State of California AIR RESOURCES BOARD

#### STAFF REPORT: INITIAL STATEMENT OF REASONS FOR PROPOSED RULEMAKING

#### PROPOSED CALIFORNIA GREENHOUSE GAS EMISSIONS STANDARDS FOR MEDIUM- AND HEAVY-DUTY ENGINES AND VEHICLES AND PROPOSED AMENDMENTS TO THE TRACTOR-TRAILER GHG REGULATION

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#### LIST OF ACRONYMS AND ABBREVIATIONS

AB	Assembly Bill		
ABT	Averaging, banking, and trading		
AC	Alternating current		
A/C	Air conditioning		
ACEEE	American Council for Energy-Efficient Economy		
ACLT	Advanced Clean Local Truck (Rule)		
ADCO <sub>2</sub>	Analytically Derived CO <sub>2</sub>		
AECD	Auxiliary emission control device		
AESS	Automatic engine shutdown system		
AER	All-electric range		
ALVW	Adjusted loaded vehicle weight		
AMT	Automated manual transmission		
APS	Air Pollution Specialist		
APU	Auxiliary power unit		
ARE	Air Resources Engineer		
ARS	Air Resources Supervisor		
ATC	Advanced technology credit		
ATIS	Automatic tire inflation system		
CAA	Clean Air Act		
CARB	California Air Resources Board		
CCR	California Code of Regulations		
CEQA	California Environmental Quality Act		
CFD	Computational fluid dynamics		
CFR	Code of Federal Regulations		
CH <sub>4</sub>	Methane		
CI	Compression ignition		
CNG	Compressed natural gas		
CO <sub>2</sub>	Carbon dioxide		
CPI	Consumer price index		
CRR	Coefficient of rolling resistance		
CW	Curb weight		
DCP	Dual cam phasing		
DMC	Direct manufacturing cost		
DMS	Document management system		
DMV	Department of Motor Vehicles		
DOHC	Dual overhead camshaft engine		

DPF	Diesel particulate filter		
DVVL	Discrete variable valve lift		
EA	Environmental analysis		
ECARS	Emissions Compliance, Automotive Regulations and Science (Division)		
E-CERT	Electronic certification		
ECI	Emission control identifier		
EGR	Exhaust gas recirculation		
EMA	Truck and Engine Manufacturers Association		
EMFAC	Emission Factors model		
EO	Executive Order		
EOY	End-of-year		
EPA	Environmental Protection Agency		
ePTO	Electric power take-off		
FCL	Family certification limit		
FEL	Family emission limit		
FRM	Final rulemaking		
FTA	Federal Transit Administration		
FTP	Federal test procedure		
g/bhp-hr	Grams per brake horsepower-hour		
gCO <sub>2</sub> /bhp-hr	Grams CO <sub>2</sub> per brake horsepower-hour		
g/mile	Grams emitted per mile travelled		
gCO <sub>2</sub> /mile	Grams CO <sub>2</sub> emitted per mile travelled		
g/ton-mile	Grams emitted from carrying a ton of cargo over a distance of one mile		
gCO <sub>2</sub> /ton-mil	e Grams CO <sub>2</sub> emitted from carrying a ton of cargo over a distance of one		
mile			
GCWR	Gross combined weight rating		
GDP	Gross domestic product		
GEM	Greenhouse gas emissions model		
GHG	Greenhouse gas(es)		
GVWR	Gross vehicle weight rating		
GWP	Global warming potential		
HEV	Hybrid electric vehicle		
HFC	Hydrofluorocarbons		
HFET	Highway fuel economy test		
HFO-1234yf	Hydrofluoroolefin-1234yf		
HHD	Heavy heavy-duty		
HHDDT	Heavy-duty transient		
HSC	Health and Safety Code		
HVIP	Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project		
ICM	Indirect cost multiplier		
ICR	Information Collection Request		
ISOR	Initial statement of reasons for proposed rulemaking		
ITR	Innovative Technology Regulation		

kg/ton	Kilogram per ton
LEV	Low-emission vehicles
LHD	Light heavy-duty
LRR	Low rolling resistance
MHD	Medium heavy-duty
MMT	Million metric tons
MMTCO <sub>2</sub> e	Million metric tons of carbon dioxide equivalent
MVAC	Motor vehicle air conditioning
MY	Model year
N <sub>2</sub> O	Nitrous oxide
NAICS	North American Industry Classification System
NG	Natural Gas
NGO	Non-governmental organization
NHTSA	National Highway Traffic Safety Administration
NMHC	Non-methane hydrocarbon
NMOG	Non-methane organic gas
NOx	Oxides of nitrogen
NPRM	Notice of proposed rulemaking
NREL	National Renewable Energy Laboratory
OBD	On-board diagnostic
OEM	Original equipment manufacturer
OHV	Overhead valve
PEMS	Portable emission measurement system
PHEV	Plug-in hybrid electric vehicle
PM	Particulate matters
PUV	Pick-ups and vans (Class 2b and 3 vehicles)
RIA	Regulatory impact analysis
SAE	Society of Automotive Engineers
SB	Senate Bill
SCR	Selective catalytic reduction
SET	Supplemental engine test
SI	Spark-ignition
SIP	State Implementation Plan
SNAP	Significant New Alternatives Policy
SOHC	Single overhead camshaft
SRIA	Standardized regulatory impact analysis
TPMS	Tire pressure monitoring system
TRRL	Tire rolling resistance level
TRU	Transport refrigeration unit
TTMA	Truck Trailer Manufacturers Association
TW	Test weight
ULSD	Ultra-low sulfur diesel
U.S.	United States

VIN	Vehicle identification number		
VIUS	Vehicle Inventory and Use Survey		
VMT	Vehicle miles traveled		
VOC	Volatile organic compound		
WF	Work factor		
WHR	Waste heat recovery		
ZEV	Zero-emission vehicle		

#### **EXECUTIVE SUMMARY**

Heavy-duty on-road trucks provide a variety of essential functions that are critical to California's economy. Unfortunately, these trucks and the fossil fuels that power them are also major contributors to regional smog-forming oxides of nitrogen (NOx) emissions, local toxic particulate matter (PM) levels, and greenhouse gas (GHG) emissions in California. The focus of the effort described herein is the reduction of GHG emissions in California. Significant and comparable efforts are being undertaken by California Air Resources Board (CARB or Board) to meet air quality standards, by reducing NOx emissions, and reduce toxics health risk, by reducing PM emissions. In California, although heavy-duty trucks only account for about 8 percent of the statewide GHG emissions from all sources, they still account for about 20 percent of carbon dioxide (CO<sub>2</sub>) emissions from the transportation sector and consume about 20 percent of on-road fuel. Medium- and heavy-duty trucks are the fastest growing segment of the transportation sector in both the United States (U.S.) and worldwide. As a result, both the U.S. Environmental Protection Agency (U.S. EPA) and the CARB continue to focus attention on strategies to reduce the GHG emissions emitted by, and corresponding fuel consumption rates of these vehicles (CARB, 2015d, CARB, 2016c).

CARB is mandated to reduce GHG emissions in California. In 2006, the Legislature passed and the Governor signed the California Global Warming Solutions Act of 2006, (Assembly Bill (AB) 32, Chap. 488, Stats. 2006 (Nunez)), AB 32. AB 32 requires CARB to enact regulations to achieve the level of statewide GHG emissions in 1990 by 2020, authorizes and directs CARB to monitor and regulate sources of GHG emissions, (California Health and Safety Code (HSC) § 38510), and specifically directs CARB to "adopt rules and regulations … to achieve the maximum technologically feasible and cost-effective greenhouse gas emission reductions from sources … subject to the criteria and schedules set forth in this part". California HSC § 38560.

In 2016 California's Legislature adopted, and California's Governor Brown signed Senate Bill (SB) 32 (Chap. 249, Stats. 2016 (Pavley), which requires CARB to ensure that California's statewide emissions of greenhouse gas emissions are reduced to at least 40 percent below the level of statewide GHG emissions in 1990, no later than December 31, 2030. California HSC § 38566.

In 2008, the Board approved the California Tractor-Trailer GHG regulation, and it became effective in 2010. The regulation reduced the GHG emissions and corresponding fuel consumption from long-haul tractor-trailers traveling on California highways by requiring tractor-trailer fleet owners to improve the aerodynamic performance and reduce the tire rolling resistance of both their tractors and their trailers. As a result, it is commonplace to see trailers equipped with side-skirt fairings in California today.

In 2011, the U.S. EPA and the U.S. Department of Transportation's National Highway Traffic Safety Administration (NHTSA) jointly adopted the first federal GHG emission standards and fuel economy standards for heavy-duty engines and vehicles, referred to as the federal Heavy-Duty GHG Phase 1 regulation (Phase 1). That regulation requires both engine and vehicle manufacturers to employ more efficient components and systems, such as engine friction reduction, after treatment optimization, low temperature exhaust gas recirculation, turbo compounding, vehicle mass reduction, and idling reduction technology. The federal Phase 1 regulation also requires improvements in vehicle aerodynamics and the use of fuel-efficient, low rolling resistance (LRR) tires. The federal Phase 1 standards took effect with model year (MY) 2014 tractors, vocational vehicles, and heavy-duty pick-up trucks and vans (PUVs)<sup>1</sup> and the engines powering such vehicles. They did not set standards for trailers.

In 2013, the CARB approved for adoption California Phase 1 GHG regulations that were substantially identical to the federal Phase 1 regulations. This provided California the authority to certify new California certified engines and vehicles to the Phase 1 standards, as well as enforce them.

Although the Phase 1 GHG standards will reduce emissions below the baseline of what they would be without any standards in place, they are not enough to offset the projected growth in heavy-duty truck vehicle miles traveled (VMT). From around 2023 forward, without standards stricter than Phase 1, GHG emissions from medium- and heavy-duty trucks would increase each year. A second phase of GHG standards, the Phase 2 GHG standards, are needed to offset that projected VMT growth and keep heavy-duty truck CO<sub>2</sub> emissions declining.

CARB staff worked closely with U.S. EPA and NHTSA over the past several years on the development of Phase 2 GHG standards. CARB staff submitted extensive comments on U.S. EPA's initial proposal for Phase 2 standards, and, in response, U.S. EPA modified their proposal. The outcome is a Phase 2 program that California can support and that will allow manufacturers to continue to build a single fleet of vehicles and engines for the U.S. market.

On October 25, 2016, U.S. EPA and NHTSA jointly adopted the federal Phase 2 standards that built on the Phase 1 standards and achieved additional GHG reductions. The federal Phase 2 standards follow the same regulatory structure as the federal Phase 1 standards. GHG emission standards are set for tractors, vocational vehicles, and PUVs. Separate engine standards are also established for the engines used in

<sup>&</sup>lt;sup>1</sup> In the U.S. EPA's Phase 2 GHG rulemaking materials, EPA uses the term "heavy-duty pickups and vans" while the California regulation uses the term PUVs for these same vehicle types (class 2b and class 3). This staff report uses the term "pick-ups and vans" or "PUVs" to refer to these vehicles.

tractors and vocational vehicles. In addition, the federal Phase 2 standards establish for the first time, federal emissions requirements for trailers hauled by heavy-duty tractors. The federal Phase 2 standards are more technology-forcing than the federal Phase 1 standards, requiring manufacturers to improve existing technologies or develop new technologies to meet the standards. The progressively more stringent federal Phase 2 standards are phased-in from 2021 to 2027 for tractors, vocational vehicles and PUVs. For trailers, the standards are phased-in from 2018 through 2027. To meet these standards, manufacturers will likely seek to improve the performance of the Phase 1 compliance technologies listed above. In addition, the federal Phase 2 regulation will require further GHG emission reductions that may require manufacturers to employ more advanced compliance options such as engine waste-heat recovery (WHR), hybrids, fully electric vehicles, advanced transmissions, intelligent vehicle controls, heat rejection management, electrification of ancillary equipment, and other technologies. Further improvements in vehicle aerodynamics and LRR tires will also be required. Trailer manufacturers will likely utilize aerodynamic technologies, including skirts, and rear fairings, as well as LRR tires, automatic tire inflation systems (ATIS), and weight reducing materials to meet the Phase 2 trailer standards. Overall, the federal Phase 2 program in California is expected to result in significant GHG emissions reductions and fuel savings in California.

It should be noted the Truck Trailer Manufacturers Association (TTMA) has filed a petition with the U.S. Court of Appeals requesting the rescission of the trailer standards, and has successfully garnered a stay of the Phase 2 trailer requirements by the U.S. Court of Appeals, and reconsideration of the trailer provisions by U.S. EPA and NHTSA. However, these actions do not affect California's authority to establish standards for trailers, and CARB staff is proposing to adopt the Phase 2 trailer standards as they existed in October 2016 when they were originally published in the federal register.

#### A. What is staff's proposal?

Staff is proposing that the Board adopt new, more stringent California Phase 2 GHG emission standards that largely harmonize with the federal Phase 2 standards, and proposed amendments to the Tractor-Trailer GHG regulation to harmonize California's Tractor-Trailer GHG regulation with the proposed Phase 2 trailer standards. The proposed California Phase 2 GHG standards are needed to meet the mandates of both AB 32 and of SB 32, and the California HSC.

A summary of the primary regulatory proposals is provided below:

1. New Phase 2 GHG Emission Standards

In this rulemaking action, CARB staff is primarily proposing the adoption of new regulations, collectively referred to as the California Phase 2 regulations, that would establish new GHG emission standards for trailers, and that would amend existing regulations to establish more stringent GHG standards applicable for tractors,

vocational vehicles, PUVs, and medium-and heavy-duty engines, and amend requirements for glider vehicles, glider engines, and glider kits. The proposed new regulations and amendments would generally align California's GHG emission standards and test procedures with those of the federal Phase 2 GHG regulations in structure, timing, and stringency, providing nationwide consistency for engine and vehicle manufacturers.

Unlike in the California Phase 1 regulations, where federally certified engines and vehicles were "deemed to comply" with the California regulations, for the Phase 2 regulations, CARB staff is proposing to independently verify certification information, as is standard procedure for most other certification efforts. The proposed California Phase 2 regulations would not include "deemed to comply" provisions. In order to certify to California's Phase 2 regulations, manufacturers would be required to submit certification documents directly to CARB. CARB staff would independently review these documents before issuing an Executive Order (EO). Although the overall standards and test procedures would be aligned, there would be some minor distinctions between the California Phase 2 regulations and the federal Phase 2 regulations. Specifically, the California Phase 2 proposal would include the following:

- Include language strengthening the statement that manufacturers provide with their certification submittals. Manufacturers would need to unconditionally certify that the information submitted in certification packages is accurate, and that it describes engines and vehicles as built;
- Require tractors and vocational vehicles to have specific emission control identifiers (ECI) included on their emission control labels for technologies that can be visually inspected;
- Require the engine family to be included in the vehicle certification documentation;
- Require additional air conditioning (A/C) system information to be included in vehicle certification application;
- Establish a credit adjustment protocol that would encourage the use of low global warming potential (GWP) refrigerants, the sale of plug-in hybrid electric vehicles (PHEV) with a minimum all-electric range (AER) and low NOx emissions, and the manufacture of lower-emitting transit buses;
- Require PUVs to display consumer labels; and
- Continue to include ethane in the calculation of non-methane hydrocarbon (NMHC) emissions.
- 2. Amendments to CARB's Existing Tractor-Trailer GHG Regulation

The proposed amendments to the Tractor-Trailer GHG regulation would provide trailer fleet owners the option of complying with the Tractor-Trailer GHG regulation through the purchase of a Phase 2 certified trailer, or the installation of Phase 2 aerodynamic

technologies and LRR tires that are components of Phase 2 certified trailer configurations. This proposed change does not lessen or strengthen the existing requirements of the Tractor-Trailer GHG regulation; it simply provides another pathway to compliance.

#### B. What emission reductions would Phase 2 achieve?

Overall, the federal Phase 2 program in California plus the California distinctions are expected to result in a reduction of 207.6 million metric tons of CO<sub>2</sub> equivalent (MMTCO<sub>2</sub>e) emissions in California from 2019 to 2050. This is equivalent to saving 20.5 billion gallons of diesel fuel over the same time period. Table ES-1 shows the emission benefits in California from the California Phase 2 Program. A more detailed discussion of the assumptions and methodology used in estimating the emission impact of the California Phase 2 program is found in Chapter IV, Air Quality.

CO <sub>2</sub> Emissions from Affected Vehicles (in million metric tons (MMT) per year)					
Calendar Year	Baseline CO₂ Emissions	Baseline CO2CO2 EmissionsCO2 EmissionsEmissionswith Phase 1with Phase		Phase Redu	2 CO <sub>2</sub> ctions
				From Baseline	From Phase 1
2030	44.4	39.2	34.1	23%	13%
2050	55.3	47.9	36.5	34%	24%

#### Table ES- 1: California Phase 2 CO<sub>2</sub> Benefits

The amendments to the Tractor-Trailer GHG regulation provide another pathway to compliance through the use of Phase 2 certified trailers, without impacting the stringency of the existing standards, and as such, they have no emissions impact.

CARB is the lead agency for the proposed California Phase 2 regulation and the Tractor-Trailer GHG regulation amendments and has evaluated the need for an environmental analysis pursuant to the requirements of the California Environmental Quality Act (CEQA). The proposal is designed to protect the environment and staff found no substantial evidence indicating that the proposal could adversely affect air quality or any other environmental resource area. Therefore, this proposal is exempt from the requirements of CEQA. See Chapter V., Environmental Analysis for further discussion.

#### C. What benefits would the California Phase 2 distinctions provide?

The proposed California Phase 2 regulation would allow CARB to verify and enforce the Phase 2 regulatory standards, thereby potentially leading to higher levels of compliance,

which would ensure the program's GHG emission benefits occur. Specifically, the exclusion of "deemed to comply" provisions in the proposed California Phase 2 rule would allow staff's timely access to certification documentation for independent review to ensure compliance.

As detailed further below, the proposed minor California distinctions from the federal Phase 2 program would be necessary to ease enforcement, preserve the benefits of California incentive programs and regulations, and encourage manufacturers to bring low-emission technologies to market:

- The proposed A/C system reporting would allow staff to better enforce the A/C system leakage requirements. This is important because refrigerants have significantly higher GWP than CO<sub>2</sub>.
- The low-GWP proposal would provide incentives for manufacturers to use A/C refrigerants with low GWPs for heavy-duty vehicles. Low-GWP refrigerants have been widely used in the light-duty sector, but have not been adopted in the heavy-duty sector due to high capital investment cost. The use of low-GWP refrigerants could significantly decrease the global warming impact of refrigerant leakage emissions.
- The proposed additional requirement of showing no NOx increase and meeting a minimum AER in order for PHEVs to receive an advanced technology multiplier would prevent NOx increases and spur the development of better hybrids.
- The transit bus custom chassis proposal would incentivize the introduction of advanced zero-emission technology in the transit bus sector.
- The proposed consumer label for Class 2b/3 PUVs would allow consumers to compare vehicle choices based on the provided GHG and smog ratings on the required label and potentially choose lower-emitting, more fuel efficient vehicles.

#### D. What cost impacts would California Phase 2 have?

California Phase 2 harmonizes with the federal Phase 2 regulation in structure, timing and stringency. As a result the majority of vehicle manufacturer costs associated with designing and manufacturing compliant vehicles have already been accounted for at the federal level. However, the proposed California Phase 2 regulation would pose additional costs on affected parties due to the costs of certifying separately in California (i.e., not having "deemed to comply" provisions); and the inclusion of minor California distinctions regarding vehicle labeling, A/C system reporting, California credit provisions, and consumer labeling requirements for PUVs. Staff estimates that the total additional direct cost to all affected manufacturers from the proposed separate California Phase 2 certification and minor California Phase 2 distinctions would be approximately \$55,500,000 over nine years, 2020 through 2028. The proposed amendments to the Tractor-Trailer GHG regulation are designed to provide trailer fleet owners with another pathway for compliance through the use of Phase 2 certified trailers. As such, they pose no additional costs.

# E. Why is it important that California perform independent review and certification for California Phase 2 engines and vehicles (i.e., not adopt a "deemed to comply" approach)?

Under the Phase 1 standards, CARB certification staff issue an EO for any engine or vehicle family that has demonstrated compliance with the federal Phase 1 GHG regulation and has been issued a federal Certificate of Conformity by U.S. EPA (i.e., it is "deemed to comply"). Under the proposed California Phase 2 regulations, CARB certification staff would conduct an independent review and approval of Phase 2 certification applications for all engine and vehicle families sold in California.

California's active role in certifying engines, vehicles, and trailers is critical to ensure the benefits of the California Phase 2 GHG program, especially given the recent change in federal administration, the subsequent call to defund programs to combat climate change (NBC, 2017) and to substantially reduce U.S. EPA staffing levels (Washington Post, 2017), and the lack of willingness by senior federal government officials to acknowledge climate change as a problem (Tracy, 2017). Given the current political climate and its potential to impede the continued implementation of the existing federal Phase 2 regulation, CARB staff does not believe the "deemed to comply" approach that was used in Phase 1 is appropriate. California cannot currently rely on federal review of applications for engine and vehicle certification.

Phase 2 certification will be more time consuming and require additional staffing, both for manufacturers and for CARB. Manufacturers will be submitting much more information than was required under Phase 1 (for example, engine fuel maps, transmission data files, and rear axle efficiency information). Manufacturers have expressed concerns that the additional certification review by CARB staff could substantially delay the timely issuance of engine and vehicle certification.

CARB staff wants to be sensitive to manufacturers' concerns; while at the same time ensuring engines and vehicles meet emission standards and air quality is protected. To that end, as part of this rulemaking, the proposed amendments include language strengthening the statement that manufacturers provide with their certification submittals. Under the proposed amendments, manufacturers would need to unconditionally certify that the information submitted in certification packages is accurate, and that it describes engines and vehicles as built. This additional assurance of accuracy would provide CARB staff greater confidence that submitted information accurately reflects engine and vehicle designs and test results, which should enable CARB to more expeditiously process and issue certification executive orders. In addition, CARB staff is looking for ways to further streamline upfront certification. For example, CARB staff could develop an expedited certification option in which CARB staff agrees to streamline upfront review in exchange for manufacturers agreeing to provide additional in-use data. This option could be included in a future upcoming rulemaking, such as amendments to the heavy-duty warranty regulations or the heavy-duty OBD regulations, both currently planned for 2018.

## F. Why is it necessary to increase the reporting requirements regarding the A/C system over what is requested in the federal rule?

A/C refrigerants have a significantly higher GWP than CO<sub>2</sub>. For this reason, under the U.S. EPA's GHG Phase 2 final rule, manufacturers are required to provide refrigerant type, refrigerant capacity, and refrigerant leak rate, when demonstrating compliance with the A/C leakage standard. Staff's proposal would establish California requirements that would require detailed A/C system information allowing CARB staff to enforce the A/C system leakage requirements. The system schematics and the actual J2727 spreadsheets are critical to adequately demonstrate compliance with the leakage standard and necessary to allow CARB staff to effectively certify A/C systems to the leakage standard.

The proposed regulations include a requirement to submit a spreadsheet for each group of sufficiently similar A/C system configurations (for example, those with same refrigerant capacity but different hose lengths, or those that differ only in fitting specifications). Because of the enormous diversity of heavy-duty vehicle designs and of A/C system configurations, it would typically not be possible for a manufacturer to use "engineering judgment" for selecting one configuration to represent all vehicles they produce. Hence, most manufacturers would need to submit a set of spreadsheets to adequately demonstrate compliance. Staff has worked with affected manufacturers to limit the proposed A/C reporting requirements so that they provide adequate information to CARB certification staff, while not presenting an undue administrative burden on manufacturers. Overall, without the proposed A/C reporting requirements, the possibility of A/C leakage going unchecked would be greater, and the potential impact of refrigerant leakage on global warming would be increased.

#### G. Why does California Phase 2 include special provisions for Californiacertified transit buses?

In the federal Phase 2 program, manufacturers of motor homes, coach buses, transit buses, school buses, refuse trucks, cement mixers, and emergency vehicles have an option to certify those vehicles with a less stringent process called "custom chassis". Custom chassis standards that are significantly less stringent than the primary vocational vehicle standards and include a simplified certification process. The primary standards require nearly 30 percent more emission reductions from the 2017 baseline than the custom chassis standards in 2021. The difference grows in later years, with the primary standards requiring over 40 percent more emission reductions in 2027 and later.

U.S. EPA established these optional less-stringent standards because they believe the manufacturers of these types of vehicles may have difficulty meeting the primary standards due to an inability to take advantage of averaging, and the limited number of technologies that may be used on these specialized vehicles to meet the standards. Staff understands U.S. EPA's reasoning behind the creation of the custom chassis certification option and is proposing to align with it for all proposed vehicle types except transit buses, for the reasons discussed below.

Both battery and fuel-cell electric buses are commercially available for transit applications. In fact, staff for several years have been pursuing an Innovative Clean Transit measure to incentivize or require such buses. In California, there are already nearly 450 fuel cell and battery electric buses in operation or on order (CARB, 2017). Due to the generous advanced technology credits in the Phase 2 program, a transit bus manufacturer can meet the primary vocational standards by manufacturing relatively few zero-emission buses (no more than two percent of their total production).

Given the need for zero-emission heavy-duty technologies and the importance of the transit bus application for advancing such technologies, staff's proposal would require the manufacturers of California-certified transit buses that certify to the custom chassis standards to retire any credits gained over and above what would have been gained if the transit buses were certified to the more stringent primary vocational vehicle standard. This requirement would discourage transit bus manufacturers from certifying to the less stringent custom chassis standards and would incentivize the introduction of advanced zero-emission technology in the transit bus sector.

#### H. What does the proposal include with respect to glider vehicles?

A "glider vehicle" is a vehicle where the "chassis and cab assembly is produced by a vehicle manufacturer without a new engine, transmission, or rear axle and a third party installs an engine, transmission, and/or rear axle to complete the vehicle. With the implementation of the 2007/2010 engine emission standards, glider sales ballooned as the glider industry increased production using pre-2007 remanufactured engines, rather than salvaged engines. The increase in glider vehicles was seemingly driven by the desire of truck owners to avoid purchasing more expensive, new trucks with advanced engine technologies and exhaust aftertreatment, including selective catalytic reduction systems to cut NOx and diesel particulate filters to cut toxic diesel particulate matter (U.S. EPA, 2015b). Based on U.S. EPA's own testing this year, glider vehicle NOx levels were 4 to 40 times higher, and PM levels were 50 to 450 times higher than for modern vehicles (U.S. EPA., 2017a). The increasing population of glider vehicles with old, high-emitting engines is of concern. In fact, U.S. EPA estimated that this significant

increase in the glider market could nearly double the emissions of NOx and PM2.5 from new Class 8 trucks (U.S. EPA, 2015b).

To address this growing air quality and public health concern, the final federal Phase 2 regulations limited the production of glider vehicles with pre-2007 engines, ultimately shifting the glider industry's use of these engines back to pre-2007 levels.

Although California has in-use regulations such as the Truck and Bus Rule that restricts the use of trucks with pre-2010 engines (due to their high emissions), in practice, it is often difficult to enforce such regulations for out of state trucks (CARB, 2017g). If the population of glider vehicles with pre-2010 engines increases, California will face an increasingly difficult enforcement challenge. Because glider vehicles are newly manufactured with new chassis, on the exterior, they may appear identical to modern trucks and may be very difficult to distinguish from trucks equipped with modern, much cleaner, engines and aftertreatment.

States other than California do not have regulations like the Truck and Bus Rule restricting the use of pre-2010 engines. Hence, outside California the potential emission increases from glider vehicles, and their associated impacts on ambient ozone, fine particulate matter, and public health, would be even worse.

On November 9, 2017, U.S. EPA released a notice of proposed rulemaking (NPRM) to repeal the current heavy-duty glider requirements that represents a departure from its position taken during the federal Phase 2 rulemaking. Under this proposed new interpretation, U.S. EPA would lack authority to regulate glider vehicles, glider engines, and glider kits.

In staff's proposal, staff is proposing to align with the final federal Phase 2 regulations adopted by U.S. EPA on October 25, 2016, including emission standards and other requirements for heavy-duty glider vehicles, glider engines, and glider kits. As described above, these glider provisions are intended to close an unintended emission standards loophole and curtail criteria pollutant increases that occurred after implementation of the 2007/2010 heavy-duty engine emissions standards.

The November 9, 2017, U.S. EPA glider NPRM does not change CARB staff's current proposal. However, if the U.S. EPA should prevail in its efforts to repeal the glider requirements, CARB staff intends to reevaluate the associated emissions increases to determine the best course of action necessary to attain California's air quality commitments and to protect the health of its residents.

#### I. What does staff recommend?

Staff recommends that the Board approve the proposed regulation orders, test procedures, and label specifications in Appendices A thru C. These include new Phase 2 GHG emission standards as well as amendments to CARB's existing Tractor-Trailer GHG regulation. Staff also recommends that adequate CARB staff resources be

provided to effectively implement and enforce the California Phase 2 program. The main body of this report provides further discussion and justification for staff's proposal.

#### I. INTRODUCTION AND BACKGROUND

#### A. Introduction

The California Air Resources Board (CARB or Board) has a comprehensive regulatory program in place to reduce emissions from on-road medium- and heavy-duty engines and vehicles in California. These regulatory programs are part of CARB's program to improve air quality and reduce the emissions that contribute to climate change.

This report presents staff's proposal for two separate, but related regulatory actions designed to further reduce greenhouse gas (GHG) emissions from on-road heavy-duty engines and vehicles in California while harmonizing the California and federal programs. These regulatory actions are:

- New Phase 2 GHG Emission Standards: These proposed regulations would build upon the California Phase 1 standards that address model year (MY) 2014 through 2019 engines and vehicles. The California Phase 2 regulations would set new more stringent GHG emission standards for medium- and heavy-duty engines, tractors, vocational vehicles, heavy-duty pick-up trucks and vans (PUVs), and trailers that are sold in California. The California Phase 2 standards would be nearly identical to the federal Phase 2 standards in structure, timing, and stringency<sup>2</sup>. By adopting California standards identical to the federal standards, California would gain the ability to certify engines and vehicles to the new Phase 2 standards and enforce them as well.
- Amendments to CARB's Existing Tractor-Trailer GHG regulation: The proposed amendments to CARB's existing Heavy-Duty Vehicle GHG Emission Reduction Regulation (Tractor-Trailer GHG regulation) would allow trailer fleet owners the option of either purchasing Phase 2 certified trailers, or installing Phase 2 approved aerodynamic technologies and low-rolling resistance (LRR) tires to meet the requirements of the Tractor-Trailer GHG regulation.

<sup>&</sup>lt;sup>2</sup> There would be a small difference in the timing of the initial trailer standards, which would begin later in California to accommodate the timing of California's rulemaking process. The federal Phase 2 trailer standards begin with the 2018 MY; the California Phase 2 trailer regulations will not begin until MY 2020. For the other categories - engines, tractors, vocational vehicles, and PUVs - the timing of the federal and California Phase 2 standards are identical, beginning in MY 2021 and become progressively more stringent in MY 2024 and 2027

Section B below presents the statutes directing CARB to reduce GHG emissions as well as CARB's regulatory authority to do so. Section C provides background on the Phase 1 GHG standards and CARB's Tractor-Trailer GHG regulation. Section D discusses the purpose of California adopting the Phase 2 GHG standards and summarizes the California Phase 2 proposal's minor distinctions from the federal Phase 2 program. The following chapters contain the following:

- Chapter II describes the problem this rulemaking is intended to address and the proposed solution to the problem;
- Chapter III provides a summary of the proposed regulatory amendments;
- Chapter IV summarizes the air quality benefits of the proposed regulatory amendments for California Phase 2 and CARB's Tractor-Trailer GHG regulation;
- Chapter V presents the Environmental Analysis prepared to comply with the California Environmental Quality Act (CEQA);
- Chapter VI describes how the proposal is consistent with CARB's environmental justice policies;
- Chapter VII summarizes the cost and economic impact analysis for the proposed regulatory amendments;
- Chapter VIII provides a justification for the adoption of regulations different from federal regulations.
- Chapter IX summarizes the public process for development of the proposed regulatory amendments; and
- Chapter X lists references used.

#### **B.** Need for Emission Reductions and Regulatory Authority Introduction

The California Global Warming Solutions Act of 2006, Assembly Bill (AB) 32, Chap. 488, Stats. 2006 (Nunez)) (AB 32) requires CARB to enact regulations to achieve the level of statewide GHG emissions in 1990 by 2020, authorizes and directs CARB to monitor and regulate sources of GHG emissions, California Health and Safety Code (HSC) § 38510, and specifically directs CARB to "adopt rules and regulations ... to achieve the maximum technologically feasible and cost-effective greenhouse gas emission reductions from sources ... subject to the criteria and schedules set forth in this part." California HSC § 38560. AB 32 requires CARB to develop and approve a Scoping Plan that describes the approach California will take to reduce GHGs to achieve the goal of reducing emissions to 1990 levels by 2020. The Scoping Plan was first approved by CARB in 2008 and, per AB 32, must be updated every five years to evaluate the mix of AB 32 policies to ensure that California is on track to achieve the 2020 GHG reduction goal and the goals set forth in Executive Order S-3-05 and B-16-2012.

In 2016 California's Legislature adopted, and California's Governor Brown signed Senate Bill (SB) 32 (Chap. 249, Stats. 2016 (Pavley), which requires CARB to ensure that California's statewide emissions of GHG emissions are reduced to at least 40 percent below the level of statewide greenhouse gas emissions in 1990, no later than December 31, 2030. California HSC § 38566.

Key to meeting the AB-32 and SB-32 GHG emission reduction goals is the reduction of GHG emissions from medium- and heavy-duty trucks, which account for approximately 1/5th of the GHG emissions from the transportation sector nationally, and are the fastest growing segment of the transportation sector in both the United States (U.S.) and worldwide. Similar to their contribution on a national basis, medium and heavy-duty trucks over 8,500 pounds in California emit about a fifth of the total transportation GHG emissions, which is about eight percent of the statewide total (CARB, 2016a).

#### C. Background

In response to the statutory authority described above, CARB has developed and implemented a comprehensive regulatory program to reduce emissions that contribute to climate change from on-road medium- and heavy-duty engines and vehicles in California. In 2011, the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Transportation's National Highway Traffic Safety Administration (NHTSA) jointly adopted GHG emission standards and fuel economy standards for medium- and heavy-duty engines and vehicles for MY 2014 and later medium-and heavy-duty engines and vehicles, commonly referred to as the U.S. Phase 1 GHG regulations or federal Phase 1 program. In 2014, CARB adopted California GHG emission standards and test procedures that aligned with the U.S. Phase 1 GHG regulations (CARB, 2013a). At the same time, CARB amended its existing Tractor-Trailer GHG regulation to sunset redundant requirements on MY 2014 and later tractors certified to the Phase 1 standards. The Phase 1 GHG standards and Tractor-Trailer GHG regulation are described further below.

CARB staff worked closely with U.S. EPA and NHTSA over the past several years on the development of Phase 2 GHG standards. As part of that effort, CARB staff assessed technologies that could reduce GHG from heavy-duty trucks and engines (CARB, 2015d). In crafting the Phase 2 GHG proposal in this document, CARB staff relied on that assessment as well as the underlying facts on technical feasibility and cost that are set forth in U.S. EPA's rulemaking record.

In 2016, U.S. EPA and NHTSA adopted their second phase of GHG and fuel economy standards, collectively known as the Phase 2 program. The Phase 2 program (U.S. EPA, 2016; U.S. EPA, 2015), discussed further in Chapter III, establishes more stringent GHG standards for new medium- and heavy-duty engines and vehicles, and for the first time, includes federal GHG emission standards for trailers.

1. Phase 1 GHG Emission Standards

U.S. EPA and NHTSA adopted the Phase 1 GHG Emission Standards and Fuel Economy Standards for Heavy-Duty Engines and Vehicles, the first ever national GHG emission standards for heavy-duty engines and vehicles, in 2011. CARB adopted California's Phase 1 standards that largely align with the federal Phase 1 requirements, albeit with minor differences in 2013 to align with California's existing programs. The Phase 1 standards give CARB the ability to certify new heavy-duty vehicles and engines and enforce those requirements in the State. In addition, these standards provide nationwide consistency for vehicle and engine manufacturers thereby minimizing their compliance burden.

California's Phase 1 regulation is projected to reduce carbon dioxide (CO<sub>2</sub>) emissions in California by 12 percent in 2030. The cumulative statewide GHG emission benefits from the California Phase 1 regulation are estimated at 19 million metric tons of CO<sub>2</sub> equivalent (MMTCO<sub>2</sub>e) from 2015 to 2020. The proposed California Phase 2 standards will build on these Phase 1 standards and help California meet its GHG emission goals and address the serious threat that global warming poses to the State. This section describes the major requirements of California's Phase 1 regulation. (CARB, 2013; CARB, 2014b)

California's Phase 1 GHG emission standards for CO<sub>2</sub>, and other GHGs (nitrous oxide  $(N_2O)$ , methane (CH<sub>4</sub>), and hydrofluorocarbons (HFC)) started with MY 2014 and ratcheted down again in 2017 for vehicles with greater than 8,500 pounds gross vehicle weight rating (GVWR), and the engines that power them, except for medium-duty passenger vehicles already covered by the light-duty regulation.

Vehicle standards were established in three regulatory categories: 1) class 7 and 8 combination tractors, 2) class 2b to 8 vocational vehicles (chassis), and 3) class 2b and 3 PUVs (complete vehicle). There are separate engine standards for diesel (compression-ignition (CI)) and gasoline (spark-ignition (SI)) engines. Trailers were not regulated as part of Phase 1.

Class 7 and 8 combination tractors have nine subcategories to recognize the differences in expected emission associated with the various tractor cab attributes related to GHG emissions: the vehicle's GVWR, roof height of the cab, and cab characteristics (day cab or sleeper cab). See Table 1 in Appendix J for the current California Phase 1 GHG emission standards for new for heavy-duty combination tractors.

Vocational vehicles include, but are not limited to, delivery vehicles, refuse vehicles, and transit buses and have three regulatory categories according to GVWR: light heavy-duty (LHD) vehicles that range from 8,501 to 19,500 pounds, medium heavy-duty (MHD) vehicles that range from 19,501 to 33,000 pounds, and heavy heavy-duty (HHD)

vehicles that have greater than 33,000 pounds. See Table 2 in Appendix J for the current California Phase 1 GHG emission standards for new for heavy-duty vocational vehicles.

The regulated entities (i.e., vehicle/chassis manufacturers, but not body builders for vocational vehicles) are required to install a certified Phase 1 engine to meet the appropriate vehicle standards. Engine standards differ for diesel and gasoline (Otto cycle) with gasoline engines standards starting with 2016 MY, and diesel engines standards starting with 2014 MY. Natural gas (NG) engines derived from diesel engines must comply with the diesel engine standards, and those derived from gasoline engines must comply with the gasoline engine standards. See Table 3 in Appendix J for the current California Phase 1 GHG emission standards for new heavy-duty Otto cycle and diesel engines.

Unlike the traditional dynamometer testing used for engine certification, Phase 1 emission standards require that tractors and vocational vehicles use a vehicle simulation, known as the GHG Emissions Model (GEM), to demonstrate compliance with U.S. EPA's GHG emissions and NHTSA's fuel consumption vehicle standards. GEM was developed by U.S. EPA and is free software. Most of the simulation parameters in Phase 1 GEM are predefined and there are only a very limited number of user input parameters, specifically coefficient of aerodynamic drag, tire rolling resistance (steer/drive), vehicle speed limiter, vehicle weight reduction, and extended idle reduction.

PUVs (i.e., class 2b vehicles with GVWR of 8,501 to 10,000 pounds and class 3 vehicles with GVWR of 10,001 to 14,000 pounds) were required to meet a combined vehicle/engine, or "complete-vehicle" standard, expressed as grams of CO<sub>2</sub> emitted per mile travelled (gCO<sub>2</sub>/mile), and show compliance using chassis dynamometer testing. The fleet average standard for these vehicles is based on combined medium-duty PUVs produced in each MY. PUV standards were established taking into account payload and towing capability, which are the key design parameters for these vehicles. See Tables 4 through 7 in Appendix J for the current California Phase 1 GHG fleet average standard targets for PUVs.

Additionally, Phase 1 standards provide a variety of compliance and flexibility provisions, including an alternative compliance path that started in 2013, an opportunity to average, bank, and trade credits, as well as recognition of advanced technologies and availability of early compliance credits.

2. Tractor-Trailer GHG Regulation

In December 2008, the Board approved the Tractor-Trailer GHG regulation, which became effective January 1, 2010 (CARB, 2014). The regulation reduces the GHG

emissions from long-haul tractors and trailers by improving the aerodynamic performance and reducing the rolling resistance of tractor-trailers. The cumulative statewide GHG emission benefit from the Tractor-Trailer GHG regulation is estimated at 4.8 MMTCO<sub>2</sub>e from 2010 to 2020.

The requirements specified in the regulation are based on elements of the U.S. EPA SmartWay program. Launched in 2004, SmartWay is a voluntary U.S. EPA program that reduces transportation-related emissions by creating incentives to improve supply chain fuel efficiency. Under the SmartWay program, U.S. EPA establishes performance criteria and reviews test data to ensure that designated tractors and trailer models have been demonstrated to be more fuel efficient than their traditional counterparts.

The Tractor-Trailer GHG regulation applies primarily to the owners of 53-foot or longer box van trailers, both dry vans and refrigerated vans, and the owners of the heavy-duty tractors that pull them on California highways. These owners are responsible for replacing or retrofitting their affected vehicles with compliant aerodynamic technologies and LRR tires. Besides the owners of these vehicles, drivers, motor carriers, and California-based brokers and California-based shippers share the responsibility for compliance with the Tractor-Trailer GHG regulation.

The Tractor-Trailer GHG regulation exempts specific types of tractor-trailers: military tactical vehicles, authorized emergency vehicles, drayage tractor-trailers, curtain side vans, solid waste vehicles, drop frame vans, and container chasses. There are also exemptions for tractors and trailers that are used in applications (i.e., local haul and short-haul) that would not benefit from aerodynamic technologies and/or LRR tires. A local haul tractor or trailer travels exclusively within a 100-mile radius of its local-haul base. A short haul tractor travels no more than 50,000 miles per year.

Tables I-1 and I-2 identify the requirements of the Tractor-Trailer GHG regulation for owners of tractors and trailers subject to the regulation. MY 2014 and newer tractors are not subject to the Tractor-Trailer GHG regulation since they must meet requirements of the California Phase 1 regulation<sup>3</sup> (CARB, 2013; CARB, 2014b).

<sup>&</sup>lt;sup>3</sup> Although the Tractor-Trailer GHG regulation applies to 2011 and newer MY tractors, CARB only requested a waiver for the elements of the regulation applicable to new 2011 through 2013 MY tractors. U.S. EPA granted that waiver request in 2017. 79 FR 46256 (Aug. 7, 2014).

Tractor Type	MYs	Requirement
Sleeper-Cab	2011 through 2013	SmartWay Designated Model
Day-Cab	2011 through 2013	Must use SmartWay verified LRR tires
All	2010 and older	Must use SmartWay verified LRR tires

 Table I- 1: Tractor Requirements of the Tractor-Trailer GHG Regulation

SmartWay designated tractor models are sleeper-cab tractors that have been outfitted at the point of sale with equipment that significantly improves fuel efficiency and reduces GHG emissions. This equipment includes an integrated roof fairing, aerodynamic mirrors, aerodynamic bumper, cab side extenders, fuel tank fairings, LRR steer and drive tires, and idle-reduction technology. SmartWay designated tractors must also demonstrate, using the modified Society of Automotive Engineers (SAE) J1321 track test (U.S. SmartWay, 2015a), that they meet or exceed the fuel efficiency performance of at least one current SmartWay designated sleeper-cab model.

 Table I- 2: Trailer Requirements of the Tractor-Trailer GHG Regulation

Trailer Type	MYs	Requirement
53'+ Dry Van	All	SmartWay Designated or retrofitted with
		SmartWay Verified Aero (5% minimum
		fuel savings) and LRR tires
53'+Refrigerated Van	All	SmartWay Designated or retrofitted with
		SmartWay Verified Aero (4% minimum
		fuel savings) and LRR tires

As shown in Table I-2, 53-foot or longer dry van and refrigerated van trailers subject to the Tractor-Trailer GHG regulation must be SmartWay designated trailers or be retrofitted with SmartWay verified aerodynamic technologies and LRR tires. Dry vans must be equipped with aerodynamic technologies that have been verified to achieve to 5 percent or greater fuel savings. For refrigerated vans, the technologies must be verified to achieve 4 percent or greater fuel savings. (U.S. EPA, SmartWay 2015c) (U.S.EPA, SmartWay, 2015e)

SmartWay trailer aerodynamic technologies can have their fuel saving performance verified by U.S. EPA with any of four methods: wind-tunnel testing (U.S. EPA SmartWay, 2015d), coast down testing, computational fluid dynamics (CFD), and the modified SAE J1321 track test (U.S. EPA SmartWay, 2015a). U.S. EPA maintains a list of SmartWay verified devices on its SmartWay website:

<u>www.epa.gov/smartway/forpartners/technology.htm</u>. (U.S. EPA SmartWay, 2015b) (U.S.EPA, SmartWay, 2015e)

Figure I-1 sets forth the compliance timeline for the Tractor-Trailer GHG regulation. The top half of the figure shows the compliance deadlines for meeting the tractor and trailer requirements. The bottom half shows the compliance deadlines for registering for the optional trailer fleet registration program. The optional fleet registration program was offered to owners of trailer fleets so that they could phase in the retrofitting of their MY 2010 and older (pre-2011) trailers with aerodynamic technologies, rather than meeting the January 1, 2013 compliance deadline for their entire fleet. Refrigerated van trailers (reefers) with 2003 and later transport refrigeration units (TRU) have later compliance dates because owners of these vehicles are subject to another CARB regulation, called the Airborne Toxic Control Measure for In-Use Diesel-Fueled Transport Refrigeration Units and TRU Generator Sets, and Facilities Where TRUs Operate, which required replacement or retrofit of the TRU concurrent with the proposed optional compliance schedules.





#### D. Specific Purpose for the New Regulation and Amendments

The proposed California Phase 2 regulations would establish GHG emission standards that are nearly identical to the federal Phase 2 standards in structure, timing, and stringency for MY 2021 and newer vehicles and engines and MY 2020 and newer trailers sold in California. The Phase 2 standards would result in significant GHG

emission benefits in California, as detailed in Chapter IV. These emission benefits are needed to meet the mandates of AB 32 and SB 32. Although the Phase 1 GHG standards will reduce emissions below the baseline of what they would have been without any heavy-duty GHG standards in place, the Phase 2 GHG standards, are needed to offset growth in vehicle miles traveled (VMT) and keep heavy-duty truck CO<sub>2</sub> emissions declining.

By adopting these regulations, California would gain the ability to enforce the Phase 2 standards in California, as well as, certify all new heavy-duty engines and vehicles sold in California to the Phase 2 standards. Unlike with Phase 1, federal Phase 2 certified engines and vehicles would not be considered "deemed to comply" with the proposed California Phase 2 regulations. The proposed California Phase 2 regulation would require manufacturers to submit certification information directly to CARB for an independent review before CARB issues any California Executive Orders (EO).

The proposed California Phase 2 regulations differ from the federal Phase 2 regulations in the following areas in order to facilitate enforcement, align with existing California programs, and provide additional incentives for manufacturers to bring advanced technologies to the market.

- Include language strengthening the statement that manufacturers provide with their certification submittals. Manufacturers would need to unconditionally certify that the information submitted in certification packages is accurate, and that it describes engines and vehicles as built;
- Require tractors and vocational vehicles to have specific emission control identifiers (ECI) included on their emission control labels, as applicable;
- Require the engine family to be included in the vehicle certification documentation;
- Require additional air conditioning (A/C) system information to be included in vehicle certification documentation;
- Establish a credit adjustment protocol that would incentivize the use of low global warming potential (GWP) refrigerants, incentivize the sale of plug-in hybrid electric vehicles (PHEV) to meet a minimum all-electric range (AER) and ensure no increase to oxides of nitrogen (NOx) emissions, and incentivize transit bus manufacturers not to certify to the less stringent custom chassis standards;
- Require PUVs to display consumer labels; and
- Continue to include ethane in the calculation of non-methane hydrocarbon (NMHC) emissions.

The proposed amendments to the Tractor-Trailer GHG regulation would provide trailer fleet owners the option of complying with the Tractor-Trailer GHG regulation through the

purchase of a Phase 2 certified trailer, or the installation of Phase 2 aerodynamic technologies and LRR tires that are components of Phase 2 certified trailer configurations. This proposed change would not weaken or strengthen the existing requirements of the Tractor-Trailer GHG regulation, rather it is intended to just provide another pathway to compliance.

#### II. STATEMENT OF REASONS

#### A. Description of Problem the Proposal is Intended to Address

GHGs are the primary cause of anthropogenic climate change. Climate change is already having dramatic impacts in California in the form of reduced snowpack, more intense drought, increased wildfire intensity, and sea level rise. Human-caused climate change threatens both public health and public welfare. Extreme weather events, changes in air quality, increases in food- and water-borne pathogens, and increases in temperatures are anticipated to have adverse health effects. GHG emissions can remain in the atmosphere for decades to millennia. Transportation activities, in particular, were the largest contributor to total California GHG emissions in 2012 (37 percent of total emissions) (CARB, 2016d).

To address these concerns, CARB has been authorized and directed to both reduce GHG emissions and to transform the State's transportation system. These directives require CARB to:

- Reduce GHG emissions to 1990 levels by 2020;
- Reduce GHG emissions 40 percent from 1990 levels by 2030;
- Reduce GHG emissions 80 percent from 1990 levels by 2050;
- Reduce petroleum use in cars and trucks by up to 50 percent by 2030; (Office of the Governor Edmund G. Brown, 2015)

The federal Phase 2 GHG program will provide substantial GHG reductions which will help California achieve the state's GHG reduction goals. Adoption of the California Phase 2 regulation will give California the ability to certify and enforce the federal Phase 2 standards in California, and with proposed minor distinctions, help preserve the air quality benefits of California's incentive and regulatory programs.

1. Glider Vehicles, Glider Engines, and Glider Kits

The term "glider kit" refers to a chassis and cab assembly that is produced by a vehicle manufacturer without a new engine, transmission, or rear axle. A third party typically installs an engine, transmission, and/or rear axle to complete the vehicle, which is then referred to as a "glider" or "glider vehicle." Glider kits and glider vehicles have been manufactured for years, primarily to salvage working engines and drivetrains from badly damaged Class 8 trucks and reuse them in new chassis/cab assemblies (i.e., glider kits). With the implementation of the 2007/2010 engine emission standards, U.S. EPA estimated that glider sales ballooned by a factor of 10 as the glider industry increased production using pre-2007 remanufactured engines, rather than salvaged engines, seemingly driven by the desire of truck owners to avoid purchasing more expensive, new trucks with advanced engine technologies and exhaust aftertreatment, including

selective catalytic reduction systems to cut NOx and diesel particulate filters to cut toxic diesel particulate matter (U.S. EPA, 2015b). Based on U.S. EPA's own testing this year, glider vehicle NOx levels were 4 to 40 times higher, and PM levels were 50 to 450 times higher than for modern vehicles (U.S. EPA., 2017a). In fact, U.S. EPA estimated that this significant increase in the glider market could nearly double the emissions of NOx and particulate matter (PM2.5) from new Class 8 trucks, based on current production levels in 2014 (U.S. EPA, 2015b). To address this growing air quality and public health concern, the Phase 2 notice of proposed rulemaking (NPRM) proposal required all engines used in glider vehicles to meet the same NOx, PM, and GHG requirements as new engines, but with some exceptions for small businesses. CARB supported this action as necessary to close the inadvertent glider emissions loophole resulting from the 2007/2010 emissions standards.

U.S. EPA, however, modified the glider provisions for the final Phase 2 program. In the final program, glider manufacturers are allowed to continue using older engines, but under limited and prescribed conditions intended to ultimately shift the glider industry's use of these engines back to pre-2007 levels. The use of engines meeting the latest emission standards in glider vehicles remains unrestricted.

The final federal Phase 2 regulations adopted by U.S. EPA on October 25, 2016, include emission standards and other requirements for heavy-duty glider vehicles, glider engines, and glider kits. Because glider vehicles are newly manufactured with new chassis, on the exterior, they may appear identical to modern trucks and may be very difficult to distinguish from trucks equipped with modern, much cleaner, engines and aftertreatment.

On November 9, 2017, U.S. EPA released a NPRM to repeal the current heavy-duty glider requirements. The rationale for the NPRM is based on a proposed interpretation of the Clean Air Act (CAA) under which glider vehicles would be found not to constitute "new motor vehicles" within the meaning of CAA section 216(3), glider engines would be found not to constitute "new motor vehicle engines" within the meaning of CAA section 216(3), and glider kits would not be treated as "incomplete" new motor vehicles. Under this proposed interpretation, U.S. EPA would lack authority to regulate glider vehicles, glider engines, and glider kits under CAA section 202(a)(1). U.S. EPA's proposed interpretation is a departure from its position taken during the federal Phase 2 rulemaking.

Although California has in-use regulations such as the Truck and Bus Rule that restricts the use of trucks with pre-2010 engines (due to their high emissions), in practice, it is often difficult to enforce such regulations for out of state trucks (CARB, 2017g). If the population of out-of-state glider vehicles with pre-2010 engines increases, California will face an increasingly difficult enforcement challenge trying to ensure the requirements of the Truck and Bus rule are met. Because glider vehicles are newly manufactured with new chassis, on the exterior, they may appear identical to modern trucks and may be

very difficult to distinguish from trucks equipped with modern, much cleaner, engines and aftertreatment.

States other than California do not have regulations like the Truck and Bus Rule restricting the use of pre-2010 engines. Hence, outside California the potential emission increases from glider vehicles, and their associated impacts on ambient ozone, fine particulate matter, and public health, would be even worse.

#### B. Proposed Solutions to the Problem

Staff is proposing that the Board adopt the proposed California Phase 2 regulation, which establishes GHG emission standards and other emission-related requirements for new medium- and heavy-duty engines and vehicles. The proposed California requirements are largely identical to the corresponding federal requirements in the federal Phase 2 regulation, but include minor distinctions from the federal requirements. The proposed California Phase 2 regulation would allow CARB to both certify new heavy-duty engines and vehicles to the federal Phase 2 standards and to enforce those requirements in California.

Although CARB sees the benefit of one national strategy and intends to harmonize with the federal program in structure, timing, and stringency, minor distinctions are necessary to facilitate enforcement, align with existing California programs, and provide incentives for manufacturers to bring advanced technologies to the market. As described in further detail in Chapter III, the California Phase 2 proposal differs from the federal Phase 2 rule in the following areas:

- Independent California review to receive certification (i.e., no "deemed to comply");
- Additional vehicle label requirements;
- Additional reporting of engine and A/C system-related information;
- Additional credit provisions;
- Additional certification requirements for transit buses;
- Additional consumer label requirements;
- Including ethane in the hydrocarbon emission standards for NG engine requirements; and

Staff is also proposing to provide an additional pathway for compliance for trailer fleet owners currently subject to California's existing Tractor-Trailer GHG regulation. The federal trailer standards are as stringent as the Tractor-Trailer GHG regulation in 2018, and become more stringent in 2024 and 2027. Currently, there is no compliance pathway where owners of trailer fleets can use Phase 2 compliant trailers to meet the Tractor-Trailer GHG regulation requirements. Staff's proposal would identify federal and California Phase 2 certified trailers as Tractor-Trailer GHG regulation compliant trailers.

1. Glider Vehicles, Glider Engines, and Glider Kits

Staff is proposing to align with the final federal Phase 2 regulations adopted by U.S. EPA on October 25, 2016, including emission standards and other requirements for heavy-duty glider vehicles, glider engines, and glider kits. As described above, these glider provisions are intended to curtail criteria pollutant increases that occurred after implementation of the 2007/2010 heavy-duty engine emissions standards. These emissions impacts are due to industry's use of an unintended emissions standards loophole that enabled an increase in the production of glider vehicles equipped with pre-2007 model year remanufactured engines.

The November 9, 2017 U.S. EPA glider NPRM does not change CARB staff's current proposal. However, if the U.S. EPA should prevail in its efforts to repeal the glider requirements, CARB staff intends to reevaluate the associated emissions increases to determine the best course of action necessary to attain California's air quality commitments and to protect the health of its residents.

#### C. Rationale Supporting the Proposed Solutions

Climate change is the result of various GHGs that are emitted into the atmosphere, which have a heat forcing effect on the atmosphere. Sharp rises of GHGs over the last century and a half have led to higher overall worldwide temperatures, reduced snowpack in the higher elevations, greater fluctuations of temperature and precipitation, global sea level rise and more frequent and severe extreme weather events, including hurricanes, heatwaves, and droughts. All of these things present a threat to California. Although CARB has already implemented the Tractor-Trailer GHG regulation and the California Phase 1 regulation, additional GHG emission reductions are needed from the transportation sector to offset projected increases in VMT and keep heavy-duty truck CO<sub>2</sub> emissions declining. In response, CARB staff worked closely with U.S. EPA and NHTSA to develop a federal Phase 2 regulation that will generate further needed GHG reductions. These reductions will help us meet the directives listed in subsection II.A.

The proposed California Phase 2 regulation and amendments to the Tractor-trailer GHG regulation establish heavy-duty engine and vehicle standards that largely harmonize with the federal Phase 2 standards in structure, timing, and stringency. As a result, vehicle manufacturers can continue to build a single fleet of compliant vehicles and engines for the U.S. market. However, as previously listed, there are some distinctions between the California proposal and the federal Phase 2 rule. Discussed below is a more detailed description of the distinctions:
- <u>No "Deemed to Comply" Provisions.</u> Under staff's proposal, CARB staff would conduct their own independent review and approval of Phase 2 certification documents for all engine and vehicle families sold in California. Engine and vehicle families for which U.S. EPA has issued a federal Certificate of Conformity would not be automatically "deemed to comply" with the California Phase 2 requirements. This approach is necessary to ensure the benefits of the Phase 2 program, including the proposed minor California distinctions, will be realized.
- <u>Additional Vehicle Label Information.</u> Staff's proposal would require vocational vehicles and tractors to have vehicle labels that identify the emission control systems that can be visually inspected by CARB enforcement staff. This change is necessary to facilitate enforcement of the Phase 2 regulation in the field.
- <u>Additional reporting of engine and A/C system-related information.</u> California Phase 2 would require vehicle manufacturers to include engine family for each certified vehicle in their end-of-year report, and additional reporting of A/C system information:
  - Staff's proposal would require vehicle manufacturers to include the engine family information used in each certified vehicle in the vehicle's end-of-year report that is required as part of vehicle certification. This change will allow CARB staff to more easily cross-reference vehicle information to engine family information.
  - Staff's proposal would require vehicle manufacturers to provide additional A/C system information at time of certification to support enforcement of the Phase 2 A/C leakage standard. This change would provide staff the necessary information to verify manufacturers' leak rate calculations.
- <u>Additional Credit Provisions.</u> California Phase 2 establishes additional requirements that would apply to PHEVs to qualify for advanced technology multiplier credits, additional requirements for transit buses that are certified to the less stringent custom chassis provisions, and additional credits for the use of low-GWP refrigerants.
  - The federal Phase 2 regulation establishes a 3.5 credit multiplier for credits generated through the certification and sale of PHEVs. Staff's proposal would establish additional criteria for PHEVs sold in California. To qualify to use the multiplier, the PHEV would need to demonstrate no NOx emission increase (compared to a conventionalpowered vehicle) and meet minimum AER requirements. If these

criteria are not met, the manufacturer would be required to adjust their credit balance to reflect a reduction or elimination of the credit multiplier. These additional criteria would give manufacturers additional incentive to ensure NOx emissions from certified hybrid vehicles do not exceed levels from similar conventional-powered vehicles. In addition, staff's proposal would reduce the advanced technology multiplier value for those zero-emission vehicles (ZEV) or PHEVs that are subject to other CARB regulations requiring mandated sale of ZEVs in California. This provision is necessary to ensure the GHG benefits of the California Phase 2 program.

- Staff's proposal would require transit bus manufacturers to report all transit bus families/sub-families produced for sale in California that are certified to the less-stringent federal custom chassis standards. The manufacturers would then be required to retire any emission credits that were used to demonstrate compliance with the more-stringent primary vocational standards. This provision is designed to dissuade transit bus manufacturers from certifying to the less stringent custom chassis standards and in turn, certify more advanced technology buses (e.g., hybrid, battery-electric, fuel cell) in California in order to comply with the more-stringent primary vocational standards.
- Staff's proposal would provide additional California credits to vehicle manufacturers that use low-GWP refrigerants. These credits could be used to offset any credit deficit created when adjusting credit balances. This provision would incentivize manufacturers to bring low-GWP refrigerants to the market.
- <u>Additional Consumer Label.</u> Staff's proposal would require "light-duty style" consumer labels for PUVs. The change would provide consumers with easy to read information on the relative GHG emission performance of a particular PUV model as compared to other similar PUVs.
- <u>NG Engine Requirements</u>: Staff's proposal would continue to include ethane in the hydrocarbon emission standards for NG Otto-cycle and CI engines. This is necessary because removing it would allow for the possibility of increased toxics and volatile organic compound (VOC) emissions that "fill the void" left by the ethane.

The proposed amendments to the Tractor-Trailer GHG regulation would provide trailer fleet owners the option of complying with the Tractor-Trailer GHG regulation through the purchase of a Phase 2 certified trailer, or the installation of Phase 2 aerodynamic technologies and LRR tires that are components of Phase 2 certified trailer

configurations. This proposed change provides trailer fleet owners subject to the regulation with another pathway to compliance.

(For a detailed summary and rationale for each proposed amendment or addition to the existing regulations and test procedures, see Appendix D, Proposed Phase 2 GHG Regulations, Summary and Rationale for each Regulatory Provision.)

# III. SUMMARY OF PROPOSED ACTION

Section A below discusses the proposed California Phase 2 GHG emission standards for medium- and heavy-duty vehicles and engines. Section B discusses the proposed amendments to CARB's existing Tractor-Trailer GHG regulation. Additional information is contained in Appendix E: Further Detail on Phase 2 GHG Emission Standards.

## A. Phase 2 GHG Emission Standards

1. Background

In 2016, U.S. EPA and NHTSA jointly adopted GHG emission standards and fuel economy standards for medium- and heavy-duty engines and vehicles. These standards are informally known as the "Phase 2" GHG program (or federal Phase 2 regulations). The federal Phase 2 regulations build upon the Phase 1 GHG emission and fuel economy standards for medium- and heavy-duty engines and vehicles, which are described above in Section I.C. The federal Phase 2 standards will be phased-in over the 2018 through 2027 MYs.

The Phase 1 regulations established emission standards for  $CO_2$  and other GHGs (N<sub>2</sub>O, CH<sub>4</sub>, and HFC)). The Phase 1 standards were largely established based on the application of "off-the shelf" technologies that were already in production. The Phase 2 regulations establish more stringent  $CO_2$  emission standards based on the application of technologies that are currently under development or not yet widely deployed. The emission standards for the other GHGs (N2O, CH4, and HFC) remain at their Phase 1 numeric values for Phase 2.

The structure of the Phase 2 regulations is similar to the Phase 1 regulation, and establishes GHG emission standards for tractors, vocational vehicles, and PUVs, and the engines used in tractors and vocational vehicles. In addition, the Phase 2 standards address an additional vehicle category: trailers used in combination with tractors.

In this rulemaking, staff is proposing to largely align the requirements of California's proposed Phase 2 regulation with the requirements of the corresponding U.S. EPA Phase 2 GHG regulations with the exception of a few minor distinctions. As discussed previously in section II.C, these distinctions are necessary to facilitate enforcement, align with existing California programs, and provide additional incentives for manufacturers to bring advanced technologies to the market.

As mentioned, the Phase 2 GHG regulations establish emission standards for trailers. Although this marks the first time trailers have been regulated at the federal level, as described above in Section I.C.2., trailers have been regulated in California since 2008 via the Tractor-Trailer GHG regulation. The Phase 2 regulations partially overlap with the Tractor-Trailer GHG regulation because they set emission standards for the trailers covered by the Tractor-Trailer GHG regulation. As described in greater detail below in Section B, staff is proposing to amend the Tractor-Trailer GHG regulation in conjunction with the proposed adoption of the Phase 2 GHG regulations to ensure that California's GHG requirements are consistent with the U.S. Phase 2 GHG requirements.

2. Summary of Proposed Regulation Requirements and Deadlines

Section a. below provides an overview of the federal and California Phase 2 GHG standards, and Section b. describes applicability of the standards. Section c. presents requirements and compliance deadlines of the federal and California Phase 2 standards, and Section d. details proposed distinctions between the California and federal Phase 2 programs.

a. Proposed Regulation Overview

California strives to harmonize its standards with the federal standards as much as possible to achieve a comprehensive, unified national program, while ensuring that California's needs for emission reductions are met. The intent of the proposed regulations is to largely harmonize with federal Phase 2 GHG program in structure, timing, and stringency.

Broadly speaking, the Phase 2 standards are more stringent than the Phase 1 standards. As shown in the Table III-1 below, the Phase 2 tractor standards require nearly double the CO<sub>2</sub> reduction as the Phase 1 tractor standards.

Table III- 1: (	Comparison of	stringency of Phase	1 and Phase 2 tractor st	andards
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	Phase 1	Phase 2
Per tractor CO <sub>2</sub> improvement over a 2010 baseline	10% - 23% depending on tractor subcategory	27% - 42% depending on tractor subcategory

Phase 2 establishes GHG emission standards for medium- and heavy-duty engines and vehicles, as well as trailers. Phase 2 will take effect with MY 2021 for all new class 2b-8 medium- and heavy-duty trucks and MY 2018 for new trailers<sup>4</sup>, and will be fully phased in by MY 2027. Phase 2 maintains separate engine standards for CI versus SI engines, and vehicle standards for Class 7 and 8 combination tractors, Class 2b to 8 vocational vehicles, and Class 2b and 3 PUVs. However, Phase 2 introduces trailer requirements and adds provisions that recognize the benefit of engine/transmission integration. To meet the proposed standards, regulated manufacturers are expected to apply GHG reducing technologies (CARB, 2015d), and may additionally elect to take advantage of

<sup>&</sup>lt;sup>4</sup> The federal Phase 2 trailer standards begin with the 2018 MY; to accommodate the timing of California's rulemaking process, the California Phase 2 trailer regulations would not begin until MY 2020.

credit opportunities. While staff is proposing to maintain the same compliance flexibility as in the federal program to minimize manufacturers' compliance burden, there will be some minor distinctions between California Phase 2 and the federal Phase 2 rules as discussed further in subsection d below.

b. Applicability

Staff is proposing that the applicability of California's Phase 2 GHG requirements be identical to the federal Phase 2 GHG program, with the exception of trailers. The proposed Phase 2 GHG requirements would apply to MY 2021 and newer class 2b to 8 medium- and heavy-duty vehicles with greater than 8,500 pounds GVWR and the engines that power them, except for medium-duty passenger vehicles already covered in the light-duty regulations. There would be a small difference in the timing of the initial trailer standards, which would begin two years later with MY 2020 in California to accommodate the timing of California's rulemaking process.

Although staff is proposing identical applicability, the LHD terminology based on weight classes differs in federal and CARB regulations, as shown in Table III-2. In California, vehicles with 8,501 to 14,000 pounds GVWR are considered PUVs and may use engines certified to heavy-duty engine standards or may certify to CARB's low-emission vehicle standards. However for the purpose of this staff report, staff used the federal weight classifications for LHD, MHD, and HHD vehicles.

GVWR (pounds)	8,501- 10,000	10,001- 14,000	14,001-16,000	16,001- 19,500	19,501- 26,000	26,001- 33,000	33,001 +
Federal	Light heav	vy-duty			Medium he	eavy-duty	Heavy heavy- duty
California (1995 and later MY) <sup>5</sup>	Medium-c	duty	Light heavy-dut	у	Medium he	eavy-duty	Heavy heavy- duty

Table III- 2: Federal and CARB Heavy-Duty Vehicles Weight Classes

c. Requirements and Compliance Deadlines

The proposed California GHG standards for CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, and HFC emissions are identical to those in the federal Phase 2 program. CO<sub>2</sub> standards are established

<sup>&</sup>lt;sup>5</sup> For emissions inventory purposes, CARB's EMFAC model defines LHD and MHD differently than shown in Table 1. EMFAC defines LHD as LHD trucks with 8,501 to 14,000 pounds GVWR, and MHD as T6 trucks with 14,001 to 33,000 pounds GVWR. The EMFAC definitions are not used in the body of this staff report.

separately for CI (diesel) and SI (gasoline) engines, with different stringency points and effective dates. The CO<sub>2</sub> standards are also separately established for four distinct vehicle classes: tractors over 26,000 pounds GVWR, trailers, vocational vehicles, and PUVs. The trailer standards begin in MY 2020. The standards for the other three vehicle classes begin in MY 2021. All federal and California Phase 2 standards will be fully phased in by MY 2027. Additional information on these standards is provided in Appendix E.

## i. CO2 Vehicle Standards

Staff is proposing to use the same metrics as U.S. EPA for CO<sub>2</sub> vehicle standards. For PUVs, U.S. EPA finalized standards based on a "work factor" attribute that combines truck payload and towing capabilities, with an added adjustment for 4-wheel drive vehicles. There are separate target curves for diesel-powered and gasoline-powered vehicles. The PUV standards are expressed in gCO<sub>2</sub>/mile. For tractors, vocational vehicles, and trailers, the U.S. EPA finalized standards are expressed as the grams of CO<sub>2</sub> emitted per ton of cargo carried per mile travelled (gCO<sub>2</sub>/ton-mile). In other words, the unit is expressed as a measure of freight movement or tons of payload per mile travelled. See Appendix E for the work factor based PUV standards for 2021 through 2027 MYs.

## <u>CO2</u> Exhaust Emission Standards for Tractors above 26,000 pounds <u>GVWR</u>

Staff is proposing to align California's Phase 2 GHG standards for tractors above 26,000 pounds GVWR (class 7 and class 8 tractors) with the federal Phase 2 program.

The U.S. EPA Phase 2 GHG standards for tractors above 26,000 pounds GVWR apply to Class 7 and 8 combination tractors. The federal Phase 2 standards for tractors are based on increased use of Phase 1 technologies (U.S. EPA, 2011) plus the application of advanced technologies (CARB, 2015c). In addition to the tractor, or vehicle standards, as discussed in this section, there are separate performance standards for engines manufactured for use in these tractors, as discussed further below.

The Phase 1 tractor standards established CO<sub>2</sub> standards for nine subcategories of Class 7 and 8 tractors in recognition of the differences in CO<sub>2</sub> emissions associated with tractors with various tractor attributes. The Phase 1 standards differed depending on GVWR, cab roof height, and whether the vehicle is a day-cab or sleeper cab. For Phase 2, the U.S. EPA largely maintained the structure of the Phase 1 tractor standards, but adopted new more stringent standards and updated test procedures, including a revised GEM simulation tool. For Phase 2, the U.S. EPA also added a tenth tractor subcategory for heavy-haul tractors (gross combined weight rating (GCWR) greater than or equal to 120,000 pounds) which have unique engine and transmission needs. To align with U.S. EPA requirements, staff proposes to adopt these same ten subcategories. As shown in Table III-3, the proposed standards would begin with

tractors produced for the 2021 MY and then become more stringent for the 2024 MY and the 2027 and subsequent MYs (U.S. EPA, 2015). The engine and vehicle technologies employed to meet these standards will vary by tractor subcategory. Manufacturers will use various combinations of the technologies listed in Appendix E to meet the standards.

Subcategory		Phase 2 Tractor Standards (gCO <sub>2</sub> /ton-mile)		
		2021 MY	2024 MY	2027 MY
1	Class 7 Tractor Low Roof (all cabs)	105.5	99.8	96.2
2	Class 7 Tractor Mid Roof (all cabs)	113.2	107.1	103.4
3	Class 7 Tractor High Roof (all cabs)	113.5	106.6	100
4	Class 8 Tractor Day Cab Low Roof	80.5	76.2	73.4
5	Class 8 Tractor Day Cab Mid Roof	85.4	80.9	78
6	Class 8 Tractor Day Cab High Roof	85.6	80.4	75.7
7	Class 8 Tractor Sleeper Cab Low Roof	72.3	68	64.1
8	Class 8 Tractor Sleeper Cab Mid Roof	78	73.5	69.6
9	Class 8 Tractor Sleeper Cab High Roof	75.7	70.7	64.3
10	Heavy Haul Tractors	52.4	50.2	48.3

Table III- 3:	Proposed Phase 2 CO <sub>2</sub> Standards for Class 7 and 8 Heavy-Duty
Tractors	

# CO2 Exhaust Emission Standards for Vocational Vehicles

Staff is proposing to largely align California's Phase 2 vocational vehicle provisions with the corresponding federal Phase 2 vocational vehicle provisions, with the exception of a minor difference in the custom chassis provisions for transit buses.

#### Primary CO<sub>2</sub> Standards

The federal Phase 2 GHG program establishes CO<sub>2</sub> standards (in grams emitted from carrying a ton of cargo over a distance of one mile (g/ton-mile)) for vocational vehicles

that fall within 15 subcategories, distinguished by GVWR, duty cycle, and engine type (CI vs. SI). To align with the federal program, staff is proposing to adopt primary vocational CO<sub>2</sub> standards for the California Phase 2 program identical to the federal ones (shown in Table III-4, III-5, and III-6).

Vocational Vehicle with CI Engine Effective MY2021 (gCO2/ton-mile)						
Duty Cycle	LHD Class 2b-5	MHD Class 6-7	HHD Class 8			
Urban	424	296	308			
Multi-Purpose	373	265	261			
Regional	311	234	205			
Vocational	Vehicle with SI Engine	Effective MY 2021 (gCO	2/ton-mile)			
Duty Cycle	LHD Class 2b-5	MHD Class 6-7 (and				
		C8 Gasoline)				
Urban	461	328				
Multi-Purpose	407	293				
Regional	335	261				

# Table III- 4: Proposed Primary CO2 Standards for MY 2021- 2023 Class 2b-8Vocational Vehicles

# Table III- 5: Proposed Primary CO2 Standards for MY 2024 -2026 Class 2b-8Vocational Vehicles

Vocational Vehicle with CI Engine Effective MY2024 (gCO2/ton-mile)						
Duty Cycle	LHD Class 2b-5	MHD Class 6-7	HHD Class 8			
Urban	385	271	283			
Multi-Purpose	344	246	242			
Regional	296	221	194			
Vocational	Vocational Vehicle with SI Engine Effective MY 2024 (gCO2/ton-mile)					
Duty Cycle	LHD Class 2b-5	MHD Class 6-7 (and				
		C8 Gasoline)				
Urban	432	310				
Multi-Purpose	385	279				
Regional	324	251				

# Table III- 6: Proposed Primary CO2 Standards for MY 2027 and Later Class 2b-8Vocational Vehicles

Vocational Vehicle with CI Engine Effective MY2027 (gCO2/ton-mile)						
Duty Cycle	LHD Class 2b-5	MHD Class 6-7	HHD Class 8			
Urban	367	258	269			
Multi-Purpose	330	235	230			
Regional	291	218	189			
Vocational	Vocational Vehicle with SI Engine Effective MY 2027 (gCO2/ton-mile)					
Duty Cycle	LHD Class 2b-5	MHD Class 6-7 (and				
		C8 Gasoline)				
Urban	413	297				
Multi-Purpose	372	268				

Regional	310	247	
Regional	519	241	

#### Custom Chassis CO<sub>2</sub> Standards

In the federal Phase 2 program, custom chassis manufacturers of motor homes, coach buses, other buses (which includes transit buses), school buses, refuse trucks, cement mixers, and emergency vehicles have an option to certify those vehicles with less stringent standards than the primary vocational standards through a simplified GEM process. Staff is proposing to largely adopt this provision in the California Phase 2 regulation, as listed in Table III-7, but would dis-incentivize transit bus manufacturers from using the custom chassis provisions (as discussed further in Section III.A.2.d., below).

U.S. EPA established these optional less-stringent standards because they believe the manufacturers of these types of vehicles may have difficulty meeting the primary standards. Reasons given by U.S. EPA include the inability of the manufacturers of these types of vehicles to take advantage of the flexibility of averaging since they generally do not manufacture a broad spectrum of vehicles, and there is likely a limited number of technologies that may be used on these specialized vehicles to meet the standards.

The custom chassis standard is significantly less stringent than the primary standard. A comparison of the stringency between the primary vocational standard and the custom chassis standard for a transit bus is shown in Table III-8. The primary standards require nearly 30 percent more emission reductions than the custom chassis in the 2021 MY (9 percent vs. 7 percent reduction from the 2017 MY baseline). The difference grows in later years, with the primary standards requiring over 40 percent more emission reductions in 2027 MY and later (20 percent vs. 14 percent reduction from the 2017 MY baseline).

Custom Chassis Category	MY 2021	MY 2027
Coach Bus	210	205
Motor Home	228	226
School Bus	291	271
Other Bus*	300	286
Refuse Truck	313	298
Mixer	319	316
Emergency	324	319

#### Table III- 7: Proposed CO<sub>2</sub> Standards for Custom Chassis (gCO<sub>2</sub>/ton-mile)

# Table III- 8: Stringency Comparison of Primary Vocational Standard to Other (Transit) Bus Custom Chassis Standard from 2017 Baseline

Standard	MY 2021	MY 2024	MY 2027+
Custom Chassis Transit Bus	7% reduction	7% reduction	14% reduction
Primary (heavy-heavy urban)	9% reduction	9% reduction	20% reduction

# Design Standards for Select Custom Chassis

In the federal Phase 2 program, custom chassis manufacturers of motor home, cement mixer, and emergency vehicles have an option to certify those vehicles with design standards (non-GEM standards). This path of certification does not require the use of GEM to demonstrate compliance; instead, manufacturers are required to install specific technologies on every certified vehicle. Staff is proposing to incorporate these federal optional design standards into the California Phase 2 program. These standards are discussed in more detail in Appendix E.

#### <u>CO2</u> Exhaust Emission Standards for PUVs at or below 14,000 pounds <u>GVWR</u>

PUVs, many of which are <sup>3</sup>/<sub>4</sub> and 1-ton pick-up trucks, 12- and 15- passenger vans, and large work vans, are comprised of two classes of vehicles: Class 2b and 3. Heavy-duty vehicles with GVWR between 8,501 and 10,000 lbs. are classified in the industry as Class 2b motor vehicles. Heavy-duty vehicles with GVWR between 10,001 and 14,000 lbs. are classified as Class 3 motor vehicles. Together these two classes of vehicles emit approximately 15 percent of the GHGs emitted from the heavy-duty vehicle sector. Approximately 90 percent of these vehicles are sold by vehicle manufacturers as complete vehicles with no secondary manufacturers making substantial modifications prior to registration and use. The other 10 percent are sold as incomplete vehicles to body-builders where they are outfitted with work related equipment such as a dump bed or delivery box. These vehicles are primarily manufactured by GM, Ford, and Fiat/Chrysler.

The Phase 2 PUV standards phase in over MYs 2021 to 2027, with a year-over-year increase in stringency of 2.5 percent per year. The standards are vehicle-based and impose a fleet average standard on each manufacturer's fleet.

The main technologies used in standard setting for PUVs are listed in Appendix E. When setting the Phase 2 standards, U.S. EPA assumed an emission reduction effectiveness and adoption rate for the technologies listed. Over time, the standards become more stringent based on either an expected increase in the effectiveness of the technologies used to set the standard, or an increase in adoption rate of the technologies, or a combination of both.

See Appendix E for a complete list of the Phase 2 CO<sub>2</sub> emission fleet average target standards for PUVs.

### ii. CO<sub>2</sub> Emission Standards for Trailers

Staff is proposing to align California's Phase 2 GHG standards for trailers with the federal Phase 2 trailer standards.

The federal Phase 2 program when published in the federal register in October 2016 included the first ever CO<sub>2</sub> emission standards for manufacturers of trailers used in combination with tractors. The Truck Trailer Manufacturer Association (TTMA), an association of trailer manufacturers, has petitioned U.S. EPA and NHTSA to reconsider the rescission of the trailer standards, and filed a petition requesting that the U.S. Court of Appeals, District of Columbia Circuit vacate the federal Phase 2 GHG regulation's requirements applicable to trailers and provide other relief. On September 25, 2017, TTMA filed a motion to stay the trailer rules during the pendency of the litigation, and on October 27, 2017 the U.S. Court of Appeals for the District of Columbia granted TTMA's request to stay the trailer requirements. The Court also placed the lawsuit in abeyance. On August 17, 2017, the Administrator of U.S. EPA stated in a letter to TTMA that U.S. EPA decided to revisit the federal trailer provisions and intends to issue a Federal Register NPRM. The Administrator of NHTSA stated in a letter to TTMA that same date that NHTSA had granted TTMA's petition for rulemaking to reconsider and rescind the federal trailer requirements.

That lawsuit and U.S. EPA and NHTSA's reconsideration of the trailer provisions, however, does not affect California's authority to establish standards for trailers hauled by heavy-duty tractors, and CARB is accordingly proposing to adopt the Phase 2 trailer requirements that largely mirror the U.S. EPA's trailer requirements as they existed in October 2016 and establish other specific requirements for trailers.

The federal Phase 2 trailer program applies to trailers manufactured on or after January 1, 2018. The standards get progressively more stringent for 2021, 2024, and 2027 and later MY trailers. The federal Phase 2 program establishes separate standards for fullaero box vans, partial aero box vans, non-aero box vans, and non-box trailers. A fullaero box van is a box van that does not have any side or rear work performing equipment that would inhibit the application of aerodynamic technologies. A partial-aero box van has either side or rear work-performing equipment, but not both. A non-aero box van has both side and rear work performing equipment. Examples of work performing equipment include lift gates, access doors, and belly boxes. Examples of non-box trailers include flatbed, tanker, and container chassis trailers. The federal Phase 2 regulation also establishes separate standards for long box vans and short box vans. A short box van is less than or equal to 50 feet in length. A long box van is greater than 50 feet in length.

The federal Phase 2 standards for full- and partial- aero box vans are based on GEM simulations of standard tractors pulling trailers equipped with various combinations of aerodynamic technologies (e.g., side skirts, rear fairings, underbody devices), LRR tires; and tire inflation systems (e.g., automatic tire inflation system (ATIS) and tire

pressure monitoring system (TPMS)). The stringency of the standards increase over time reflecting a higher adoption rate of more effective CO<sub>2</sub> reducing technologies. The MY 2021-2023 full-aero box van standards are more stringent than the MY 2021+ partial-aero box van standards because the full-box standards are based on the application of both side and rear aerodynamic technologies. The MY 2024-2026 and MY 2027+ full-aero box van standards reflect further improvements in aerodynamic technologies not applicable to partial-aero vans. Tables III-9 and III-10 show the Phase 2 CO2 emission standards for trailers.

The Phase 2 standards for non-aero box vans and non-box trailers are design based standards, as shown in table III-11. Trailer manufacturers may comply by using TPMSs, ATISs, and LRR tires without running the GEM model.

MAX	Dry	van	Refriger	ated van
	Short	Long	Short	Long
2018-2020	125.4	81.3	129.1	83.0
2021-2023	123.7	78.9	127.5	80.6
2024-2026	120.9	77.2	124.7	78.9
2027+	118.8	75.7	122.7	77.4

(g/ton-mile)

Table III- 9: Phase 2 CO<sub>2</sub> Standards for Full-Aero Box Vans

#### Table III- 10: Phase 2 CO2 Standards for Partial-Aero Box Vans

#### (g/ton-mile)

MV	Dry van		Refrigerated van	
IVI T	Short	Long	Short	Long
2018-2020	125.4	81.3	129.1	83.0
2021+	123.7	80.6	127.5	82.3

#### Table III- 11: Non-Aero Box Van and Non-Box Van Design Requirements

Subcategory	MYs 2018-2020	MYs 2021	
Non-Aero Box Van	Tire pressure system (ATIS or TPMS) with wheels on all axles		
	Tire Rolling Resistance	TRRL at or below 4.7	
	Level (TRRL) at or below	kg/ton	
	5.1kg/ton		
Non-Box Van	ATIS or TPMS with wheels on all axles		
	TRRL at or below 6.0	TRRL at or below 5.1	
	kg/ton	kg/ton	

iii. CO<sub>2</sub> Emission Standards for Engines

# CO2 Standards for Medium- and Heavy-Duty Gasoline Engines

The Phase 2 gasoline engine standard of 627 grams  $CO_2$  per brake horsepower-hour (g $CO_2$ /bhp-hr) is identical to the Phase 1 standard that started in MY 2016 and later except for HHD vocational engines. Also, there are no gasoline engine standards proposed for tractors because gasoline engines are not typically used in Class 7 and 8 tractors. Appendix E lists the engine technologies that were used in the gasoline (SI)  $CO_2$  engine standard.

# CO2 Standards for Tractor Diesel Engines

Staff is proposing to align California's Phase 2 CO<sub>2</sub> standards for tractor engines with the federal Phase 2 CO<sub>2</sub> standards.

Tractor engine standards apply to all tractor engines, without regard to the fuel used (e.g., diesel or NG) or engine-cycle classification (e.g., CI or SI). To show compliance with the tractor engine standards, U.S. EPA will continue to follow the Phase 1 engine dynamometer certification test procedure. This procedure requires testing the engine over the tractor engine 13-mode steady-state test cycle (i.e., the Supplemental Engine Test cycle or "SET"). However, for Phase 2, the SET weighting factors have been revised to better reflect the lower engine speed operation of modern engines.

As shown in Table III-12, the proposed tractor engine standards would begin in 2021 MY, and then become more stringent for the 2024 MY and again for 2027 and subsequent MYs. The proposed tractor standards do not include gasoline-fueled engines or LHD engines because those types of engines are not used in Class 7 and 8 tractors. Appendix E identifies alternate tractor engine standards for the 2024 through 2026 MYs identified as transition flexibility provisions.

Table III- 12:	Phase 2 Heavy-Duty	<b>Tractor Engine</b>	Standards for Engine	es Over the
SET				

MV	gCO₂/ton-mile		
	HHD	MHD	
2021-2023	447	473	
2024-2026	436	461	
2027 and subsequent	432	457	

The engine technologies employed to meet the proposed tractor engine standards will vary by tractor subcategory. Appendix E provides a list of technologies U.S. EPA anticipates will be used to meet the standards.

# CO2 Standards for Vocational Vehicle Diesel Engines

Staff is proposing to align California's Phase 2 vocational engine provisions with the federal Phase 2 standards.

Similar to the existing Phase 1 standards, the federal Phase 2 GHG standards contain separate vocational engine standards to increase the performance and efficiency of engines used in LHD, MHD, and HHD vocational vehicles. The vocational engine standards also differ for diesel and gasoline engines. As shown in Table III-13, the federal Phase 2 GHG standards have new vocational diesel engine standards starting in MY 2021 then gradually phase in through 2027 to provide some lead time for manufacturer's technology development, introduction, and improvements.

MYs	LHD	MHD	HHD
2021-2023	563	545	513
2024-2026	555	538	506
2027+	552	535	503

## Table III- 13: Vocational Diesel Engine Standards in gCO<sub>2</sub>/bhp-hr

Engine manufacturers are required to measure the emissions through engine dynamometer testing using the steady-state duty cycle and the transient duty cycle (Federal Test Procedure (FTP) engine cycle) and are expected to use the technologies listed in Appendix E to comply with these standards.

- d. Distinctions between California and Federal Phase 2 Programs
  - i. Not adopting a "Deemed to Comply" Approach (independent California certification review required for California-sold engines and vehicles)

For Phase 1, manufacturers were "deemed to comply" with the California Phase 1 GHG regulation if they demonstrated compliance with the federal Phase 2 GHG program. CARB certification staff would issue an EO for any engine or vehicle family that had demonstrated compliance with the federal Phase 1 GHG regulation and had been issued a federal Certificate of Conformity by U.S. EPA.

California's active role in certifying engines and vehicles (including trailers) is critical to ensure the benefits of the California Phase 2 GHG program, especially given the recent change in the federal administration, and subsequent call to defund programs to combat climate change (Tracy, 2017), and to substantially reduce U.S. EPA staffing levels. (Washington Post, 2017) California cannot rely on the federal administration at this time to review applications for engine and vehicle certification as has been done for the Phase 1 GHG program. This California certification process is described in Appendix E.

Phase 2 certification will be more time consuming and require additional staffing, both for manufacturers and for CARB. Manufacturers will be submitting GEM input files, and Phase 2 has more input files than were required under Phase 1 (for example, engine fuel maps, transmission data files, and rear axle efficiency information). Manufacturers have expressed concerns that the additional certification review by CARB staff could substantially delay the timely issuance of executive orders for certification.

CARB staff wants to be sensitive to manufacturers' concerns; while at the same time ensure engines and vehicles meet emission standards and air quality is protected. To that end, as part of this rulemaking, the proposed amendments include language strengthening the statement that manufacturers provide with their certification submittals. Under the proposed amendments, manufacturers would need to unconditionally certify that the information submitted in certification packages is accurate, and that it describes engines and vehicles as built. This additional assurance of accuracy would provide CARB staff greater confidence that submitted information accurately reflects engine and vehicle designs and test results, which should enable CARB to more expeditiously process and issue executive orders.

In addition, CARB staff is looking at future rulemakings and whether there are ways to streamline upfront certification further, both for Phase 2 certification and more broadly for certification in general. For example, there is a potential that manufacturers could opt into an expedited certification option in which CARB staff agrees to streamline upfront review in exchange for manufacturers providing additional in-use data. This option could be included in a future upcoming rulemaking, such as amendments to the heavy-duty warranty regulations that are scheduled for board consideration in spring 2018, or the heavy-duty OBD regulations, currently planned for later in 2018.

Many manufacturers are already collecting telematics data on in-use engine performance; in some cases they collect and analyze engine and vehicle performance information and provide that information to fleets for a fee. Providing such in-use data to CARB staff (potentially, for example, on a quarterly basis from multiple engines per engine family averaged by engine family for both criteria and GHG emissions) would be very helpful for compliance, enforcement, and as a research tool to understand the realworld impacts of the Phase 2 regulations.

ii. California vehicle labeling requirements for tractors and vocational vehicles

The federal Phase 2 regulation requires engines, trailers, and PUVs to be labelled with the appropriate ECIs but does not require ECIs on tractor and vocational vehicle labels.

Staff is proposing to align with the federal labeling requirements for engines, trailers, and PUVs, but to ease enforcement for tractors and vocational vehicles, is proposing that the labels on tractors and vocational vehicles must include specific ECIs for technologies that can be visually inspected. Having the emission control system identifiers on the emission control label is a simple and effective way of verifying that a vehicle is typically in a certified configuration, and is the most commonly used method of making a compliance determination during a vehicle inspection.

Staff understands from manufacturer comments on the federal NPRM that there were concerns regarding the number of technology options under Phase 2 and the difficulty of fitting identifiers for them on the labels.<sup>6</sup> Hence, staff proposes to streamline the list of ECIs found in 40 Code of Federal Regulations (CFR) 1037, Appendix III—Emission Control Identifiers (page 74131 of the Phase 2 GHG final rule) and require manufacturers to list only the ECIs for tractor and vocational vehicles technologies that would be identifiable during a vehicle inspection.

Table III-14 lists the ECIs staff is proposing to be required on California Phase 2 labels. For the most part, the proposed California Phase 2 identifiers are identical to those in 40 CFR 1037, Appendix III; all identifiers not included in Appendix III are indicated with an asterisk.

Vehicle Clas	ssification		
Vocational Vehicles (Class 2b-8)	Tractor (Class 7-8)	Emission Control System	ECI
		Engine shutoff System	IRT*
x	x	Low Rolling Resistance Tires (drive)	LRRD
Х	х	Low Rolling Resistance Tires (steer)	LRRS
х	x	Low Rolling Resistance Tires (all)	LRRA
x	x	Aerodynamic side skirt and/or fuel tank fairing-	ATS
x	x	Aerodynamic roof fairing	ARF

#### Table III- 14: ECIs for Vocational Vehicles and Tractors

<sup>&</sup>lt;sup>6</sup> Vehicle labeling is discussed on pages 75301 through 73502 of the Phase 2 Final Rule (U.S. EPA, 2016)

x	x	Adjustable height aerodynamic roof fairing	ARFR
x		Aerodynamic front fairing	AFF*
x		Aerodynamic rear fairing	AREF*
	x	Gap reducing fairing *(tractor to trailer gap)	TGR
x	x	Automatic tire inflation system	ATI
x	х	Tire pressure monitoring system	TPMS

\* Not currently identified in Appendix 3 to Part 1037

iii. Additional reporting requirement to include engine family for each certified vehicle in end-of-year report

Unlike light-duty vehicles, heavy-duty vehicles are assembled and finalized by chassis manufacturers which are separate entities than engine manufacturers. For example, a Freightliner vehicle might be built with a Cummins, Detroit Diesel, or Daimler engine. (CARB, 2016d) While various in-use vehicle studies have provided staff with fleet wide emissions and vehicle information (e.g., license plate data), in order to associate technology and engine standards with the real-world fleet, individual vehicle identification numbers (VINs) must be linked to specific engine family information. This would provide the ability to characterize the emissions of the real-world fleet down to specific engines as opposed to only chassis MY as is done currently. Further, such information could help CARB design more targeted enforcement strategies based on emission trends and distribution of high emitters. Staff could also use this information to inform our surveillance program about possible candidates for further testing. Lastly, having the ability to cross-reference the vehicle technology information such as engine family, certification levels, and U.S. EPA fuel economy rating to Department of Motor Vehicles (DMV) registration data, would help us to better characterize emission benefits from these technologies at the regional level.

Currently, engine manufacturers provide serial numbers and engine configurations for each engine family to CARB. Under the proposed California Phase 2 regulations, vehicle manufacturers would need to include the engine family information used in each certified vehicle along with the VIN in the vehicle's end-of-year report.

iv. Additional detailed reporting of A/C system information requirements

Under the federal GHG Phase 2 rule (40 CFR §86.1819-14(h), and 40 CFR §1037.115(e)), manufacturers are required to provide refrigerant type, refrigerant

capacity, and refrigerant leak rate, when demonstrating compliance with the A/C leakage standard. In particular, the refrigerant leak rate is evaluated using a method directly adapted from the SAE International's J2727 standard (SAE, 2012), a model that estimates A/C system leak rate based on consensus leak rates for each component of the system, and system component specifications provided by the user. SAE International has generated a spreadsheet to carry out the J2727 calculation. The federal Phase 2 GHG rule requires the submission of the J2727 leak rates, but not the actual J2727 spreadsheets.

Staff is proposing to require manufacturers to report the following detailed A/C system information to demonstrate compliance with the A/C leakage standard:

- Cover letter with summary table, similar to what manufacturers are required to submit under the federal Phase 2 GHG rule;
- A/C system schematics to show the topological layout of the system components;<sup>7</sup> and
- SAE J2727 spreadsheets to show the system component specifications and system leak rate calculation.

Having the system schematics and the actual J2727 spreadsheets are critical to adequately demonstrate of compliance with the leakage standard, show the essential leakage-related characteristics of the A/C system, and allow staff to effectively certify A/C systems to the leakage standard.<sup>8</sup> A/C systems for heavy-duty vehicles vary significantly in leakage-related parameters, such as fitting numbers and hose lengths. Without the information contained in the schematic and the J2727 spreadsheet, staff would have insufficient system information to verify the leakage calculation, an important task to ensure certification rigorousness. In addition, having the proposed detailed system information would also allow staff to track the status of refrigerant containment technologies, which could inform future regulatory activities.

The current Phase 1 A/C leakage certification data (under Phase 1 requirements that are very similar to the U.S. EPA Phase 2 requirements) submitted by manufacturers are organized by vehicle family. Manufacturers commonly use multiple A/C platforms with different configurations tailored to specific vehicle dimensions, operating conditions, and

<sup>&</sup>lt;sup>7</sup> The system schematics do not need to be generated to scale. Nor do the components in the schematics have to resemble the physical appearance of the real system components. Furthermore, the schematics need not show vehicle parts such as the engine or cab that are not part of the A/C system.

<sup>&</sup>lt;sup>8</sup> The system component specifications in the J2727 spreadsheet define the system's numeric characteristics relating to refrigerant leakage, whereas the system schematic puts those characteristics into spatial perspective.

other factors. It is also common for one A/C platform to be shared across vehicle families. Under staff's proposal, both the system schematics and SAE J2727 spreadsheets would be organized by A/C platforms, hence avoiding the need to repeat the information across vehicle families.

Manufacturers often resort to engineering judgment to select a "worst-case" scenario A/C configuration to represent a group of similar A/C configurations. The existing medium- and heavy-duty vehicle GHG rules (including the U.S. EPA and CARB Phase 1 rules and the federal Phase 2 rule) do not have a provision regarding the designation of "worst-case" configuration. Staff believes that using engineering judgment to select a "worst-case" configuration from a group of configurations is feasible only when there are limited variations among the configurations. If there are significant variations, engineering judgment by itself would not be reliable for selecting a "worst-case" configuration, and SAE J2727 calculations must be performed to aid in the "worst-case" configuration selection. Therefore, staff believes that, for the purpose of complying with the federal Phase 2 rule, it is necessary to use reasonable constraints when selecting "worst-case" configurations. The inclusion of "worst-case" constraints in the CARB Phase 2 rule merely elaborates what staff believes is necessary for complying with the federal Phase 2 rule, rather than add new requirements. This view is corroborated by the fact that several tractor manufacturers have been using constraints when relying on engineering judgment to select "worst-case" configurations in the Phase 1 A/C leakage standard certification. As a result, instead of having one overarching "worst-case" configuration, they each have dozens of "worst-case" configurations representing different A/C platforms.

Staff proposes that a "worst-case" scenario A/C configuration, selected using a technical assessment or engineering judgment, may be allowed to represent a group of configurations provided those configurations a) have refrigerant capacities within 100 grams of each other if the configurations differ only in hose length, or have refrigerant capacities within 10 grams of each other if the configurations differ in other aspects of the specifications, and b) differ only in fitting specifications, or hose specifications (essentially allowing both low-pressure side and high-pressure side hoses to vary), or compressor seal specifications. Staff also included another revision that exempts from the California-specific reporting requirements A/C platforms with an annual sales volume of less than 20. This is intended to further reduce manufacturers' reporting workload by focusing on larger-volume A/C platforms.

In order to evaluate the potential impact of these revisions on consolidating A/C platform groups that need to be represented by separate SAE J2727 spreadsheets, staff examined the MY2017 Phase 1 leakage standard certification package of one tractor manufacturer. There were 76 distinct A/C platforms for all of the manufacturer's 2017 MY class 7 and 8 tractors. Using the revised criteria for "worst-case" configuration selection, it appears possible to consolidate those platforms to 26 groups, each of which will need to be represented by a separate SAE J2727 spreadsheet. Staff then applied

the lower sales volume threshold of 20 units; the A/C platform groups that are subject to the detailed system information requirements were further reduced to 17. This represents a reduction of the necessary SAE J2727 spreadsheets by about 78 percent.<sup>9</sup>

v. Separate California credit tracking due to California differences in credit provisions

Staff is proposing four differences that would affect some manufacturers' Phase 2 compliance and credit reports:

- Manufacturers may generate a low-GWP refrigerant extra credits.
- There would be additional requirements for manufacturers that produce transit buses that are California-certified to the custom chassis standards.
- There are additional requirements to allow the use of a plug-in hybrid advanced technology multiplier of 3.5 (no NOx increase, AER, etc.).
- No advanced technology credits (ATCs) would be granted for advanced technology vehicles produced to meet another regulation.

If one or more of the above mentioned differences apply, a manufacturer would be required to submit a California-specific credit tracking document. Each difference is discussed further below. (Also see Appendix G: *California Proposed Credit Tracking Template* for the proposed credit tracking template).

# Low-GWP Credits

Manufacturers that wish to claim low-GWP credits would report all vehicle families/subfamilies produced for sale in California that have low GWP refrigerant. Credits would be calculated based on California sales. Generated low GWP credits could only be used in California and within the same averaging set.

# Transit Bus Custom Chassis

Manufacturers would be required to report all transit bus families/sub-families produced for sale in California that are certified with federal custom chassis standards. Any credit deficit created by transit buses sold in California certified to the optional custom chassis standard as compared to the full vocational standard, would need to be offset by use of California credits or federal credits of the same averaging set.

<sup>&</sup>lt;sup>9</sup> This evaluation represents staff's best estimate made with the best available information (from Phase 1 A/C leakage standard certification packages). A more precise evaluation could be made with system component-level information (the level of details being proposed in the current detailed A/C system information requirements).

# PHEVs Credit Multiplier

Manufacturers would be required to report California-certified PHEV families/subfamilies that do not qualify for the ATC multiplier due to an increase in NOx emissions or insufficient AER. There would be a deficit in California-earned PHEV credits because these vehicles would not be allowed to use a multiplier of 3.5 in California. The deficit would be the difference between federal and applicable California ATC calculations. The deficit could be compensated by use of California or federal Averaging Banking and Trading (ABT) credits of the same averaging set using federal ABT credits. The manufacturer would have to retire the credit difference in the federal report.

### ATC Amendment to Address Potential Future Rulemaking Requiring Use of Advanced Technologies

U.S. EPA, in response to CARB comments, reinstituted the granting of extra credit to manufacturers that incorporate qualifying advanced technologies. The purpose of these credits is to encourage manufacturers to use and introduce more advanced technology vehicles and engines into the marketplace. The heavy-duty sector tends to significantly lag the light-duty sector in the adoption of advanced technologies. For this reason, the credits were significant, as shown in Table III-15.

Technology	Multiplier	
PHEVs	3.5	
All-electric vehicles	4.5	
Fuel cell vehicles	5.5	

Table III- 15: Federal Phase 2 Advanced Technology Multipliers

Achieving California's long-term air quality, climate, and public health goals will require a transition from the conventional combustion technologies to zero emission technology everywhere feasible and near-zero emissions powered by clean, low-carbon renewable fuels everywhere else. CARB is in the process of developing proposals which would require medium- and heavy-duty truck manufacturers to produce ZEV and plug-in hybrid trucks. The Advanced Clean Local Truck (ACLT) is one such potential rulemaking that would require manufacturers to produce a minimum percentage of zero emission capable vehicles and/or PHEVs from their medium- and heavy-duty fleets. The goal of this proposed strategy is to achieve NOx and GHG emission reductions through advanced clean technology, and to increase the penetration of the first wave of zeroemission heavy-duty technology into applications that are well suited to its use. (CARB, 2017f) Under the current federal Phase 2 provisions, these manufacturers would receive a 3.5 to 5.5 credit multiplier for producing vehicles in which they are already required to produce pursuant to another regulation (e.g. the ACLT rule). This multiplier was originally developed to incentivize manufacturers to go above and beyond the technology requirements of Phase 2, encouraging the use of advanced technologies, and thus there is an inherent conflict in granting extra credits in one regulation to a manufacturer that is producing vehicles and engines that are required by another regulation. For this reason, staff proposes to eliminate the granting of ATCs for vehicles produced in response to other already established mandatory requirements. Manufacturers would still receive ATCs for vehicles using advanced technologies that are above and beyond such mandatory requirements. Because no mandatory requirements for manufacturers to make heavy-duty zero-emission vehicles are yet in place, the proposed credit tracking template does not include quantification for this ATC amendment.

# Use of Federal Credits for California Deficits

Federal credits that would not be allowed under California's program (such as those generated through custom chassis provisions, or PHEVs that have a NOx increase and/or do not meet the AER requirement) could not be used to offset California deficits. Manufacturers would be required to provide documentation showing federal credits used under the California program meet these criteria.

vi. California credit provision differences

# Additional credits for use of low-GWP refrigerants

Several low-GWP refrigerant alternatives are available for the medium- and heavy-duty vehicle sector. The U.S. EPA's Significant New Alternatives Policy (SNAP) program has approved CO<sub>2</sub> and HFC-152 for use in all motor vehicle A/C (MVAC) systems, including those for the medium- and heavy-duty vehicles, and HFO-1234yf for use in MVAC systems for Classes 2b and 3 PUVs. Despite the availability of those alternatives, there is lack of vehicle manufacturer movement toward adopting low-GWP refrigerants in this sector, likely due to the lack of regulatory requirements or incentives. The U.S. EPA did not extend the light-duty vehicle credit provisions for low-GWP refrigerants to medium- and heavy-duty vehicles in its Phase 1 and Phase 2 rules. This is because a credit amount commensurate with the GHG benefit likely would not provide sufficient incentives to foster a transition to low-GWP refrigerants, due to the relatively small contribution of refrigerant emissions to overall CO<sub>2</sub> emissions for medium- and heavy-duty vehicles. Nor did U.S. EPA require the use of low-GWP refrigerants (or equivalently, prohibit the use of high-GWP refrigerants), likely because none of the low-GWP refrigerant technologies has been demonstrated by a vehicle manufacturer and become commercially available.

CARB is required by California SB 1383 (SB 1383, 2016) to develop strategies that will reduce California HFC emissions by 40 percent below 2013 levels by 2030. Reducing HFC-134a emissions, preferably via a transition to low-GWP alternatives, for MVAC systems in medium- and heavy-duty vehicles, is an integral part of that effort. Although CARB believes that the most effective and efficient approach to addressing the low-GWP refrigerant issue for medium- and heavy-duty vehicles would be through federal regulations, CARB has pledged, in its Short-Lived Climate Pollutants Plan (CARB, 2017c), to explore state-level measures in the absence of federal actions.

For the California Phase 2 Rule, staff is proposing to provide additional credits to manufacturers of medium- and heavy-duty vehicles that use a low-GWP refrigerant. "Low-GWP" in this context refers to 100-year GWPs that are equal to or less than 150. The total credit that a vehicle using a low-GWP refrigerant is eligible for would be proportional to the useful life of the type of that vehicle. The credit would be tracked for various vehicle types.<sup>10</sup>

For the first MY that any manufacturer produced credit-eligible vehicles for a certain vehicle type, the vehicles would receive a full credit amount. The credit amount would remain at that level for subsequent MYs, until the fraction of the credit-eligible vehicles in relation to all vehicles in a certain vehicle type and MY (i.e., the Low-GWP Volume Fraction) reaches or exceeds 20 percent for the first time. At that point, a credit countdown would be initiated, and the credit amount would remain at that level for the subsequent four MYs. After four MYs, the credit would be reduced. The eventual "reduced" credit amount would be equivalent to the estimated GHG reduction from switching from HFC-134a to a refrigerant with a GWP of 150. The "full" credit amount is 1.8 times the reduced credit amount, implying a credit multiplier of 1.8. The multiplier is the estimated ratio of the incremental cost per emission reduction from using a low-GWP refrigerant to the incremental cost per emission reduction from using "conventional" tailpipe CO<sub>2</sub> reduction technologies to comply with Phase 2.

Because the Low-GWP Volume Fraction determines whether and when the credit countdown is triggered for a certain vehicle type, CARB will calculate and publish this parameter for all vehicle types for each MY, after receiving manufacturer reports of the actual volume of vehicles produced and delivered for sale in California.

<sup>&</sup>lt;sup>10</sup> Vehicle types for tracking would include: Vocational, classes 2b-5; Vocational, classes 6 and 7; Vocational, class 8;Tractor, class 7; Tractor, class 8, day cab; Tractor, class 8, sleeper cab; Tractor, heavy haul; HD PUVs, classes 2b and 3; Custom chassis school bus; Custom chassis motor home; Custom chassis coach bus; Custom chassis other bus; Custom chassis refuse hauler; Custom chassis concrete mixer; Custom chassis mixed-use vehicle; and Custom chassis emergency vehicle.

# Additional requirements for PHEVs to qualify for federal advanced technology multiplier credit

The federal Phase 2 GHG regulations allow ATC multipliers of 3.5 for hybrids, 4.5 for all-electric vehicles and 5.5 for fuel cell vehicles. Staff supports the ATC multipliers, but is also concerned with supporting CARB's incentive programs for heavy-duty hybrid vehicles, improving hybrid technology, increasing the AER capability of PHEVs, and the overall emissions impact of PHEVs. Thus, under the California Phase 2 GHG rule, staff is proposing that PHEVs, in order to qualify for the ATC multiplier, must have no NO<sub>x</sub> emissions increases compared to a similar conventional vehicle, and must be able to demonstrate a certain minimum AER<sup>11</sup>. These restrictions are necessary to safeguard against unintended increases in NO<sub>x</sub> emissions and provide additional incentives for manufacturers to bring advanced hybrids to the market.

Testing for NO<sub>x</sub> emissions could be accomplished through chassis dynamometer, portable emission measurement system (PEMS), or powertrain testing using the prescribed test cycles, or an approved alternate test cycle. For chassis dynamometer testing, four different test procedures would be allowed depending on the vehicle/engine duty class and whether the hybrid vehicle has electric power take-off (ePTO), as referenced in Appendix E of the Innovative Technology Regulation (ITR) (CARB, 2017d). For PEMS testing, the ITR PEMS testing provision would be used. The AER for PHEVs would be determined in accordance with the procedures provided in the ITR. Alternatively, a manufacturer could petition CARB's Executive Officer to approve an alternative test method and/or duty cycles that they believe would be more applicable for their technology and intended vocational vehicle placement.

Staff is proposing a phased in approach for the PHEV's AER requirement, as shown in Table III-16 below. The required AER of PHEVs would be 10 miles starting with the 2021 to 2023 timeframe for both slow-charge and fast-charge compatible PHEVs. The AER would be increased to 20 miles and 15 miles for slow-charge and fast-charge compatible PHEVs, respectively, in the 2024 to 2026 timeframe. Finally, for 2027 and later MY, the AER would be increased to 35 miles and 20 miles for slow-charge and fast-charge and fast-charge PHEVs, respectively.

<sup>&</sup>lt;sup>11</sup> Appendix K contains further discussion on NOx emissions from heavy-duty hybrids and the rationale for setting a no NOx increase and minimum AER requirements.

Vahiala MV	AER (miles)		
	Slow-Charge <sup>(1)</sup>	<u>Fast-Charge<sup>(2)</sup></u>	<u>AIC Multiplier</u>
<u> 2017 – 2020</u>	<u>0</u>	<u>0</u>	<u>1.5 (Phase 1)</u>
<u> 2021 – 2023</u>	<u>10+</u>	<u>10+</u>	<u>3.5<sup>(3)</sup></u>
<u> 2024 – 2026</u>	<u>20+</u>	<u>15+</u>	<u>3.5<sup>(3)</sup></u>
2027+	35+	20+	3.5 <sup>(3)</sup>

#### Table III- 16: Phase 2 PHEVs AER Requirement and ATC Multipliers

Notes:

<sup>(1)</sup> <u>Slow-charge refers to Level 1 and Level 2 chargers with electrical circuit rated up to 240 volts alternating current (AC), up to 80 amps, and 19.2 kilowatts.</u>

<sup>(2)</sup> Fast-charge compatible PHEVs must: 1) be capable of charging from 15 percent state-of-charge to 85 percent state-of-charge within one-half hour (0.5hr); and 2) demonstrate that typical operating time is at least 8 times (8x) typical charging time (i.e., a vehicle must be capable of operating for 8 minutes for each minute of charge time).

<sup>(3)</sup> If the PHEV AER is less than that specified in the AER column for the respective vehicle MY, an ATC multiplier of 1.5 would be applicable if the PHEV demonstrates no increase in NOx emissions compared to an equivalent conventional vehicle.

#### <u>Credit adjustment to meet primary vocational standards for transit buses certified</u> to the federal custom chassis provisions and produced for sale in California

In the federal Phase 2 program, custom chassis manufacturers of motor homes, coach buses, transit buses, school buses, refuse trucks, cement mixers, and emergency vehicles have an option to certify those vehicles with less stringent standards than the primary vocational standards, and through a simplified GEM process. CARB staff understands the reasoning behind the creation of the custom chassis certification option, but does not believe it is appropriate for the transit bus category. For the California Phase 2 rule, transit bus manufacturers would still have the option of California certifying their vehicles to the custom chassis standards using simplified GEM. However, if they do, they would also be required to perform emission modelling using full-GEM to determine the family emission level of these vehicles, and demonstrate how these vehicles would comply with the primary vocational standards. The manufacturer would then be required to retire any emission credits that were used to demonstrate compliance. The credits could come from the averaging set used to demonstrate compliance with the primary standards, or from the low-GWP credits the manufacturer may have generated from vehicles of the same averaging set.

The rationale behind this proposed California difference is twofold. First, transit buses can meet the more stringent primary standards through hybridization or electrification and these technologies have been widely commercialized. Second, California is looking to introduce advanced zero or near-zero emission technologies, and thus weaker Phase 2 requirements for this transit bus category might dis-incentivize the introduction of these advanced technologies.

Advanced technologies such as hybrid and zero-emission technology have been well developed for transit buses. Indeed, transit buses are the heavy-duty application most ripe for use of zero-emission technologies. Hybrid and battery electric buses have been

commercialized (over 2,500 battery electric buses worldwide (CARB, 2015)); fuel-cell electric buses are under demonstration and expected to be commercialized in the near future (CARB, 2015a). In California, there are currently more than 100 fuel cell and battery electric buses in operation and more than 300 fuel cell and battery electric buses on order (CARB, 2017). As shown in Table III-16 below, electric transit buses are currently available from BYD, Proterra, New Flyer, and Gillig, while Nova's new electric bus model is in demonstration and ready to begin production in the U.S. and Canada. By allowing transit buses to be certified with the simplified GEM, the provisions would adversely steer manufacturers away from adopting these available advanced technologies since manufacturers would no longer need these technologies to comply with the less stringent Phase 2 custom chassis standards. In the federal Phase 2 program, U.S. EPA and NHTSA allowed an ATC multiplier of 3.5, 4.5, and 5.5 for three types of advanced technologies: PHEVs, all-electric vehicles, and fuel cell vehicles, respectively (US EPA, 2016). To certify transit buses with the more stringent primary vocational standards, manufacturers can produce a small portion of advanced PHEVs or zero emission transit buses and take advantage of the federal ATC provision to compensate for other transit buses that are certified with the federal Phase 2 custom chassis provisions. Staff estimated that with an advanced multiplier of 4.5 for batteryelectric buses, manufacturers would only need to produce less than 2 percent of total California transit bus production with battery-electric buses to have enough credits to compensate for the rest of transit buses that only meet custom chassis stringency. In addition, there are various federal and California incentive programs to support transit fleets and promote electric bus production/purchase (e.g., Federal Transit Administration fund - FTA, Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project – HVIP). In fact, staff, for several years have been pursuing an Innovative Clean Transit measure. (CARB, 2017b)

Original Equipment Manufacturers (OEM)	Size	Market Share	Advanced Technology Manufacturer?
New Flyer	Large	45%	Yes, commercially available
Gillig Corporation	Middle Size with 500- 999 employees	33%	Yes, commercially available
Volvo ( <u>Nova Bus</u> )	Large	15%	In demonstration and ready for production in U.S. and Canada

Table III- 17: U.S. Transit Bus Manufacturers
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Original Equipment Manufacturers (OEM)	Size	Market Share	Advanced Technology Manufacturer?
Others ( <u>BYD</u> , <u>Proterra,</u> <u>El Dorado</u> , etc.)	Small	5%	Yes, commercially available

# vii. Consumer label requirements for PUVs (class 2b and 3 PUVs)

Consumer window labels are paper information sheets in the windows of new vehicles for sale at dealerships. Consumer window labels are already required on light-duty vehicles, including passenger cars, light-duty trucks up to 8,500 pounds GVWR, and medium-duty passenger vehicles up to 10,000 pounds GVWR. CARB began requiring a consumer window label called a Smog Index Label on new light-duty vehicles beginning with the 1998 MY. The label provided consumers with an indication of the relative emission contribution of these new vehicles for smog forming exhaust emissions of non-methane organic gas (NMOG), NOx, and evaporative hydrocarbons. In 2005, AB 1229, Nation, (Chapter 575, October 6, 2005) was signed, requiring CARB to revise the existing Smog Index Label to include emissions of global warming gases information. The revised label requirements, referred to as a California Environmental Performance Label (CARB, 2012), took effect for MY 2009 for light-duty vehicles sold in California. An example of California's Environmental Performance Label is shown in Figure III-1.



#### Figure III- 1: CARB Environmental Performance Label

Federally, as required by the Energy Policy and Conversation Act, fuel economy labels have been displayed on the window sticker of all new passenger cars and light-duty trucks as well. In 2007, per the Energy Independence and Security Act, the Federal Fuel Economy Labels must reflect a car's fuel economy and GHG and other emissions over its useful life, as well as a rating scheme that makes it easy for consumers to compare at point of purchase. The Federal Fuel Economy and Environment Label was required on all 2013 MY and subsequent year cars. CARB harmonized with the Federal Fuel Economy and Environment Label requirements in 2012, and thus the federal label became sufficient to meet both California and federal requirements beginning in MY 2013. Figure III-2 shows an example of the Federal Fuel Economy and Environment Label. The California Environmental Performance Label remained in California regulation, but is optional.



## Figure III- 2: Federal Fuel Economy and Environment Label

In the Phase 1 rule, U.S. EPA and NHTSA committed to consider requiring similar window labels for class 2b and 3 PUVs with 8,501 to 14,000 pounds GVWR as part of the federal Phase 2 proposal. However, there was no discussion of consumer labels in the NPRM for Phase 2. CARB staff encouraged U.S. EPA and NHTSA to develop consumer label requirements for these vehicles in our submitted Phase 2 NPRM comments. Having window labels would give buyers of such vehicles better information to consider when purchasing new vehicles. It would also increase the likelihood that more efficient, lower GHG emitting vehicles required by the Phase 2 standards would be embraced by consumers. Although many NPRM commenters expressed support for consumer label requirements, the federal Phase 2 final rule did not include requirements for these window labels (U.S. EPA, 2016b).

Consistent with CARB's historical label approach, staff is proposing to require consumer window labels similar in appearance to the existing light-duty labels for new complete medium-duty vehicles<sup>12</sup> (CFR, 2017). Specifically, the requirement would apply to chassis-certified class 2b and 3 PUVs with GVWR of 8,501 to 14,000 pounds except medium-duty passenger vehicles. The proposed California Environmental Performance label was derived from two labels: 1) CARB Environmental Performance label, and 2) Federal Fuel Economy and Environment label, as modified per comments from stakeholders. Figure III-3 shows an example of the Proposed California Environmental Performance Label. Under the proposed California Phase 2 program, these labels would have to be displayed on any new medium-duty vehicle offered for sale in California beginning with the 2021 MY.<sup>13</sup> The label would have to be placed on the side window to the rear of the driver or, if it cannot be placed there, on the windshield, in accordance with paragraph (3) of subdivision (b) of Section 26708 of the Vehicle Code.

The manufacturer is responsible to obtain approval of label values and specifications from the Executive Officer of CARB prior to affixing the Environmental Performance label to these vehicles. Staff is proposing to require affected manufacturers to submit sample labels to CARB, as well as data necessary to determine the GHG and Smog Ratings, as part of the certification application for review and approval (CARB, 2009). Staff is also proposing to require submission of sample labels to CARB annually to demonstrate compliance.

 <sup>&</sup>lt;sup>12</sup> As defined in title 40, CFR, sections 1036.801 and 1037.801, as last amended October 25, 2016
 <sup>13</sup> The consumer label requirement would apply to California certified new 2021 and subsequent MY medium-duty vehicles except medium-duty passenger vehicles manufactured on or after January 1, 2021.





Most of the affected medium-duty manufacturers also produce light-duty trucks and passenger cars, which are subject to consumer window label requirements under the current light-duty vehicle rule. In practice, these manufacturers are already using the federal Monroney consumer window label, required for light-duty vehicles by the Automobile Information Disclosure Act (15 U.S.C. 1231-1233), for these medium-duty vehicles with a disclaimer such as, "fuel economy ratings not required on this vehicle or Fuel Economy and Environmental information is not applicable to this vehicle." The Monroney label is the label placed on new automobiles with the manufacturer's suggested retail price and other consumer information (Section 575.401, Title 49 CFR). Based on our discussions with affected vehicle manufacturers, they prefer to place the information that CARB is proposing within the place on the Monroney sticker where the disclaimer language is currently located, to save costs for setup, programming, and testing of such labels. We value the importance of avoiding redundant or overlapping requirements and minimizing implementation costs. The proposal's intent is not to increase the number of consumer window labels but to require additional information on the existing label the manufacturers are already affixing for these new vehicles to encourage consumers to buy new vehicles with the lowest emissions. To the extent that the added information accomplishes this, vehicle emissions would decrease.

The ownership type of these vehicles can vary but many of the uses are similar to those of lighter trucks: for personal use, for both commercial and personal use, or for commercial use. The owners are more likely to purchase their vehicle based on specific work function such as payload and towing capacity, but it is envisioned that consumers would also take into account environmental performance when making a purchase

decision. However, despite varying payloads and towing capacities of these vehicles, they are nonetheless similar to light-duty trucks. Given that a potential buyer of a medium-duty vehicle with 8,501 to 10,000 pounds GVWR (class 2b) may compare medium-duty vehicle ratings with those of a light-duty vehicle, staff is proposing to have disclaimer language and design features placed on the medium-duty vehicle window label to make it clear that a direct comparison should not be made, as explained further below.

The proposed window label would provide consumers with a user-friendly scoring system for comparing the relative GHG emissions (GHG Rating) and smog emissions (Smog Rating) from comparable vehicles (CARB, 2007; CARB, 2011; CARB, 2012; U.S. EPA, 2010; U.S. EPA, 2011a). Ratings, displayed using slider bars, would be based on a letter scale with A being the cleanest.

## GHG Rating (tailpipe only)

The vehicle's gCO<sub>2</sub>/mile value would be determined by the sum of the FTP vehicle testing value multiplied by 55 percent and the Highway Fuel Economy Test (HFET) vehicle testing value multiplied by 45 percent. Alternatively, if actual data are not available for the vehicle configurations being labeled, for the purpose of the GHG Environmental Performance Label rating only, manufacturers may determine the vehicle gCO<sub>2</sub>/mile value using Analytically Derived CO<sub>2</sub> (ADCO<sub>2</sub>) methods as cited in title 17, California Code of Regulations (CCR), section 95663. This value must be compared to values in the GHG Rating table and must represent the worst-case configuration defined below.

"Worst-Case" means the complete vehicle configuration within each test group, as defined in Section 86.1803.01 title 40, CFR, as last amended October 25, 2016, that generates the highest combined CO<sub>2</sub> value as calculated above (13 CCR 1961.3) (CCR, 2017; CFR, 2017).

Staff is recommending the GHG Rating using letter ratings, as shown in Table III-17 (U.S. EPA, 2013; U.S. EPA, 2014; U.S. EPA, 2015a; ICCT, 2015). The reason for using letter ratings is to distinguish the ratings from the 1 to 10 ratings used on medium- and existing light-duty window labels. Staff also is proposing a disclaimer that medium-duty ratings are not directly comparable to light-duty ratings.<sup>14</sup> This proposed GHG Rating scale would begin with MY 2021.

<sup>&</sup>lt;sup>14</sup> See Appendix L for a discussion on methodology to compare the light-duty 2018 GHG Rating vs. proposed adjusted medium duty GHG rating.

### Table III- 18: Proposed GHG Rating

GHG Rating	gCO₂/mile	
A	0	
В	1-300	
C	301-350	
D	351-400	
E	401-450	
F	451-500	
G	501-550	
Н	551-600	
	601-650	
J	>650	

The tailpipe emissions would be zero for vehicles that run on electricity only, and thus would be given an "A" GHG Rating, the highest rating. Using Table 1, a  $CO_2$  combined value greater than 650 grams per mile (g/mile) would receive a GHG Rating of "J", the lowest possible. For flexible-fuel and dual-fuel vehicles, the GHG Rating is based on exhaust mass emission tests when the vehicle is operating on gasoline.

Based on staff's projection, a MY 2017 Phase 1 compliant vehicle would get around a 3 or 4 GHG Rating. A Phase 2 2021 MY vehicle would get around a 4 or 5 rating; a Phase 2 2024 MY vehicle would get around a 5 or 6 rating; and a Phase 2 2027 MY vehicle would get around a 6 or 7 rating.

# Smog Rating (tailpipe only)

As shown in the Table III-18 below, the proposed Smog Rating would be based on CARB's Low-Emission Vehicle III program and the g/mile of pollution related to each standard with a specific Smog Rating (13 CCR 1961.2) (CCR, 2017). A vehicle's Smog Rating would be determined based on the emission standard to which it is certified; for example, a vehicle certified to the "LEV3SULEV150" would get a "B" Smog Rating. The g/mile level of NMOG and NOx relates to the amount of smog forming pollutants that are emitted from the vehicle's tailpipe.

Vehicle Class*	California Emissions Standard	NMOG + NOx (g/mile)	Smog Rating
MDV4, MDV5	ZEV	0.000	А
MDV4	LEV3 SULEV150	0.150	В
MDV4	LEV3 SULEV170	0.170	С
MDV4	LEV3 ULEV200	0.200	D
MDV5	LEV3 SULEV200	0.200	
MDV5	LEV3 SULEV230	0.230	Е
MDV4	LEV3 ULEV250	0.250	F
MDV5	LEV3 ULEV270	0.270	G
MDV4	LEV3 ULEV340**	0.340	Н
MDV4	LEV3 LEV395**	0.395	I
MDV5	LEV3 ULEV400	0.400	
MDV5	LEV3 ULEV570**	0.570	J
MDV5	LEV3 LEV630**	0.630	

Table III- 19: Proposed Smog Rating

\*MDV4 – Medium-Duty Vehicle (class 2b with 8,501 to 10,000 pounds GVWR) MDV5 – Medium-Duty Vehicle (class 3 with 10,001 to 14,000 pounds GVWR)

\*\*Applicable only through 2021 MYs

viii. Sales limits for "specialty" heavy-duty vehicle types

Federal Phase 2 GHG standards allow the use of a non-road engine in several "specialty" heavy-duty vehicle types, which are exempted from the Phase 2 emission standards. These exempted specialty vehicle types are hybrids, amphibious, speed-limited, and certain all-terrain vehicles. Since these vehicles are exempted from the Phase 2 emission standards, the U.S. EPA Phase 2 regulations limit the annual sales volumes of up to 1,000 vehicles per manufacturer per MY for hybrids, and up to 200 vehicles per manufacturer per MY for amphibious, speed-limited, and certain all-terrain vehicles.

(1) All-terrain motor vehicles with portal axles (i.e., axles that are offset from the corresponding wheel centerline by a gear assembly) or any axle configuration involving gear reduction such that the wheels rotate more slowly than the axle.

(2) Amphibious vehicles (i.e., a motor vehicle that is also designed for operation on water. High ground clearance that enables a vehicle to drive through water rather than floating on the water does not make a vehicle amphibious.)

(3) Vehicles with a maximum speed at or below 45 miles per hour.

CARB's ITR (CARB, 2017d), [adopted October 16, 2017], contains provisions that fully address certification issues pertaining to heavy-duty hybrid vehicles with non-road engines. For amphibious, speed-limited, and certain all-terrain vehicles, CARB staff proposes to align with the federal Phase 2 GHG provisions.

Staff considered setting lower California-specific sales limits for exempted amphibious, speed-limited, and certain all-terrain vehicles to prevent a potential disproportionate shares of these vehicles being sold in California, but concluded such sales limits are unnecessary because existing CARB regulations are already more protective in terms of restricting the use of higher-emitting off-road engines in on-road vehicles. Specifically, title 13 CCR section 1956.8(f)(1) does allow limited sales exemptions for vehicles installed with non-compliant engines for up to a total of 100 heavy-duty vehicles per year for all manufacturers combined, on a first-come, first-served basis. In order to qualify for an exemption, the vehicle manufacturer needs to submit in writing to the Executive Officer the justification(s) for such an exemption request (CCR, 2017). The exemption request must show that, due to circumstances beyond the control of the vehicle manufacturer, California certified on-road engines are unavailable for use in the vehicle. The request must further show that redesign or discontinuation of the vehicle would result in extreme cost penalties and disruption of business. If approved, the vehicle manufacturer can produce the requested vehicles per year only if other vehicle manufacturers have not already claimed the 100 allowed annual sales exemptions.

ix. Continue to include ethane in the hydrocarbon emission standards for NG Otto cycle and CI engines

As part of the federal GHG Phase 2 final rulemaking, U.S. EPA promulgated new hydrocarbon standards that no longer require the inclusion of ethane. These new standards are applicable to NG engines certified under the Otto cycle and CI engine regulations for highway, nonroad, locomotive, and marine engines<sup>15</sup> (CFR, 2017). U.S. EPA took this action because some manufacturers of NG engines, in particular those that produce dual-fuel fumigated engines, were having difficulty meeting the

<sup>&</sup>lt;sup>15</sup> The sections in Title 40, of the Code of Federal Regulations CFR, affected by this action are §86.007-11, §86.008-10, §1033.101, §1039.101, §1042.101, §1065.15, §1065.260, §1065.266, §1065.360, §1065.366, §1065.650, §1065.660, and §1065.1001.

existing NMHC standards due to the high levels of ethane present in commercially available pipeline fuel. U.S. EPA concluded that the removal of ethane from the calculation of the NMHC standard was an appropriate means of relief because ethane is neither atmospherically reactive with respect to the formation of ozone nor does it have a significant GWP.

CARB staff proposes not to align with U.S. EPA's non-ethane NMHC standards. The removal of ethane from the exhaust measurement can leave a substantial margin of compliance (void) that staff is concerned has the potential to significantly increase the amount of toxics and VOCs that an engine can produce while still remaining within the new standard. Ethane can make up as much as 28 percent of the NMHC emissions for compressed NG (CNG)-fueled engines (UCR CE-CERT, 2007; Email, 2016), which means that exhaust toxics and VOCs could potentially increase by 28 percent in the absence of ethane, yet still be in compliance with U.S. EPA's non-ethane NMHC standards. For example, manufacturers could recalibrate their engines from current specifications as a result of the elimination of ethane from the NMHC calculation.

x. Continue to utilize California's anti-tampering provision

California's anti-tampering provisions are found in the California Vehicle Code sections 27156 and 38391. "Tampering" refers to the installation of any non-original manufacturer part that alters the design or performance of any required motor vehicle pollution control device or system. California's anti-tampering provisions provide a mechanism for CARB to exempt non-original manufacturer parts from this prohibition if it finds that such components will not reduce the effectiveness of any required pollution control device or will not cause vehicle emissions to exceed applicable standards. Pursuant to this authority, CARB has adopted regulations that establish criteria for exempting add-on and modified parts such as fuel injection systems. superchargers, and controllers from the anti-tampering prohibitions, so they can be sold and used in California. CARB approves the use of these products by issuing an EO that certifies the part "does no harm" to the emission level of a specific engine. The EO contains requirements to ensure that no emission increases occur from the original engine certified configuration. These products are not approved by CARB to reduce emissions, but have an anti-tampering waiver to be used as a replacement or add-on part.

U.S. EPA has adopted regulations applicable to aftermarket parts in Title 40, CFR Part 85. However, these regulations only establish a voluntary self-certification program. In contrast, California law and CARB's program requires aftermarket part manufacturers to obtain an EO, as described above, before they can sell parts in California. Consequently, California's more stringent and more protective anti-tampering provisions will apply to the California Phase 2 regulation.
xi. Warranty requirements and reporting provisions for GHG components and conducting audits of warranty claim records at repair facilities

Staff proposes to establish California requirements for warranty periods that harmonize with the warranty periods in the federal GHG Phase 2 rule. Table III-20 lists these warranty periods for each vehicle category.

Vehicle Category	Part Affected	Warranty Period	Regulatory Reference
LHD, MHD, HHD*	Emission-related parts	5 years/100K miles/ 3000 hrs.+ base mechanical warranty +extended warranty	13 CCR 2036(c)(4)
MHD, HHD	GHG components	5 years/100K miles	13 CCR 2036(c)(4.2)**
LHD, MD	GHG components	5 years/50K miles	13 CCR 2036(c)(4.1)**(8.1)**
Tractors	GHG components (except tires) Tires	5 years/100K miles 2 years/24K miles	13 CCR 2036(c)(4.2)** 40 CFR 1037.120**
Trailers	GHG components (except tires) Tires	5 years 1 year	40 CFR 1037.120**

Table III- 20: Warranty Periods

\* MD 8,500-14,000 lbs. GVWR, LHD 14,000-19,500 lbs. GVWR, MHD 19,501-33,000 lbs. GVWR, HHD > 33,000 lbs. GVWR \*\* Proposed amendment

Existing California regulations require manufacturers to monitor warranty claims for emission-related components on a quarterly basis, submit specified warranty claims for emission-related components on a quarterly basis, submit specified warranty reports when those claims meet or exceed specified levels and provide that if the failure rates for emission related components meet or exceed specified levels, manufacturers must take corrective actions, including recall, to remedy the issue.

The emission control components that are covered by GHG warranty requirements are listed in 40 CFR 1037.120. Components such as tires, ATISs, vehicle speed limiters, idle shutdown systems, fairings, hybrid system components, A/C refrigerants, and devices added to the vehicle to improve aerodynamic performance would be subject to CARB's reporting requirements and corrective action requirements. This would expand to parts affecting trailers.

Engine and vehicle manufacturers necessarily rely upon warranty repair claims submitted by repair facilities in order to comply with the previously described regulatory requirements to review and report warranty claim data, and in order to verify the accuracy of a manufacturer's warranty reporting, it may become necessary for staff to conduct audits of warranty claim related activities at repair facilities. Staff was refused access to check records at heavy-duty vehicle repair facilities on approximately 20 separate occasions. Staff is therefore proposing new regulatory provisions that specify staff's right of entry to warranty repair facilities for the purposes of inspecting heavy-duty vehicles and engines for which emissions standards have been adopted, or for which emission equipment is required and which is situated on the premises for the purpose of emission-related maintenance, repair, or service, or for the purpose of sale, lease, or rental. The right-of-entry includes, but not be limited to, inspecting repair records, vehicles, and engines.<sup>16</sup> (CCR, 2017)

# **B.** Tractor-Trailer GHG (Amendments)

The proposed amendments to the Tractor-Trailer GHG regulation would provide another pathway to compliance for affected trailer fleet owners by identifying Phase 2 certified trailers and trailers retrofitted with approved Phase 2 aerodynamic technologies as compliant trailers. These amendments will not result in any emission benefit or disbenefit, nor any cost impact on regulated parties. Staff is also proposing to revise the definition of a 53-foot or longer box-type trailer to be consistent with the definition of a long box van trailer contained in the federal Phase 2 regulation.

- 1. Background
  - a. Trailer GHG Requirements for 53-foot and longer Box-Type Trailers

In December 2008, the Board approved the Tractor-Trailer GHG regulation, which became effective January 1, 2010 (CARB, 2014). The regulation reduces the GHG emissions from long-haul tractors and trailers by improving the aerodynamic performance and reducing the rolling resistance of tractor-trailers. The requirements specified in the regulation are based on elements of the U.S. EPA SmartWay program. A more detailed description of the Tractor-Trailer GHG regulation is provided in Chapter I.

In 2014, concurrent with the adoption of California Phase 1 regulations, CARB modified the Tractor-Trailer GHG regulation by sunsetting the requirements for MY 2014 and later tractors. These tractors were no longer required to be SmartWay verified models (sleeper-cabs) or use SmartWay verified LRR tires (day cabs) because such requirements were duplicative of the then newly adopted Phase 1 certification requirements for tractors (CARB, 2013; CARB, 2014b).

b. Phase 2 Standards for Trailers

As discussed earlier in Chapter III, the federal Phase 2 program includes the first ever CO<sub>2</sub> emission standards for manufacturers of trailers used in combination with tractors.

<sup>&</sup>lt;sup>16</sup> Even though CARB has right of entry to inspect dealerships for all vehicle categories listed in the CCR Section 2111 outlined in the HSC Sections 43008.6, 43012, and 43150 – 43152, and Vehicle Code Section 24007 clarifying language is needed to explain that CARB has the right of entry for inspection at heavy-duty vehicle/engine dealers and warranty repair stations, where sales and service are not often performed on the same premises. The authority to inspect these facilities has already been established pursuant to 13 CCR 2702(r), 13 CCR 2222(m)(4), and 13 CCR 2025 (v).

The federal Phase 2 trailer program begins with trailers manufactured on or after January 1, 2018 (with California trailer provisions proposed to begin two years later). The standards get progressively more stringent for 2021, 2024, and 2027 and later MY trailers. The MY 2018 through 2021 standards are based, in part, on the application of SmartWay-equivalent aerodynamic technologies and LRR tires on long box van trailers. The Tractor-Trailer GHG regulation applies only to 53-foot and longer box-type vans, which are equivalent to the long box van trailer category defined in the federal Phase 2 regulation. The federal Phase 2 trailer standards for MY 2018 through 2020 long box van trailers are equivalent to California's Tractor-Trailer GHG regulation requirements for trailers. Further, the federal Phase 2 trailer standards for subsequent years are more stringent than California's Tractor-Trailer GHG regulation requirements.

2. Summary of Proposed Amendments

The proposed amendments would give trailer fleet owners the option of complying with the Tractor-Trailer GHG regulation by using a Phase 2 certified trailer, or by using a trailer retrofitted with Phase 2 compliant aerodynamic technologies and LRR tires.

To provide clarification, staff also proposes to replace the term "53-foot or longer boxtype trailer" with "Long box-type trailer" when describing trailers manufactured after January 1, 2020, that must comply with the rule. "Long box-type trailer" would be defined as a trailer that is greater than 50 feet in length. This is consistent with the federal Phase 2 regulation language and does not change the applicability of the Tractor-Trailer GHG regulation since the typical standard, next-shorter, trailer length sold in the U.S. is 48 feet long. With the average cargo pallet size in North America being 48 inches (4 feet) long and 40 inches wide, box-type trailers are generally multiples of four feet in length (plus a small allowance for door closing).

### IV. AIR QUALITY

This chapter discusses the projected emission benefits from the proposed amendments. Benefits from the California Phase 2 program (federal Phase 2 program with California differences) in California are described in further detail below. Because the California Phase 2 program would align with the federal program in terms of structure, timing<sup>17</sup>, and stringency, the California changes are aimed at ensuring the emission benefits of the federal program are achieved in practice, rather than achieving additional emission reductions. Hence, no additional emission benefits are quantified for the California differences. Further detail on the method used to estimate the Phase 2 emission benefits is presented in Appendix F.

As previously discussed, the proposed amendments to the Tractor-Trailer GHG regulation would simply provide another pathway to compliance for affected trailer fleet owners and hence would not result in any emission benefit or disbenefit.

### A. GHG - Emissions Inventory Analysis and Results

Emissions from heavy-duty trucks are major contributors to the NOx and CO<sub>2</sub> inventory in California. Approximately a third of statewide NOx emissions and one fifth of GHG emissions (CARB, 2016; CARB, 2016a) come from medium- and heavy-duty trucks over 8,500 pounds GVWR. Additionally, medium- and heavy-duty trucks account for one fifth of the GHG emissions from the transportation sector nationally, and are the fastest growing segment of the transportation sector in both the U.S. and worldwide.

As previously discussed, in 2013, CARB adopted the California Phase 1 regulations, aligning California's medium- and heavy-duty vehicle and engine regulations with the federal Phase 1 program. Also, in conjunction with the adoption of the California Phase 1 regulations, CARB amended its existing Tractor-Trailer GHG regulation making it consistent with the federal program. Phase 1 is expected to reduce CO<sub>2</sub> emissions in California by 12 percent in 2030.

On-road mobile source emissions in California are estimated using CARB's EMission FACtors (EMFAC) inventory model (CARB, 2015f). EMFAC2014 reflects the California-specific vehicle fleet mix, vehicle age, and VMT profiles, and is used as the starting

<sup>&</sup>lt;sup>17</sup> Timing of effective dates for both federal and California Phase 2 standards are identical for all engine and vehicle categories, except trailers. The Federal Phase 2 trailer requirements begin January 1, 2018. The California Phase 2 trailer requirements would begin January 1, 2020. There would be no emission impact since the Tractor-Trailer GHG regulation is already in place in California.

point for this analysis. This analysis focuses on the GHG emissions impact of the proposed rule as applied to heavy-duty vehicles operated in California.

1. Emission Inventory Methods

Since EMFAC2014 vehicle categories are different than the vehicle categories defined by the federal Phase 2 regulations, staff made necessary adjustments to translate the emission reductions in terms of EMFAC2014 vehicle categories. Staff aggregated the emission rates obtained from the vehicle standards to obtain a composite CO<sub>2</sub> emission rate (g/mile) applicable to each EMFAC2014 vehicle category. Staff applied these reductions to EMFAC2014 CO<sub>2</sub> emissions output. For this analysis, school bus, urban transit bus, motor coaches, motor homes, and all other buses were assigned the same reduction level as MHD vocational vehicles. The trailer reductions are the result of implementing the Phase 2 regulation while keeping the CARB heavy-duty Tractor-Trailer GHG regulation in place. The basic assumption is that a Phase 2 compliant trailer complies with the Tractor-Trailer GHG regulation and therefore the Tractor-Trailer GHG regulation will not result in any additional benefit after the Phase 2 standards are implemented. The percentage reductions in CO<sub>2</sub> emission rates with respect to 2010 are shown in Tables IV-1 through IV-3.

MV	LHDT1/LHDT	Population	
	Diesel	Gasoline	Regulation
2010	100.0%	100.0%	
2014	97.7%	98.5%	
2015	97.0%	98.0%	Phase 1
2016	94.0%	96.0%	FIIASE I
2017	91.0%	94.0%	
2018-2020	85.0%	90.0%	
2021	82.9%	87.8%	
2022	80.8%	85.6%	
2023	78.8%	83.4%	
2024	76.8%	81.4%	Phase 2
2025	74.9%	79.3%	
2026	73.0%	77.3%	
2027+	71.2%	75.4%	

Table IV- 1	Phase 1 and 2 CO	2 Remaining	Emissions	(Class 2	h-3)18
		2			

<sup>&</sup>lt;sup>18</sup> The table shows remaining emission percentages; for example, 97.7% in the table for diesel MY 2014 would mean there is a 2.3% reduction in emissions due to the standards for that model year.

MV	<b>Composite Reduction</b>		Busse	Population	
	Т6	T7	Duses	Regulation	
2010	100.0%	100.0%	100.0%		
2014	94.7%	87.0%	94.7%		
2015	94.7%	87.0%	94.7%	Dhoop 1	
2016	94.7%	87.0%	94.7%	FIIdSE I	
2017	91.1%	84.5%	91.1%		
2018-2020	91.1%	84.5%	91.1%		
2021-2023	82.4%	74.2%	82.4%		
2024-2026	76.2%	68.6%	76.2%	Phase 2	
2027+	73.4%	65.5%	73.4%		

Table IV- 2: Phase 1 and 2 CO<sub>2</sub> Remaining Emissions (T6, T7 and Buses)<sup>33</sup>

Table IV- 3:	Phase 2 CO <sub>2</sub>	Reduction	Percentage	(due to	<b>Trailer Im</b>	provements)
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Phase 2 Tra	ailer Reduction	Reductions				
Trailer Type	Assumed Distribution	2018-	2021-	2024-	2027+	
	from MOVES	2020	2023	2026	2021+	
53'+ Dry Van	55.50%	6.7%	9.0%	10.5%	11.8%	
<53' Dry Van	12.30%	2.9%	4.2%	5.1%	5.6%	
53'+ Reefer	18.20%	5.8%	8.3%	10.0%	11.6%	
<53' Reefer	5.20%	2.7%	3.8%	5.2%	5.9%	
Container Chassis	0.20%	2.0%	3.0%	3.0%	3.0%	
Flatbed	6.90%	2.0%	3.0%	3.0%	3.0%	
Tank	0.40%	2.0%	3.0%	3.0%	3.0%	
Other On-Highway	1.20%	0.0%	0.0%	0.0%	0.0%	
Other Off-Highway	0.00%	0.0%	0.0%	0.0%	0.0%	
Weighted Average	Combination Tractor- Trailer (except drayage trucks)	5%	7%	9%	10%	
	Drayage trucks pulling container chassis only	2%	3%	3%	3%	

2. Emissions Inventory Results

Figure IV-1 shows the impact of the Phase 1 and Phase 2 regulation on GHG emissions from affected vehicles<sup>19</sup>. As shown in Figure IV-1, although the Phase 1 GHG standards are projected to reduce emissions below the baseline of what they would be without the standards, they are not enough to offset the projected growth in heavy-duty truck VMT. From around 2023 forward, without standards stricter than Phase 1, emissions would increase (see the orange line in the figure). The Phase 2 GHG standards are needed to offset that projected VMT growth and keep heavy-duty truck CO2 emissions declining through the mid-2030s (as shown in the green line in the figure). The results show that from 2019 to 2050, the California Phase 2 regulation achieves additional 207.6 MMT CO<sub>2</sub> reductions beyond those achieved by Phase 1.

Figure IV- 1: Statewide On-Road GHG Emissions from Phase 1 and Phase 2 Regulated Vehicles (TTGHG=Tractor-Trailer GHG regulation)



<sup>&</sup>lt;sup>19</sup> The affected EMFAC vehicle categories by Phase 1 and 2 regulations are heavy-duty trucks and buses exceeding 8,500 pounds GVWR.

Table IV-4 shows the emission benefits in California from the California Phase 2 Program.

	CO <sub>2</sub> Emissions from Affected Vehicles (in MMT per year)							
Calendar Year	Baseline CO <sub>2</sub> Emissions	CO <sub>2</sub> Emissions with Phase1 +TTGHG	CO <sub>2</sub> Emissions with Phase 2	Phase Redu	2 CO <sub>2</sub> ctions			
				From	From			
				Baseline	Phase			
					1+TTGHG			
2030	44.4	39.2	34.1	23%	13%			
2050	55.3	47.9	36.5	34%	24%			

Table IV- 4:	California	Phase 2	<b>CO2 Benefits</b>
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#### **B. NOx Emissions**

CARB is not claiming any NO<sub>x</sub> emission benefits as a result of the California Phase 2 GHG amendments. The PHEV credit provisions aimed at preventing NOx increases may prevent NOx increases, but would not necessarily decrease NOx emissions. The inclusion of the emission standards and other requirements for heavy-duty glider vehicles, glider engines, and glider kits may prevent an increase in NOx emissions from these vehicles that would otherwise occur due to the proposed federal repeal of the glider provisions. Glider vehicles equipped with remanufactured engines from pre-2007 may have NOx emissions anywhere from 10 to 20 times higher and toxic diesel particulate matter emissions as much as 10 times higher than modern engines. (CARB, 2001a).

### V. ENVIRONMENTAL ANALYSIS

### A. Introduction

This chapter provides the basis for CARB staff's determination that the proposed regulation is exempt from the CEQA requirements. A brief explanation of this determination is provided in section B below. CARB's regulatory program, which involves the adoption, approval, amendment, or repeal of 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 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. CARB, as a lead agency, prepares a substitute environmental document (referred to as an "Environmental Analysis" or "EA") as part of the Staff Report prepared for a proposed action to comply with CEQA (17 CCR 60000-60008) (CCR, 2017). If the regulation is finalized, a Notice of Exemption will be filed with the Office of the Secretary for the Natural Resources Agency and the State Clearinghouse for public inspection.

### B. Analysis

Staff has determined that the proposed regulation is exempt from CEQA under the general rule or "common sense" exemption (14 CCR 15061(b)(3)). CEQA Guidelines state "the activity is covered by the general rule that CEQA applies only to projects which have the potential for causing a significant effect on the environment. Where it can be seen with certainty that there is no possibility that the activity in question may have a significant effect on the environment, the activity is not subject to CEQA". The proposal is also categorically exempt from CEQA under the "Class 8" exemption (14 CCR 15308) because it is an action taken by a regulatory agency for the protection of the environment. (CCR, 2017)

The proposed regulation would largely harmonize with the existing federal regulation with regards to stringency, structure, and timing of the standards. Several minor changes relative to the federal Phase 2 standards, to preserve the benefits of California's existing regulatory and incentive programs, are proposed for the California Phase 2 program. They include minor changes to the A/C refrigerant leakage requirements (increased reporting), additional consumer labeling for 2b/3 vehicles, changes to the credits (i.e., extra credit for low GWP refrigerants, absence of transit bus custom chassis standards in California, and additional requirements for PHEV credit multipliers), exclusion of transit buses from the custom chassis provisions, and California Specific Sales Limits for "Specialty" Heavy-duty Vehicle Types. Regardless of CARB's proposed regulation, the regulated community is already certifying lower-emitting engines and vehicles in order to

meet the existing federal regulation. In addition, CARB proposes not to align with U.S. EPA's non-ethane NMHC standards, and as such, there will be zero environmental impact with respect to existing CARB regulations. While this regulation will largely mirror the federal rule, it will be enforced in California and manufacturers will be required to certify in California.

In the short term the low GWP credit program could create a GHG disbenefit, because the full credit amount would exceed the actual GHG emission reductions from switching to a low-GWP refrigerant, and would last until 20 percent or more of the vehicles in a vehicle type use low-GWP refrigerants. This credit program, however, is intended to foster a transition to low-GWP refrigerants that would otherwise be significantly delayed. Staff believes that the long-term GHG benefit would outweigh the potential short-term disbenefit.

Based on staff's review, because the regulation harmonizes with the federal Phase 2 regulation (the only differences are minor distinctions that are air quality protective), the proposed regulation will not result in a significant adverse impact on the environment and should be exempt from CEQA under the general rule exemption. Further, the proposed action is designed to protect the environment and staff found no substantial evidence indicating the proposal could adversely affect air quality or any other environmental resource area, or that any of the exceptions to the exemption applies (14 CCR 15300.2). Therefore, this activity is exempt from CEQA (CCR, 2017).

### VI. ENVIRONMENTAL JUSTICE

State law defines environmental justice as the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies. Government Code section 65040.12 subdivision (c). CARB is committed to making environmental justice an integral part of its activities. 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 recognize that environmental justice issues have been raised more in the context of low-income and minority communities.

Over the past thirty years, CARB, local air districts, and federal air pollution control programs have made substantial progress towards improving air quality in California.

Heavy-duty vehicles are the predominant means of transporting goods and services in California. Their prevalence can be seen along primary transportation corridors as well as in more densely populated urban areas, including in and surrounding environmental justice communities. Some of the locations where heavy-duty vehicles frequent include ports, warehouses, and distribution hubs.

A significant reduction in criteria pollutants from medium- and heavy-duty trucks has occurred over the last three decades, as a result of the various regulations implemented by CARB and U.S. EPA with manufacturer and fleet efforts to comply. For example, since 1990, heavy-duty engine standards have steadily declined, from 6 grams per brake horsepower-hour (g/bhp-hr) down to 0.20 g/bhp-hr for NOx. Recently, the increased engine standard stringency has required the introduction of highly effective exhaust aftertreatment controls such as diesel particulate filters (DPF) and selective catalytic reduction (SCR) technology. As heavy-duty trucks have gotten cleaner, there has been a reduction in the exposure of all Californians to air pollution.

As discussed earlier in Chapter III, the California Phase 2 GHG rulemaking would align with the final federal Phase 2 regulations adopted by U.S. EPA on October 25, 2016, including emission standards and other requirements for heavy-duty glider vehicles, glider engines, and glider kits. Such glider vehicles have NOx and toxic diesel PM emissions many times higher than modern engines. Limiting their production would help protect all people who breath California air, but would be of particular benefit in environmental justice communities, which tend to be located near areas frequented by heavy-duty trucks.

Also, as discussed earlier in Chapter III, another element of the California Phase 2 GHG rulemaking would encourage manufacturers to make more heavy-duty PHEVs with reduced NOx emissions and greater AER. Heavy-duty PHEVs can be used in vocational applications such as delivery vehicles, utility vehicles, refuse haulers and transit buses, and may be used in environmental justice communities. Insofar as the proposed amendments mitigate potential excess NOx emissions from PHEVs, the proposed amendments would be protective of environmental justice communities. Overall, the proposed Phase 2 GHG standards and proposed amendments to the Tractor-Trailer GHG regulation are consistent with CARB's environmental justice policies. The Phase 2 GHG program (federal and California programs) substantially reduce GHG pollution from class 2b through 8 engines and vehicles. Reducing GHG emissions will help stabilize the climate, which will benefit all communities, including environmental justice communities.

### VII. ECONOMIC IMPACTS ANALYSIS

This chapter provides a summary of the estimated costs incurred to industry and local and state agencies to comply with the two regulatory proposal.

The proposed amendments to the Tractor-Trailer GHG regulation would result in "no cost impact" on businesses, since they do not lessen or strengthen the existing requirements, but simply provide another pathway to compliance.

The proposed California Phase 2 regulation costs and economic impacts are discussed further below. For more detail regarding how they were determined, refer to Appendix H: Further Detail on Cost and Economic Analysis.

### A. Introduction

As previously discussed, the proposed California Phase 2 GHG regulation would largely harmonize with the federal Phase 2 GHG regulation with some minor California distinctions.

The proposed California Phase 2 GHG regulation would align with the federal Phase 2 GHG regulation in terms of timing, stringency, and structure. There would be minor differences from the federal Phase 2 GHG regulation to help align with current California requirements and preserve the benefits of California incentive programs and regulations.

If California did not adopt its own Phase 2 regulation, manufacturers would still need to meet the federal Phase 2 standards to legally sell vehicles in the U.S. Hence, most of the costs and cost savings associated with Phase 2 in California are due to the federal Phase 2 GHG regulation, and would occur regardless of the proposed California Phase 2 GHG regulation. The proposed minor California distinctions are responsible for the costs associated with California Phase 2.

# B. California Phase 2 GHG Regulation Costs

Staff estimated the proposed California Phase 2 GHG regulation costs using the federal Phase 2 costs as baseline (in the absence of California Phase 2, manufacturers would still need to comply with federal Phase 2 regulation). The proposed California Phase 2 GHG regulation would regulate medium- and heavy-duty engines, vehicles, and trailer manufacturers. The proposed California Phase 2 differences from the federal Phase 2 GHG regulation that would lead to an increase in California compliance costs are listed below: (Note – All costs were updated to 2017 dollar value and rounded to the nearest \$1000)

- No "deemed to comply" provisions Unlike the California Phase 1 GHG regulation, staff is not proposing to include "deemed to comply" provisions in the California Phase 2 GHG regulation. Manufacturers would be required to submit information directly to CARB to certify their engines, vehicles, and trailers with the Phase 2 GHG regulation. CARB would independently determine whether affected engines, vehicles, and trailers comply with the California Phase 2 requirements
- Additional labeling requirements for tractors and vocational vehicles
- Detailed reporting of A/C system information to support A/C leakage standard
- California credit provision differences:
  - Extra emission credits to manufacturers for use of low-GWP refrigerants
  - Additional requirements for PHEVs to qualify for federal advanced technology multiplier credit
  - Credit adjustment to meet primary vocational standards for transit buses certified to the federal custom chassis provisions (U.S. EPA, 2016) and produced for sale in California
- Separate California credit tracking due to California differences in credit provisions
- Consumer label requirements for Class 2b and 3 PUVs

Table VII-1 summarizes annual direct costs associated with each difference listed above to all affected manufacturers from 2018 to 2028. The manufacturers are largely located outside of California. The direct costs on all affected manufacturers listed in Table VII-1 would be passed on to California heavy-duty vehicle fleets who purchase the California Phase 2-certifed vehicles and trailers, including local and state government fleets.

# Table VII- 1: Direct Costs to All Affected Manufacturers due to the Proposed California Phase 2 Regulation from2018 to 2028 (2017\$)

Calendar	Cost of	No "Deemed to	Comply" Provis	ions +	Cost of	Cost of	Cost of Califor	nia Credit Prov	ision Difference	Cost of Class	Total Cost
Year	Additions t	o Tractor & Voc	ational Vehicle	Label (\$)	Detailed	Separate	(\$)			2b/3 Consumer	(\$)
		T	1		Reporting of	California		1		Label (\$)	
	Engine	Tractor and	Trailer	Class	A/C Systems	Credit	Low-GWP	PHEV	Transit Bus		
		Vocational		2b/3	(\$)	Tracking (\$)	Refrigerant	Credits	Custom Chassis		
		Vehicle		PUVs			Credits		Provisions		
2018	-	-	-	-	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-	-	-	-	-
2020	-	-	891,000	-	-	-	-	-	-	-	891,000
2021	88,000	2,129,000	891,000	30,000	73,000	1,000	2,772,000	431,000	4,000	298,000	6,716,000
2022	131,000	2,718,000	891,000	-	92,000	2,000	2,988,000	431,000	6,000	124,000	7,382,000
2023	131,000	2,718,000	891,000	-	69,000	2,000	3,248,000	431,000	6,000	124,000	7,620,000
2024	131,000	2,718,000	891,000	30,000	69,000	4,000	3,404,000	1,006,000	6,000	124,000	8,382,000
2025	131,000	2,718,000	891,000	-	69,000	5,000	854,000	1,006,000	6,000	124,000	5,804,000
2026	131,000	2,718,000	891,000	-	69,000	5,000	868,000	1,006,000	6,000	124,000	5,818,000
2027	131,000	2,718,000	915,000	-	69,000	6,000	882,000	1,581,000	6,000	124,000	6,432,000
2028	131,000	2,718,000	915,000	-	69,000	6,000	897,000	1,581,000	6,000	124,000	6,448,000
Total Cost	1,007,000	21,156,000	8,067,000	59,000	576,000	31,000	15,913,000	7,475,000	43,000	1,167,000	55,494,000
over 11											
Years (\$)											

Figure VII-1 illustrates the cost proportion of the costs listed in Table VII-1 for the total cost of \$55 million over an 11-year timeframe, 2018 through 2028. As shown, the proposed California Phase 2 regulation cost would mostly come from no "deemed to comply" provisions and the tractor/vocational labeling provisions (\$30 million out of \$55 million, approximately 55 percent). The second largest cost contribution would come from the optional low-GWP refrigerant credit provisions (\$16 million out of \$55 million, approximately 29 percent); however, the use of low-GWP refrigerants is optional, thus manufacturers may choose not to incur these costs.



# Figure VII- 1: The Proposed California Phase 2 GHG Cost over 11-Year Regulation Timeframe

### C. Benefits

The costs added by the proposed California Phase 2 regulation, about \$55 million over 11 years, are minimal compared to the federal Phase 2 regulation costs of \$35 billion (2017\$) over the same timeframe from 2018 to 2028 (U.S. EPA, 2016d) (only about 0.2 percent of the total federal Phase 2 regulation's costs). The proposed California Phase 2 regulation is intended to allow CARB to verify and enforce Phase 2 regulatory standards, thereby leading to higher levels of compliance. The proposed minor California distinctions from the federal Phase 2 regulation would be necessary to ease enforcement, align with existing California programs to preserve the benefits of California incentive programs and regulations, and provide incentives to bring low-emission technologies to market.

Specifically, the exclusion of "deemed to comply" provisions in the proposed California Phase 2 regulation would give staff timely access to certification documentation for independent review to ensure compliance. California's active role in certifying engines, vehicles, and trailers is critical to preserve the benefits of the California Phase 2 GHG regulation. The proposed detailed A/C reporting data requirement would allow staff to better evaluate the certified A/C system leakage. Refrigerants have significantly higher GWP than CO<sub>2</sub>; hence, stricter data reporting requirements would help ensure the A/C leakage compliance rate requirements are met. The low-GWP proposal would provide incentives for manufacturers to develop and implement A/C refrigerants that have low GWPs in heavy-duty vehicles. Low-GWP refrigerants have been widely used in the light-duty sector, but not as well adopted in the heavy-duty sector given its high capital investment cost. The use of low-GWP refrigerants could significantly decrease the global warming impact of refrigerant leakage emissions. The proposed additional requirement of showing no NOx increase and meeting a minimum AER in order for PHEVs to receive an advanced technology multiplier could prevent NOx increases and spur the development of better hybrids. The transit bus custom chassis proposal would incentivize the introduction of advanced zero-emission technology in the transit bus sector. The proposed consumer label for Class 2b and 3 PUVs could influence consumers to buy more fuel-efficient vehicles as they would be able to compare fuel efficiency between vehicle choices based on the provided GHG emission scores on the required label.

# D. Affected Businesses

The proposed California Phase 2 regulation would have direct cost impacts on mediumand heavy-duty engine, vehicle, and trailer manufacturers. Staff estimated that 164 manufacturers would be impacted by the rule, based on information from U.S. EPA and NHTSA published reports (U.S.EPA, 2016; U.S. EPA, 2016a). Since staff assumed the increased cost impacts on these manufacturers would be passed on to heavy-duty vehicle fleets who purchase the California Phase 2-certified heavy-duty vehicles and trailers, the proposed regulation would have indirect cost impacts on those heavy-duty vehicle fleets. Staff estimated the number of impacted California vehicle fleets to be approximately 158,000, based on California DMV 2015 registration data and CARB's emission inventory model, EMFAC2014.

# E. Potential Impacts on Jobs and Business Creation, Elimination or Expansion

Minimal impacts to the creation or elimination of jobs within California are anticipated. This is because nearly all affected engine/vehicle/trailer manufacturers are located outside of California (staff is aware of only one manufacturer located in California). The direct and indirect costs to manufacturers and California heavy-duty fleets are small and can be absorbed without changing the number of staff or driving any businesses out of business.

# F. Potential Impact on Business Competitiveness

No significant impacts to the competitive advantages or disadvantages for businesses currently doing business within the state are anticipated because the costs to affected manufacturers and fleets are small.

### G. Potential Impact on Small Business

Staff estimated about 61 percent of the impacted manufacturers are small businesses<sup>20</sup> and 87 percent of the impacted heavy-duty fleets are small businesses.<sup>21</sup> Staff assumed the increased cost on regulated manufacturers due to the proposed California Phase 2 GHG regulation to be passed on to California heavy-duty vehicle fleets who purchase the California Phase 2-certified vehicles and trailers, thus costs per impacted business were estimated based on costs per California heavy-duty vehicle fleet. The average annual costs for an impacted private small business range from zero to \$53.05 within the considered regulation's lifetime of 11 years (2018 to 2028).

# H. Fiscal impact to State and Local Agencies

1. Local Government

The proposed California Phase 2 regulation would have cost impacts on local government fleets who purchase California Phase 2-certifed heavy-duty vehicles and trailers. The impact to local governments in 2017/2018 and 2018/2019 fiscal years is

<sup>&</sup>lt;sup>20</sup> "Small business" is defined in 40 CFR 1068.30 – Definitions. See also 40 CFR 1037.150 (c) – Interim Provisions and Table XIV-2 of the federal Phase 2 Greenhouse Gas Rules.

<sup>&</sup>lt;sup>21</sup> A vehicle fleet consisting of 3 vehicles or less is defined as a small business.

zero as the proposed program's cost would not be incurred until 2020. In 2019/2022 fiscal year, the cost impacts were estimated at \$84,000. The estimated cost to local governments impacted by the proposed California Phase 2 program would be \$5,255,000 over an 11-year period from 2018 to 2028 (this \$5,255,000 cost would be part of the \$55,494,000 total cost estimated in Table VII-1).

- 2. State Government
  - a. State Government Fleets

The proposed California Phase 2 regulation would have cost impacts on state government fleets that purchase California Phase 2-certifed heavy-duty vehicles and trailers. The impact to state governments in 2017/2018 and 2018/2019 fiscal years would be zero as the proposed program's cost would not be incurred until 2020. In 2019/2020 fiscal year, the cost impacts were estimated at \$28,000. The estimated cost to state governments impacted by the proposed California Phase 2 program would be \$1,719,000 over an 11-year period from 2018 to 2028 (this \$1,719,000 cost would be part of the \$55,494,000 total cost estimated in Table VII-1).

b. CARB

There would be some additional state costs to implement and enforce the proposed California Phase 2 regulation. The exclusion of "deemed to comply" provisions in the California Phase 2 proposal would require additional CARB resources for certification review/process as well as the program enforcement. Staff estimated an addition of 15 CARB positions (two Air Pollution Specialists (APS), 11 Air Resources Engineers (ARE), one Staff Air Pollution Specialist (SAPS), and one Air Resources Supervisor I (ARS I)) would be needed for the proposed California Phase 2 program implementation. The cost for an ARS I position (salary + benefit + overhead) is \$202,000 for the first year with an annual cost in subsequent years of \$201,000. The cost for a SAPS position (salary + benefit + overhead) is \$187,000 for the first year with an annual cost in subsequent years of \$186,000. The cost for an ARE position (salary + benefit + overhead) is \$175,000 for the first year with an annual cost in subsequent years of \$174,000. The cost for an APS position (salary + benefit + overhead) is \$165,000 for the first year with an annual cost in subsequent years of \$164,000. Table VII-2 below lists estimated annual costs to CARB from 2018 to 2028 (2027\$).

# Table VII- 2: Annual Costs to CARB due to the Proposed Phase 2 California GHGRegulation from 2018 to 2028 (2017\$)

Fiscal Year	Annual Cost to State
	Agency (\$)
2018-2019	515,000
2019-2020	1,064,000
2020-2021	1,936,000
2021-2022	2,271,000
2022-2023	2,631,000
2023-2024	2,629,000
2024-2025	2,629,000
2025-2026	2,629,000
2026-2027	2,629,000
2027-2028	2,629,000

### I. Major Regulations

For a major regulation, a standardized regulatory impact analysis (SRIA) is required. A major regulation is one that has "an estimated economic impact to business enterprises and individuals located in or doing business in California exceeding \$50 million in any 12-month period between the date the major regulation is estimated to be filed with the Secretary of State through 12 months after the major regulation is estimated to be fully implemented." The annual economic impacts of the proposed California Phase 2 regulation do not exceed \$50 million, and hence a SRIA is not required. Therefore, this proposal is not a major regulation as defined by title 1 CCR section 2000(g) (CCR, 2017).

# J. Regulatory Alternatives

Government Code section 11346.2, subdivision (b)(4) requires CARB to consider and evaluate reasonable alternatives to the proposed regulatory action and provide reasons for rejecting those alternatives. This section discusses alternatives evaluated and provides reasons why these alternatives were not included in the proposal. As explained below, no alternative proposed was found to be less burdensome and equally effective in achieving the purposes of the regulation in a manner than ensures full compliance with the authorizing law. Further, the Board has not identified any reasonable alternatives that would lessen any adverse impact on small business.

In developing the preferred California Phase 2 regulatory proposal, staff also considered two alternative proposals. Brief descriptions of the two alternative proposals, including the reasons the two alternatives were rejected, are listed below:

1. Alternative 1: Align with the federal Phase 2 GHG standards but at accelerated timeline (with no minor California differences)

One alternative staff considered was to phase in emission requirements faster than required by the federal Phase 2 GHG rule and require manufacturers to certify their engines, vehicles, and trailers with CARB (i.e., no "deemed-to-comply" provision). Alternative 1 would set the same standard stringency levels as the federal Phase 2 regulation, but would phase in 3 years sooners (fully phase in by 2024 instead 2027). Given the faster phase-in schedule, Alternative 1 could yield GHG emissions benefits faster than the proposed regulation.

Staff rejected this alternative for the reasons described below. First, imposing a faster California-only phase-in of the GHG standards would likely impose a significant financial burden on manufacturers, and significantly disrupt engine and vehicle manufacturers' federal compliance strategies that are already underway. Second, as discussed in the federal Phase 2 document, given the insufficient lead time, there are concerns it could be technologically infeasible to have the Phase 2 regulation fully phased in by 2024 (U.S. EPA, 2016). U.S. EPA and NHTSA projected that only engine improvements and some tire improvement technologies would be achievable by 2024. U.S. EPA and NHTSA stated that pulling the program ahead too fast would significantly compromise the technologies' reliability and durability. Third, staff rejected this alternative because it would not establish requirements necessary to align with existing California programs and provide incentives to bring advanced technologies to market.

2. Alternative 2: Align with the federal Phase 2 GHG standards but at accelerated timeline with minor California differences

Another alternative considered was to phase in emission requirements faster than required by the federal Phase 2 GHG rule, require manufacturers to certify their engines, vehicles, and trailers with CARB (i.e., no "deemed-to-comply" provision), and include the same minor California differences as in staff's proposal. This alternative, Alternative 2, would be identical to Alternative 1, except that it would include the minor California differences. Alternative 2 would set the same standard stringency levels as the federal Phase 2 regulation, but with an accelerated timeline (3 years sooner, fully phase in by 2024 instead of 2027). Given the faster phase-in schedule, Alternative 2 could yield GHG emissions benefits faster than the proposed regulation; however, in the long-term, the proposed regulation and Alternative 2 would achieve similar GHG emissions benefits. Although Alterative 2 was more attractive than Alternative 1 because it would achieve the benefits of the minor California distinctions, staff rejected Alternative 2 per the first two reasons described above for rejecting Alternative 1. First, imposing a faster California-only phase-in of the standards in addition to the proposed California differences would impose a significant financial burden on manufacturers.

Second, pulling the regulation phase-in schedule too fast could be technologically infeasible and compromise technologies' reliability and durability.

### VIII. JUSTIFICATION FOR ADOPTION OF REGULATIONS DIFFERENT FROM FEDERAL REGULATIONS CONTAINED IN THE CODE OF REGULATIONS

The federal Phase 2 regulations are contained in the CFR, title 40, parts 9, 22, 85, 86, 600, 1033, 1036, 1037, 1039, 1042, 1043, 1065, 1066, and 1068. Staff's proposal largely harmonizes with these regulations, with minor differences, or distinctions, to ease enforcement, align with existing California programs to preserve the benefits of California incentive programs and regulations, and provide incentives to bring low-emission technologies to market. Staff's regulatory proposals are found in Appendix A: Proposed Regulation Orders, Appendix B: Proposed Amendments to Test Procedures, and Appendix C: Proposed California Environmental Performance Label Specifications. Justification for the key California distinctions from the federal Phase 2 regulations are described above in Chapters II and III and summarized briefly below:

**Independent California certification review: No more "Deemed to Comply".** Staff's proposal would discontinue the current "deemed to comply" approach for certifying engines and vehicles to GHG emission standards. California's more active role in certifying engines and vehicles is necessary to ensure the integrity of the submitted data and the benefits of the California Phase 2 GHG program are achieved.

Additional Vehicle Label Requirement. Staff's proposal would require vocational vehicles and tractors to have vehicle labels that identify the emission control systems that can be visually inspected by CARB enforcement staff. This change is necessary facilitate enforcement of the Phase 2 regulation in the field.

Additional A/C Leakage Requirement and Low GWP Credits. Staff's proposal would also establish California requirements that would allow CARB staff to better enforce the A/C system leakage requirements, and provide incentives for manufacturers to develop and use low-GWP refrigerants in heavy-duty vehicles. Without these amendments, the possibility of A/C leakage going unchecked is greater, and the potential impact of the refrigerant leakage on global warming is increased. The impact of leaking refrigerant is heightened by the fact that refrigerants have a significantly higher GWP than CO<sub>2</sub>.

Additional PHEV Requirements. In California, under staff's proposal, manufacturers of PHEVs would have to show no NOx increase and meet a minimum AER in order to receive ATCs. These additional credit provisions are designed to prevent NOx increases and spur the development of better hybrids.

Additional Transit Bus Requirements. Staff's proposal would require the manufacturers of California-certified transit buses that certify to the custom chassis standards to retire any credits gained over and above what would have been gained if the transit buses were certified to the more stringent primary vocational vehicle standard. This requirement would discourage transit bus manufacturers from certifying

to the less stringent custom chassis standards and incentivize the introduction of advanced zero-emission technology in the transit bus sector.

Additional Consumer Label. Staff's proposal would require new PUVs (class 2b and 3) to have a GHG consumer label that would be required to be displayed at time of sale. The information on the label may influence consumers to buy more fuel-efficient, lower-emitting vehicles as they would be able to compare vehicle choices based on the provided GHG and smog ratings on the required label.

**Ethane to Remain in NMHC Definition.** Staff is proposing to continue to include ethane in the hydrocarbon emission standards for NG CI engines. Removing ethane, without changing the standard, would allow for the possibility of increased toxics and VOC emissions that "fill the void" left by the ethane.

# IX. 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 had other meetings with interested persons during the development of the proposed regulation. These informal pre-rulemaking discussions provided staff with useful information that was considered during development of the regulation that is now being proposed for formal public comment.

### A. Collaboration with U.S. EPA and NHTSA on Federal Phase 2

CARB staff worked closely with U.S. EPA and NHTSA over the past several years on the development of Phase 2 GHG final rule for new 2021 (2018 for trailers) and subsequent MY heavy-duty engines and vehicles. CARB staff submitted extensive comments on U.S. EPA's NPRM for Phase 2 (CARB, 2015b). U.S. EPA staff met with CARB staff numerous times to discuss our comprehensive NPRM comments in more detail. In response to our input, U.S. EPA modified their proposal. The outcome is a Phase 2 program that California can support and that will allow manufacturers to continue to build a single fleet of vehicles and engines for the U.S. market.

### B. Stakeholder Participation in Developing California Phase 2 Proposal

On April 22, 2015, CARB staff held a symposium on California's development of Phase 2 GHG emission standards in Diamond Bar, California. Representatives from environmental government agencies, engine manufacturers, component suppliers, environmental policy and technical research organizations, and trucking fleets participated in panel discussions and presented the latest information on technology options expected for use in the post-2020 timeframe to reduce fuel consumption, improve tractor-trailer efficiency, and assist efforts to achieve California's climate goals.

Staff also held two public workshops in Sacramento on February 6, 2017 and August 31, 2017 to solicit input on possible California Phase 2 regulation differences from the federal Phase 2 program. The workshops were webcast. For additional information on these public workshops, see Appendix I.

In addition to these public workshops, staff had numerous meetings and discussions with engine, transmission, and vehicle (including bus and refuse truck) manufacturers, environmental groups, and associations such as the American Council for Energy-

Efficient Economy (ACEEE), Truck & Engine Manufacturers Association (EMA), AutoAlliance, MVAC community, Autocar Truck, New Flyer Industries, and others.

These meetings provided an opportunity for leading government, industry, and environmental stakeholders to engage in an open discussion regarding efforts to further reduce GHG emissions from on-road heavy-duty vehicles and engines.

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### XI. APPENDICES

Appendix A: Proposed Regulation Order for Phase 2 Greenhouse Gas Regulations Appendix B: Proposed Amendments to Test Procedures

Appendix B-1: Proposed Phase 2 Greenhouse Gas Amendments to California Greenhouse Gas Exhaust Emission Standards and Test Procedures for 2014 and Subsequent Model Heavy-Duty Vehicles

Appendix B-2: Proposed Phase 2 Greenhouse Gas Amendments to California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles

Appendix B-3: Proposed Phase 2 Greenhouse Gas Amendments to California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines and Vehicles

Appendix B-4: Proposed Phase 2 Greenhouse Gas Amendments 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

- Appendix C: Proposed California Environmental Performance Label Specifications for 2021 and Subsequent Model Year medium-Duty Vehicles, except Medium-Duty Passenger Vehicles
- Appendix D: Proposed Phase 2 Greenhouse Gas Regulations Summary and Rationale for each Regulatory Provision
- Appendix E: Further Detail on Phase 2 Greenhouse Gas Emission Standards
- Appendix F: Emissions Inventory Analysis and Results
- Appendix G: California Proposed Credit Tracking Template
- Appendix H: Further Detail on Cost and Economic Analysis
- Appendix I: Public Process Notices
- Appendix J: Phase 1 CO<sub>2</sub> Standards
- Appendix K: Discussion on NOx Emissions from Heavy-Duty Hybrids and Rationale for Setting no NOx increase and Minimum AER
- Appendix L: Methodology to Compare the Light-Duty 2018 GHG Rating vs. Proposed Adjusted Medium Duty GHG Rating