verification as described in § 1065.543.”
- In § 1065.140(a), change the text “synthetic air” **to** “purified air,” add a statement that references in this part to “dilution air” may include ambient air, purified air, or nitrogen, and add text addressing multi-stage dilution, primary dilution, and secondary dilution.
- In § 1065.140(c)(1), add text that describes where flexible tubing may, or may not, be used in dilution tunnel construction.
- In § 1065.140(c)(2), delete the phrases “an engine” and “that engine.”
- In § 1065.140(c)(2), add the sentence “If you dilute directly from the exhaust stack, the end of the exhaust stack is considered to be the start of the dilution tunnel.”
- In § 1065.140(c)(6)(i), change the text “dew point” **to** “dewpoint.”
- In § 1065.140(c)(6)(ii)(C), delete the parenthetical “i.e., 2%.”
- In § 1065.140(c)(6)(ii)(D), delete the parenthetical “i.e., 0.5%.”
- In § 1065.140(e)(1), change the text “select a location to measure this temperature. We recommend that you measure this temperature as close as practical upstream of the point” **to** “select a location to measure this temperature that is as close as practical upstream of the point.”

- In § 1065.140(e)(2), revise the instruction regarding combining dilution air and raw exhaust, and change the text “Base this minimum value on the maximum engine exhaust flow rate for a given test interval” to “Base this minimum value on the maximum engine exhaust flow rate during a given duty cycle for discrete-mode testing and on the maximum engine exhaust flow rate during a given test interval for other testing.”
- In § 1065.140(e)(3), change the residence time values from “1 to 5” to “1.0 to 5.0.”
- In § 1065.145(c)(1), change the term “tailpipe” to “stack.”
- In § 1065.145(e)(3)(i), change the text “it must be heated to prevent aqueous condensation” to “design the sampling system to prevent aqueous condensation.”
- In § 1065.170(a)(1), add the sentence “You must exclude from the proportional sampling verification any portion of the test where you are not sampling emissions because the engine is turned off and the batch samplers are not sampling, accounting for exhaust transport delay in the sampling system.” Add the text indicated in underline and strikeout in the following: “For example, do not use sample bags for storing emissions if the bags are permeable with respect to emissions or if they ~~off gas~~ off gas emissions to the extent that it affects your ability to demonstrate compliance with the applicable gaseous emission standards in this chapter. As another example, do not use PM filters that irreversibly absorb or adsorb gases to the extent that it affects your ability to demonstrate compliance with the applicable PM emission standard in this chapter.”
- In § 1065.170(b), change the text “the following table” to “Table 1 of this section,” add the text “Sample temperatures must stay within the following ranges for each container material:,” and add two new paragraphs, 1065.170(b)(1) and (b)(2), that specify the allowable temperature ranges. The Proposed Amendments also include California-specific changes to the federal text added as paragraph 1065.170(b)(2), which are described in the purpose/rationale subsection specific to paragraph 1065.170(b)(2).
- In § 1065.170(c)(1)(i), change “ASTM D2986-95a” to “ASTM D2986.”

Harmonization Updates: Subpart C – Measurement Instruments

The Proposed Amendments include the following recent federal Part 1065 amendments to Subpart C:

- In § 1065.201(d), delete the reference to § 1065.25, and change the text “This requirements” to “This requirement.”
- In § 1065.201(h), change the sentence, “Our decision to follow or not follow a given recommendation when testing your engine is not dependent on whether or not you followed it during your testing,” **to** “Our decision to follow or not

follow a given recommendation when we perform a test does not depend on whether you followed it during your testing.”

- In § 1065.202, add the sentence, “Set up the measurement and recording equipment to avoid aliasing by ensuring that the sampling frequency is at least double that of the signal you are measuring, consistent with good engineering judgment; this may require increasing the sampling rate or filtering the signal.”
- In Table 1 of § 1065.202, add § 1065.545 to “Applicable Test Section Protocol” column corresponding to “Sample flow from a CVS that has a heat exchanger.”
- In Table 1 of § 1065.202, add footnote (a) reference mark to the “Minimum command and control frequency” column heading, footnotes (b) and (c) reference marks to the “Minimum recording frequency” column heading, and footnote (d) reference mark to the “Measured values” column entry for “Dilution air flow if actively controlled (for example, a partial flow PM sampling system), along with the following footnote text:

“^aThe specifications for minimum command and control frequency do not apply for CFVs that are not using active control.

^b 1 Hz means are data reported from the instrument at a higher frequency, but recorded as a series of 1 s mean values at a rate of 1 Hz.

^c For CFVs in a CVS, the minimum recording frequency is 1 Hz. The minimum recording frequency does not apply for CFVs used to control sampling from a CVS utilizing CFVs.

^d Dilution air flow specifications do not apply for CVS dilution air.”
- In § 1065.205, change the text “in subparts D and F of this part or subpart J of this part for using PEMS and for performing field testing” **to** “elsewhere in this part for laboratory testing or field testing, as applicable.”^{PP} Change the text “the specifications in Table 1 of this section” **to** “the specifications in this section,” and change the text “in Table 1 of this section” to “in the following table:.”
- In § 1065.210(c), delete the parenthetical quantity symbols and abbreviations: (V), (A), (pf), (VA), (VAR) and (W).
- In § 1065.220(a), change the text, “You may use fuel flow in combination with a chemical balance of carbon (or oxygen) between the fuel, inlet air, and raw exhaust to calculate raw exhaust flow as described in § 1065.650 as follows:” **to** “You may use fuel flow meters in combination with a chemical balance of fuel, intake air, and raw exhaust to calculate raw exhaust flow as described in § 1065.655(f). You may also use fuel flow meters to determine the mass flow rate of carbon-carrying fuel streams for performing carbon balance error

^{PP} PEMS: Portable emission measurement system.

verification in §1065.543 and to calculate the mass of those fuel streams as described in §1065.643. The following provisions apply for using fuel flow meters:"

- Add a new paragraph 1065.220(a)(1)(iii) with the text, "For calculating the dilution air flow for background correction as described in §1065.667."
- In § 1065.225(a), change the text "You may use an intake-air flow meter in combination with a chemical balance of carbon (or oxygen) between the fuel, inlet air, and raw exhaust to calculate raw exhaust flow as described in § 1065.650, as follows:" **to** "You may use intake-air flow meters in combination with a chemical balance of fuel, intake air, and raw exhaust to calculate raw exhaust flow as described in § 1065.655(f) and (g). You may also use intake-air flow meters to determine the amount of intake air input for performing carbon balance error verification in § 1065.543 and to calculate the measured amount of intake air, n_{int} , as described in § 1065.643. The following provisions apply for using intake air flow meters:"
- Add new paragraphs 1065.225(a)(1)(iii) and 1065.225(a)(1)(iv), stating that intake-air flow meters may be used for verifying PM batch sampling dilution and calculating dilution air flow for background correction.
- In § 1065.240(d)(3), change the text, "If cooling causes aqueous condensation, do not sample NOX downstream of the cooling unless the cooler meets the performance verification in § 1065.376," **to** "The cooling must not cause aqueous condensation, as described in § 1065.140(c)(6)."
- Delete the entirety of § 1065.240(d)(4).
- In the section title of §1065.250 and in paragraph 1065.250(a), change "infra-red" to "infrared."
- In the section title of §1065.260 and in paragraph 1065.260(a), change "flame-ionization" to "flame ionization."
- In § 1065.260(a), change the text "Determine methane and nonmethane hydrocarbon values as described in paragraph (e) of this section" **to** "For measuring THC or THCE you must use a FID analyzer. For measuring CH₄ you must meet the requirements of paragraph (f) of this section."
- In § 1065.260(c), add the text "measuring THC or THCE from."
- Delete the entirety of paragraph 1065.260(e) and add the following paragraph:

"NMHC and NMOG. For demonstrating compliance with NMHC standards, you may either measure THC or determine NMHC mass as described in §1065.660(b)(1), or you may measure THC and CH₄ and determine NMHC as described in §1065.660(b)(2) or (3). You may also use the additive method in § 1065.660(b)(4) for natural gas-fueled

engines as described in § 1065.266. See 40 CFR 1066.635 for methods to demonstrate compliance with NMOG standards for vehicle testing."

- Add two new paragraphs to § 1065.260, paragraph 1065.260(f), relating to determination of nonmethane-nonethane hydrocarbon, and paragraph 1065.260 (g), relating to the measurement of methane.
- In § 1065.265, change the text "NMHC emission" to "CH₄ or NMHC emissions."
- Add a new section 1065.266, which contains equipment specifications for Fourier-transform infrared (FTIR) analyzers used to measure NMHC and NMNEHC for continuous sampling for engines that run only on natural gas.
- In § 1065.267(a), change the text "You may use a gas chromatograph to measure CH₄" to "You may use a gas chromatograph with a flame ionization detector (GC-FID) to measure CH₄ and C₂H₆."
- In § 1065.267(b), change the text "We recommend that you use a gas chromatograph that meets the specifications in Table 1 of § 1065.205, and it must also meet the linearity verification in § 1065.307" to "We recommend that you use a GC-FID that meets the specifications in Table 1 of § 1065.205, and that the measurement be done according to SAE J1151 (incorporated by reference in §1065.1010). The GC-FID must meet the linearity verification in §1065.307."
- Add two new paragraphs, 1065.269(a) and 1065.269(b), containing specifications for photoacoustic analyzers for ethanol and methanol.
- In § 1065.275(b)(1), change the text "infra-red" to "infrared."
- In § 1065.275(b)(2), change the text "infra-red" to "infrared," and change the text "For example, EPA Test Method 320 is considered a valid method for spectral interpretation (see <http://www.epa.gov/ttn/emc/methods/method320.html>)" to "For example, EPA Test Method 320 (see § 1065.266(b)) and ASTM D6348 (incorporated by reference in § 1065.1010) are considered valid methods for spectral interpretation."
- Renumber paragraphs 1065.275(b)(3) and 1065.275(b)(4) as 1065.275(b)(4) and 1065.275(b)(5), respectively. Add a new paragraph 1065.275(b)(3), which provides examples of types of laser infrared analyzers.
- In § 1065.275(c), add the text "laser infrared analyzers,."
- In § 1065.275(c)(1), change the text "Note that interference species, with the exception of H₂O, are dependent on the N₂O infrared absorption band chosen

by the instrument manufacturer and should be determined dently ⁹⁹ for each analyzer." **to** "Note that interference species, with the exception of H₂O, are dependent on the N₂O infrared absorption band chosen by the instrument manufacturer. For each analyzer determine the N₂O infrared absorption band. For each N₂O infrared absorption band, use good engineering judgment to determine which interference gases to use in the verification."

- In § 1065.275(c)(2), add the text "and laser infrared analyzers" to the end of the first sentence, and change the text "Note that interference species, with the exception of H₂O, are dependent on the N₂O infrared absorption band chosen by the instrument manufacturer and should be determined independently for each analyzer." **to** "Note that interference species, with the exception of H₂O, are dependent on the N₂O infrared absorption band chosen by the instrument manufacturer. For each analyzer determine the N₂O infrared absorption band. For each N₂O infrared absorption band, use good engineering judgment to determine interference gases to use in the verification."

Harmonization Updates: Subpart D – Calibrations and Verifications

The Proposed Amendments include the following recent federal Part 1065 amendments to Subpart D:

- In § 1065.305(d)(10)(i), delete the text "in subparts D, F, and J of this part, as applicable."
- In § 1065.307(a), change the text "the table" to "Table 1 of § 1065.303," delete the text "Note that this linearity verification may replace requirements we previously referred to as "calibrations"," add the text "accurately and," and change the text "a linearity verification" to "linearity verification."
- In § 1065.307(c)(1), change the text "we use the letter "y" to denote a generic measured quantity, the superscript over-bar to denote an arithmetic mean (such as \bar{y}), and the subscript "ref" to denote the known or reference quantity being measured" **to** "the letter "y" denotes a generic measured quantity, the superscript over-bar denotes an arithmetic mean (such as \bar{y}), and the subscript "ref" denotes the known or reference quantity being measured."
- In § 1065.307(c)(2), change the text "specified temperatures, pressures, and flows" **to** "normal operating conditions."
- In § 1065.307(c)(3), (4), and (5), add the text "If applicable," to the beginning of each paragraph.
- In § 1065.307(c)(6), change the text "instrument manufacturer recommendations" **to** "the instrument manufacturer's recommendations,"

⁹⁹ The text "dently" is a typographical error in the 2011 federal text that was inadvertently carried into the California regulation during the 2012 adoption process.

change the text “of the linearity verification” **to** “for the linearity verification,” and add the text “power, current, voltage, photoacoustic analyzers,” to the list of types of linearity verifications where three reference values are recommended.

- In § 1065.307(c)(7), change the text “instrument manufacturer recommendations” **to** “the instrument manufacturer’s recommendations,” add the text “and to avoid hysteresis,” change the text “, or as another example; you may select” to “or you may select,” change the text “reference signals, or as another example” **to** “reference signals; or,” and change the text “which might incorporate the effects” **to** “to incorporate the effects.”
- In §§ 1065.307(c)(10) and (11), change the text “the reference value” **to** “the value at the reference condition.”
- In § 1065.307(c)(11), change the text “ \bar{y}_i ” to “ \bar{y} .”
- In § 1065.307(c)(12), change the text “Repeat steps” **to** “Repeat the steps,” and change the text “until all reference quantities are measured” **to** “until measurements are complete at each of the reference conditions.”
- In § 1065.307(c)(13), change the text “Use the calculations described in § 1065.602 described in § 1065.602” **to** “Use the calculations for a floating intercept described in § 1065.602.”
- In § 1065.307(d), change the text “otherwise in other sections in this part” **to** “elsewhere in this part.”
- In § 1065.307(d)(3), change the text “Electrical power. Use a controlled source of current and a watt-hour standard reference meter. Complete calibration systems that contain a current source and a reference watt-hour meter are commonly used in the electrical power distribution industry and are therefore commercially available” **to** “Electrical power, current, and voltage. You must perform linearity verification for either electrical power meters, or for current and voltage meters. Perform linearity verifications using a reference meter and controlled sources of current and voltage. We recommend using a complete calibration system that is suitable for the electrical power distribution industry.”
- In § 1065.307(d)(5)(i), delete the requirement that flow meter calibration be done by the manufacturer.
- In § 1065.307(d)(7), change the text “use a series of gas cylinders of known gas concentration” **to** “use a series of gas cylinders of known gas concentration containing only a single constituent of interest with balance of purified air or purified N₂.”
- In §§ 1065.307(e)(3)(i) and (ii), change the text “refers to the typical mass of a PM filter” **to** “is the typical mass of a PM filter.”
- Add new paragraphs that define the maximum reference values for linearity verification for various instruments to subsection 1065.307(e)(3) as follows:

1065.307(e)(3)(iii) for a fuel mass scale, 1065.307(e)(v) for a fuel flow rate meter, 1065.307(e)(vii) for an intake-air flow rate meter, 1065.307(e)(viii) for a raw exhaust flow rate meter, 1065.307(e)(ix) for an electrical-power measurement system, 1065.307(e)(x) for an electrical-current measurement system, 1065.307(e)(xi) for an electrical-voltage measurement system.

- In § 1065.307(e)(5), change the text “These linearity verifications are optional for systems that pass the flow-rate verification for diluted exhaust as described in § 1065.341 (the propane check) or for systems that agree within $\pm 2\%$ based on a chemical balance of carbon or oxygen of the intake air, fuel, and exhaust” **to** “Table 2 of this section describes optional verification procedures you may perform instead of linearity verification for certain systems. The following provisions apply for the alternative verification procedures.”
- Add two new paragraphs to § 1065.307(e)(5), paragraph 1065.307(e)(5)(i) relating to propane check verification frequency and paragraph 1065.307(e)(5)(ii) relating to carbon balance error verification frequency.
- In § 1065.307(e)(7)(i)(C), change the text “Dilution air for PM sampling” **to** “Dilution air for gaseous and PM sampling.”
- In § 1065.307(e)(7)(i)(D), delete the text “if applicable.”
- In paragraphs 1065.307(e)(7)(i)(E) and 1065.307(e)(8)(i)(E), change the text “in the amount of water calculations in § 1065.645” **to** “in determining the amount of water removed from the emission sample.” Change the text “in lieu of the” **to** “instead of.” Change the text “We recommend that you input a reference simulated temperature signal below the alarm trip point, increase this signal until the high alarm trips, and verify that the alarm trip point value is no less than 2.0 °C below the reference value at the trip point” **to** “To verify that the alarm trip point value is no less than 2.0 °C below the reference value at the trip point, we recommend that you input a reference simulated temperature signal below the alarm trip point and increase this signal until the high alarm trips.”
- Add two new paragraphs, 1065.307(e)(7)(i)(F) with the text “Transmission oil” and 1065.307(e)(7)(i)(G) with the text “Axle gear oil,” as temperature signals requiring linearity verification.
- In § 1065.307(e)(8)(i)(B), add the text “as required in § 1065.130(h).”
- In § 1065.307(e)(8)(i)(D), add the text “where the raw exhaust enters the tunnel.”
- Create a new subsection 1065.307(f) to contain the current Table 1 of § 1065.307 and make the following changes to Table 1:
 - Delete the “Minimum verification frequency” column in Table 1.
 - Add entries for “Current,” “Voltage,” and “Fuel mass scale.”

- Add a new footnote (a) reference mark to "Intake air flow rate," "Dilution air flow rate," "Diluted exhaust flow rate," "Raw exhaust flow rate," and "Batch sampler flow rate," with the footnote text, "For flow meters that determine volumetric flow rate, \dot{V}_{std} , you may substitute \dot{V}_{std} for \dot{n} as the quantity and substitute \dot{V}_{stdmax} for \dot{n}_{max} ."
- Add a new subsection 1065.307(g) to contain the new Table 2 of § 1065.307, describing optional verification to linearity verification for certain measurement systems.
- In § 1065.308(d)(2), add the text "If you inject the gas at a tee near the outlet of the probe, you may correct the transformation time, t_{50} , for an estimate of the transport time from the probe inlet to the tee." Change the text, "probe sample flow rate," and the text, "probe flow rate," **to** "sample flow rate." Add the text "We recommend you use the final, stabilized analyzer reading as the final gas concentration." Add the text "The change in gas concentration must be at least 20% of the analyzer's range."
- In § 1065.308, add a new subsection 1065.308(g) with paragraphs (g)(1) through (g)(4), describing an optional procedure to use a fast-acting two-way valve to switch between zero and span gases, and listing provisions required for such a procedure.
- In § 1065.309(d)(2):
 - Add the text "If you inject the gas at a tee near the outlet of the probe, you may correct the transformation time, t_{50} , for an estimate of the transport time from the probe inlet to the tee."
 - Change the text "probe sample flow rate," and the text, "probe flow rate," **to** "sample flow rate."
 - Add the text "We recommend you use the final, stabilized analyzer reading as the final gas concentration."
 - Add the text, "The change in gas concentration must be at least 20% of the analyzer's range."
 - Change the text "purified synthetic air" **to** "purified air."
 - Change the text "If your system does not use a sample dryer to remove water from the sample gas, you must humidify your span gas to the highest sample H₂O content that you estimate during emission sampling. If your system uses a sample dryer during testing, it must pass the sample dryer verification check in § 1065.342" **to** "If the sample does not pass through a dryer during emission testing, humidify your span gas to an H₂O level at or above the maximum expected during emission testing. If the sample does not pass through a dryer during emission testing, it must pass the sample dryer verification check in § 1065.342."

- Add a new subsection 1065.309(g), stating that the optional procedures described in § 1065.308(g) may be used and that ambient air may be mixed with compensating gases for oxygen analyzers.
- Add new subsections 1065.309(h), with paragraphs 1065.309(h)(1) and 1065.309(h)(2), describing conditions under which span gas humidification may be omitted for analyzers with H₂O compensation sampling downstream of a sample dryer.
- In § 1065.310(b), change the text “Recommended procedure” to “Recommended procedure to quantify lever-arm length. Quantify the lever-arm length, SI-traceable within $\pm 0.5\%$ uncertainty. The lever arm's length must be measured from the centerline of the dynamometer to the point at which the reference force is measured. The lever arm must be perpendicular to gravity (i.e., horizontal), and it must be perpendicular to the dynamometer's rotational axis. Balance the lever arm's torque or quantify its net hanging torque, SI-traceable within $\pm 1\%$ uncertainty, and account for it as part of the reference torque.”
- Delete subsections 1065.310(b)(1) and 1065.310(b)(2).
- At the beginning of § 1065.310(c), add the text “Recommended procedure to quantify reference force. We recommend dead-weight calibration, but you may use either of the following procedures to quantify the reference force, SI-traceable within $\pm 0.5\%$ uncertainty.”
- Move the currently adopted text of paragraph 1065.310(c), relating to dead weight calibration, to a new paragraph 1065.310(c)(1); replace the instructions relating to local gravitational acceleration with a reference to 1065.630; delete the weight's reference force specified, and the text “using this equation: torque – force – lever arm length.”
- Change the lettering of paragraph 1065.310(d), relating to strain gage or proving ring calibration, to paragraph 1065.310(c)(2), so that it is identified as one of the two procedures allowed under 1065.310(c). Add text to specify that 1065.310(d) [re-lettered to 1065.310(c)(2)] also applies to load transducer calibration.
- Delete the current text of § 1065.320(b) and add the text “[Reserved].”
- In paragraph 1065.340(b), add the text “except as allowed in paragraph (c) of this section.”
- Change the lettering of paragraph 1065.340(c) to § 1065.340(d).
- Add a new subsection 1065.340(c), allowing CFV or FFV flow meters to be removed from their permanent positions for calibration if certain conditions are met.
- Change the lettering of subsection 1065.340(d) to 1065.340(e). Change the text “Do not use an upstream screen” to “Calibrate the system with any upstream

screens or other restrictions that will be used during testing and that could affect the flow ahead of the CVS flow meter, taking appropriate measures to minimize the effect on the flow distribution. You may not use any upstream screen." Add the text "In the case of a free standing SSV reference flow meter, you may not have any upstream screens."

- Change the lettering of subsection 1065.340(e) **to** § 1065.340(f).
- In § 1065.340(e)(8) [re-lettered to § 1065.340(f)(8)], change the text "the minimum expected pressure at the PDP inlet" **to** "the minimum expected pressure at the PDP inlet or the maximum expected differential (outlet minus inlet) pressure across the PDP during testing." See also the proposed California-specific changes described in the purpose and rationale for § 1065.340(f)(8) provided later in this section G.
- In § 1065.340(e)(13) [re-lettered to § 1065.340(f)(13)], change the text, "Do not use the PDP below the lowest inlet pressure tested during calibration" **to** "During emission testing ensure that the PDP is not operated either below the lowest inlet pressure point or above the highest differential pressure point in the calibration data."
- Move § 1065.340(f) in the current regulation to a new location and re-letter it to § 1065.340(h). Change the text "at the lowest expected static differential pressure between the CFV inlet and outlet" **to** "up to the highest expected pressure ratio, r , according to § 1065.640." Add a new paragraph as paragraph 1065.340(h)(2), with the text, "Verify that any leaks between the calibration flow meter and the CFV are less than 0.3% of the total flow at the highest restriction." Re-letter paragraphs 1065.340(f)(2) and 1065.340(f)(3) to § 1065.340(h)(3) and 1065.340(h)(4), respectively. Delete the current § 1065.340(f)(4), "Leaks between the calibration flow meter and the CFV must be less than 0.3 % of the total flow at the highest restriction."
- Move § 1065.340(g), containing instructions for calibrating a subsonic venturi (SSV), to before the section describing critical-flow venturi calibration.
- Change the lettering of subsection 1065.340(h) to 1065.340(i).
- In paragraphs 1065.340(f)(9) and 1065.340(f)(10) [re-lettered to paragraphs 1065.340(f)(9) and 1065.340(f)(10) in the Proposed Amendments], change references to lowest allowable pressure ratios to references to highest allowable pressure ratios.
- In the title of § 1065.341, change the text "CVS and batch sampler verification" **to** "CVS and PFD flow verification."
- In § 1065.341, add the following unnumbered paragraph to the beginning of the section as follows: "This section describes two optional methods, using propane as a tracer gas, to verify CVS and PFD flow streams. You may use good engineering judgment and safe practices to use other tracer gases, such as CO₂ or CO. The first method, described in paragraphs (a) through (e) of this section,

applies for the CVS diluted exhaust flow measurement system. It may also apply for other single-flow measurement systems as described in Table 2 of §1065.307. Paragraph (g) of this section describes a second method you may use to verify flow measurements in a PFD for determining the PFD dilution ratio."

- Delete subsection 1065.341(a) and change the lettering of paragraph 1065.341(b) to 1065.341(a).
- Change the lettering of subsection 1065.341(c) to 1065.341(b). Add a provision allowing a prediluted propane tracer gas meeting certain specifications to be substituted for pure propane to subparagraph 1065.341(c)(1) (1065.341(b)(1) in the Proposed Amendments). In 1065.341(c)(3) (1065.341(b)(3) in the Proposed Amendments), change the text "where you introduce engine exhaust into the CVS" **to** "where you introduce engine exhaust into the CVS or at some point in the laboratory exhaust tubing upstream of this location." In 1065.341(c)(5) (1065.341(b)(5) in the Proposed Amendments), change the text "precool" **to** "pre-cool."
- Change the lettering of subsections 1065.341(d), 1065.341(e), and 1065.341(f) **to** 1065.341(c), 1065.341(d), and 1065.341(e), respectively.
- In § 1065.341(d) [1065.341(c) in the Proposed Amendments], change the reference to 1065.520(g) **to** 1065.520(f).
- In § 1065.341(f)(5) [1065.341(e)(5) in the Proposed Amendments], change the reference to 1065.341(a) **to** 1065.341(f).
- Add a new subsection 1065.341(f), containing a table listing possible causes of failed propane checks and recommended corrective actions.
- In § 1065.341(g), change the text "You may repeat the propane check to verify a batch sampler, such as a PM secondary dilution system" **to** "You may verify flow measurements in a PFD (usually dilution air and diluted exhaust streams) for determining the dilution ratio in the PFD using the following method:." In subsidiary paragraphs (g)(1) through (g)(4), change references to "batch samplers," to references to PFDs; change instructions to "repeat" to "perform" the procedure; and specify that the propane should be injected in the same exhaust stream that is being sampled.
- In paragraph 1065.341(g)(4), change the allowable difference of calculated and reference mass from 5% to 2%. Change the text "the batch sampler passes" **to** "all PFD flow measurements for determining PFD dilution ratio pass." Change the reference to subsection 1065.341(a) **to** reference subsection 1065.341(f). Add a statement that for PFDs sampling only for PM, the allowable difference is 5%.
- Add a new paragraph 1065.341(h) referring to alternatives to propane checks for linearity verification.

- In § 1065.342(d)(2), change the text "Humidify room air, N₂, or purified air by bubbling it through distilled water in a sealed vessel that humidifies the gas" **to** "Humidify room air, purified N₂, or purified air by bubbling it through distilled H₂O in a sealed vessel or use a device that injects distilled H₂O as vapor into a controlled gas flow to humidify the gas."
- In paragraph 1065.345(d)(2), change the text "Supply span gas to the analyzer port and verify that it measures the span gas concentration within its expected measurement accuracy and repeatability" **to** "Supply span gas to the analyzer span port and record the measured value."
- In paragraph 1065.345(d)(4), change the text "within ± 0.5% of the span gas concentration" **to** "within ± 0.5% of the concentration measured in paragraph (d)(2) of this section."
- In § 1065.360(a)(3), add the text "If you determine NMNEHC by subtracting from measured THC, determine the ethane (C₂H₆) response factor after initial analyzer installation and after major maintenance as described in paragraph (f) of this section." Change the text "methane (CH₄) response" **to** "C₂H₆."
- Add a new subsection 1065.360(a)(4) to provide instructions for determining methane and ethane response factors for gaseous-fueled engines.
- In paragraph 1065.360(d)(7), change the text "Introduce at the sample port of the FID analyzer, the CH₄ span gas that you selected under paragraph (d)(2) of this section" **to** "Introduce the CH₄ span gas that you selected under paragraph (d)(2) of this section into the FID analyzer."
- Renumber paragraph 1065.360(d)(10) to 1065.360(d)(11).
- Add a new paragraph 1065.360(d)(10), stating that the procedure in paragraph (d) only needs to be performed for one range of the analyzer.
- Add a new paragraph 1065.360(d)(12), describing the process of determining the response factor as a function of molar water concentration.
- Delete § 1065.360(e), containing prior instructions for THC FID CH₄ response verification, and its subsidiary paragraphs (1-3).
- Add a new subsection 1065.360(e) containing new instructions for THC FID CH₄ response verification with subsidiary paragraphs (1-5).
- Add a new paragraph 1065.362(d)(15), stating that the procedure in subsection d only needs to be performed for one range of the analyzer.
- In § 1065.365(d), add a statement that the method described in that subsection is required for gaseous-fueled engines, and add instructions for determining penetration fractions and response factors as a function of molar water concentration.
- In § 1065.365(d)(1), add the text "For CH₄ analyzers with multiple ranges, perform this procedure on the highest range used for emission testing."

- In § 1065.365(d)(9), change the text “this combined response factor and penetration fraction” **to** “this combined C₂H₆ response factor and C₂H₆ penetration fraction.” Change the reference to 1065.660(c)(1)(i) to refer to 1065.660(d)(1)(i).
- In § 1065.365(d), add new subsections as 1065.365(d)(10), (d)(11), and (d)(12), which provide instructions for determining NMC FID methane penetration fraction and ethane response factors as a function of exhaust molar water content when measuring emissions from a gaseous fueled engine to account for the effect water has on nonmethane cutters.
- In § 1065.365(e)(1), change the text “or equal to the THC analyzer's span value” **to** “and the C₂H₆ concentration typical of the peak total hydrocarbon (THC) concentration expected at the hydrocarbon standard or equal to the THC analyzer's span value. For CH₄ analyzers with multiple ranges, perform this procedure on the highest range used for emission testing.”
- In § 1065.365(e)(10), change the reference to 1065.660(c)(1)(ii) to refer to 1065.660(d)(1)(ii).
- In § 1065.365(f)(1), add the text “For CH₄ analyzers with multiple ranges, perform this procedure on the highest range used for emission testing.”
- In § 1065.365(f)(9), change the text “this combined response factor and penetration fraction” **to** “this combined C₂H₆ response factor and C₂H₆ penetration fraction.” Change the reference to 1065.660(c)(1)(i) to 1065.660(d)(1)(i).
- In § 1065.365(f)(14), change the text “this penetration fraction” **to** “this CH₄ penetration fraction,” and change the reference to 1065.660(c)(1)(iii) **to** 1065.660(d)(1)(iii).
- Add a new section 1065.366, regarding interference verification for FTIR analyzers.
- Add a new section 1065.369, regarding interference verification for photoacoustic alcohol analyzers.
- In § 1065.370(d)(9), add the option to determine CO₂ concentration from the gas divider output by measuring it using NDIR.
- In § 1065.370(e)(5), change the text “Humidify the NO span gas by bubbling it,” **to** “Create a humidified NO span gas by bubbling a NO gas that meets the specifications in §1065.750.” (Other changes in this paragraph are described in the “Updates to Harmonize with Amended Federal Text” subsection in this section E).
- In § 1065.375(d)(9), add the parenthetical text “(the arithmetic mean of 30 second data described in paragraph (d)(7) of this section).” Change the text “the tolerance specified” **to** “the tolerance for combined interference as specified.”

- In § 1065.378(d)(3)(iv), change the text “20 percent of x_{NOref} ” **to** “20 percent of x_{NOref} or a value which would simulate the maximum concentration of NO_2 expected during testing.” Add the text “This ensures that the ozonator is generating NO_2 at the maximum concentration expected during testing.”
- In § 1065.390(b), add the text “Balances have internal weights that compensate for drift due to environmental changes. These internal weights must be verified as part of this independent verification with external, certified calibration weights that meet the specifications in §1065.790.”
- In § 1065.390(c), change the text “at least one calibration weight, and any weights you use must that meet the specifications in § 1065.790 to perform this verification” **to** “at least one calibration weight. Also, any external weights you use must meet the specifications in § 1065.790. Any weights internal to the PM balance used for this verification must be verified as described in paragraph (b) of this section.”
- In § 1065.390(c)(2), change the text “internal calibration weights that are used automatically to verify balance performance” **to** “internal weights for automatically verifying balance performance.”

Harmonization Updates: Subpart E – Engine Selection, Preparation, and Maintenance

The Proposed Amendments include the following recent federal Part 1065 amendments to Subpart E:

- In § 1065.405(a), add the text “consistent with paragraph (f) of this section.” Add the text “If your engine is equipped with multiple user-selectable governor types and if the governor does not manipulate the emission control system (i.e., the governor only modulates an “operator demand” signal such as commanded fuel rate, torque, or power), choose the governor type that allows the test cell to most accurately follow the duty cycle. If the governor manipulates the emission control system, treat it as an adjustable parameter. See paragraph (b) of this section for guidance on setting adjustable parameters.” Add the text “In certain circumstances, you may incorporate test cell components to simulate an in-use configuration. For example, §§1065.122 and 1065.125 allow the use of test cell components to represent engine cooling and intake air systems. The provisions in §1065.110(e) also apply to emission-data engines for certification.”
- Add a new paragraph 1065.405(b) as follows: “We may set adjustable parameters to any value in the valid range, and you are responsible for controlling emissions over the full valid range. For each adjustable parameter, if the standard-setting part has no unique requirements and if we have not specified a value, use good engineering judgment to select the most common setting. If information on the most common setting is not available, select the setting representing the engine's original shipped configuration. If information

on the most common and original settings is not available, set the adjustable parameter in the middle of the valid range.”

- Change the lettering of subsections 1065.405(b), 1065.405(c), 1065.405(d), and 1065.405(e) **to** 1065.405(c), 1065.405(d), 1065.405(e), and 1065.405(f), respectively.
- In § 1065.405(e)(2) [now re-lettered to (f)(2)], change the sentence “Use a canister that is fully loaded with fuel vapors.” **to** “Precondition the canister as described in 40 CFR 86.132-96(j).”
- Add a new § 1065.405(g) to define the components that are considered to be part of the engine for laboratory testing.
- In § 1065.410(c), change the text “Keep a record of the inspection and update your application to document any changes as a result of the inspection. You may use equipment, instruments, or engineering grade tools to identify bad engine components. Any equipment, instruments, or tools used for scheduled maintenance on emission data engines must be representative of what is planned to be available to dealerships and other service outlets” **to** “If you inspect an engine, keep a record of the inspection and update your application to document any changes that result. You may use any kind of equipment, instrument, or tool that is available at dealerships and other service outlets to identify bad engine components or perform maintenance.”
- In § 1065.410(d), add the text “You may repair defective parts from a test engine if they are unrelated to emission control. You must ask us to approve repairs that might affect the engine’s emission controls.”

Harmonization Updates: Subpart F – Performing an Emission Test Over Specified Duty Cycles

The Proposed Amendments include the following recent federal Part 1065 amendments to Subpart F:

- Change the Subpart F title from “Performing an Emission Test in the Laboratory” **to** “Performing an Emission Test Over Specified Duty Cycles.”
- Change the lettering of subsections 1065.501(b), 1065.501(c), and 1065.501(d) **to** 1065.501(c), 1065.501(d), and 1065.501(e), respectively. Add a new paragraph 1065.501(b) as described in the purpose and rationale for 1065.501(b) provided later in this section G.
- In paragraph 1065.501(b)(2)(i) [re-lettered to 1065.501(c)(2)(i) in the Proposed Amendments], change the text “Before emission sampling, stabilize an engine at the first discrete mode. Sample emissions and other parameters for that mode in the same manner as a transient cycle, with the exception that reference speed and torque values are constant. Record mean values for that mode, and then stabilize the engine at the next mode. Continue to sample each mode discretely as separate test intervals and calculate weighted emission results

according to the standard-setting part” **to** “Before emission sampling, stabilize an engine at the first discrete mode of the duty cycle specified in the standard-setting part.-Sample emissions and other parameters for that mode in the same manner as a transient cycle, with the exception that reference speed and torque values are constant. Record data for that mode, transition to the next mode, and then stabilize the engine at the next mode. Continue to sample each mode discretely as a separate test interval and calculate composite brake-specific emission results according to § 1065.650(g)(2).”

- Add three new paragraphs to § 1065.501(c)(2)(i), paragraph (c)(2)(i)(A) relating to determination of the time required to stabilize the engine, paragraph (c)(2)(i)(B) relating to PM sampling, and paragraph (c)(2)(i)(C) relating to minimum sampling intervals.
- In paragraph 1065.510(b)(5)(i), delete the parenthetical text “(i.e., discrete mode or ramped modal)” and add the text “Record the mean speed and torque at each setpoint.”
- Change the numbering of paragraph 1065.510(b)(6) to 1065.510(b)(7). Add a new subsection 1065.510(b)(6) to describe methods to determine warm high-idle speed for engines with a high-speed governor subject to a transient testing cycle with reference speeds above 100%.
- In § 1065.510(c)(2), add the text “You may start the negative torque map at either the minimum or maximum speed from paragraph (b) of this section.”
- Add three new paragraphs to § 1065.510(d)(5), paragraph (d)(5)(i) relating to engine mapping for constant speed engines subject only to steady state testing, paragraph (d)(5)(ii) relating to engine mapping for any constant speed engine, and paragraph (d)(5)(iii) relating to engine mapping for isochronous governed constant speed engines.
- In § 1065.510(f)(5), move the text “For constant-speed engines you may declare a maximum test torque. You may use the declared value for cycle generation if it is within (95 to 100)% of the measured value” to a new paragraph 1065.510(f)(5)(ii). Add a new paragraph 1065.510(f)(i), “For variable-speed engines you may declare a maximum torque over the engine operating range. You may use the declared value for measuring warm high-idle speed as specified in this section,”
- Change the lettering of paragraph 1065.510(g) to 1065.510(h). Add a new paragraph 1065.510(g) with the text “[Reserved].” The new federal 1065.510(g) text is omitted because it relates to engines beyond the scope of the SORE category. See the Global Amendments subsection, “Changes to References of Equipment Types, Engine Types, and Fuel,” for additional explanation.
- In § 1065.512(b)(1), add the text “You may do either of the following when using enhanced-idle devices:”, and delete the text, “and we recommend controlling.” Move the text “the dynamometer so it gives priority to follow the

reference torque, controlling the operator demand so it gives priority to follow reference speed and let the engine govern the speed when the operator demand is at minimum" to a new paragraph 1065.512(b)(1)(i) with the text "Control" added at the beginning of the new paragraph. Add a new paragraph 1065.512(b)(1)(ii), stating that the ECM broadcast speed may be used as the reference speed in certain cases added.

- In § 1065.512(b)(2), delete the text ". This provision" and add ", which" as indicated in ~~strikeout~~ and underline in the following: "Section 1065.610 also describes under what conditions you may command T_{ref} greater than the reference torque you calculated from a normalized duty cycle. ~~This provision,~~ which permits you to command T_{ref} values that are limited by a declared minimum torque."
- In § 1065.514(e), change the text "calculate regression statistics as described" **to** "calculate regression statistics for a floating intercept as described." Change "Table 2 of § 1065.514" **to** "Table 2 of this section."
- In § 1065.514(e)(3), change the text "Standard estimates of error" **to** "Standard error of the estimate."
- In § 1065.514(f)(3), change the text "paragraph (f)(1) or (2)" **to** "paragraph (f)(1) or (f)(2)," and add the text "Note that if the gaseous and particulate test intervals are different periods of time, separate validations are required for the gaseous and particulate test intervals. Table 2 follows:."
- Add a new section 1065.516 to describe how to manage the impact of sampling system contamination on emission measurements, along with a recommended procedure for how to precondition or decontaminate sampling systems.
- In § 1065.520(a), change the text "If your engine must comply with a PM standard" **to** "For tests in which you measure PM emissions."
- Delete § 1065.520(f) and its subsidiary paragraphs.
- Change the numbering of subsection 1065.520(g) to 1065.520(f). Change the text "nonmethane contamination" **to** "nonmethane hydrocarbon contamination." Add the text "or for any CH_4 measurement system that uses an NMC." Change the text "for this verification, however you may measure" **to** "for this verification; however, you may measure." Change the text "sample train" **to** "sample path." Change the text "subtracting CH_4 from THC" **to** "subtracting CH_4 from THC or, where CH_4 is determined." Change the text "and the calculations in § 1065.660(b)(2)" **to** "and using the calculations in § 1065.660(b)(2)."
- In § 1065.520(g)(5)(i) [re-lettered to 1065.520(f)(5)(i) in the Proposed Amendments], change the text "zero air flows" to "zero gas flows."

- Change the lettering of paragraphs 1065.520(g)(7) and 1065.520(g)(8) to 1065.520(f)(8) and 1065.520(f)(9), respectively. In subparagraphs 1065.520(g)(7)(i) and (ii) [re-lettered to 1065.520(f)(8)(i) and (ii) in the Proposed Amendments], change the text “mean wet, net concentration” **to** “mean concentration.”
- Add a new subsection 1065.520(f)(7) to describe the manner in which THC initial concentration may be corrected for drift.
- In the § 1065.525 title, delete the text “, and optional repeating of void discrete modes.”
- In § 1065.525(a), change the text “Start the engine” **to** “For test intervals that require emission sampling during engine starting, start the engine.”
- Delete paragraph 1065.525(c)(4), relating to engine stalls.
- In § 1065.526(a), change the text “instrument malfunctions” **to** “instrument malfunction” and change the text “instrument ranges” **to** “instrument ranges, and other unexpected deviations from the specified procedures.”
- In paragraph 1065.526(c)(2), change the text “test sequence” **to** “duty cycle.”
- In paragraph 1065.526(c)(3), change the text “Precondition the engine” **to** “Stabilize the engine,” and change the text “previous mode for approximately the same amount of time it operated at that mode for the previous emission measurement” **to** “mode at which the duty cycle was interrupted and continue with the duty cycle as specified in the standard-setting part.”
- Change the lettering of subsections 1065.526(d) and 1065.526(e) **to** 1065.526(e) and 1065.526(f), respectively. Add a new subsection 1065.526(d), describing the manner in which results for an individual mode may be voided and repeated.
- In § 1065.526(d)(1) [re-lettered to 1065.526(e)(1) in the Proposed Amendments], change the text “precondition the engine and emission sampling system” **to** “precondition the engine.”
- In § 1065.526(e) [re-lettered to 1065.526(f) in the Proposed Amendments], delete the text “and include a description of the reason for voiding the test mode or test interval.”
- In § 1065.530(a)(1), change the text “precondition sampling systems as described in § 1065.520(f)” **to** “precondition the engine as described in § 1065.518.”
- In § 1065.530(a)(1)(ii), change the text “shut down the engine. Start the hot-start duty cycle as specified in the standard-setting part” **to** “shut down the engine immediately after completing the last preconditioning cycle. For any repeat cycles, start the hot-start transient emission test within 60 seconds after

completing the last preconditioning cycle (this is optional for manufacturer testing)."

- In § 1065.530(a)(1)(iii), change the text "such as any steady state testing, you may continue to operate the engine at maximum test speed and 100% torque if that is the first operating point. Otherwise, operate the engine at warm idle or the first operating point of the duty cycle. In any case, start the emission test within 10 min after you complete the preconditioning procedure" **to** "such as any steady-state testing with a ramped-modal cycle, start the hot-stabilized emission test within 60 seconds after completing the last preconditioning cycle (the time between cycles is optional for manufacturer testing). If the hot-stabilized cycle begins and ends with different operating conditions, add a linear transition period of 20 seconds between hot-stabilized cycles where you linearly ramp the (denormalized) reference speed and torque values over the transition period. See § 1065.501(c)(2)(i) for discrete-mode cycles."
- In § 1065.530(a)(2), change the text "precondition sampling systems" **to** "precondition the engine as described in §1065.518."
- In paragraph 1065.530(a)(2)(iii), add instructions on how to determine that the engine temperature has stabilized for air cooled engines. Change the text "as the point at which the engine coolant, block, or head absolute temperature is within $\pm 2\%$ of its mean value for at least 2 min, or as the point at which the engine thermostat controls engine temperature" **to** "as the point at which the engine thermostat controls engine temperature or as the point at which the engine coolant, block, or head absolute temperature is within $\pm 2\%$ of its mean value for at least 2 min based on the following parameters." Add three new paragraphs 1065.530(a)(2)(iii)(A), 1065.530(a)(2)(iii)(B), and 1065.530(a)(2)(iii)(C), listing temperatures that may be referenced.
- Delete paragraph 1065.530(b)(12), relating to starting the measurement of background concentrations, and paragraph 1065.530(b)(13), containing previous instructions regarding closing drains. Add a new paragraph 1065.530(530(b)(12), containing current instructions regarding closing drains.
- Delete subsection 1065.530(c) and its subsidiary paragraphs and add amended text containing instructions for starting and running each test interval. (The Proposed Amendments include California-specific changes to the federal text, as described in the purpose/rational section for § 1065.530(c) provided later in this section G).
- Add a new paragraph 1065.530(g)(5), describing carbon balance error verification if it is performed as part of the test sequence.
- In § 1065.545(a), change the text "For any pair of flow meters rates, use recorded sample and total flow rates, where total flow rate means the raw exhaust flow rate for raw exhaust sampling and the dilute exhaust flow rate for CVS sampling, or their 1 Hz means, with the statistical calculations in § 1065.602." **to** "For any pair of flow rates, use recorded sample and total flow

rates. Total flow rate means the raw exhaust flow rate for raw exhaust sampling and the dilute exhaust flow rate for CVS sampling, or their 1 Hz means with the statistical calculations in § 1065.602 forcing the intercept through zero."

- In § 1065.545(b), change the text "For any pair of flow meters, use recorded sample and total flow rates, where total flow rate means the raw exhaust flow rate for raw exhaust sampling and the dilute exhaust flow rate for CVS sampling, or their 1 Hz means, to demonstrate that each flow rate was constant within $\pm 2.5\%$ of its respective mean or target flow rate." **to** "For any pair of flow rates, use recorded sample and total flow rates. Total flow rate means the raw exhaust flow rate for raw exhaust sampling and the dilute exhaust flow rate for CVS sampling, or their 1 Hz means to demonstrate that each flow rate was constant within $\pm 2.5\%$ of its respective mean or target flow rate."
- In § 1065.545(c), change the text "total dilute exhaust (CVS) flow" **to** "total flow."
- In § 1065.546(a), change the capitalization of the text "Raw exhaust flow" **to** "raw exhaust flow." Change the text "You may determine the raw exhaust flow rate based on the measured intake air molar flow rate and the chemical balance terms as given in § 1065.655(f)" **to** "You may determine the raw exhaust flow rate based on the measured intake air or fuel flow rate and the raw exhaust chemical balance terms as given in § 1065.655(f)." Add the text "You may determine the raw exhaust flow rate based on the measured intake air and dilute exhaust molar flow rates and the dilute exhaust chemical balance terms as given in § 1065.655(g)."
- Delete subsection 1065.550(b) and add a new subsection 1065.550(b), containing amended instructions for drift validation.
- In § 1065.590(f)(2), delete the text "For manual weighing."
- In § 1065.590(j)(3), change the text "Select a substitution weight" **to** "Select and weigh a substitution weight."
- In paragraphs 1065.590(j)(4), 1065.590(j)(6), and 1065.590(j)(7), change the text "calibration weight" **to** "substitution weight."

Harmonization Updates: Subpart G – Calculations and Data Requirements:

The Proposed Amendments include the following recent federal Part 1065 amendments to Subpart G:

- In § 1065.601(b), change the text "You may not use test results from multiple emission tests" **to** "Although you may use an average of multiple measurements from a single test, you may not use test results from multiple emission tests."
- In § 1065.601(b), move the following two sentences from the end of paragraph (b) to two new subsections numbered (1) and (2): "We allow

weighted means where appropriate. You may discard statistical outliers, but you must report all results." Add a new paragraph 1065.601(b)(3) relating to provisions for when manufacturers may be allowed to exclude certain durability test data relative to compliance with emission standards.

- In § 1065.602(f)(3), delete the period at the end of the last sentence and add the text ", which follows:."
- In § 1065.602(g)(1), change the text "Table 2 of this section" **to** "the following table."
- In 1065.602(g)(2), change the text "Table 3 of this section" **to** "the following table." Move Table 2 so that it follows § 1065.602(g)(1) rather than following § 1065.602(g)(2).
- In § 1065.602(h), change the text "as follows" **to** "using one of the following two methods." Move the equations attached to paragraph 1065.602(h) to a new paragraph 1065.602(h)(1) and add the text "If the intercept floats, i.e., is not forced through zero:" to the beginning of the new paragraph. Add a new paragraph 1065.602(h)(2), addressing equations to be used if the intercept is forced through zero.
- In § 1065.602(j), change the text "Standard estimate of error" **to** "Standard error of the estimate." Move the equations attached to paragraph 1065.602(h) to a new paragraph 1065.602(j)(1) and add the text "For a floating intercept" to the beginning of the new paragraph. Add a new paragraph 1065.602(j)(2), addressing equations to be used if the intercept is forced through zero.
- In § 1065.602(k), change the equation label from, "Eq. 1065.602-12" **to** "Eq. 1065.602-14."
- In § 1065.602(l)(2)(iii), change the equation label from, "Eq. 1065.602-15" **to** "Eq. 1065.602-17."
- In § 1065.610(a), change the text "determine the measured f_{ntest} from the power-versus-speed map, generated according to § 1065.610, as follows" **to** "determine f_{ntest} as follows." Delete subsection 1065.610(a)(1) and its subsidiary paragraphs and equations, containing previous instructions for determining maximum power and the speed at which it occurs. Add a new subsection 1065.610(a)(1) containing instructions for determining f_{ntest} , maximum power, and the speed at which it occurs. Change the numbering of subsections 1065.610(a)(2) and (a)(3) to 1065.610(a)(3) and (a)(4), respectively. Add a new subsection 1065.610(a)(2) containing instructions for determining $f_{ntest,alt}$, an alternate maximum power, and the speed at which it occurs, for engines with a high-speed governor that will be subject to a reference duty cycle that specifies normalized speeds greater than 100 percent.
- Delete subsection 1065.610(b) and its subsidiary paragraphs and equations, containing previous instructions for determining maximum test torque. Add a

new subsection 1065.610(b), containing current instructions for determining maximum test torque.

- Delete subsection 1065.610(c) and its subsidiary paragraphs and equations, containing previous instructions for generating reference speed values from normalized duty cycles. Add a new subsection 1065.610(c), containing current instructions for generating reference speed values from normalized duty cycles.
- In the title of § 1065.630, change the text “1980 international gravity formula” **to** “Local acceleration of gravity.”
- Delete the current text of § 1065.630 and its subsidiary equations, containing previous instructions for calculating local gravity based on location. Add two new subsections, 1065.630(a), containing a reference to the United States National Oceanographic and Atmospheric Administration’s surface gravity prediction web tool, and 1065.630(b), containing current instructions for calculating local gravity based on location.
- Delete subsection 1065.640(b) and its subsidiary paragraphs (b)(1) through (b)(4) and their associated equations, containing instructions for PDP calibration calculations. Add a new subsection 1065.640(b) with new paragraphs (b)(1) through (b)(4), containing current instructions for PDP calibration calculations.
- In paragraph 1065.640(b)(6), change the text “corresponding slope, a_1 , and intercept, a_0 ” **to** “the appropriate regression equation from this paragraph (b).”
- In subsection 1065.640(c):
 - Change the text “In paragraph (c)(4) of this section, we describe other assumptions that you may make, depending upon how you conduct your emission tests” **to** “Paragraph (c)(5) of this section describes other assumptions that may apply.”
 - Delete the text “If we do not allow you to assume that the measured flow is an ideal gas, the governing equations include a first-order correction for the behavior of a real gas; namely, the compressibility factor, Z .”
 - Move the equations associated with the initial paragraph and the text “Calculate molar flow rate, n_i , as follows” to a new paragraph 1065.640(c)(1).
 - Delete paragraph 1065.640(c)(4), containing previous guidance regarding simplifying assumptions. Renumber paragraphs 1065.640(c)(1), 1065.640(c)(2), and 1065.640(c)(3), and 1065.640(c)(5) **to** 1065.640(c)(2), 1065.640(c)(3), 1065.640(c)(4), and 1065.640(c)(6), respectively. Add a newly proposed paragraph 1065.640(c)(5), containing current guidance regarding simplifying assumptions.
- In paragraph 1065.640(c)(1) [(1065.640(c)(2) in the Proposed Amendments], change the text “calculate C_d ” **to** “calculate C_d for each flow rate”

- In paragraph 1065.640(c)(2)(ii) (1065.640(c)(3)(ii) in the Proposed Amendments), change the text "use the following equation to calculate C_f " to "use the following equation to calculate C_f for each flow rate."
- In paragraph 1065.640(c)(5) [renumbered to 1065.640(c)(6) in the Proposed Amendments], change the text "the discharge coefficient, C_d " to " C_d ." Change the text " $\text{J}/(\text{mol}\cdot\text{K})$ " to " $(\text{m}^2 \cdot \text{kg})/(\text{s}^2 \cdot \text{mol} \cdot \text{K})$." Change the text " 99132.0 Pa to " $99.132 \text{ kPa} = 99132.0 \text{ Pa} = 99132 \text{ kg}/(\text{m}\cdot\text{s}^2)$."
- In the first paragraph of § 1065.640(d)(1), change the text "reference molar flow rate, using" to "reference molar flow rate, \dot{n}_{ref} , using." Make the following changes to text and formulas that follow the first paragraph:
 - Change the text "Sutherland three-coefficient viscosity model" to "Sutherland three-coefficient viscosity model as captured in Table 4 of this section."
 - Change the text " $d_T = 152.4 \text{ mm}$ " to " $d_T = 152.4 \text{ mm} = 0.1524 \text{ m}$."
 - Change the formula steps

$$Re^\# = \frac{4 \cdot 28.7805 \cdot 57.625}{3.14159 \cdot 0.1524 \cdot 1.838 \cdot 10^{-5}}$$
 to

$$Re^\# = \frac{4 \cdot 0.0287805 \cdot 57.625}{3.14159 \cdot 0.1524 \cdot 1.838 \cdot 10^{-5}}$$
 and " $Re^\# = 7.541 \cdot 10^5$ " to

$$Re^\# = 7.538 \cdot 10^5$$
 - In the example that follows Table 4 of § 1065.640, change " $T_0 = 273.11 \text{ K}$ " to " $T_0 = 273 \text{ K}$," change " $S = 110.56 \text{ K}$ " to " $S = 111 \text{ K}$," and change " $M_{\text{mix}} = 28.7805 \text{ g/mol}$ " to " $M_{\text{mix}} = 28.7805 \text{ g/mol} = 0.0287805 \text{ kg/mol}$."
- In Table 4 of 1065.640, add a new footnote (b) reference mark to the headings of the "Temperature range within $\pm 2\%$ error" and "Pressure limit" columns, and stating that the model results are valid only for ambient conditions in the specified ranges.
- In paragraph 1065.640(d)(2), change the text "Create an equation for C_d versus $Re^\#$, using paired values of ($Re^\#$, C_d). For the equation, you may use any mathematical expression, including a polynomial or a power series. The following equation is an example of a commonly used mathematical expression for relating C_d and $Re^\#$:" to "Create an equation for C_d as a function of $Re^\#$, using paired values of the two quantities. The equation may involve any mathematical expression, including a polynomial or a power series. The following equation is an example of a commonly used mathematical expression for relating C_d and $Re^\#$."
- In paragraph 1065.640(d)(3), change the text "Perform a least-squares regression analysis to determine the best-fit coefficients to the equation and calculate the equation's regression statistics, SEE and r^2 , according to

§ 1065.602" **to** "Perform a least-squares regression analysis to determine the best-fit coefficients for the equation and calculate-SEE as described in § 1065.602." Add the text "When using Eq. 1065.640-12, treat C_d as y and the radical term as y_{ref} and use Eq. 1065.602-12 to calculate SEE. When using another mathematical expression, use the same approach to substitute that expression into the numerator of Eq. 1065.602-12 and replace the 2 in the denominator with the number of coefficients in the mathematical expression."

- In paragraph 1065.640(d)(4), change the text "If the equation meets the criteria of $SEE \leq 0.5\% \cdot n_{refmax}$ and $r^2 \geq 0.995$, you may use the equation to determine C_d for emission tests, as described in § 1065.642" **to** "If the equation meets the criterion of $SEE \leq 0.5\% \cdot C_{dmax}$, you may use the equation for the corresponding range of $Re^\#$, as described in §1065.642."
- In paragraph 1065.640(d)(5), change the text "If the SEE and r^2 criteria are not met" **to** "equation does not meet the specified statistical criterion." Change the text "You must use at least seven calibration data points to meet the criteria" **to** "however, you must use at least seven calibration data points to meet the criteria." Delete the text "to meet the regression statistics." Add the text "For example, this may involve narrowing the range of flow rates for a better curve fit."
- In paragraph 1065.640(d)(6), change the text "If omitting points does not resolve outliers, take corrective action" **to** "Take corrective action if the equation does not meet the specified statistical criterion even after omitting calibration data points."
- In paragraph 1065.640(d)(7), change the text "only to determine flow rates that are within the range of the reference flow rates used to meet the C_d versus $Re^\#$ equation's regression criteria" **to** "only for the corresponding range of $Re^\#$."
- In 1065.640(e), change the text "all of the venturis" **to** "all the venturis."
- In 1065.640(e)(3), change the text "use the mean C_d in Eq 1065.642-6, and use the CFV only down to the lowest r" **to** "use the mean C_d in Eq 1065.642-4, and use the CFV only up to the highest venturi pressure ratio r."
- In 1065.640(e)(4), change the text "omit the C_d values corresponding to the data point collected at the lowest r" **to** "omit the C_d value corresponding to the data point collected at the highest r."
- In 1065.640(e)(7), change the text "use that mean C_d in Eq 1065.642-6, and use the CFV only down to the lowest r" **to** "use that mean C_d in Eq 1065.642-4, and use the CFV only up to the highest venturi pressure ratio r."
- Delete subsection 1065.642(a), containing instructions for calculating the PDP molar flow rate, and add a new subsection 1065.642(a), containing amended instructions for calculating PDP molar flow rate.

- In 1065.642(b), change the text "Based on the C_d versus Re # equation you determined according to § 1065.640, calculate SSV molar flow rate, \dot{n} during an emission test as follows" **to** "Calculate SSV molar flow rate, \dot{n} as follows." Add a list of symbols used in this subsection's calculations and their meanings. Change the text " $p_{in} = 99132 \text{ Pa}$ " **to** " $p_{in} = 9.132 \text{ kPa} = 99132 \text{ Pa} = 99132 \text{ kg}/(\text{m}\cdot\text{s}^2)$."
- In 1065.642(c), change the text "you calibrated each venturi" **to** "you calibrate each venturi." Change the text " C_d , for each venturi" **to** " C_d (or calibration coefficient, K_v), for each venturi." Change the text "each combination of venturis" **to** "venturis in combination." Change the text "calculate \dot{n} as using" **to** "calculate \dot{n} using." Change the text "all of the venturis" **to** "all the venturis." Delete the text "To calculate the molar flow rate through one venturi or one combination of venturis, use its respective mean C_d and other constants you determined according to § 1065.640 and calculate its molar flow rate \dot{n} during an emission test, as follows:."
- Move the equations associated with paragraph 1065.642(c) to a new subsection 1065.642(c)(1). Add the text "To calculate \dot{n} through one venturi or one combination of venturis, use its respective mean C_d and other constants you determined according to §1065.640 and calculate \dot{n} as follows:" to the beginning of the new subsection. Add the text "Where: C_f = flow coefficient, as determined in §1065.640(c)(3)." Change the text " $p_{in} = 98836 \text{ Pa}$ " **to** " $p_{in} = 98.836 \text{ kPa} = 98836 \text{ Pa} = 98836 \text{ kg}/(\text{m}\cdot\text{s}^2)$."
- Add a new subsection 1065.642(c)(2), containing instructions for using the mean molar flow rate and other constants to calculate the molar flow rate through one venturi or combination of venturis.
- In § 1065.644, change the text "Eq. 1065.644-1" **to** "the following equation." Change the text " $R = 8.314472 \text{ J}/(\text{mol L}\cdot\text{K})$ " **to** " $R = 8.314472 \text{ J}/(\text{mol}\cdot\text{K}) = 8.314472 (\text{m}^2 \cdot \text{kg})/(\text{s}^2 \cdot \text{mol} \cdot \text{K})$." Change the text " $p_2 = 50.600 \text{ kPa} = 50600 \text{ Pa}$ " **to** " $p_2 = 50.600 \text{ kPa} = 50600 \text{ Pa} = 50600 \text{ kg}/(\text{m} \cdot \text{s}^2)$." Change the text " $p_1 = 25.300 \text{ kPa} = 25300 \text{ Pa}$ " **to** " $p_1 = 25.300 \text{ kPa} = 25300 \text{ Pa} = 25300 \text{ kg}/(\text{m} \cdot \text{s}^2)$." Change the text "AM" **to** "a.m.."
- In § 1065.645, add the text "Paragraph (d) of this section provides an equation for determining dewpoint from relative humidity and dry bulb temperature measurements. The equations for the vapor pressure of water as presented in this section are derived from equations in "Saturation Pressure of Water on the New Kelvin Temperature Scale" (Goff, J.A., Transactions American Society of Heating and Air-Conditioning Engineers, Vol. 63, No. 1607, pages 347-354). Note that the equations were originally published to derive vapor pressure in units of atmospheres and have been modified to derive results in units of kPa by converting the last term in each equation."
- Add a new subsection 1065.645(d), containing instructions for dewpoint determination from relative humidity and dry bulb temperature.

- Renumber the currently adopted paragraphs 1065.650(c)(1)(i), 1065.650(c)(1)(ii), 1065.650(c)(1)(iii), 1065.650(c)(1)(iv), and 1065.650(c)(1)(v) **to** 1065.650(c)(1)(ii), 1065.650(c)(1)(iv), 1065.650(c)(1)(v), 1065.650(c)(1)(vi), and 1065.645(c)(1)(vii), respectively. Add a new paragraph 1065.650(c)(1)(i), with the text "Use good engineering judgment to time-align flow and concentration data to match transformation time, t_{50} , to within ± 1 s." Delete the same text from paragraph 1065.650(c)(1)(i) [renumbered to 1065.650(c)(1)(ii) in the Proposed Amendments]. Delete paragraph 1065.650(c)(1)(vi), relating to background correction of NMHC, and paragraph 1065.650(c)(1)(vii), relating to calculation of brake-specific emissions with regard to drift.
- In paragraph 1065.650(c)(1)(i) [renumbered to 1065.650(c)(1)(ii) in the Proposed Amendments], change the text "Correct all THC and CH₄ concentrations, including continuous readings, sample bags readings, and dilution air background readings, for initial contamination, as described in § 1065.660(a)" to "Correct all gaseous emission analyzer concentration readings, including continuous readings, sample bag readings, and dilution air background readings, for drift as described in §1065.672. Note that you must omit this step where brake specific emissions are calculated without the drift correction for performing the drift validation according to §1065.550(b). When applying the initial THC and CH₄ contamination readings according to §1065.520(f), use the same values for both sets of calculations. You may also use as measured values in the initial set of calculations and corrected values in the drift corrected set of calculations as described in §1065.520(f)(7)."
- Add a new paragraph 1065.650(c)(1)(iii), with the text "Correct all THC and CH₄ concentrations, for initial contamination as described in §1065.660(a), including continuous readings, sample bags readings, and dilution air background readings."
- In paragraph 1065.650(c)(1)(iii) [renumbered to 1065.650(c)(1)(v) in the Proposed Amendments], change the text "THC and NMHC" **to** "NMHC and CH₄."
- Add a new paragraph 1065.650(c)(5), relating to comparison of the correct masses of NMHC and THC.
- Add a new paragraph 1065.650(c)(6), relating to NMNEHC calculations for test fuels of specific ethane content.
- In § 1065.650(d), change references to paragraphs "(b)(1) through (7)" and "(b)(8)" **to** "(d)(1) through (7)" and "(d)(8)," respectively. Change "Note, that there must be two consecutive reference zero load idle points to establish a period where this applies." **to** "Note, that there must be two consecutive reference zero load idle points to establish a period where the zero-load exclusion applies." Change "meets these requirements using rectangular integration" **to** "meets the requirements of this paragraph (d) using rectangular integration."

- In paragraph 1065.650(e)(2), change the text "Equation 1065.650-13" **to** "Eq. 1065.650-13."
- In paragraph 1065.650(f)(2), change the text "you may use the default values" **to** "you may use default values." Change the text "as described in § 1065.655" **to** "as described in § 1065.655(e)."
- Add a new paragraph 1065.655(b)(2), with the text "Raw exhaust molar flow rate either from measured intake air molar flow rate or from fuel mass flow rate as described in paragraph (f) of this section."
- In § 1065.655(b), renumber paragraphs 1065.655(b)(2) and 1065.655(b)(3) **to** 1065.655(b)(4) and 1065.645(b)(5), respectively.
- Add a new paragraph 1065.655(b)(3), with the text "Raw exhaust molar flow rate from measured intake air molar flow rate and dilute exhaust molar flow rate, as described in paragraph (g) of this section.".
- In 1065.655(b)(2) [renumbered to 1065.655(b)(4) in the Proposed Amendments], change the text "according to § 1065.659(c)(2)" **to** "according to § 1065.659."
- In 1065.655(b)(3) [renumbered to 1065.655(b)(5) in the Proposed Amendments], change the text "The flow-weighted mean fraction of dilution air in diluted exhaust, $x_{dil/exh}$, when you do not measure dilution air flow to correct for background emissions as described in § 1065.667(c). Note that if you use chemical balances for this purpose, you are assuming that your exhaust is stoichiometric, even if it is not." **to** "The calculated total dilution air flow when you do not measure dilution air flow to correct for background emissions as described in § 1065.667(c) and (d)."
- In 1065.655(c)(3), change the text "for this paragraph (c)" **to** "for performing the chemical balance calculations in this paragraph (c)."
- In 1065.655(c)(3), add the text "and any injected fluids" to the definition of $X_{C_{combdry}}$ as indicated in underline in the following, "amount of carbon from fuel and any injected fluids in the exhaust per mole of dry exhaust."
- In 1065.655(c)(3), change the text "mixture of fuel(s) being combusted, weighted by molar consumption" **to** "fuel (or mixture of test fuels) and any injected fluids" in each of the definitions of α , β , γ , and δ .
- In 1065.655(c)(3), change the format of the list of "symbols and subscripts in the equations for performing the chemical balance calculations in this paragraph (c)" from a list format to a table titled "Table 1 of §1065.655— Symbols and Subscripts for Chemical Balance Equations." Because the list of symbols and subscripts in federal Part 1065.655(c)(3) was extensively reformatted subsequent to CARB's adoption of California's Part 1065, the Proposed Amendments replace the entirety of the list with a table formatted to mirror the current organization of the federal Part 1065.655(c)(3).

- In 1065.655(d), add “of fuel” to the section title, “Carbon mass fraction of fuel,” and delete the text “using one of the following methods:.” Move the currently adopted text of subsection 1065.655(d)(1) to subsection 1065.655(d) and delete the text “You may calculate w_c as described in this paragraph (d)(1) based on measured fuel properties. To do so, you must determine values for α and β in all cases, but you may set γ and δ to zero if the default value listed in Table 1 of this section is zero.” Change the text “mixture of fuel(s) being combusted, weighted by molar consumption” **to** “fuel (or mixture of test fuels) and any injected fluids” in each of the definitions of α , β , γ , and δ . Other changes to this subsection are described in the Global Amendments subsection, “Changes to References of Equipment Types, Engine Types, and Fuel,” provided earlier in this section G.
- Delete paragraph 1065.655(d)(2), with the text “You may use the default values in the following table to determine w_c for a given fuel:”.
- Change the lettering of subsection 1065.655(e) to 1065.655(f). Add a new subsection 1065.655(e), with California-specific changes to otherwise harmonized text as described in the purpose and rationale specific to § 1065.655(e) later in this section G.
- Move Table 1 of 1065.655 to a new paragraph 1065.655(e)(5), with the text “Table 2 follows:.” In the table title, change “Table 1” to “Table 2.” Delete the text “, for Various Fuels” from the table title. Add table rows for “E10 Gasoline,” “E15 Gasoline,” and “E85 Gasoline.” Change Table 1 entries for “Ethanol” and “Methanol” **to** “E100 Ethanol” and “M100 Methanol,” respectively, and move the entries to a higher position in the table so that they are in alpha-numeric order. Other changes are described in the Global Amendments subsection earlier in this section G, “Changes to References of Equipment Types, Engine Types, and Fuel.”
- In paragraph 1065.655(e) [re-lettered to 1065.655(f) in Proposed Amendments], add the text “For laboratory tests, calculating raw exhaust molar flow rate using measured fuel mass flow rate is valid only for steady-state testing. See § 1065.915(d)(5)(iv) for application to field testing.”
- In paragraph 1065.655(f)(2), change the text “Based on \dot{n}_{int} , calculate \dot{n}_{exh} as follows” **to** “Calculate \dot{n}_{exh} based on \dot{n}_{int} as follows.” Change the equation number from 1065.655-20 to 1065.655-24.
- In paragraph 1065.655(f)(3), change the text “Fuel mass flow” **to** “Fluid mass flow.” Add the text “This calculation may be used only for steady-state laboratory testing. You may not use this calculation if the standard-setting part requires carbon balance error verification as described in §1065.543. See §1065.915(d)(5)(iv) for application to field testing.” Renumber Equation 1065.655-21 **to** Equation 1065.655-25. Delete the text “ \dot{m}_{fuel} = fuel flow rate including humidity in intake air.” Add the following definitions:

j = an indexing variable that represents one fuel or injected fluid, starting with $j = 1$.

N = total number of fuels and injected fluids over the duty cycle.

\dot{m}_j = the mass flow rate of the fuel or any injected fluid j .

W_{Cj} = carbon mass fraction of the fuel and any injected fluid j .

Add the lines " $N = 1$ " and " $J = 1$ " to the beginning of the example. Change the text " \dot{m}_{fuel} " to " \dot{m}_1 " in the example.

- Add a new subsection 1065.655(g), containing instructions for calculation of raw exhaust molar flow.
- In paragraph 1065.659(a), change the text "If you remove water upstream of a concentration measurement, x , or upstream of a flow measurement, n , correct for the removed water. Perform this correction based on the amount of water at the concentration measurement, $x_{\text{H}_2\text{O}[\text{emission}]\text{meas}}$, and at the flow meter, $x_{\text{H}_2\text{Oexh}}$, whose flow is used to determine the concentration's total mass over a test interval" to "If you remove water upstream of a concentration measurement, x , correct for the removed water. Perform this correction based on the amount of water at the concentration measurement, $x_{\text{H}_2\text{O}[\text{emission}]\text{meas}}$, and at the flow meter, $x_{\text{H}_2\text{Oexh}}$, whose flow is used to determine the mass emission rate or total mass over a test interval." Add additional instructions for continuous analyzers downstream of a sample dryer for transient and ramped-modal cycles, and for batch analyzers.
- Delete subsection 1065.659(b) and its subsidiary paragraphs, containing instructions for removed water calculations for certain types of analyzers. Add a new paragraph 1065.659(b), containing instructions relating to concentrations upstream and downstream of a sample dryer.
- In paragraph 1065.659(c), change the text "For a corresponding concentration or flow measurement where you did not remove water, you may determine the amount of initial water by any of the following" to "For a concentration measurement where you did not remove water, you may set $x_{\text{H}_2\text{O}[\text{emission}]\text{meas}}$ equal to $x_{\text{H}_2\text{Oexh}}$. You may determine the amount of initial water at the flow meter, $x_{\text{H}_2\text{Oexh}}$, using any of the following methods."
- In paragraph 1065.659(c)(1), change the text "Use any of the techniques described in paragraph (b) of this section" to "Measure the dewpoint and absolute pressure and calculate the amount of water as described in §1065.645."
- Delete subsections 1065.660(a) containing instructions for THC determination and initial THC/CH₄ contamination corrections, 1065.660(b) containing instructions for NMHC determination, and 1065.660(c) containing instructions for CH₄ determination. Add new subsections 1065.660(a), containing amended instructions for THC determination and initial THC/CH₄ contamination corrections, 1065.660(b) containing amended instructions for NMHC

determination, 1065.660(c) containing instructions for NMNEHC determination, 1065.660(d) containing amended instructions for CH₄ determination, and 1065.660(e) containing instructions for C₂H₆ determination.

- In § 1065.665(a), change the text “NOTHC” **to** “non-oxygenated total hydrocarbon (NOTHC).” Change the text “THCE” **to** “total hydrocarbon equivalent (THCE).” Change the text “only required” **to** “required only.” Change the text “OHC” **to** “oxygenated hydrocarbon (OHC).” Change the text “ x_{OHCi} ” in Eq. 1065.655-2 **to** “($x_{\text{OHCi}} - x_{\text{OHCi-init}}$).” Delete the text “C_# = the mean number of carbon atoms in the particular compound.”
- In § 1065.665(b), change the text “NMHCE” **to** “nonmethane hydrocarbon equivalent (NMHCE).”
- In § 1065.665(c), change the text “HCHO” **to** “CH₂O.”
- In paragraph 1065.667(a), change the text “This may be a measured quantity or a quantity calculated from the diluted exhaust flow and the flow-weighted mean fraction of dilution air in diluted exhaust, $x_{\text{dil/exh}}$. Multiply the total flow of dilution air by the mean concentration of a background emission” **to** “This may be a measured quantity or a calculated quantity. Multiply the total flow of dilution air by the mean mole fraction (i.e., concentration) of a background emission.” Add the text “Finally, multiply by the molar mass, M, of the associated gaseous emission constituent.” Change the text “The product of n_{dil} and the mean concentration of a background emission is the total amount of a background emission. If this is a molar quantity, convert it to a mass by multiplying it by its molar mass, M. The result is the mass of the background emission, m” **to** “The product of n_{dil} and the mean molar concentration of a background emission and its molar mass, M, is the total background emission mass, m.” Change the text “total background masses” **to** “total background mass.”
- In paragraph 1065.667(b), delete the text “In this case, calculate the total mass of background as described in § 1065.650(c), using the dilution air flow, n_{dil} . Subtract the background mass from the total mass. Use the result in brake-specific emission calculations.”
- In paragraph 1065.667(c), add the text indicated in underline, “You may determine the total flow of dilution air by subtracting the calculated raw exhaust molar flow as described in §1065.655(g) from the measured dilute exhaust flow. This may be done by totaling continuous calculations or by using batch results.” Move the remainder of the text in paragraph 1065.667(c) to a new paragraph 1065.667(d).
- Make the following changes to the newly lettered paragraph 1065.667(d):
 - Change the text “from the total flow of diluted exhaust and a chemical balance of the fuel, intake air, and exhaust as described in § 1065.655.” **to** “(d) You may determine the total flow of dilution air from the

measured dilute exhaust flow and a chemical balance of the fuel, any injected fluids, intake air, and dilute exhaust as described in §1065.655."

- Change the text "In this case, calculate the total mass of background as described in § 1065.650(c), using the total flow of diluted exhaust, n_{dexh} , then multiply this result by the flow-weighted mean fraction of dilution air in diluted gas to dilute exhaust, $x_{dil/exh}$, from the dilute chemical balance" **to** "For this option, the molar flow of dilution air is calculated by multiplying the dilute exhaust flow by the mole fraction of dilution gas to dilute exhaust, $x_{dil/exh}$, from the dilute chemical balance."
- Add the text "This may be done by totaling continuous calculations or by using batch results. For example, to use batch results, the total flow of dilution air is calculated by multiplying the total flow of diluted exhaust, n_{dexh} , by the flow-weighted mean mole fraction of dilution air in diluted exhaust, $\bar{x}_{dil/exh}$."
- Change the text "You may assume that your engine operates stoichiometrically" **to** "The chemical balance in §1065.655 assumes that your engine operates stoichiometrically."
- Change the text "corrects excess air" **to** "treats excess air."
- Change the text "If this error might affect your ability to show that your engines comply with applicable standards, we recommend that you remove background emissions" **to** "If this error might affect your ability to show that your engines comply with applicable standards in this chapter, we recommend that you either determine the total flow of dilution air using one of the more accurate methods in paragraph (b) or (c) of this section, or remove background emissions."
- Other changes are as described in the Global Amendments subsection, "Changes to References of Equipment Types, Engine Types, and Fuel," earlier in this section G and in the purpose and rationale specific to "§ 1065.667(d) [newly lettered paragraph]" provided later in this section G.
- Change the lettering of paragraphs 1065.667(d) and 1067.667(e) **to** 1065.667(e) and 1065.667(f), respectively.
- In subsection 1065.670, change the text "first apply any NO_x corrections for background emissions and water removal from the exhaust sample, then correct NO_x concentrations for intake-air humidity" **to** "correct NO_x concentrations for intake-air humidity as described in this section. See §1065.650(c)(1) for the proper sequence for applying the NO_x intake-air humidity and temperature corrections."
- In subsection 1065.675(d), change several values of initial parameters, intermediate values in the calculation, and the example answers ar.

- Add a new section 1065.680, providing instructions for how to calculate and apply emission adjustment factors for engines using aftertreatment technology with infrequent regeneration events that may occur during testing.
- In paragraph 1065.690(c), change the text “in the buoyancy correction equation” **to** “when determining the air density of the balance environment.”
- Add a new paragraph 1065.695(c)(6)(x), with the text “Number and type of preconditioning cycles.”
- Add a new paragraph 1065.695(c)(8)(v), with the text “Carbon balance error verification, if performed.”

Harmonization Updates: Subpart H – Engine Fluids, Test Fuels, Analytical Gases, and Other Calibration Standards

The Proposed Amendments include the following recent federal Part 1065 amendments to Subpart H:

- Change the labelling of paragraph 1065.701(d) **to** paragraph 1065.701(d)(2). Add a new subsection 1065.701(d) with the text “Fuel specifications. Specifications in this section apply as follows:.” Add a new paragraph 1065.701(d)(1) describing measurement, calculation, and reporting of values for fuel specification purposes. Change the references in the second and third sentences of the newly numbered paragraph 1065.701(d)(2) from 40 CFR part 80 and 80.46 to 40 CFR part 1090 and 1090.1360, respectively.
- In Table 1 of 1065.750, change the footnote labels from 1 and 2 **to** a and b, respectively. Delete the footnote 1 reference mark from the column headings “Purified synthetic air” and “Purified N₂” and add a footnote a reference mark to the table title. In footnote b, change the text “requires you to report N₂O” **to** “requires you to report N₂O or certify to an N₂O standard.”
- In paragraph 1065.750(a)(2)(i), add the text “For GC-FIDs that measure methane (CH₄) using a FID fuel that is balance N₂, perform the CH₄ measurement as described in SAE J1151 (incorporated by reference in §1065.1010).”
- In paragraph 1065.750(a)(2)(iii), change the text “flame-ionization” to “flame ionization.”
- Add a new paragraph 1065.750(a)(3)(xii), with the text “CH₄, C₂H₆, balance purified air and/or N₂ (as applicable).”
- Add a new paragraph 1065.750(a)(3)(xiii), with the text “CH₄, CH₂O, CH₂O₂, C₂H₂, C₂H₄, C₂H₄O, C₂H₆, C₃H₈, C₃H₆, CH₄O, and C₄H₁₀. You may omit individual gas constituents from this gas mixture. If your gas mixture contains oxygenated hydrocarbon, your gas mixture must be in balance purified N₂, otherwise you may use balance purified air.”

Harmonization Updates: Subpart I – Testing with Oxygenated Fuels

The Proposed Amendments include the following recent federal Part 1065 amendments to Subpart I:

- In paragraph 1065.805(d), add the text “as described in §1065.269.”
- In subsection 1065.845, change the text “alcohol/carbonyl response factor (such as RF_{MeOH})” **to** “alcohol/carbonyl response factor ($RF_{OHCi[THC-FID]}$).” Change the text “You are not required to determine the response factor for a compound unless you will subtract its response to compensate for a response. Formaldehyde response is assumed to be zero and does not need to be determined. Use the most recent alcohol/carbonyl response factors to compensate for alcohol/carbonyl response.” **to** “Use the most recently determined alcohol/carbonyl response factors to compensate for alcohol/carbonyl response. You are not required to determine the response factor for a compound unless you will subtract its response to compensate for a response.”
- Change the lettering of subsections 1065.845(a) and 1065.845(b) **to** 1065.845(b) and 1065.845(c), respectively. Add a new paragraph 1065.845(a) with the text, “(a) You may generate response factors as described in paragraph (b) of this section, or you may use the following default response factors, consistent with good engineering judgment:,” and a corresponding table, Table 1 of 1065.845 “Default Values for THC FID Response Factor Relative to Propane on a C1-Equivalent Basis.”
- In paragraph 1065.845(a)(10) [re-lettered to 1065.845(b)(10) in the Proposed Amendments], change the text “calibration gas” **to** “calibration gas on a C₁-equivalent basis” and change the text “ RF_{MeOH} ” **to** “ RF_{MeOH} on a C₁-equivalent basis.”

Harmonization Updates: Subpart J – Field Testing and Portable Emission Measurement Systems

The Proposed Amendments include the following recent federal Part 1065 amendments to Subpart J:

- In Table 1 of § 1065.905 following § 1065.905(e), add the text “of this part” after the text “Use § 1065.101 and § 1065.140 through the end of subpart B” in the “Applicability for field testing” column for the “B. Equipment for testing” row.
- In paragraph 1065.910(a)(2), change the text “Use rigid 300 series stainless steel tubing” **to** “We recommend using rigid 300 series stainless steel tubing.”
- In paragraph 1065.920(a), add the text “or if it measures PM using any method other than that described in §1065.170(c)(1).”
- Delete the current text of paragraph 1065.920(b), and add text for amended instructions for recordkeeping for PEMS verification.

- In paragraph 1065.920(b)(7), change the text as indicated by underline and strikeout text: "(7) The PEMS passes ~~this verification~~ the verification of this paragraph (b) if any one of the following are true for each constituent:."
- In paragraph 1065.925(h)(3), delete the text "When spanning the FIDs, use the FIDs' burner air that would be used in-use (for example, use ambient air or a portable source of burner air)."

Harmonization Updates: Subpart K – Definitions and Other Reference Information

The Proposed Amendments include the following recent federal Part 1065 amendments to Subpart K:

- In the definition for "C₁ equivalent (or basis)" in § 1065.1001, add the text "Molar mass may also be expressed on a C1 basis. Note that calculating HC masses from molar concentrations and molar masses is only valid where they are each expressed on the same carbon basis."
- In § 1065.1001, add the following new definition entries:
 - "Enhanced-idle means a mode of engine idle operation where idle speed is elevated above warm idle speed as determined by the electronic control module, for example during engine warm-up or to increase exhaust temperature."
 - "High-idle speed means the engine speed at which an engine governor function controls engine speed with operator demand at maximum and with zero load applied. "Warm high-idle speed" is the high-idle speed of a warmed-up engine."
 - "High-speed governor means any device, system, or element of design that modulates the engine output torque for the purpose of limiting the maximum engine speed."
 - "Purified air means air meeting the specifications for purified air in §1065.750. Purified air may be produced by purifying ambient air. The purification may occur at the test site or at another location (such as at a gas supplier's facility). Alternatively, purified air may be synthetically generated from purified oxygen and nitrogen. The addition of other elements normally present in purified ambient air (such as Ar) is not required."
- In the definition for "Idle speed" in § 1065.1001, change the text "Idle speed means the lowest engine speed with minimum load (greater than or equal to zero load), where an engine governor function controls engine speed. For engines without a governor function that controls idle speed, idle speed means the manufacturer-declared value for lowest engine speed possible with minimum load. Note that warm idle speed is the idle speed of a warmed-up engine." to "Idle speed means the engine speed at which an engine governor

function controls engine speed with operator demand at minimum and with minimum load applied (greater than or equal to zero). For engines without a governor function that controls idle speed, idle speed means the manufacturer-declared value for lowest engine speed possible with minimum load. This definition does not apply for operation designated as "high-idle speed." "Warm idle speed" is the idle speed of a warmed-up engine."

- In § 1065.1001, delete the text of the definition for "Nonmethane hydrocarbon equivalent (NMHCE)." Add a new definition as follows: "Nonmethane nonethane hydrocarbon (NMNEHC) means the sum of all hydrocarbon species except methane and ethane. Refer to §1065.660 for NMNEHC determination."
- In the definition for "Oxygenated fuels" in § 1065.1001, change the text "fuels composed of oxygen-containing compounds" **to** "fuels composed of at least 25% oxygen-containing compounds."
- In § 1065.1001, delete the definition for "Percent (%)" and add a new definition with the following text: "Percent (%) means a representation of exactly 0.01. Numbers expressed as percentages in this part (such as a tolerance of $\pm 2\%$) have infinite precision, so 2% and 2.000000000% have the same meaning. This means that where we specify some percentage of a total value, the calculated value has the same number of significant digits as the total value. For example, 2% of a span value where the span value is 101.3302 is 2.026604."
- In the definition for "Precision" in § 1065.1001, add the text "See also the related definitions of noise and repeatability in this section."
- In the definition for "Round" in § 1065.1001, change the text "to round numbers according to NIST SP 811 (incorporated by reference in § 1065.1010)" **to** "to apply the rounding convention specified in §1065.20(e)."
- In the definition for "Test interval," add "in this chapter" to the end of the last sentence.
- In the initial unnumbered paragraph in § 1065.1005, delete the text "1995 Edition, "Guide for the Use of the International System, of Units (SI),"."
- Include the following recent federal Part 1065 amendments to the table in § 1065.1005(a):
 - Change the column heading "Base SI Units" **to** "Units in terms of SI base units."
 - Delete the entry for "%."
 - Change the text "atomic hydrogen-carbon ratio" **to** "atomic hydrogen-to-carbon ratio."
 - Add an entry for a_g .
 - Add entries for " C_d ," " C_f ," and " δ ."
 - In the entry for "e," change the text " 3.6^{-1} " **to** "3.6."

- In the entry for " f_n ," change the text "rotational frequency" **to** "angular speed" and change the text " $2\pi \cdot 60^{-1}$ " **to** " $\pi \cdot 30^{-1}$."
- Add an entry for K_v .
- Change the symbol for "RH%" **to** "RH."
- Add an entry for " ϑ ."
- Add the unit of seconds (s) to the "Base SI Units" column ["Units in terms of SI base units" in the Proposed Amendments] for the t and Δt variables.
- Add the unit of " m^3 " to the "Base SI Units" column ["Units in terms of SI base units" in the Proposed Amendments] for the " V " (volume cubic meter) variable.
- In the entry for " W ," change the text " 3.6 " **to** " 3.6^{-1} ."
- Add an entry for compressibility factor (Z).
- Include the following recent federal Part 1065 amendments to the table in 1065.1005(b):
 - Add entries for formaldehyde, formic acid, methanol, acetaldehyde, ethanol, propanol, sulfuric acid, hydrocarbon, nonmethane-nonethane hydrocarbon, nonmethane organic gases, non-oxygenated nonmethane hydrocarbon, semi-volatile organic compound, and total hydrocarbon equivalent.
 - Delete the entry for sulfur dioxide.
 - In § 1065.1005(c), change the text "to define a quantity" **to** "for units and unit symbols."
- In §§ 1065.1005(d) and 1065.1005(e), change the text "to define a quantity" **to** "for modifying unit symbols."
- Include the following recent federal Part 1065 amendments to the table in § 1065.1005(e):
 - Add the following subscripts: background (bkgnd), combined (comb), composite value (composite), dewpoint (dew), dry condition (dry), duty cycle (duty cycle), feedback speed (fn), friction (frict), fuel consumption (fuel), condition at high-idle (hi,idle), intake air (int), conditions over which an engine can operate (mapped), PM sample media (media), mixture of diluted exhaust and air (mix), normalized (norm), power (P), after the test interval (post), before the test interval (pre), stoichiometric product (prod), record rate (record), engine strokes per power stroke (stroke), torque (T), alternate test quantity (test,alt), vacuum side of the sampling system (vac), and calibration weight (weight).
 - Delete the entry for "slip."

- Include the following recent federal Part 1065 amendments to the table in 1065.1005(f)(2):
 - Add entries for the molar mass of the following quantities: methanol, ethanol, acetaldehyde, urea, propanol, methane, formaldehyde, ammonia, and effective molar mass of nonmethane-nonethane hydrocarbon.
 - Move the entry for the molar mass of propane to be adjacent to the entry for molar mass of propanol.
 - In footnote (b), change the text “THC, THCE, NMHC, and NMHCE are defined by an atomic hydrogen-to-carbon ratio” **to** “THC, THCE, NMHC, NMHCE, and NMNEHC are defined on a C1 basis and are based on an atomic hydrogen-to-carbon ratio” and add the text “(with β , γ , and δ equal to zero).”
 - Add a Footnote (b) reference mark to the new entry for nonmethane-nonethane hydrocarbon.
- Add the following acronyms and abbreviations to the table in 1065.1005(g): acrylonitrile butadiene styrene (ABS), for example (e.g.), Fourier transform infrared (FTIR), gas chromatograph with a flame ionization detector (GC-FID), high efficiency particulate air (HEPA), incorporated by reference (IBR), in other words (i.e.), magnetopneumatic detection (MPD), porous layer open tubular (PLOT), paramagnetic detection (PMD), rechargeable energy storage system (RESS), response factor penetration fraction (RFPF), surface acoustic wave (SAW), standard estimate of error (SEE), total hydrocarbon flame ionization detector (THC FID), and inverse student t test function in Microsoft Excel (TINV). In the entry for “FID,” change the text “flame-ionization” to “flame ionization.”
- In § 1065.1010, change the ASTM D2986 reference description from “ASTM D2986-95a (Reapproved 1999), Standard Practice for Evaluation of Air Assay Media by the Monodisperse DOP (Diethyl Phthalate) Smoke Test” **to** “ASTM D2986 – 95a, Standard Practice for Evaluation of Air Assay Media by the Monodisperse DOP (Diethyl Phthalate) Smoke Test, approved September 10, 1995.”
- In § 1065.1010, change the reference edition for NIST Special Publication 811 from “1995 Edition” to “2008 Edition.”

The Proposed Amendments above reflect changes made to the corresponding provisions in the federal Part 1065, up to and including U.S. EPA’s final regulatory amendments, “Improvements for Heavy-Duty Engine and Vehicle Test Procedures, and Other Technical Amendments,” published in the Federal Register on June 29, 2021. The purpose of these changes is to harmonize California’s Part 1065 with subsequent amendments to the federal Part 1065, except as necessary to uphold

the stringency of California emission standards, maintain consistency with existing California SORE regulation, or prevent confusion.

Rationale. These changes, additions, and deletions are identical to the changes, additions, and deletions in the equivalent sections, subsections, and paragraphs of the federal Part 1065 due to amendments adopted at the federal level subsequent to June 2011. The Proposed Amendments to this section are necessary to establish consistency with similar provisions in the federal regulations for small nonroad engines.

Changes to References of Equipment Types, Engine Types, and Fuel

Purpose. The Proposed Amendments include the following changes to clarify that California's Part 1065 does not apply to locomotives, licensed on-road light-duty motor vehicles, or marine vessels that are not SORE equipment:

- Change "vehicles, equipment, and vessels" to "engines and equipment," "an engine assembly or piece of equipment," "piece of equipment," or "equipment," depending on the context of the sentence, in the following sections: 1065.1(c)(1), 1065.10(c)(1), 1065.15(f)(1)(ii), 1065.110(a)(1)(iv), 1065.910(d)(1), and 1065.910(d)(2).
- Delete "vehicles" from the following sections: 1065.101(e), 1065.110(f), 1065.130(b)(1), 1065.145(b), and 1065.695(c)(7)(x).
- Change "vehicles" to "equipment" or "piece of equipment," depending on the context of the sentence, in the following sections: Table 1 of 1065.303, 1065.345(a), 1065.405(f), 1065.695(c)(12)(xiv), 1065.905(c)(3), 1065.910, and 1065.910(a)(2).
- Add "or equipment" to "vehicle," in the context of PEMs testing, in § 1065.910(c).
- Delete examples involving motor vehicles and/or special provisions relating to light duty motor vehicles or vehicles equipped with automatic transmissions from the following section: 1065.510(f)(4)(i), 1065.512(b)(2), and 1065.595(e).
- Delete § 1065.610(d)(3), which describes special provisions for engines intended for propulsion of vehicles with automatic transmissions.
- Omit a reference to 40 CFR 1066.635 from § 1065.260(e), which describes methods specific to light-duty vehicle engine testing.
- Change the example "locomotive notch setting" to "throttle setting" in 1065.140(d)(2)(iv).
- Delete other examples relating to vessels or locomotives from the following sections: 1065.110(a)(1)(iv), 1065.145(b), 1065.210(a), and the definition for "mode" in 1065.1001.
- Omit other examples relating to vessels or locomotives in the corresponding amended federal text in § 1065.530.

The Proposed Amendments include the following changes to clarify that California's Part 1065 applies to spark-ignition engines and to prevent confusion resulting from including text in the SORE regulations about compression-ignition engines produced during the 2000 and later model years, which are not SORE.

- Delete text for special provisions or requirements for testing for "compression-ignition engines" from the following sections: 1065.145(c)(2)(ii), 1065.145(d)(1)(ii), 1065.145(e)(2)(ii), 1065.145(e)(3)(ii), 1065.230(d)(2), 1065.240(d)(2), and 1065.260(c).
- Delete text related to "compression-ignition engines" from the following sections: 1065.362, 1065.595(e), 1065.655(c)(1), 1065.667(d) [re-lettered], 1065.670(a), and 1065.920(b)(2)(iii). Delete subsection 1065.602(l)(1), relating to NO_x flow estimates for compression-ignition engines, and subsection 1065.670(a), relating to intake air humidity correction for compression-ignition engines, and add "[Reserved]" placeholder text.
- Delete the definition for "compression-ignition engine" in § 1065.1001 and delete the abbreviation for compression-ignition from § 1065.1005(g).
- Delete the entries for "diesel fuel" and "residual fuel blends" from Table 1 of § 1065.655.
- Omit other examples relating to compression-ignition engines in the amended federal text from § 1065.518.

The Proposed Amendments include the following changes to clarify that California's Part 1065 applies to spark-ignition engines and to prevent confusion resulting from the inclusion of text about diesel engines and control of diesel-engine emissions, given SORE regulations do not apply to compression-ignition engines produced during the 2000 and later model years.

- Omit provisions relating to "diesel exhaust fluid" or "DEF" without replacement, except with "[Reserved]," in the following sections of amended federal text that is being included in Proposed Amendments to harmonize the California Part 1065 with the federal Part 1065: Table 1 of 1065.205, Table 1 of 1065.303, 1065.307(d)(4), 1065.307(e)(iv), 1065.307(e)(vi), Table 1 of 1065.307, 1065.655(a), 1065.655(d), and 1065.667.
- Provisions in the amended federal text relating to "diesel exhaust fluid" or "DEF" in certain calculations are replaced with "any other fluids injected into the exhaust," "any other injected fluids," "any injected fluids," or "any fluid injected" in the following sections, subsections, or paragraphs: 1065.307(d)(9), 1065.543, 1065.643, 1065.655(c), 1065.655(d), 1065.655(e), Table 1 of 1065.655, and 1065.667(d).

Rationale. The federal Part 1065 describes general engine testing procedures and requirements as established by U.S. EPA. It includes text representative of the range

of engines it covers. The Part 1065 adopted into the California Code of Regulations in 2012, with California-specific changes, applies to SORE. While some types of SORE equipment, such as go-karts and utility carts, could reasonably be described as vehicles, they are regulated in California using equipment-based and engine-based standards. In the context of PEMS testing, the word “vehicle” may refer to either a piece of equipment or to a vehicle used to transport or follow the equipment. Otherwise, it is necessary to delete or modify text with the word “vehicle” to prevent confusion. Similarly, it is necessary to delete text related to “Diesel Exhaust Fluid” to prevent confusion. Diesel Exhaust Fluid, or DEF, refers to a fluid injected into the exhaust from diesel engines to help reduce NO_x emissions. The use of the diesel exhaust fluid or DEF, and the inclusion of special provisions related to DEF, in text adopted to otherwise harmonize with federal amendments could be confusing because SORE regulations do not apply to diesel engines produced during the 2000 and later model years.

Amending or Removing the Phrase “Selective Enforcement Audit”

Purpose. The federal regulatory term, “selective enforcement audit,” is incorporated in three sections in the Part 1065 regulations that CARB adopted into the California Code of Regulations. However, this term is not used in other California SORE regulations. To prevent confusion for manufacturers and improve regulatory certainty, the Proposed Amendments delete the federal regulatory term, “selective enforcement audit,” throughout the current regulations. The Proposed Amendments also include replacement text, “compliance testing,” if needed to preserve the meaning or requirements of the affected provisions. The Proposed Amendments include the following changes, as indicated by underline and strikeout:

- In § 1065.2(a), regarding manufacturer responsibilities for submitting information under Part 1065: “You are responsible for statements and information in your applications for certification, requests for approved procedures, ~~selective enforcement audits~~ compliance testing, laboratory audits, production-line test reports, field test reports, or any other statements you make to us related to this part 1065.”
- In § 1065.170(c)(1)(iii), regarding batch sampling for gaseous and PM constituents and PM sample media: “Note that we will use pure PTFE filter material for compliance testing, and we may require you to use pure PTFE filter material for any compliance testing we require, ~~such as for selective enforcement audits.~~”
- In § 1065.695(a), regarding data requirements: “We may require different information for different purposes, such as for certification applications, approval requests for alternate procedures, ~~selective enforcement audits~~ compliance testing, laboratory audits, production line test reports, and field test reports.

Rationale. These changes are necessary to improve consistency and prevent confusion for the reader by correcting an oversight that occurred at the time the federal regulations were incorporated into the California Code of Regulations in 2012. Federal regulations use the term “selective enforcement audit” to refer to provisions substantially similar to the provisions that California SORE regulations describe as “compliance testing” for in-use testing and validation of engines in § 2407, “New Engine Compliance and Production Line Testing – New Small Off-Road Engine Selection, Evaluation, and Enforcement Action.” The term “selective enforcement audit” is not used in other California SORE regulations. The proposed changes would not result in cost impacts to manufacturers because manufacturers already must follow applicable CCR § 2407 requirements.

Preface

Purpose. The current regulations include the following preface text before and after the table of contents:

Before the table of contents:

“Note: This appendix shows the entirety of regulatory amendments to the test procedures titled below, which were approved by the Air Resources Board on December 16, 2011, and refined via subsequent conforming modifications authorized under Resolution 11-41. Incorporated by reference into these test procedures are portions of Title 40 of the Code of Federal Regulations (CFR) Part 1065 – Engine-Testing Procedures, Subparts A through K inclusive, as amended June 28, 2011; and, the internally referenced sections of Title 40 CFR, Parts 60, 80, 86, 90, 1054, and 1068. Sections that have been included in their entirety are set forth with the section number and title. California provisions that replace specific federal language provisions are denoted by the words “DELETE” for the federal language and “REPLACE WITH” or “ADD” for the California language. The notation [* * * *] or [...] means that the remainder of the CFR text for a specific section is not shown in these procedures but has been incorporated by reference, with only the printed text changed. CFR sections that are not listed are not part of California’s test procedures. If there is any conflict between the provisions of this document and the California Health and Safety Code, Division 26, or Title 13 of the California Code of Regulations (CCR), the Health and Safety Code and Title 13 apply.

This document is all newly adopted text.”

After the table of contents:

“The following provisions of Part 1065, Title 40, Code of Federal Regulations, as promulgated by the United States Environmental Protection Agency on the date listed, are adopted and incorporated herein by this reference for 2013 model year and later small off-road engines as the California Exhaust Emission

Standards and Test Procedures for New 2013 and Later Small Off-Road Engines, except as altered or replaced by the provisions set forth below.”

“SOURCE: 76 FR 37977, June 28, 2011, unless otherwise noted.”

The Proposed Amendments delete this preface text and add the following updated text before the table of contents:

“Note: This document provides the entirety of the California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1065), as adopted by the California Air Resources Board (CARB) on December 16, 2011, with additional conforming modifications authorized under Resolution 11-41 on October 25, 2012, and amended on [insert amendment date]. These standards and test procedures are incorporated by reference in Title 13, California Code of Regulations, § 2403. The Part 1065 section numbers, titles, and text correspond to same-numbered sections in Title 40 of the Code of Federal Regulations (CFR) Part 1065 – Engine-Testing Procedures, with California-specific modifications as necessary to maintain the stringency of California emission standards and provide consistency with other California regulations. CFR sections that are not listed herein are not a part of this Part 1065. The 2011/2012 CARB rulemaking incorporated by reference portions of Title 40 CFR Part 1065, including Subparts A through K, as amended June 28, 2011; for clarity, the 2021 CARB rulemaking included the entirety of the language from those portions of Title 40 CFR Part 1065, including Subparts A through K, incorporated by reference in Part 1065 from the 2011/2012 rulemaking into Part 1065. The 2011/2012 CARB rulemaking also incorporated by reference the internally referenced sections in Part 1065 to Title 40 CFR Parts 2, 51, 80, 86, 1054, and 1068, as amended May 26, 2011, March 30, 2011, December 21, 2010, April 8, 2011, November 8, 2010, and April 30, 2010, respectively. The 2021 CARB rulemaking included those portions of Title 40 CFR Part 1065 Subparts A through K, as amended between June 28, 2011, and June 29, 2021, in Part 1065. The 2021 CARB rulemaking incorporated by reference the internally referenced sections in Part 1065 to Title 40 CFR Part 86 as amended June 29, 2021, and Title 40 CFR Part 1090 as adopted December 4, 2020. The 2021 CARB rulemaking removed the references to 40 CFR Parts 2, 51, 80, 1054, 1065, and 1068, and those CFR Parts are no longer incorporated by reference in this Part 1065. If there is any conflict between the provisions of this document and the California Health and Safety Code, Division 26, or Title 13 of the California Code of Regulations, the Health and Safety Code and Title 13 apply.”

The Proposed Amendments include a placeholder for the amended date, “[insert amended date],” that will be updated to reflect the CARB adoption date of the Proposed Amendments to Part 1065.

Rationale. An updated preface is necessary for accuracy and clarity because, once the Proposed Amendments are approved, California Part 1065 will no longer be comprised of “all newly adopted text.” Instead, California Part 1065 will include text adopted by the 2011/2012 rulemaking as amended by the current rulemaking. The Proposed Amendments also provide an updated date of publication for the federal Part 1065 that is the source material for the Proposed Amendments, and updates the list of other 40 CFR parts internally referenced by the amendments and their associated publication dates. Two CFR parts, CFR Parts 60 and 90, were listed in the 2011/2012 preface but were not cited later in California Part 1065, and therefore need not be incorporated by reference. The updated publication dates are necessary to maintain CARB’s ability to independently implement or enforce its regulations should U.S. EPA make a change that does not support the stringency of California emission standards or is otherwise not consistent with other California SORE regulations. Also, Title 1, California Code of Regulations, § 20(c)(3), generally prohibits the incorporation by reference of material into California regulations without a date of publication or issuance. The 2011/2012 preface text that explains why some federal Part 1065 text is not shown is now not necessary because, for clarity, the document now includes the entirety of the language from those portions of Title 40 CFR Part 1065 incorporated by reference in Part 1065 by the 2011/2012 rulemaking into Part 1065.

Subpart A – Applicability and General Provisions

§ 1065.1(d)

Purpose. The current regulations in § 1065.1 specify the applicability and provisions of Part 1065. The current regulations in § 1065.1(a) specifies the following:

“This part applies to 2013 and later model year small off road engines regulated under Title 13, California Code of Regulations, Chapter 9, Article 1, and subject to the emission standards in § 2403(b)(1) of that Article. These provisions do not apply to engines and equipment that fall within the scope of the preemption of Section 209(e)(1)(A) of the federal Clean Air Act, as amended, and as defined by regulation of the Environmental Protection Agency.

Section 1065.1(d) specifies: “Paragraph (a) of this section identifies the parts of the CFR that define emission standards and other requirements for particular types of engines.” The Proposed Amendments change the text “CFR” to “California Code of Regulations”

Rationale. This change is necessary to provide clarity and improve consistency by correcting an oversight that occurred at the time the federal Part 1065 regulations

were incorporated into the California Code of Regulations. In 2012, CARB modified the SORE regulations to adopt portions of the federal Part 1054 and Part 1065, to improve alignment of the certification and testing requirements without any changes in the stringency of the emission standards and associated test procedures, and without any cost impacts. Changing "CFR" to "California Code of Regulations" in § 1065(d) is necessary to provide consistency with the incorporation of federal regulations into California's SORE regulations and does not change any of the standards and test procedures. Section 1065.1(a) currently specifies that this part exists and applies under CARB regulations rather than federal regulations.

§ 1065.1(g)

Purpose. The Proposed Amendments change the address for the CARB website that provides additional information regarding the test procedures from "http://www.arb.ca.gov/msprog/offroad/sore/sore.htm" to "https://ww2.arb.ca.gov/our-work/programs/small-off-road-engines-sore."

Rationale. This change is necessary because CARB recently implemented a redesigned web platform that changed webpage addresses for the SORE Program and other CARB programs.

§ 1065.2

Purpose. The current regulations in § 1065.2 specify manufacturer responsibilities for submitting information to CARB. The Proposed Amendments make corrections in three subsections:

- In § 1065.2(b), delete unnecessary references to federal regulations, as indicated by strikeout in the following: "In the standard-setting part ~~and in 40 CFR 1068.101~~, we describe your obligation to report truthful and complete information and the consequences of failing to meet this obligation. ~~See also 18 U.S.C. 1001 and 42 U.S.C. 7413(c)(2).~~"
- In § 1065.2(e), replace references to federal regulations with references to applicable California SORE regulations, as indicated by strikeout in the following: "See ~~40 CFR 1068.10~~ Title 17, California Code of Regulations, Section 91000-91022 for provisions related to confidential information. Note however that under ~~40 CFR 2.301~~ California Government Code 6254.7, emission data is generally not eligible for confidential treatment."
- In § 1065.2(f), replace the reference to federal regulations with a reference to applicable California SORE regulations, as indicated by strikeout in the following: "Nothing in this part should be interpreted to limit our ability under ~~Clean Air Act section 208 (42 U.S.C. 7542)~~ Title 13, California Code of Regulations, Section 2400, and the California Health and Safety Code to verify that engines conform to the regulations."

Rationale. These changes are necessary to prevent confusion for the reader by correcting an oversight that occurred at the time the federal regulations were incorporated into the California Code of Regulations in 2012, with changes to address other California-specific regulations. The federal Part 1065 regulations previously adopted into the California Code of Regulations referred to the relevant portions of the Code of Federal Regulations. For SORE in California, for which California's Part 1065 was adopted, the relevant standards and other requirements are those in Title 13, California Code of Regulations, Chapter 9, Article 1, and California's Part 1054. Referencing the federal regulations here, rather than the applicable California regulations, could create confusion. The proposed changes would not result in cost impacts to manufacturers because manufacturers already must follow the cited California and federal regulations, as applicable.

§ 1065.10(c)(5)

Purpose. The Proposed Amendments change the text, "You may ask to use emission data collected using other procedures, such as those of the California Air Resources Board or the International Organization for Standardization," to "You may ask to use emission data collected using other procedures, such as those of the United States Environmental Protection Agency or the International Organization for Standardization." This change establishes that manufacturers may request permission to follow U.S. EPA procedures for SORE testing.

Rationale. This change is necessary to provide the flexibility for manufacturers intended under federal Part 1065 by correcting an oversight that occurred at the time the federal Part 1065 regulations were incorporated into the California Code of Regulations. The federal regulations contained a provision allowing those conducting testing under federal Part 1065 to request to use emission data collected using procedures specified by others than U.S. EPA, including CARB. This text was inadvertently incorporated into California's Part 1065 in the 2012 adoption.

Subpart B – Equipment Specifications

§ 1065.170

Purpose. The current regulations in § 1065.170 specify requirements for batch sampling for gaseous and PM constituents. Batch sampling involves collecting and storing emissions for later analysis. U.S. EPA's final regulatory amendments published in June 2021 include the following new text for 40 CFR Part 1065.170 in the initial unnumbered paragraph:

"You may stop emission sampling anytime the engine is turned off, consistent with good engineering judgment. This is intended to allow for higher concentrations of dilute exhaust gases and more accurate measurements. Account for exhaust transport delay in the sampling system and integrate over the actual sampling duration when determining n_{dexh} . Use good engineering

judgment to add dilution air to fill bags up to minimum read volumes, as needed.”

The Proposed Amendments would incorporate the above U.S. EPA amendment into California Part 1065.170 to harmonize the California Code of Regulations with the recent federal regulation changes, with one modification. The Proposed Amendments would change the text “anytime” in the first sentence to “during any time.”

Rationale. The addition of these sentences is necessary to provide consistency with (i.e., “harmonize”) recent changes made to the corresponding provisions in the federal Part 1065. The proposed modifications to the federal text are necessary to improve clarity and grammar.

§ 1065.170(b)(2)

Purpose. The current federal regulations include the following new text for 40 CFR Part 1065.170(b):

“(2) (191 ±11) °C for Teflon™ and 300 series stainless steel used with measuring THC or NMHC from compression-ignition engines, two-stroke spark-ignition engines, and four-stroke spark-ignition engines at or below 19 kW. For all other engines and pollutants, these materials may be used for sample temperatures up to 202 °C.”

The Proposed Amendments would incorporate the above text into California Part 1065.170(b) to harmonize the California Code of Regulations with the recent federal regulation changes, with modifications to make the changes specific to California, as noted in underline and strikeout in the following:

“(2) (191 ±11) °C for Teflon™ and 300 series stainless steel used with measuring THC or NMHC from ~~compression-ignition engines~~, two-stroke spark-ignition engines, and four-stroke spark-ignition engines at or below 19 kW. For all other engines and pollutants, these materials may be used for sample temperatures up to 202 °C.”

Rationale. The addition of these sentences is necessary to provide consistency with recent changes made to the corresponding provisions in the federal Part 1065. The rationale for not including the “compression-ignition engines” text is the same as that provided in the Global Amendments subsection in this section G, “Changes to References of Equipment Types, Engine Types, and Fuel.” The proposed text is otherwise identical to the text in the same-numbered paragraph of the federal Part 1065.

§ 1065.170(b)(2) Table 1

Purpose. The current federal and California regulations include Table 1, which specifies container materials for gaseous batch sampling. Recent U.S. EPA amendments to the federal regulations change the title of the table from “Gaseous

Batch Sampling Container Materials” to “Container Materials for Gaseous Batch Sampling,” change the heading for the second and third columns from “Engines” to “Engine Type,” add the text “N₂O” to the second row “Emissions” column, and delete all table footnotes. The Proposed Amendments would incorporate these changes into Table 1 of California Part 1065.170(b) to harmonize the California Code of Regulations with the recent federal regulation changes, with one modification to make the changes specific to California. The Proposed Amendments change the column heading “Compression-ignition, two-stroke spark ignition, 4 -stroke spark-ignition <19 kW” to “Two-stroke spark-ignition” and “Four-stroke spark-ignition at or below 19 kW” with a line break between them.

Rationale. These proposed changes are necessary to provide consistency with recent changes made to the corresponding provisions in the federal Part 1065. Deleting the Table 1 footnotes aligns the California SORE regulations with the federal regulations and removes redundant information. The recent federal amendments and corresponding Proposed Amendments described earlier in this section add the information currently presented in California Table 1 footnotes (1) through (4) to the paragraph text of §§ 1065.170(b)(1) and (2). The rationale for not including the “compression-ignition” engine type is the same as that provided in the Global Amendments subsection in this section G, “Changes to References of Equipment Types, Engine Types, and Fuel.” The proposed text is otherwise identical to the text in the corresponding table in the federal Part 1065.

Subpart C – Measurement Instruments

§ 1065.205 Table 1

Purpose. The current regulations in this section specify required and recommended performance criteria for measurement instruments, with recommended performance specifications listed in Table 1 of § 1065.205. Recent federal amendments included two new rows in Table 1 for “Fuel mass scale” and “DEF mass scale,” each noted with a new footnote d, “Base performance specifications for mass scales on differential mass over the test interval as described in §1065.307(e)(9).” The federal amendments also added a new footnote c, “The procedure for accuracy, repeatability and noise measurement described in §1065.305 may be modified for flow meters to allow noise to be measured at the lowest calibrated value instead of zero flow rate.” The federal amendments noted the already adopted “Fuel mass flow rate meter,” “Total diluted exhaust meter (CVS),” and “Dilution air, inlet air, exhaust, and sample flow meters” table entries with the new footnote c. The Proposed Amendments would incorporate the table row “fuel mass scale” and footnotes c and d into California Part 1065.202 to harmonize the California Code of Regulations with the recent federal regulation changes, but would not incorporate the table row for “DEF mass scale.”

Rationale. These changes are necessary to provide consistency with recent changes made to the corresponding provisions in the federal Part 1065. The omission of the federal regulation text for the table row for “DEF mass scale” is necessary to prevent

confusion. DEF refers to Diesel Exhaust Fluid, which is used to reduce NO_x emissions from diesel engines. The use of diesel exhaust fluid or DEF, and the inclusion of special provisions related to DEF, in text adopted to otherwise harmonize with federal amendments could be confusing because SORE regulations do not apply to diesel engines produced during the 2000 and later model years. The rationale for not including the table row for "DEF mass scale" is the same as that provided in the Global Amendments subsection in this section G, "Changes to References of Equipment Types, Engine Types, and Fuel." The proposed text is otherwise identical to the text in the same-numbered paragraph of Title 40, Code of Federal Regulations, Part 1065.

Subpart D – Calibrations and Verifications

§ 1065.303 Table 1

Purpose. Subpart D of Part 1065 specifies required and recommended calibrations and verifications of measurement systems, and Table 1 of § 1065.303 provides a summary that indicates the minimum frequency for their performance. The Proposed Amendments would incorporate recent U.S. EPA amendments into California § 1065.303 Table 1 to harmonize the California Code of Regulations with the recent federal regulation changes as follows:

- Under the "§ 1065.303: Linearity verification" section of the table, make the following changes:
 - Change the text "Electrical power:" to "Electrical power, current, and voltage:" and add a reference mark for footnote b.
 - Change the entry heading "Fuel flow:" to "Fuel mass flow rate:."
 - Add a new entry for "Fuel mass scale: Upon initial installation, within 370 days before testing, and after major maintenance."
 - Change the entry heading "Clean gas and diluted exhaust flows:" to "Intake-air, dilution air, diluted exhaust, and batch sampler flow rates:," add a footnote c reference mark, and delete the text "unless flow is verified by propane check or by carbon or oxygen balance."
 - Change the entry heading "Raw exhaust flow:" to "Raw exhaust flow rate:," and delete the text "unless flow is verified by propane check or by carbon or oxygen balance."
 - Change the entry heading "Gas analyzers:" to "Gas analyzers (unless otherwise noted):."
 - Change the text "§ 1065.341: CVS and batch sampler verification" in the "Type of calibration or verification" column to "CVS and PFD flow verification (propane check)" and delete the reference mark for footnote b. For its corresponding entry in the "Minimum-frequency" column, add a new reference mark for footnote e.

- Under the “§ 1065.360: FID calibration THC FID optimization, and THC FID verification” section of the table, add a new entry for “Verify C₂H₆ response for THC FID analyzers if used for NMNEHC determination: upon initial installation, within 185 days before testing, and after major maintenance.”
- Add two new table rows for minimum frequencies for the following types of calibration or verification:
 - § 1065.366: Interference verification for FTIR analyzers—Upon initial installation and after major maintenance.
 - §1065.369: H₂O, CO, and CO₂ interference verification for ethanol photoacoustic analyzers—Upon initial installation and after major maintenance.
- Make the following changes to footnote text:
 - Footnote a: Change the text “more frequently” to “more frequently than we specify.” Footnote a applies to the “Minimum-frequency” column heading.
 - Footnote b: Change the text “The CVS verification described in § 1065.341 is not required for systems that agree within ± 2% based on a chemical balance of carbon or oxygen of the intake air, fuel, and diluted exhaust” to “Perform linearity verification either for electrical power or for current and voltage.”
 - Footnote c: Add footnote c with the text “[Reserved].”
 - Footnote d: Add footnote d with the text “Linearity verification is not required if the flow signal’s accuracy is verified by carbon balance error verification as described in §1065.307(e)(5) or a propane check as described in §1065.341.”
 - Footnote e: Add footnote e with the text “CVS and PFD flow verification (propane check) is not required for measurement systems verified by linearity verification as described in §1065.307 or carbon balance error verification as described in §1065.341(h).”

The Proposed Amendments do not include the recent federal amendment that adds a new entry for “DEF mass scale” under the “§ 1065.307: Linearity verification” section of the table.

The Proposed Amendments also make a change to make the previously adopted federal Part 1065 text specific to California SORE regulations. Under the entry for “§ 1065.345: Vacuum leak,” change the text “vehicle” to “equipment” in the corresponding entry in the “Minimum-frequency” column, as indicated in underline and strikeout text in the following: “For field testing: After each installation of the sampling system on the ~~vehicle~~ equipment, prior to the start of the field test, and after maintenance such as pre-filter changes.”

Rationale. These changes are necessary to provide consistency with recent changes made to the corresponding provisions in the federal Part 1065. The omission of the federal table row for Diesel Exhaust Fluid (DEF) mass scale is necessary to prevent confusion because the California SORE regulations do not apply to diesel engines produced during the 2000 and later model years. The rationale for not including the federal table row for "DEF mass scale" is the same as that provided in the Global Amendments subsection in this section G, "Changes to References of Equipment Types, Engine Types, and Fuel." The rationale for the proposed modification to make the previously adopted federal text specific to California SORE regulations is the same as that described in the Global Amendments subsection, "Updates to Harmonize with Amended Federal Text." The proposed changes are otherwise identical to the table text in the same-numbered section of the federal Part 1065.

§ 1065.307(d)(4)

Purpose. The current regulations in § 1065.307 specify provisions for linearity verification, and paragraph (d) describes recommended methods for generating reference values for the linearity verification protocol in paragraph (c) of this section. The current federal regulations include the following recent amendments made by U.S. EPA to paragraph (d)(4) to correct or account for buoyancy effects and flow disturbances to improve the flow measurement, as indicated by underline and strikethrough text:

~~Fuel and DEF mass flow rate. Operate the engine at a series of constant fuel flow rates or recirculate fuel back to a tank through the fuel flow meter at different flow rates.~~ Use a gravimetric reference measurement (such as a scale, balance, or mass comparator) at the inlet to the fuel-measurement system and a container. Use a stopwatch or timer to measure the time intervals over which reference masses of fuel are introduced to the fuel measurement system. ~~The reference fuel mass divided by the time interval is the reference fuel flow rate.~~ fluid pass through the mass flow rate meter. Use good engineering judgment to correct the reference mass flowing through the mass flow rate meter for buoyancy effects from any tubes, temperature probes, or objects submerged in the fluid in the container that are not attached to the container. If the container has any tubes or wires connected to the container, recalibrate the gravimetric reference measurement device with them connected and at normal operating pressure using calibration weights that meet the requirements in §1065.790. The corrected reference mass that flowed through the mass flow rate meter during a time interval divided by the duration of the time interval is the average reference mass flow rate. For meters that report a different quantity (such as actual volume, standard volume, or moles), convert the reported quantity to mass. For meters that report a cumulative quantity calculate the average measured mass flow rate as the difference in the reported cumulative mass during the time interval divided by the duration of the time interval. For measuring flow rate of gaseous fuel prevent condensation on the fuel container and any attached tubes, fittings, or regulators.

The Proposed Amendments would incorporate the above U.S. EPA amendments into California § 1065.307(d)(4) to harmonize the California Code of Regulations with the recent federal regulation changes, with one modification. In the paragraph title, the Proposed Amendments do not include "and DEF."

Rationale. The proposed modification to the federal text, omit the federal regulation text "and DEF," is necessary to prevent confusion. DEF refers to Diesel Exhaust Fluid, which is used to reduce NO_x emissions from diesel engines. The use of diesel exhaust fluid or DEF, and the inclusion of special provisions related to DEF, in text adopted to otherwise harmonize with federal amendments could be confusing because SORE regulations do not apply to diesel engines produced during the 2000 and later model years. The rationale for not including the text "and DEF" is the same as that provided in the Global Amendments subsection in this section G, "Changes to References of Equipment Types, Engine Types, and Fuel."

§ 1065.307(d)(9)

Purpose. The current text of § 1065.307(d)(9), and the corresponding federal text prior to June 2021, consists of one sentence: "Mass. For linearity verification for gravimetric PM balances, use external calibration weights that meet the requirements in §1065.790." The current federal regulations include the following recent amendments made by U.S. EPA to paragraph (d)(9), as indicated by underline and strikeout text:

"Mass. For linearity verification for gravimetric PM balances, ~~fuel mass scales, and DEF mass scales,~~ use external calibration weights that meet the requirements in §1065.790. ~~Perform the linearity verification for fuel mass scales and DEF mass scales with the in-use container, installing all objects that interface with the container. For example, this includes all tubes, temperature probes, and objects submerged in the fluid in the container; it also includes tubes, fittings, regulators, and wires, and any other objects attached to the container. We recommend that you develop and apply appropriate buoyancy corrections for the configuration of your mass scale during normal testing, consistent with good engineering judgment. Account for the scale weighing a calibration weight instead of fluid if you calculate buoyancy corrections. You may also correct for the effect of natural convection currents from temperature differences between the container and ambient air. Prepare for linearity verification by taking the following steps for vented and unvented containers:~~

- (i) If the container is vented to ambient, fill the container and tubes with fluid above the minimum level used to trigger a fill operation; drain the fluid down to the minimum level; tare the scale; and perform the linearity verification.
- (ii) If the container is rigid and not vented, drain the fluid down to the minimum level; fill all tubes attached to the container to normal operating pressure; tare the scale; and perform the linearity verification."

The Proposed Amendments would incorporate the above U.S. EPA amendments into California § 1065.307(d)(9) to harmonize the California Code of Regulations with the recent federal regulation changes, with the following modifications:

- In the first sentence, change the text “gravimetric PM balances, fuel mass scales, and DEF mass scales,” to “gravimetric PM balances and fuel mass scales.”
- In the second sentence, change the text “fuel mass scales and DEF mass scales” to “fuel mass scales and mass scales for any other injected fluid.”

Rationale. These changes are necessary to provide consistency with recent changes made to the corresponding provisions in the federal Part 1065. The rationale for not including federal text related to Diesel Exhaust Fluid (DEF) is the same as that provided in the Global Amendments subsection in this section G, “Changes to References of Equipment Types, Engine Types, and Fuel.” The proposed changes are otherwise identical to the table text in the same-numbered section of the federal Part 1065.

§ 1065.340

Purpose. The current regulations in § 1065.340 describe the steps to calibrate flow meters for diluted exhaust constant volume sampling (CVS) systems. In addition to the changes described in the “Updates to Harmonize with Amended Federal Text” subsection in this section G, the Proposed Amendments include three corrections to references:

- In § 1065.340(e)(8) [re-lettered to (f)(8)], change the text “Repeat the steps in paragraphs (e)(6) and (7) of this section” to “Repeat the steps in paragraphs (f)(6) and (7) of this section.”
- In § 1065.340(e)(10) [re-lettered to (f)(1)], change the text “Repeat the steps in paragraphs (e)(6) through (9) of this section” to “Repeat the steps in paragraphs (f)(6) through (9) of this section.”
- In § 1065.340(f)(8) [re-lettered to (h)(8)], change the text “Repeat the steps in paragraphs (f)(6) and (7) of this section” to “Repeat the steps in paragraphs (h)(6) and (7) of this section.”

The purpose of these changes is to update the references in the affected text to reflect the renumbering of paragraphs 1065.340(e) and 1065.340(f) in the current text to 1065.340(f) and 1065.340(h), respectively, as described in the “Updates to Harmonize with Amended Federal Text” section.

Rationale. These changes are necessary to provide consistency with the incorporation of recent amendments to federal regulations into California’s SORE regulations and to provide clarity necessary to help ensure manufacturers reference the correct regulation subsections. The recent federal amendments renumber 1065.340(e) and 1065.340(f) to 1065.340(f) and 1065.340(h), respectively, and insert a new paragraph

1065.340(e) that contains no numbered subsidiary paragraphs. These changes result in the need to also update the references to subsections within paragraphs 1065.340(e) [now re-lettered to 1065.340(f)] and 1065.340(f) [now re-lettered to 1065.340(h)].

§ 1065.350(e) [newly proposed subsection]

Purpose. The current regulations in § 1065.350 specify the steps to verify the amount of water interference after initial NDIR analyzer installation and after major maintenance, for use by manufacturers that measure CO₂ using an NDIR analyzer. The current federal regulations include the recent addition of a new subsection 1065.350(e), as follows:

“(e) Exceptions. The following exceptions apply:

(1) You may omit this verification if you can show by engineering analysis that for your CO₂ sampling system and your emission calculation procedures, the H₂O interference for your CO₂ NDIR analyzer always affects your brake specific emission results within $\pm 0.5\%$ of each of the applicable standards. This specification also applies for vehicle testing, except that it relates to emission results in g/mile or g/kilometer.

(2) You may use a CO₂ NDIR analyzer that you determine does not meet this verification, as long as you try to correct the problem and the measurement deficiency does not adversely affect your ability to show that engines comply with all applicable emission standards.”

The Proposed Amendments would incorporate this recent federal amendment into California § 1065.341 to harmonize the California Code of Regulations with the recent federal regulation changes, with one modification. The Proposed Amendments omit the sentence, “This specification also applies for vehicle testing, except that it relates to emission results in g/mile or g/kilometer.”

Rationale. These changes are necessary to provide consistency with recent changes made to the corresponding provisions in the federal Part 1065, to improve clarity, and to prevent confusion. A reference to “vehicle testing” and standards in terms of g/mi or g/km in the amended federal text is omitted from the amended California text. The Proposed Amendments omit the sentence, “This specification also applies for vehicle testing, except that it relates to emission results in g/mile or g/kilometer,” because it is not relevant for California’s Part 1065. The proposed changes are otherwise identical to the table text in the same-numbered section of the federal Part 1065.

§§ 1065.365(d)(6), (e)(6), (f)(6), and (f)(10)

Purpose. In paragraphs 1065.365(d)(6), (e)(6), (f)(6), and (f)(10), the Proposed Amendments change the text “vastly” to “significantly,” as indicated in underline and strikeout text in the following: “Use good engineering judgment to address the effect

of hydrocarbon contamination if your point of introduction is ~~vastly~~ significantly different from the point of zero/span gas introduction.”

Rationale. This change is necessary to improve clarity, which is necessary to maintain the stringency of California emission regulations and the accuracy and robustness requirements for testing under this part. The introduction of an analytical gas for determining NMC cutter penetration fraction into the sample stream of a FID, rather than at the point where calibration gases are introduced, presents a risk that hydrocarbon deposited or condensed on the walls of the sample path due to previous operation may contaminate the analytical gas, artificially increasing measured hydrocarbon levels and potentially compromising the verification. Under conditions where this is likely to occur, steps must be taken to address the issue to avoid compromising the verification, in order to ensure the accuracy and representativeness of emission data gathered through testing under this part and thereby allow the expected emission reduction benefits of the SORE regulations to be quantified and realized. Due to variations in individual system design, the conditions where this is likely to occur, including sample introduction point, may vary between systems, and as such, the requirements must allow for appropriate analysis and decision-making by regulated parties performing this verification. However, the wording “vastly different” with regard to the introduction point may be interpreted as permitting hydrocarbon contamination issues to be ignored in some cases where they in fact have a substantial effect on the result. The use of the term “significantly different” appropriately conveys the degree of accuracy and care required while allowing for the situation- and application-dependent nature of the necessary decision making. It is essential to satisfying the purpose of the regulations, and addressing the identified problem, that no such ambiguity exist and that hydrocarbon contamination of analytical gases for NMC cutter penetration verification be addressed in any case where the arrangement of gas introduction points presents a significant risk of such contamination occurring.

Subpart E – Engine Selection, Preparation, and Maintenance

§ 1065.405(g) [newly proposed paragraph]

Purpose. As described in the “Global Amendments” subsection of this section G, the Proposed Amendments add a new, multi-part § 1065.405(g) to harmonize the California Code of Regulations with recent federal regulation changes. The newly proposed section 1065.405(g) defines the components that are considered to be part of the engine for laboratory testing. The Proposed Amendments include one modification to § 1065.405(g)(1)(ii) to make the changes specific to California SORE regulations, as indicated in underline and strikeout text in the following:

“(ii) The component is covered by the applicable Executive Order ~~certificate of conformity~~. For example, this criterion would typically exclude radiators not described in an application for certification.”

Rationale. These changes are necessary to provide consistency with (i.e., “harmonize”) recent changes made to the corresponding § 1065.405 in the federal Part 1054. The proposed changes to incorporate the new federal requirements would not result in cost impacts to manufacturers because they align CCR requirements with federal requirements that manufacturers already must follow. The proposed California-specific change to replace “certificate of conformity” with “Executive Order” is necessary to prevent confusion for the reader. CARB uses the term “Executive Order” to refer to the certification document for an engine family for sale or lease for use in California. U.S. EPA uses the term “certificate of conformity,” shortened to “certificate.” The proposed change ensures consistent use of California-specific terminology throughout the regulations. See the Global Amendments subsection, ““EPA” to “CARB” Term Change, “Certificate of Conformity” to “Executive Order” Term Change, and Improvements to References to Part 1054,” in this section G for additional explanation.

Subpart F – Performing an Emission Test Over Specified Duty Cycles

§ 1065.501(b) [newly proposed paragraph]

Purpose. The current regulations in § 1065.501 specify the procedures to measure engine emissions over a specified duty cycle. The current federal regulations include the recent addition of a new paragraph 501(b), as follows:

“Unless we specify otherwise, you may control the regeneration timing of infrequently regenerated aftertreatment devices such as diesel particulate filters using good engineering judgment. You may control the regeneration timing using a sequence of engine operating conditions or you may initiate regeneration with an external regeneration switch or other command. This provision also allows you to ensure that a regeneration event does not occur during an emission test.”

The Proposed Amendments would incorporate this recent federal amendment into California § 1065.501 to harmonize the California Code of Regulations with the recent federal regulation changes, with one modification. The Proposed Amendments delete the text “diesel” from the first sentence.

Rationale. These changes are necessary to provide consistency with recent changes made to the corresponding provisions in the federal Part 1065. The rationale for not including federal text related to “diesel” particulate filters is the same as that provided in the Global Amendments subsection in this section G, “Changes to References of Equipment Types, Engine Types, and Fuel.” Particulate filters pass exhaust through a filter that traps particulate matter and must be periodically regenerated by temporarily changing engine behavior to provide heat and oxygen to combust the accumulated particular matter and prevent clogging. Particulate filters have become widespread for limiting PM emissions from diesel and other lean-burn compression-ignition engines, and as such, relevant provisions have been inserted into the federal Part 1065, which

applies to engine testing in general. However, California's Part 1065 does not apply to compression-ignition engines, such as those fueled with diesel fuel, and an explicit reference to "diesel" particulate filters presents issues substantially similar to those presented by reference to "diesel exhaust fluid," and the reference is omitted based on the same reasoning. The proposed changes are otherwise identical to the table text in the same-numbered section of the federal Part 1065.

§ 1065.518 [newly proposed section]

Purpose. The current federal regulations include the recent addition of a new section, 1065.518, which provides instructions and considerations for engine preconditioning for testing. The Proposed Amendments would incorporate this recent federal amendment into California Part 1065 to harmonize the California Code of Regulations with the recent federal regulation changes, with one modification. The Proposed Amendments omit the example related to diesel engines in the first sentence of § 1065.518(a), as indicated in strikeout: "This section applies for engines where measured emissions are affected by prior operation, ~~such as with a diesel engine that relies on urea-based selective catalytic reduction.~~"

Rationale. These changes are necessary to provide consistency with recent changes made to the corresponding provisions in the federal Part 1065. The rationale for not including federal text related to diesel engines is the same as that provided in the Global Amendments subsection in this section G, "Changes to References of Equipment Types, Engine Types, and Fuel." The proposed changes are otherwise identical to the table text in the same-numbered section of the federal Part 1065.

§ 1065.530(c) [newly proposed subsection]

Purpose. The current federal regulations include the recent addition of a new subsection 1065.530(c), which provides instructions for starting and running each test interval. The Proposed Amendments would incorporate this recent federal amendment into California Part 1065 to harmonize the California Code of Regulations with the recent federal regulation changes, with one modification. In paragraph 1065.530(c), the Proposed Amendments omit the federal text, "For example, 40 CFR part 1033 specifies a different way to perform discrete-mode testing," because 40 CFR part 1033 refers to control of emissions from locomotives.

Rationale. These changes are necessary to provide consistency with recent changes made to the corresponding provisions in the federal Part 1065. The omission of the federal regulation text related to locomotives engines is necessary to prevent confusion because the SORE regulations do not apply to locomotive engines regulated under 40 CFR part 1033. The rationale for this omission is the same as that provided in the Global Amendments subsection in this section G, "Changes to References of Equipment Types, Engine Types, and Fuel." The proposed changes are otherwise identical to the text in the same-numbered section of the federal Part 1065.

§ 1065.543 [newly proposed section]

Purpose. The current federal regulations include the recent addition of a new section, 1065.543, which provides instructions for carbon balance error verification as an alternative to linearity verification or propane checks for certain test equipment. The Proposed Amendments would incorporate this recent federal amendment into California Part 1065 to harmonize the California Code of Regulations with the recent federal regulation changes, with one modification. In the third sentence in paragraph 1065.543(a), the Proposed Amendments change the corresponding federal text “and optionally DEF or other fluids” to “any other fluids injected into the exhaust, if applicable.”

Rationale. These changes are necessary to provide consistency with recent changes made to the corresponding provisions in the federal Part 1065. Omitting the federal text related to Diesel Exhaust Fluid (DEF) is necessary to prevent confusion because the California SORE regulations do not apply to diesel engines produced during the 2000 and later model years. The rationale for this omission is the same as that provided in the Global Amendments subsection in this section G, “Changes to References of Equipment Types, Engine Types, and Fuel.” The proposed changes are otherwise identical to the text in the same-numbered section of federal Part 1065.

Subpart G – Calculations and Data Requirements

§ 1065.643 [newly proposed section]

Purpose. The current federal regulations include the recent addition of a new section, 1065.643, which specifies provisions for carbon balance error verification calculations to support the newly added §1065.543. The Proposed Amendments would incorporate this recent federal amendment into California Part 1065 to harmonize the California Code of Regulations with the recent federal regulation changes, with two modifications. In paragraph 1065.643(a), the Proposed Amendments omit text related to DEF in the corresponding amended federal text, and change the subscript “DEF” in the example calculation terms to the subscript “inj” to refer to other injected fluids.

Rationale. These changes are necessary to provide consistency with recent changes made to the corresponding provisions in the federal Part 1065. Omitting the federal text related to DEF is necessary to prevent confusion because the California SORE regulations do not apply to diesel engines produced during the 2000 and later model years. The rationale for this omission is the same as that provided in the Global Amendments subsection in this section G, “Changes to References of Equipment Types, Engine Types, and Fuel.” The proposed changes are otherwise identical to the table text in the same-numbered section of the federal Part 1065.

§ 1065.650(c)(3)

Purpose. The current regulations in § 1065.650(c)(3) provide instructions for collecting a batch sample, along with equations for calculating emission mass and example

calculations, from a varying exhaust flow rate in subsection (3)(i) and a constant exhaust flow rate in subsection (3)(ii). The Proposed Amendments add the time unit "s" (seconds) for the example calculation in subsection (3)(i) as indicated in the following text in underline, " $\Delta t = 1/5 = 0.2$ s." The Proposed Amendments add the emission mass unit "g" (grams) for the example calculation in subsection (3)(ii) as indicated in the following text in underline, " $m_{PM} = 144.0 \cdot 10^{-6} \cdot 57.692 \cdot 1200$ g."

Rationale. These changes are necessary to correct an oversight in the federal regulations and to provide complete example calculations in order to prevent confusion for testers.

§ 1065.655(c)

Purpose. The current regulations in § 1065.655 specify provisions for use of chemical balances of fuel, intake air, and exhaust to calculate flows, the amount of water in their flows, and the wet concentration of constituents in their flows. Subsection 1065.655(c) describes the chemical balance procedure. The current federal regulations include the following recent amendments made by U.S. EPA to the unnumbered initial paragraph of subsection 1065.655(c), as indicated by underline and strikeout text:

"... You must also use your ~~fuel's~~ fuel mixture's atomic hydrogen-to-carbon ratio, α , oxygen-to-carbon ratio, β , sulfur-to-carbon ratio, γ , and nitrogen-to-carbon ratio, δ ; you may optionally account for diesel exhaust fluid (or fluids injected into the exhaust), if applicable. You may ~~measure~~ calculate α , β , γ , and δ ~~or you may~~ based on measured fuel composition or based on measured fuel and diesel exhaust fluid (or other fluids injected into the exhaust) composition together, as described in paragraph (e) of this section. You may alternatively use any combination of default values and measured values for a given fuel as described in § 1065.655(d), paragraph (e) of this section. Use the following steps to complete a chemical balance: ..."

The Proposed Amendments would incorporate the above U.S. EPA amendments into California § 1065.655(c) to harmonize the California Code of Regulations with the recent federal regulation changes, with the following modifications to the amended federal text:

- In the first sentence, change the federal text "you may optionally account for diesel exhaust fluid (or fluids injected into the exhaust)" to "you may optionally account for fluids injected into the exhaust."
- In the second sentence, change the federal text "or based on measured fuel and diesel exhaust fluid (or other fluids injected into the exhaust) composition together" to "or based on measured fuel and fluids injected into the exhaust composition together."

Rationale. These changes are necessary to provide consistency with recent changes made to the corresponding provisions in the federal Part 1065. The modifications to the federal text, omitting the federal text related to diesel exhaust fluid, are necessary

to prevent confusion because the California SORE regulations do not apply to diesel engines produced during the 2000 and later model years. The rationale for this omission is the same as that provided in the Global Amendments subsection in this section G, "Changes to References of Equipment Types, Engine Types, and Fuel." The proposed changes are otherwise identical to the text in the same-numbered section of the federal Part 1065.

§ 1065.655(e) [newly proposed subsection]

Purpose. The current federal regulations include the recent addition of a new subsection 1065.655(e) that provides the procedure to determine fuel and diesel exhaust fluid composition. The Proposed Amendments would incorporate this recent federal amendment into California Part 1065 to harmonize the California Code of Regulations with the recent federal regulation changes, with four modifications:

- Change the text related to "diesel exhaust fluid" in the corresponding amended federal text to "injected fluid," "other injected fluid," or "any fluid injected into the exhaust," as appropriate, throughout this subsection.
- Change the text "You may also assume that sulfur and nitrogen have a zero concentration for all fuels except residual fuel blends" in the corresponding amended federal text in paragraph (e)(1)(i) to "You may also assume that sulfur and nitrogen have a zero concentration for all fuels used for testing under this part."
- In Table 1 of 1065.655(e)(5), omit the entry for "Diesel exhaust fluid" in the corresponding amended federal text.
- Change the text related to diesel engines in an example in the corresponding federal text in paragraph (e)(3), as indicated in underline and strikeout in the following: "Application of average values from a batch measurement generally applies to situations where one fluid is a minor component of the total fuel mixture, for example dual-fuel engines ~~and flexible fuel engines with diesel pilot injection, where the diesel pilot fuel mass is less than 5 % of the total fuel mass and diesel exhaust fluid injection~~; consistent with good engineering judgment.

Rationale. These changes are necessary to provide consistency with recent changes made to the corresponding provisions in the federal Part 1065. Omitting the federal text related to diesel exhaust fluid and diesel engines is necessary to prevent confusion because the California SORE regulations do not apply to diesel engines produced during the 2000 and later model years. The rationale for this omission is the same as that provided in the Global Amendments subsection in this section G, "Changes to References of Equipment Types, Engine Types, and Fuel." Similarly, residual fuel blends are unsuitable for use in spark-ignition engines, and a reference to special provisions relating to calculations involving a fuel unsuitable for SORE, which are by definition spark-ignition, and any explicit reference to diesel engines, is not necessary. The proposed changes are otherwise identical to the text in the same-numbered section of the federal Regulations Part 1065.

§ 1065.667(d) [newly lettered paragraph]

Purpose. The current regulations in § 1065.667 specify the procedure to determine the mass of background emissions to subtract from (i.e., correct) a diluted exhaust sample. The current federal Part 1065.667 includes a suite of recent amendments made by U.S. EPA, which include moving much of the federal text formally in paragraph 1065.667(c) to a new paragraph 1065.667(d). As described in the Global Amendments subsection, "Updates to Harmonize with Amended Federal Text," the Proposed Amendments would incorporate the recent federal amendments into California Part 1065 to harmonize the California Code of Regulations with the recent federal regulation changes.

The Proposed Amendments include one modification to the amended federal text. In the newly lettered paragraph 1065.667(d), U.S. EPA changed the text "You may determine the total flow of dilution air from the total flow of diluted exhaust and a chemical balance of the fuel, intake air, and exhaust as described in §1065.655" to "You may determine the total flow of dilution air from the measured dilute exhaust flow and a chemical balance of the fuel, DEF, intake air, and dilute exhaust as described in §1065.655." The Proposed Amendments change the text "DEF" in the corresponding amended federal text to "any injected fluids."

Rationale. These changes are necessary to provide consistency with recent changes made to the corresponding provisions in the federal Part 1065. Omitting the federal text "DEF" is necessary to prevent confusion because the California SORE regulations do not apply to diesel engines produced during the 2000 and later model years. The rationale for this omission is the same as that provided in the Global Amendments subsection in this section G, "Changes to References of Equipment Types, Engine Types, and Fuel." The proposed changes are otherwise identical to the table text in the same-numbered section of the federal Part 1065.

Subpart H – Engine Fluids, Test Fuels, Analytical Gases and Other Calibration Standards

§ 1065.701(a)

Purpose. The current regulations in § 1065.701(a) specify requirements for certification test fuel used for emission testing. The Proposed Amendments include three changes to this subsection as follows:

- In paragraph 1065.701(a)(1), the Proposed Amendments change the reference to "California Exhaust Emission Standards and Test Procedures for 2001 – 2014 Model Passenger Cars, Light Duty Trucks, and Medium-Duty Vehicles" to "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," to correctly reflect the current title, and

change the text “[insert latest amendment date]” to “December 6, 2012,” to replace the placeholder text with the most recent amendment date.

- In paragraph 1065.701(a)(2), the Proposed Amendments change the abbreviation “CCR” to “California Code of Regulations” and add “California Code of Regulations” where it is implied between Title 13 and a section number in two places.
- In paragraph 1065.701(a)(2), the Proposed Amendments change the text “adopted [insert adoption date]” to “as last amended December 19, 2018,” to replace the placeholder text with the adoption date for the reference to “California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles”

The purpose of making these changes at these points in the text is to establish consistency and currency in references to the California Code of Regulations.

Rationale. These changes are necessary to specify the exact body of regulations to which these subsections refer and to satisfy the clarity requirements for California Administrative Law. The current regulations use “CCR” and “Title 13” without elaboration in this section, while a full reference to the “California Code of Regulations” is used in others. Although the existing references are sufficient to identify the regulations, the use of different forms of reference could confuse parties subject to the regulations, as it may create the impression that these are different references. It is essential to satisfying the purpose of the regulations and addressing the identified problem that they be understandable to the regulated parties, including where references are made to other regulations, and that there is no real or perceived ambiguity in such references.

§ 1065.701(f)

Purpose. The current regulations in § 1065.701(f) specify requirements for test fuels used for service accumulation and aging. The Proposed Amendments include two amendments to this section as follows:

- First, the Proposed Amendments delete the following text from paragraph 1065.701(f)(1)(i): “As an alternative, the certification test fuels specified under either §1054.501(b)(2)(ii)(A) or §1054.501(b)(2)(ii)(B), as applicable, may be used for engine service accumulation and aging.”
- Second, in paragraph 1065.701(f)(2)(i), the Proposed Amendments change the text “Liquefied petroleum gas meeting the ASTM D1835 (11/10/1997) or NGPA HD-5 (1970) specifications must be used for service accumulation.” **to** “Liquefied petroleum gas meeting the ASTM D1835 (5/1/2020) specification or the HD-5 grade specification per GPA 2140 2017 edition (also known as “NGPA

HD-5") must be used for service accumulation. ASTM D1835 (5/1/2020) and GPA 2140 (2017) are incorporated herein by these references."

Rationale. The rationales for the Proposed Amendments to § 1065.701(f) are as follows:

- The first proposed change is necessary to provide consistency with Proposed Amendments to California's Part 1054, and prevent confusion or regulatory conflict. The Proposed Amendments delete the entire subsection 1054.501(b)(2)(ii) to harmonize California's Part 1054 with recent federal Part 1054 amendments, which deleted the corresponding federal provisions, as described in the Global Amendments subsection, "Updates to Harmonize with Amended Federal Text," in section F of this chapter. Continuing to have references in the text of California's Part 1065 that refer to provisions that no longer exist could create confusion for regulatory parties or impose conflicting regulatory requirements. It is essential to satisfying the purpose of the regulation and addressing the identified problem that no such ambiguity or conflict exist within the regulatory text.
- The second proposed change to document references is necessary to satisfy the requirements of California Administrative Procedure Act regulations (Title 1, CCR, § 16) regarding clarity, while preserving the intent of the current regulatory text to the extent possible. The text "NGPA HD-5" in the current regulation refers to the specifications for grade HD-5 liquefied petroleum gas (propane), published in the standard GPA 2140, "Liquefied Petroleum Gas Specifications and Test Methods," by GPA Midstream Association, formerly the Gas Processors Association and previously the Natural Gas Processors Association, headquartered in Tulsa, Oklahoma. This document was originally adopted in 1931, and was revised several times, including in 1970, the version to which the current regulation refers, as well as in several other years between 1970 and the adoption of California's Part 1065 in 2012. The reasons for selecting the 1970 version, which was multiple versions out of date at the time of the original rulemaking, are not elucidated in the available rulemaking record for the 2012 adoption. CARB staff has been unable to obtain a copy of the 1970 version of this publication to review, or to make available in the record for this rulemaking as required by California Administrative Law. CARB staff has however obtained copies of both the 1997 revision and of the latest revision published in 2017,^{rr} ^{ss} and observed that the HD-5 specification has not changed between these revisions; as such, it may be reasonably inferred that the 1970 version rather than a more recent one, was likely specified in the 2012

^{rr} GPA Midstream Association. 2017. GPA Midstream Standard 2140-17, Liquefied Petroleum Gas Specifications and Test Methods. Adopted as Recommended Procedures 1931, revised 2017.

^{ss} Gas Processors Association. 1997. GPA Standard 2140-97, Liquefied Petroleum Gas Specifications and Test Methods. Adopted as Recommended Procedures 1931, revised 1997.

adoption because it reflected the last actual revisions to the HD-5 propane specification at that time. If this is the case, then specifying the 2017 revision instead will allow CARB to fulfill the reference requirements in California Administrative Law without otherwise affecting regulated parties. It is essential to satisfying the purpose of this regulation and addressing the identified problem that it satisfy the requirements of California Administrative Procedure Act.

In addition, the proposed change from "ASTM D1835 (11/10/1997)" to "ASTM D1835 (5/1/2020)" is necessary to ensure manufacturers use the most recently updated industry standard, *ASTM D1835 – 20, Standard Specification for Liquefied Petroleum (LP) Gases, approved May 1, 2020* ("ASTM D1835"). CARB staff evaluated the revisions made to ASTM D1835 between 1997 and 2020 and has determined that the revisions do not relax certification standards or testing procedures and do not adversely affect industry. CARB staff determined that this change will not increase industry costs and may decrease them, as the 2020 revision does not introduce new requirements and allows additional testing methods to be used to demonstrate certain properties of the product, allowing labs to select the method which is most cost-effective given their equipment and practices. Also, industry requested that CARB reference the most recent versions of industry standards documents to prevent potential confusion and the additional cost of maintaining and referencing multiple editions, given manufacturers typically use the most recent editions of standards documents in addition to any earlier editions required by regulations.

§ 1065.790(b)

Purpose. The current regulations in § 1065.790 provide specifications for mass standards. Paragraph 1065.790(b) currently specifies, "Dynamometer calibration weights. [Reserved]", which reflects the text in the corresponding federal Part 1065.790(b) in June 2011. The current federal regulations include the following recent amendments made by U.S. EPA to paragraph (b), as indicated by underline and strikeout text:

"(b) Dynamometer, fuel mass scale, and DEF mass scale calibration weights. [Reserved] Use dynamometer and mass scale calibration weights that are certified as NIST-traceable within 0.1% uncertainty. Calibration weights may be certified by any calibration lab that maintains NIST-traceability."

The Proposed Amendments would incorporate the above U.S. EPA amendments into California § 1065.790(b) to harmonize the California Code of Regulations with the recent federal regulation changes, with two modifications:

- First, the Proposed Amendments change the text "Dynamometer, fuel mass scale, and DEF mass scale" to "Dynamometer and fuel mass scale" in the first sentence.

- Second, the Proposed Amendments change the text “NIST” to “SI” in the second and third sentences. This proposed modification would change the federal Part 1065 requirement to use NIST-traceable mass standards to instead allow the use of SI traceable mass standards through NIST or another member of the CIPM MRA.

The purpose of these changes is to harmonize California’s Part 1065 with subsequent amendments to of the federal Part 1065, except as necessary to uphold the stringency of California emission standards, maintain consistency with existing California regulation, or prevent confusion, while establishing consistency with current accepted metrological practice and establishing that reference value traceability may be through NIST or equivalent national or international standards bodies, rather than NIST alone, without special permission.

Rationale. These changes are necessary to provide consistency with recent changes made to the corresponding provisions in the federal Part 1065. The omission of the federal text related to the DEF mass scale is necessary to prevent confusion because the California SORE regulations do not apply to diesel engines produced during the 2000 and later model years. The rationale for not including federal text related to DEF is the same as that provided in the Global Amendments subsection in this section G, “Changes to References of Equipment Types, Engine Types, and Fuel.” The rationale for requiring SI-traceable standards rather than the federal requirement for NIST-traceable standards is the same as that provided in the Global Amendments subsection, “Calibration Requirements Change.” The proposed changes are otherwise identical to the table text in the same-numbered section of the federal Part 1065.

Subpart K – Definitions and Other Reference Information

§ 1065.1001

Proposed Changes to Make Adopted Federal Regulations Specific to California SORE Regulations

Purpose. Section 1065.1001 specifies the definitions that apply to Part 1065. The Proposed Amendments include the following changes in addition to the changes described in the Global Amendments section of this section G:

- First, in the unnumbered initial paragraph, the Proposed Amendments delete the reference to Title 40, Code of Federal Regulations, Part 1068.
- Second, the Proposed Amendments add a definition for the term “Act” that specifies:

“Act means the United States Clean Air Act, as amended November 15, 1990, 42 U.S.C. 7401-7671q.”
- Third, in the definition for “Engine,” the Proposed Amendments change the text “Engine as used in this part, refers to small off-road engine” to “Engine as

used in this part, refers to a small off-road engine as defined in Title 13, California Code of Regulations, § 2401.” This Proposed Amendment corrects a grammatical error by adding “a” between “to” and “small,” and adds a reference to the relevant section of the California Code of Regulations for the definition of engine.

- Fourth, the Proposed Amendments delete the definition for “Revoke” which references the meaning given in Title 40, Code of Federal Regulations, Part 1068.
- Fifth, in the definition for “Standard-setting part,” the Proposed Amendments change the text “the part in the Code of Federal Regulations that defines emission standards” to “the part in the Code of California Regulations that defines emission standards.”

The purpose of these proposed changes is to clarify that California regulations and definitions, not federal regulations and definitions, are those that apply under this part, except to the extent that definitions in harmonized federal text rely on federal statutory definitions, and in one case to correct a grammatical error.

Rationale. These changes are necessary to correct an oversight that occurred at the time certain federal regulations were incorporated into the California Code of Regulations, and to improve clarity and regulatory certainty. Part 1065 was adopted into the California Code of Regulations in 2012, and consisted primarily of text adopted from the U.S. EPA regulation in Title 40, Code of Federal Regulations, Part 1065, as of June 28, 2011, with changes to address California’s specific regulations. The previously adopted federal text referred to the relevant portions of the Code of Federal Regulations defining relevant terms and requirements as applied to testing under this part. However, the Part 1065 adopted into the California Code of Regulations applies specifically in the context of SORE as defined in California regulation, and as such, where California has adopted California-specific definitions or other regulatory text that differ from the federal text, California’s definitions and regulations are the ones that apply. References to federal regulation that are currently included in the California Part 1065 create potential confusion for regulated parties and may be interpreted as creating a regulatory conflict. It is essential to satisfying the purpose of this regulation and addressing the identified problem that there be no such confusion, or real or perceived conflict, where California definitions take precedence. However, the federal text as adopted, and as amended to harmonize with updates to the federal regulation, relies on definitions given in the United States Clean Air Act, which as federal legislation rather than regulation applies in this context; an explicit reference is included for clarity. Finally, California Administrative Procedure Act regulations (Title 1, CCR, § 16(a)(4)) requires that regulations be free of grammatical errors, which may create confusion or ambiguity or undermine the perceived authoritativeness of the regulation text. It is essential to satisfying the purpose of this regulation and addressing the identified problem that there be no such real or perceived ambiguity or error in language use in the regulatory text.

Proposed Change to Add a Definition for “Good Engineering Judgment”

Purpose. The Proposed Amendments add a definition for “good engineering judgment” to § 1065.1001 as follows:

“Good engineering judgment means decisions or determinations, relating to any aspect of testing under this part, which are based on and consistent with sound and well-established principles of science and engineering, accepted best practices as they apply to the specific type of testing and context under consideration, and all other relevant information, so as to ultimately ensure that emission measurements and other data collected under this part accurately represent the engine’s actual emissions during the testing and are representative of the engine family’s emissions in typical operation by ultimate purchasers. Good engineering judgment, as defined here, should be used in making all decisions or determinations regarding testing under this part. Explicit instructions, elsewhere in this part, to employ good engineering judgment in making certain decisions or determinations should not be construed as permitting other decisions or determinations to be made without employing it.”

The purpose of this proposed change is to clarify the meaning of the term and its use in decision making to ensure the generation of accurate and representative SORE emission data.

Rationale. This change is necessary to correct an oversight that occurred at the time federal Part 1065 regulations were incorporated into the California Code of Regulations, and to improve clarity and regulatory certainty. Current California SORE regulations do not contain a definition of the term “good engineering judgment,” but the term is frequently used in federal Part 1065 regulations adopted into the California SORE regulations in 2012 and in recent federal regulation amendments that would be incorporated by the Proposed Amendments. Title 40, Code of Federal Regulations, Part 1068, specifies the meaning of this term for use in federal regulatory text such as Title 40, Code of Federal Regulations, Part 1065, and provides standards of review and an associated hearing process. The federal regulations also contain instructions that good engineering judgment be employed in all federal testing, not only where explicitly referenced. Because these portions of Part 1068 have not been incorporated into the California SORE regulations, it is necessary to add a definition of “good engineering judgment” to California Part 1065. A California-specific definition of the term “good engineering judgment” and specific instructions to apply it in all decision-making regarding testing under California Part 1065, rather than only where called out, are necessary to ensure that the expected emission reduction benefits from the California SORE regulations are actually and measurably achieved.

§ 1065.1010

Purpose. Section 1065.1010 provides a list of reference documents that have been incorporated by reference into Part 1065. Because the federal Part 1065.1010 was extensively amended and reformatted subsequent to CARB’s adoption of California’s

Part 1065, the Proposed Amendments replace the entirety of § 1065.1010 with text formatted to mirror the current organization of the federal Part 1065.1010. The newly proposed list omits reference documents listed in the federal Part 1065.1010 that are referenced in federal text not adopted by CARB and adds "[Reserved]" in their place to preserve the continuity of the document numbering and consistency with numbering of similar federal references.

The Proposed Amendments add the following new entries to the indicated subsections:

- Subsection 1065.1010(b): ASTM material
 - (28) ASTM D4629 – 12, Standard Test Method for Trace Nitrogen in Liquid Petroleum Hydrocarbons by Syringe/Inlet Oxidative Combustion and Chemiluminescence Detection, approved April 15, 2012 ("ASTM D4629"), cited in § 1065.655(e).
 - (33) ASTM D5291 – 10, Standard Test Methods for Instrumental Determination of Carbon, Hydrogen, and Nitrogen in Petroleum Products and Lubricants, approved May 1, 2010 ("ASTM D5291"), cited in § 1065.655(e).
 - (35) ASTM D5599 – 00 (Reapproved 2010), Standard Test Method for Determination of Oxygenates in Gasoline by Gas Chromatography and Oxygen Selective Flame Ionization Detection, approved October 1, 2010 ("ASTM D5599"), cited in §§ 1065.655(e).
 - (36) ASTM D5762 – 12, Standard Test Method for Nitrogen in Petroleum and Petroleum Products by Boat-Inlet Chemiluminescence, approved April 15, 2012 ("ASTM D5762"), cited in § 1065.655(e).
 - (40) ASTM D6348 – 12^{e1}, Standard Test Method for Determination of Gaseous Compounds by Extractive Direct Interface Fourier Transform Infrared (FTIR) Spectroscopy, approved February 1, 2012 ("ASTM D6348"), cited in §§ 1065.266(b) and 1065.275(b).
 - (47) ASTM F1471 – 09, Standard Test Method for Air Cleaning Performance of a High-Efficiency Particulate Air Filter System, approved March 1, 2009 ("ASTM F1471"), cited in §1065.1001.
 - (48) ASTM D1835 – 20, Standard Specification for Liquefied Petroleum (LP) Gases, approved May 1, 2020 ("ASTM D1835"), cited in §1065.701.
- Subsection 1065.1010(c): California Air Resources Board material
 - (3) California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty

Trucks, and Medium-Duty Vehicles, amended December 6, 2012, cited in § 1065.701.

(4) California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles, amended December 19, 2018, cited in § 1065.701.

- Subsection 1065.1010(e): ISO material
(16) ISO 8178-1:2020(E), Reciprocating internal combustion engines — Exhaust emission measurement — Part 1: Test-bed measurement systems of gaseous and particulate emissions, published June 2020, (“ISO 8178-1”), cited in § 1065.601(c)(1).
- Subsection 1065.1010(g): SAE International material
(2) SAE J1151, Methane Measurement Using Gas Chromatography, stabilized September 2011, cited in §§1065.267(b) and 1065.750(a)(2)(i).

The Proposed Amendments add the following new subsections and references:

(h) U.S. EPA Material. The following documents are available from the United States Environmental Protection Agency Emissions Measurement Center, 109 TW Alexander Drive, Research Triangle Park, NC 27709, (202) 566-0556, or www.epa.gov:

(1) Title 40, Code of Federal Regulations, Part 63, Appendix A—Test Methods, Test Method 320—Measurement of Vapor Phase Organic and Inorganic Emissions by Extractive Fourier Transform Infrared (FTIR) Spectroscopy, last amended December 2, 2020, cited in §1065.266 and §1065.275.

(i) GPA Midstream Association Material: The following documents are available from GPA Midstream Association, 6060 American Plaza, Suite 700, Tulsa, Oklahoma 74135, (918) 493-3872:

(1) GPA Midstream Standard 2140-17, Liquefied Petroleum Gas Specifications and Test Methods (“GPA 2140”), revised 2017, cited in § 1065.701.

Rationale. These changes are necessary to harmonize California’s Part 1065 with subsequent amendments to the federal Part 1065, provide citations only for those references cited in California Part 1065, provide citations for references cited in California Part 1065 that are not cited in the federal Part 1065, and fulfill the requirements of California Administrative Procedure Act regulations (Title 1, CCR, § 16(a)(6)) to provide references with citation styles that clearly identify published material cited in the regulation. The changes listed are otherwise identical to the changes in the same-numbered section of the federal Part 1065 due to amendments

adopted subsequent to June 2011,^{tt} and are proposed for the reasons described in the Global Amendments subsection, "Updates to Harmonize with Amended Federal Text," in this section G of this chapter.

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XIII. Appendices

Appendix A: Proposed Amendments to the Small Off-Road Engine Exhaust Emission Regulations, California Code of Regulations, Title 13, Division 3, Chapter 9. Off-Road Vehicles and Engines Pollution Control Devices, Article 1. Small Off-Road Engines

Appendix B: Proposed Amendments to the Small Off-Road Engine Evaporative Emission Regulations, California Code of Regulations, Title 13, Division 3, Chapter 15. Additional Off-Road Vehicles and Engines Pollution Control Requirements, Article 1. Evaporative Emission Requirements for Off-Road Equipment

Appendix C: Proposed Amendments to Small Off-Road Engine Evaporative Emissions Test Procedure, TP-901, Test Procedure for Determining Permeation Emissions from Small Off-Road Engine Fuel Tanks

Appendix D: Proposed Amendments to Small Off-Road Engine Evaporative Emissions Test Procedure, TP-902, Test Procedure for Determining Evaporative Emissions from Small Off-Road Engines

Appendix E: Proposed Amendments to Small Off-Road Engine Evaporative Emission Control System Certification Procedure, CP-902, Certification Procedure for Evaporative Emission Control Systems on Small Off-Road Engines

Appendix F: Proposed Amendments to the California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1054)

Appendix G: Proposed Amendments to the California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures (Part 1065)

Appendix H: Final Environmental Analysis for the Revised Proposed 2016 State Strategy for the State Implementation Plan

Appendix I: Standardized Regulatory Impact Assessment with Department of Finance Comments

Appendix J: Pre-Rulemaking Workshop Notices and Email Soliciting Alternatives