State of California
AIR RESOURCES BOARD

STAFF REPORT: INITIAL STATEMENT OF REASONS FOR PROPOSED RULEMAKING

PROPOSED GREENHOUSE GAS (GHG) REGULATIONS FOR MEDIUM- AND HEAVY-DUTY ENGINES AND VEHICLES, OPTIONAL REDUCED EMISSION STANDARDS FOR HEAVY-DUTY ENGINES, AND AMENDMENTS TO THE TRACTOR-TRAILER GHG REGULATION, THE DIESEL-FUELED COMMERCIAL MOTOR VEHICLE IDLING RULE, AND THE HEAVY-DUTY HYBRID-ELECTRIC VEHICLES CERTIFICATION PROCEDURES

Date of Release: October 23, 2013
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I. Executive Summary

The Air Resources Board (ARB or Board) has developed and implements a comprehensive regulatory program to reduce emissions from on-road medium- and heavy-duty vehicles in California, to both improve air quality and reduce the emissions that contribute to climate change. This report presents five regulatory proposals that are all related to on-road medium- and heavy-duty vehicles and engines, and that are intended to help usher in new generations of lower-emitting trucks, to enhance the enforcement and implementation of existing requirements, and to establish new, optional provisions. A summary of the regulatory proposals is presented below, followed by a discussion of the expected costs and benefits, and staff's recommendation.

A. Background and Summary of Regulatory Proposals

1. New Phase 1 Greenhouse Gas (GHG) Emission Standards

In 2011, the U.S. Environmental Protection Agency (U.S. 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, informally known as the "U.S. Phase 1" GHG regulations or federal Phase 1 program. The program, which phases in between model years (MY) 2014 and 2019, establishes the first ever national GHG emission standards for medium- and heavy-duty engines and vehicles with gross vehicle weight rating (GVWR) over 8,500 pounds.

In this rulemaking action, ARB staff is proposing the adoption of new regulations that would establish GHG emission standards applicable to new vehicles, and to amend existing regulations to establish GHG standards applicable to new California medium- and heavy-duty engines. The proposed new regulations and related amendments would align California's GHG emissions standards and test procedures with those of the U.S. Phase 1 GHG regulations, provide nationwide consistency for engine and vehicle manufacturers, and allow ARB to both certify new motor vehicles and new motor vehicle engines to GHG standards and to enforce those requirements in California.

Since the 1990s, when appropriate, it has been ARB's practice to harmonize its heavy-duty vehicle emission standards with U.S. EPA's standards in order to have consistent nationwide standards given the interstate nature of the trucking industry, and this proposal continues that practice. Given California's unique air quality challenges and state mandates for aggressive GHG reductions, in the future, California may need to exercise its authority and consider heavy-duty engine and/or vehicle standards more stringent than U.S. EPA's.

In 2004, the U.S. Supreme Court clarified that the definition of standard as it applies to emissions from motor vehicles and motor vehicle engines under Title II of the federal Clean Air Act (CAA), relates to the emission characteristics of vehicles or engines and requires motor vehicles or motor vehicle engines to emit no more than a certain amount of a given pollutant, be equipped with a certain type of pollution-control device, or have some other design feature related to the control of emissions. *Engine Manufacturers Association v. South Coast Air Quality Management District* (2004) 541 U.S. 246, 253, 124 S.Ct. 1756, 1762 (*EMA)*. Staff is proposing to include a definition in the proposed California Phase 1 GHG regulations to be consistent with the *EMA* court's definition of "emission standard".[1]

2. Amendments to ARB's Existing GHG Tractor-Trailer Regulation

In December 2008, ARB approved the Tractor-Trailer GHG regulation, which became effective January 1, 2010 (ARB, 2010). The regulation reduces the GHG emissions from long-haul tractors and trailers by improving the aerodynamic performance and reducing the tire rolling resistance of tractor-trailers. The requirements specified in the regulation are based on elements of the U.S. EPA's voluntary SmartWay program, under which manufacturers can apply to have the performance of technologies and equipment intended to reduce GHG emissions verified by U.S. EPA. Currently, the Tractor-Trailer GHG regulation requires 2011 and subsequent MY *sleeper-cab* tractors pulling 53-foot or longer box-type trailers on California highways to be SmartWay designated tractor models, and 2011 or subsequent MY *day-cab* tractors pulling 53-foot or longer box-type trailers on California highways to be equipped with SmartWay verified low rolling resistance (LRR) tires.

The proposed amendments would sunset the Tractor-Trailer GHG requirements applicable to new 2014 sleeper cab and day cab tractors and, in conjunction with the proposed adoption of the Phase 1 GHG regulations, would harmonize California's GHG standards and test procedures for new 2014 and subsequent model year California medium- and heavy-duty engines and vehicles with the emission standards and test procedures of the U.S. Phase 1 GHG regulations, but would maintain the Tractor-Trailer GHG requirements applicable to trailers and the requirements applicable to 2010 and older in-use tractors. Staff is also proposing to modify the Tractor-Trailer GHG regulation to clarify the requirements for tractors retrofitted with sleeper cab compartments.

[1] Staff is proposing to add a number of additional definitions in 13 CCR to be consistent with the EMA court's definition of "emission standard" for purposes of clarity, consistency, and conformity. The additional definitions clarify the definition of emission standard as used in title 13, CCR section 1900, the proposed Phase 1 GHG regulations, Tractor-Trailer regulation, optional NOx emission standards, and heavy-duty diesel vehicle idling ATCM.

3. New Optional Low Oxides of Nitrogen (NOx) Emission Standards for Heavy-Duty Engines

Since 1990, the primary oxides of nitrogen (NOx) exhaust emission standards for heavy-duty on-road engines have become dramatically more stringent, decreasing from 6.0 grams per brake horsepower-hour (g/bhp-hr) in 1990 to the current 0.2 g/bhp-hr standard, which took effect in 2010. In addition to these primary NOx standards, ARB has also established several generations of optional, lower NOx standards over the past 15 years. From 1998 to 2003, optional NOx standards ranged from 2.5 g/bhp-hr to 0.5 g/bhp-hr, in 0.5 g/bhp-hr increments, which were much lower than the primary 4.0 g/bhp-hr standard. Starting in 2004, engine manufacturers could choose to certify to optional NOx + non-methane hydrocarbon (NMHC) standards ranging from 1.8 g/bhp-hr to 0.3 g/bhp-hr, in 0.3 g/bhp-hr increments, which was significantly below the primary 2.4 g/bhp-hr NOx+NMHC standard. Such optional standards allowed local air districts and ARB to preferentially provide incentive funding to the purchasers of cleaner trucks, which encouraged the development of cleaner engines.

ARB presently does not have a mechanism in place to allow heavy-duty engine manufacturers to optionally certify engines to standards more stringent than the 2010 MY standard. Staff is therefore proposing a new regulation to establish the next generation of optional NOx emission standards for heavy-duty engines, of 0.1 g/bhp-hr, 0.05 g/bhp-hr, and 0.02 g/bhp-hr (i.e., 50 percent, 75 percent, and 90 percent lower than the current primary standard of 0.2 g/bhp-hr).

The proposed optional NOx standards will only provide emission benefits and pave the way for future cleaner engines if manufacturers choose to certify engines to such optional standards. Several existing programs such as the Carl Moyer Program and Proposition 1B Program and ARB's Truck and Bus regulation currently provide some incentives for optionally certified engines, but staff does not believe existing incentives are sufficient to encourage wide use of the optional standards. In support of staff's low-NOx proposal, potential ways in which these programs could incentivize the deployment of such trucks could include providing more Carl Moyer Voucher Incentive Program funding for optional NOx engines, and/or weighting calculated benefits for projects involving optional NOx engines to recognize the benefit of advancing low NOx technology. The upcoming evaluation of Carl Moyer policies and goals required per Assembly Bill 8 will provide an opportunity to consider how the Carl Moyer Program could support the deployment of optional low NOx-certified engines to advance future low NOx technology (AB-8, 2013).

4. Amendments to ARB's Diesel Idling Measure

In July 2004, ARB adopted the initial airborne toxic control measure (ATCM) to limit idling from diesel-fueled commercial motor vehicles (ARB, 2004). That

ATCM applies to diesel-fueled commercial motor vehicles including trucks and buses, with gross vehicle weight ratings (GVWRs) greater than 10,000 pounds that operate in California, and requires drivers of such vehicles to manually shut off engines that idle longer than five minutes. In October 2005, ARB adopted amendments to the idling ATCM, and related amendments to California's new heavy-duty engine emission standards and certification procedures to establish idling-based requirements on both new and in-use vehicles and engines, and off-road engines used to power alternative idling devices installed on sleeper cab equipped tractors. The proposed amendments to the idling ATCM would extend the applicability of the regulation from the driver to also include vehicle owners and motor carriers that dispatch affected vehicles, and would additionally modify the definition of "restricted area" to include schools, hotels, and motels. Restricted area is currently defined as "any real property zoned for individual or multifamily housing units, that has one or more of such units on it," and the existing ATCM prohibits idling of a main engine longer than 5 minutes or operation of a diesel-fueled auxiliary power unit longer than 5 minutes when located within 100 feet of a restricted area. The proposed amendments will ensure that emission benefits from the existing ATCM are realized by enhancing ARB's ability to enforce the ATCM, and would provide those members of the public who attend schools, or work or reside at hotels and motels additional protection from exposure to diesel particulate matter and other toxic air contaminants, and the associated potential cancer risks and other adverse health effects associated with diesel emissions.

5. Amendments to Heavy-Duty Hybrid-Electric Vehicles Certification Procedures

Before manufacturers can legally sell or offer for sale new engines or new vehicles in California, manufacturers must certify those engines or vehicles with ARB in accordance with ARB developed test procedures. In 2002, ARB adopted "California Interim Certification Procedures for 2004 and Subsequent Model Hybrid-Electric Vehicles in the Urban Bus and Heavy-Duty Vehicle Classes" (Interim Procedures) (ARB, 2002). The Interim Procedures were designed for heavy-duty hybrid-electric vehicle manufacturers seeking voluntary vehicle-based (as opposed to engine-based) certification.

Staff is proposing to update the Interim Procedures, to reflect the expanding commercialization and advancement of hybrid technology into more sectors of the heavy-duty market and the need to better quantify emission reductions from existing and future heavy-duty hybrid vehicles. The proposed amendments will help ensure that the test procedures are applicable to a wider range of vehicle classes and vocations, and will clarify and enhance certification requirements. The proposed amendments include expanding the applicability of the Interim Procedures to a wider range of heavy-duty vehicles, including hydraulic, turbine, flywheel, and fuel cell hybrid vehicles, and updating procedures and adding definitions to match current international

recommended practices for measuring fuel economy and emissions. The proposed amended procedures would continue to remain voluntary, interim procedures.

B. Economic Impacts

The proposed regulations and regulatory amendments will impose minimal costs on affected parties and will have minimal or no economic impacts on businesses due to the voluntary nature of the proposed adoption of the Optional Low NOx Standards and the proposed amendments to the Heavy-Duty Hybrid Electric Vehicle Certification Procedures, and due to the fact that the proposed amendments to the Tractor-Trailer GHG Regulation and to the ATCM to Limit Diesel-Fueled Commercial Motor Vehicle Idling are only directed towards clarifying existing requirements or enhancing the enforceability of existing requirements. The proposed adoption of the Phase 1 GHG regulations would impose minimal costs on affected parties because such parties would be subject to nearly identical requirements under the federal Phase 1 GHG regulations. The proposed Optional Low NOx Standards are the only element of this rulemaking proposal that could have significant new costs ($36 to 279 million, depending on the level of participation by engine manufacturers). However, the proposed Optional Low NOx standards only establish voluntary requirements and consequently would not impose costs on manufacturers that choose not to participate.

C. Environmental Impacts

ARB is the lead agency for the proposed regulations and amendments and has prepared environmental analyses pursuant to its regulatory program certified by the Secretary of the Natural Resources Agency, as in the California Code of Regulations (CCR), 14 CCR 15251(d) and 17 CCR sections 60000-60008 (CCR, 2013). In accordance with Public Resources Code section 21080.5 of the California Environmental Quality Act (CEQA), 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, as in 14 CCR 15250 (CCR, 2013). ARB has prepared the environmental analyses for each of the five proposed regulatory actions to assess the potential for significant adverse and beneficial environmental impacts associated with the proposed regulations/amendments, as required by ARB's certified regulatory program in 17 CCR 60005(b) (CCR, 2013). The resource areas from the CEQA Guidelines Environmental Checklist were used as a framework for assessing the potential for significant impacts, as in 17 CCR 60005(b) (CCR, 2013).

If comments received during the public review period raise significant environmental issues, staff will summarize and respond to the comments in the Final Statement of Reasons prepared for the regulations/amendments. The written responses to environmental comments will be approved prior to final action on the proposed regulations/amendments, as in 17 CCR Title 60007(a) (CCR, 2013). If the regulations/amendments are adopted, a Notice of Decision will be posted on ARB's website and filed with the Secretary of the Natural Resources Agency for public inspection, as in 17 CCR 60007(b) (CCR, 2013).

The proposed regulations and regulatory amendments are designed to reduce GHG and criteria emissions from medium- and heavy-duty vehicles and engines and improve compliance with existing regulations. The proposed Phase 1 GHG regulations do not require additional compliance actions beyond those already required by the federal Phase 1 GHG regulations, hence resulting in no new direct emission benefits. The Tractor-Trailer GHG regulation is primarily being amended to harmonize with the U.S. Phase 1 GHG regulations, in conjunction with the adoption of the proposed California Phase 1 regulations. Overall, the federal Phase 1 program in California, in conjunction with the proposed amendments to sunset the requirements of the Tractor-Trailer GHG regulation applicable to new 2014 and later model year tractors, is expected to reduce 3.1 million metric tons carbon dioxide equivalent (MMTCO2e) in 2020 and 7.0 MMTCO2e in 2035, which corresponds to a 7.2 percent reduction in 2020 and 12.5 percent reduction in 2035.

Because the proposed regulation for Optional Low NOx emissions standards is optional, the emission benefits from that proposal will depend on the level of participation by engine manufacturers. Staff estimated NOx emission benefits for two different scenarios based on low and high participation rates from manufacturers and estimated NOx emission benefits of 0.6 to 1.2 tons per day (TPD) statewide in 2020, and 3.3 to 6.9 TPD in 2035.

The proposed amendments to the ATCM to limit idling from diesel-fueled commercial motor vehicles would enhance the ARB's ability to enforce the ATCM, and would help ensure that those members of the public who attend schools, or work or reside at hotels and motels are provided additional protection from exposure to diesel particulate matter and other toxic air contaminants, and the associated potential cancer risks and other adverse health effects associated with diesel emissions.

The proposed amendments to the Heavy-Duty Hybrid-Electric Vehicle Certification Procedures will provide a more comprehensive certification process and will not generate additional emissions reductions in the short-term. In the long-term, however, the amended procedures could enable more hybrid-electric vehicles to be certified and produced, which could provide emission benefits.

Based on staff's review, staff has determined that implementing the proposed regulatory actions would not result in any potentially significant adverse impacts on the environment. Each of the environmental analyses in Chapter IV of this staff report provides the basis for reaching this conclusion, in addition to a discussion of the air quality benefits expected from implementing the proposed regulations/amendments.

D. Recommendation

Because the proposed regulations and amendments will reduce GHG and NOx emissions from medium-duty and heavy-duty trucks, harmonize California requirements with federal requirements, and enhance enforcement and implementation of existing regulations, staff recommends that the Board adopt each and every one of the proposed regulatory actions described in the following chapters.

II. Introduction

The Air Resources Board (ARB 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 ARB's program to improve air quality and reduce the emissions that contribute to climate change. This report presents staff's proposal for five separate, but related regulatory actions related to on-road medium- and heavy-duty vehicles and engines. These include:

- New Phase 1 Greenhouse Gas (GHG) Emission Standards: These proposed regulations would set new GHG emissions standards for model year (MY) 2014 and later medium- and heavy-duty engines and vehicles sold in California identical to the national GHG emission standards established by U.S. Environmental Protection Agency (U.S. EPA) in 2011. This would provide California with the ability to certify engines and vehicles to the new standards as well as enforce them.

- Amendments to ARB's Existing Tractor-Trailer GHG Regulation: The proposed amendments to ARB's existing Heavy-Duty Vehicle GHG Emission Reduction regulation (Tractor-Trailer GHG regulation), in conjunction with the proposed new Phase 1 GHG regulations described above, would harmonize California's GHG standards and test procedures for new 2014 and subsequent model year California medium- and heavy-duty engines and vehicles with the emission standards and test procedures of the U.S. Phase 1 GHG regulations, but would maintain the Tractor-Trailer GHG requirements applicable to trailers and the requirements applicable to 2010 and older in-use tractors. Staff is also proposing to modify the Tractor-Trailer GHG regulation to clarify the requirements for tractors retrofitted with sleeper cab compartments.

- New Optional Low Oxides of Nitrogen (NOx) Emission Standards for Heavy-Duty Engines: ARB presently does not have a mechanism in place to allow heavy-duty engine manufacturers to optionally certify engines to standards more stringent than the 2010 MY standard. Staff is therefore proposing a new regulation to establish the next generation of optional NOx emission standards for heavy-duty engines, of 0.1 g/bhp-hr, 0.05 g/bhp-hr, and 0.02 g/bhp-hr (i.e., 50 percent, 75 percent, and 90% lower than the current primary standard of 0.2 g/bhp-hr). The proposed optional standards for NOx could serve to encourage development of new, cleaner engines.

- Amendments to ARB's ATCM to Limit Diesel Idling: The proposed amendments to ARB's existing airborne toxic control measure to Limit Diesel-fueled Commercial Motor Vehicle Idling (idling ATCM) would extend the applicability of the ATCM to include vehicle owners and motor carriers in addition to drivers. The proposed amendments would also modify the definition of "restricted area" to include schools, hotels, and motels.

- Amendments to ARB's Heavy-Duty Hybrid-Electric Vehicles Certification Procedures: The proposed amendments would update ARB's Interim Certification Procedures for 2004 and Subsequent Model Hybrid-Electric Vehicles, in the Urban Bus and Heavy-Duty Vehicle Classes, originally adopted by ARB in 2002. These amendments are intended to make the certification procedures more broadly applicable to additional vocational vehicles (VVs) and heavy-duty plug-in hybrid electric vehicles that have entered the market since the regulation was originally adopted. The amended procedures would remain voluntary, interim procedures.

  In 2004, the U.S. Supreme Court clarified the definition of standard as it applies to emissions from motor vehicles and motor vehicle engines under Title II of the federal Clean Air Act (CAA). *Engine Manufacturers Association v. South Coast Air Quality Management District* (2004) 541 U.S. 246, 253, 124 S.Ct. 1756, 1762 (*EMA*, 2004*)*. Staff is proposing to add a number of additional definitions of "emission standard" in 13 CCR to be consistent with the *EMA* court's definition of standard for purposes of clarity, consistency, and conformity. The additional definitions clarify that the definitions of emission standard as used in title 13, CCR section 1900, the proposed Phase 1 GHG regulations, Tractor-Trailer GHG regulation, optional NOx emission standards, and idling ATCM conform to the federal definition.

A. Need for Emission Reductions and Regulatory Authority

These regulatory proposals collectively affect the medium- and heavy-duty vehicles (trucks) category, which includes all vehicles greater than 8,500 pounds gross vehicle weight rating (GVWR). They affect trucks ranging from Class 2 full-size pickup trucks and utility vans weighing just over 8,500 pounds all the way up to Class 8 heavy-duty vehicles with a GVWR of more than 80,000 pounds. Each

of the five proposed regulations affects a different class of vehicles as is detailed in the Proposed Regulations and Amendments chapter of this report.

The truck category is a significant source of NOx, particulate matter (PM), and GHG emissions in California. According to ARB's emission inventory, medium- and heavy-duty trucks (>8,500 pounds GVWR, all fuel types) emit about 69 percent of the NOx emissions from on-road vehicles and about 32 percent of the NOx emissions from all sources in California in 2013. Similarly, medium- and heavy-duty trucks emit 38 percent of the PM emissions from on-road vehicles and about 2 percent of the PM emissions from all sources in California in 2013.

For GHG emissions, heavy-duty trucks, buses, and motor homes emitted 23 percent of the GHG emissions from on-road vehicles and 8 percent of the GHG emissions from all sources in California in 2010 (ARB, 2013a). Reducing emissions from trucks is an important part of ARB's programs to meet the heath based ambient air quality standards, reduce the toxic risk from exposure to diesel PM, and reduce the GHG emissions that contribute to climate change.

1. Ambient Air Quality Standards

Under California and federal law, ARB is the primary agency in California responsible for ensuring that all regions of California attain and maintain the state and federal ambient air quality standards (FCA, 2004). To achieve this, California must adopt all feasible measures to obtain the necessary emission reductions, including measures for mobile sources (HSC, 2013).

As discussed further below, the medium- and heavy-duty vehicles covered by these regulatory proposals are major sources of NOx and PM emissions in California. They also emit reactive organic gases and carbon monoxide (CO).

Emissions from medium- and heavy-duty vehicles contribute to violations of the health based ambient air quality standards for ozone and PM. Meeting these ambient air quality standards remains a challenge particularly in the South Coast and San Joaquin Valley Air Basins – the two parts of California with the worst air quality. State Implementation Plans (SIP) for these regions show the need for significant NOx reductions from long-term measures (beyond the specific near-term measures identified in the SIP) to meet U.S. EPA's 1997 8-hour ozone standard by 2023. These long-term NOx SIP commitments are 241 tons per day for the South Coast and 81 tons per day for the San Joaquin Valley (ARB, 2009). These regions will need even greater emission reductions to meet U.S. EPA's more stringent 2008 8-hour ozone standard by 2032 as shown in ARB's 2012 Vision for Clean Air: A Framework for Air Quality and Climate Planning study (ARB, 2012a). This package of proposed regulations would continue reducing truck emissions, helping California make progress toward attaining the ambient air quality standards.

2. Climate Change

The California Global Warming Solutions Act of 2006, Assembly Bill (AB) 32, established requirements for a comprehensive program to reduce GHG emissions. AB 32 gives ARB responsibility for monitoring and reducing GHG emissions. It requires ARB and other state agencies to adopt regulations and other requirements that would reduce statewide GHG emission levels to 1990 levels by 2020 and to maintain and continue reductions beyond 2020. Further, Governor's Executive Order S-3-05 directed that GHG emission levels be reduced to 80 percent below 1990 levels by 2050, and Governor Brown's Executive Order B-16-12 reaffirmed a 2050 GHG emission reduction target for the transportation sector of 80 percent below 1990 levels.

AB 32 requires ARB to identify a list of "discrete early action greenhouse gas reduction measures" to be adopted by 2010 and 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 Tractor-Trailer regulation was an AB 32 discrete early action measure. The initial Scoping Plan was developed by ARB 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. ARB is in the process of developing the 2013 Update to the Climate Change Scoping Plan. The 2013 Update will highlight California's progress toward meeting the 2020 GHG emission reduction goals defined in the 2008 Scoping Plan as well as define ARB's climate change priorities for the next five years. The 2013 Update will also lay the groundwork to start the transition to the post-2020 goals set forth in Executive Orders S-3-05 and B-16-2012.

Meeting the 80 percent emission reduction target for 2050 will require California to steadily drive down emissions from every sector. Staff's proposed Phase 1 regulations and the Tractor-Trailer GHG regulation as proposed to be amended would provide GHG emission reductions that help California meet these targets.

3. Diesel Risk Reduction

Under California law, ARB is also responsible for controlling toxic air contaminants (TAC). This includes adopting emission standards for motor vehicles to achieve the maximum possible reduction in public exposure to TACs (HSC, 2013).

In 1998, California identified diesel PM as a TAC. Diesel PM has been found to contain over 40 substances that are individually identified as TACs and is associated with increases in lung diseases, heart disease, mortality, and other chronic non-cancer health effects. In 2000, ARB approved the Diesel Risk Reduction Plan which identified the impacts of diesel PM, identified technologies to control diesel PM, and outlined measures necessary to reduce diesel PM by 75 percent by 2010 and 85 percent by 2020.

ARB subsequently adopted a series of regulations to reduce the health risk from exposure to diesel exhaust, which include ARB's idling ATCM.

B. Existing Emission Standards and Programs

1. New Engine Emission Standards

Table **1** below shows the current California emission standards for new on-road heavy-duty diesel engines (HDDE) as contained in the 13 CCR 1956.8 (CCR, 2013).

Table 1 – Current MY 2013 HDDE Emission Standards (in grams per brake-horsepower hour (g/bhp-hr))

Emission Standards	
NOx	0.2
PM	0.01
NMHC	0.14

The PM emission standards took effect in the 2007 heavy-duty engine MY. The NO_x and non-methane hydrocarbon (NMHC) standards were phased in for diesel engines between 2007 and 2010.

California does not currently have GHG emission standards for heavy-duty diesel or Otto cycle (spark-ignited) engines. The Phase GHG 1 standards proposed in this regulatory proposal document would be the first such standards.

2. U.S. EPA SmartWay Program

Launched in 2004, SmartWay® is a voluntary U.S. EPA program with the goal of reducing transportation-related emissions by creating incentives to improve supply chain fuel efficiency. In addition to ranking vehicles by their environmental performance, providing grants for fuel-saving equipment, and allowing freight companies to commit to lower fuel consumption, under the SmartWay program, U.S. EPA establishes performance criteria and reviews test data to ensure that designated tractor and trailer models have been demonstrated to be more fuel efficient than their traditional counterparts. The SmartWay program also verifies the performance of individual aerodynamic equipment for trailers and low-rolling resistance tires for tractors and trailers.

C. Emissions from Medium- and Heavy-Duty Vehicles

As noted above, these regulatory proposals collectively affect the medium- and heavy-duty vehicles (trucks) category, which includes vehicles greater than 8,500 pounds GVWR. Figure 1 shows the classes of vehicles covered by these regulations. There are differences in the classes of vehicles covered by the five proposed regulations or amendments, as detailed in the Proposed Regulations and Amendments chapter of this report. However, this section provides background on the emissions from the entire category.

Figure 1 - Medium- and Heavy-Duty Vehicle Classes

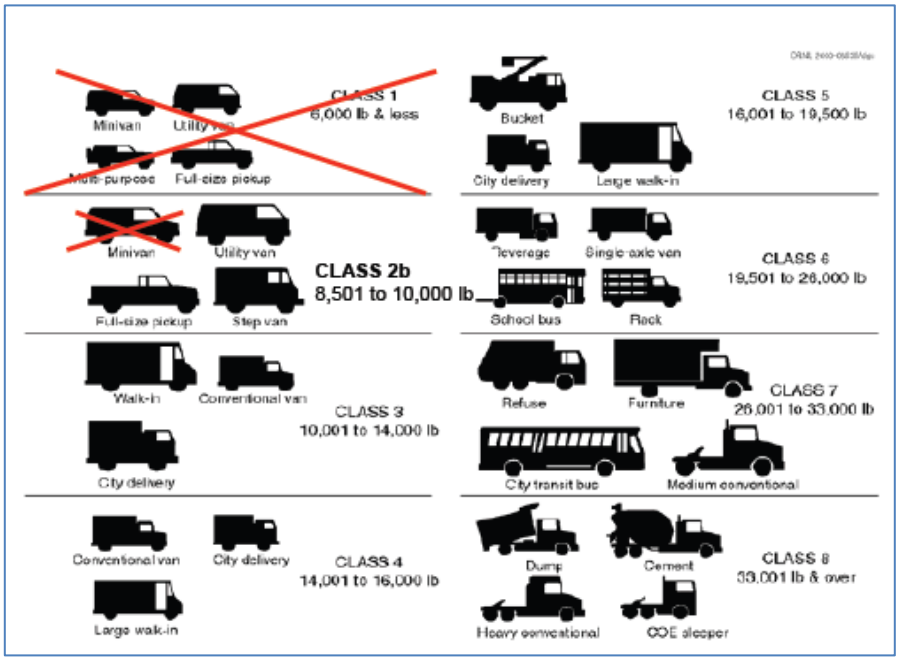


Table 2 shows the baseline NOx, PM, and carbon dioxide (CO2) emissions from these vehicles.

Table 2 - Baseline California Emissions from Trucks Greater Than 8,500 pounds GVWR
(In tons per day for NOx and PM, million metric tons (MMT) per day for CO2)

Pollutant	2013	2020	2035
NOx	686.5	405	288
PM (<10μm)	28.7	20.5	24.6
PM (<2.5μm)	20.2	11.6	13.5
CO2 (MMT per Day)	39.5	43.2	55.5

- Data are obtained from Emission Factors (model) (EMFAC) 2011 web tool (ARB, 2013e)
- Emissions includes **PTO** (power takeoff)

Diesel-cycle engines use a compression-ignition system to initiate combustion of the fuel in the engine's combustion chamber. Thus, a diesel-fueled engine does

not need an ignition source (e.g., spark plug) to ignite the air/fuel mixture. By contrast, natural gas and liquefied petroleum gas-fueled engines are also typically diesel-cycle engines (having relatively high compression) but do require an ignition source (e.g., a glow plug along with a small amount of diesel fuel injected into the cylinder) to ignite the air/fuel mixture. However, regardless of how the air/fuel mixture is ignited, if engines are derived from diesel-cycle engines,[2] they would, for the purpose of this rulemaking, be considered HDDEs.

Vehicles with HDDEs are segregated into weight classes for regulatory and emissions inventory purposes, as shown in Table 3.[3] The definition of light heavy-duty vehicle used in California regulations differs from that used in federal regulations, as shown in Table 3. In California, vehicles with a GVWR between 8,501 and 14,000 pounds are considered medium-duty vehicles and may optionally use engines certified to heavy-duty engine standards or may certify to the low-emission vehicle (LEV) standards.[4] Because the majority of this staff report concerns adopting California's Phase 1 GHG regulations that would establish GHG emission standards that are identical to those in the U.S. Phase 1 GHG emission standards, we use the federal weight classifications for light heavy-duty (LHD), medium heavy-duty (MHD), and heavy heavy-duty (HHD) vehicles for the remainder of this staff report.[5]

Table 3- Federal and ARB Heavy-duty Truck Weight Classes

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 heavy-duty				Medium heavy-duty		Heavy heavy-duty
California (1995 and later model year)[5]	Medium-duty		Light heavy-duty		Medium heavy-duty		Heavy heavy-duty

[2] HDDE emission standards are optional for engines used in medium-duty vehicles 8,501 to 14,000 pounds GVWR, pursuant to the LEV requirements in title 13, CCR, Section 1961.

[3] Title 13, CCR, Section 1900 defines heavy-duty vehicle as any motor vehicle other than a passenger car having a GVWR greater than 6,000 pounds. However, for the purposes of this staff report, heavy-duty is used to mean a vehicle with a GVWR greater than 8,500 pounds.

[4] Note that for the 2020 and subsequent MYs, medium-duty vehicles 8,501-14,000 pounds GVWR must certify to LEV III chassis standards.

[5] For emissions inventory purposes, ARB's EMFAC model defines LHD and MHD differently than shown in Table 3. EMFAC defines light heavy-duty as 8,501 to 14,000 pounds GVWR, and medium heavy-duty as 14,001 to 33,000 pounds GVWR. The EMFAC definitions are not used in the body of this staff report; instead, this staff report uses the federal weight classifications for LHD, MHD, and HHD vehicles.

Most of the emissions from heavy-duty trucks come from diesel-cycle compression ignition engines, especially in the higher weight classes. However, vehicles with gasoline and natural gas spark-ignited engines are also part of the truck fleet, particularly in the lower weight classifications shown above. The characteristics of the fleet of heavy-duty vehicles on California's roads vary depending on the weight ranges of the vehicles, as follows:

- GVWR 8,500-14,000 pounds (low end of LHD): Approximately two thirds of vehicles in this weight range are spark-ignited, and one third diesel-powered. However, two thirds of the NOx and PM emissions from vehicles in this weight range come from diesel-powered vehicles. Only a small percentage of such vehicles are spark-ignited.
- GVWR 14,001-33,000 pounds (high end of LHD and all MHD): These heavier trucks are predominantly diesel-powered (about 80 percent by population run on diesel). Their NOx and PM emissions are dominated by emissions from the diesel-powered fraction. Only a small percentage of such vehicles are spark-ignited.
- GVWR over 33,000 pounds and up (HHD): Nearly all of these heaviest of the heavy-duty trucks are diesel-powered (98 percent by population), and the non-diesel portion has only negligible NOx and PM emissions.

The primary pollutants of concern from diesel engines are NOx and PM, since both are harmful to human health. The high combustion and exhaust temperatures and excess air cause the nitrogen in the air to combine with available oxygen to form NOx. Since diesel-cycle combustion operates with excess air, gaseous by-products due to incomplete combustion are emitted at relatively low levels. These by-products include hydrocarbon (HC) and CO. The incomplete combustion of a diesel-cycle engine does however contribute to relatively high levels of PM (compared to Otto-cycle stoichiometric, or spark ignited, engines). Lubrication oil entering the combustion chamber also contributes to overall PM emissions. Evaporative emissions from diesel engines are not significant since diesel fuel has a low vapor pressure and thus, a low evaporation rate.

Natural gas, which consists largely of methane (CH4) formed underground through the decay of buried dead plants and animals, is considered a relatively clean fossil fuel because it does not contain mercury, has very little sulfur, and has a low carbon footprint compared to coal and petroleum. Natural gas is typically used as liquefied natural gas (LNG) or compressed natural gas (CNG). Although traditionally, as discussed above, heavy-duty trucks have largely been powered by diesel fuel, in recent years due to the current low prices of natural gas as compared to diesel fuel, more natural gas powered heavy-duty truck engines have become available (Smith, 2012).

The primary criteria pollutant of concern for natural gas-powered heavy-duty truck engines is NOx. However, it is generally easier to achieve low NOx emissions from a natural gas engine versus a diesel engine. Although the

newest diesel engines can meet the same NOx standards as natural gas engines, to meet the current standards, diesel engines require relatively complex emission control equipment such as a selective catalytic reduction (SCR) system with diesel exhaust fluid. Spark-ignition natural gas engines on the other hand can meet the same NOx emission standards with a basic catalytic converter (Wisconsin, 2013).

Spark-ignition engines such as natural gas engines typically have slightly lower efficiency than compression-ignition engines such as diesel engines. Hence, natural gas engines have slightly poorer fuel economy and slightly higher NMHC and carbon dioxide (CO2) tailpipe emissions, compared to diesel engines.

D. Stakeholder Participation in Developing Proposals

On March 11, 2013, ARB staff (staff) held a public workshop in Sacramento to discuss four of the five heavy-duty vehicle regulatory proposals: the Phase 1 regulations, the optional low NOx standards, amendments to the Tractor-Trailer GHG regulation, and amendments to the idling ATCM. The workshop was webcast as well. In addition to this workshop, staff held meetings with interested stakeholders. Staff also followed up by providing an early review version of the draft regulatory language for the Phase 1 regulations and the optional low NOx standards in August 2013 to those who had attended the public workshop (because the regulatory language had not been drafted at the time of the workshop).

The public outreach for the proposed amendments to the heavy-duty hybrid electric vehicle certification procedures proceeded on a separate time line from the other four proposals. Staff held two public workshops in Sacramento on February 3, 2010 and August 30, 2012. Both these workshops were webcast as well. Staff also convened a public working group to discuss the proposals in greater detail and held two working group meetings via conference calls on February 26, 2013 and March 19, 2013. In addition to these meetings, staff held meetings with interested stakeholders. Staff also followed up by providing an early review version of the draft regulatory language for the amended certification procedures in July 2013 to selected stakeholders and held teleconference discussions with some of them in August 2013.

The remainder of this report is organized as follows:

- Chapter III summarizes staff's recommendation for Board action.
- Chapter IV contains a section for each proposed regulation or regulatory amendment, providing the background, a summary of the proposed requirements or amendments, as well as a discussion of technological feasibility, environmental impacts, cost, and regulatory alternatives that were considered.
- Chapter V summarizes the cost and economic impacts for all five regulatory proposals.
- Chapter VI summarizes the environmental impacts for all five regulatory proposals.
- Chapter VII summarizes the environmental justice impacts of all five regulatory proposals.
- Chapter VIII defines acronyms and abbreviations used.
- Chapter IX lists references used.

III. Summary of Recommended Board Action

Staff recommends that the Board approve for adoption the proposed regulations and regulatory amendments included in Appendix I and described in the chapters below. Approving the adoption of the proposed regulations and amendments will reduce emissions of GHG and NOx from medium- and heavy-duty trucks, help to harmonize California requirements with federal requirements, and ease enforcement and implementation of existing medium- and heavy-duty truck regulations.

IV. Proposed Regulations and Amendments

Section A below discusses the proposed Phase 1 regulations. Section B discusses the proposed amendments to ARB's existing GHG Tractor-Trailer regulation. Section C describes the proposed new Optional Low NOx Emission Standards for Heavy-Duty Engines. Section D discusses the proposed amendments to ARB's idling ATCM. Section E describes the proposed amendments to ARB's Heavy-Duty Hybrid-Electric Vehicles Certification Procedures.

A. Phase 1 GHG Emission Standards (New Proposal)

Staff is proposing to align California's medium- and heavy-duty vehicle and engine regulations with U.S. EPA's Phase 1 program by adopting new California emission standards and test procedures identical to those adopted by U.S. EPA. This would provide California with the ability to certify engines and vehicles to the Phase 1 standards and allow ARB to enforce the requirements in California. The text of the proposed emission standards and test procedures is contained in Appendix I.A.

1. Background

In 2011, U.S. 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. These standards are informally known as the "U.S. Phase 1" GHG program (or federal Phase 1 regulations) in anticipation of a second round of rulemaking by U.S. EPA scheduled for completion in 2015 (informally known as "U.S. Phase 2 GHG" regulation). The U.S. EPA Phase 1 GHG regulations, which phase in between MYs 2014 and 2018, are the first ever national GHG emission standards for medium- and heavy-duty engines and vehicles.[6] The U.S. EPA Phase 1 GHG regulations will reduce GHG emissions from heavy-duty engines and vehicles by establishing emission standards for CO2 and other GHGs (nitrous oxide (N2O), methane (CH4), and hydrofluorocarbons (HFC)) resulting in more efficient, lower emitting engines and vehicles. The complementary NHTSA fuel economy standards will also reduce fuel use from the medium- and heavy-duty vehicle fleet improving energy security and reducing transportation costs.

In this rulemaking, staff is proposing to align California's medium- and heavy-duty vehicle and engine regulations with U.S. EPA's Phase 1 GHG regulations by adopting new California emission standards and test procedures identical to those adopted by U.S. EPA. This would provide California with the ability to certify engines and vehicles to the Phase 1 GHG standards and allow ARB to enforce the requirements in California (ARB, 2013f). It would also provide nationwide consistency for the heavy-duty truck and engine manufacturers.

When U.S. EPA adopted the U.S. Phase 1 GHG standards, it anticipated that ARB would subsequently adopt the same standards (U.S. EPA, 2011a). It has been standard practice since the 1990s for ARB to harmonize its heavy-duty vehicle emission standards with U.S. EPA's standards in order to have consistent nationwide standards given the interstate nature of the trucking industry[7]. In 1997, U.S. EPA adopted new emission standards for 2004 and subsequent heavy-duty diesel engines, and ARB adopted matching California standards in 1998. Similarly, U.S. EPA adopted emission standards for 2007 and subsequent heavy-duty diesel engines in 2001, and ARB followed suit harmonizing California's standards later the same year (ARB, 2001). This proposal would continue that practice.

The proposed Phase 1 GHG regulations would complement ARB's existing Tractor-Trailer GHG regulation for heavy-duty vehicles, which was adopted by the Board in 2008 and amended in 2010. As discussed further in Section B

[6] The U.S. EPA Phase 1 GHG regulations contain provisions allowing manufacturers the option to certify 2013 model year engines and vehicles to the GHG standards to obtain emissions credits. 40 CFR 1036.150(e) and 40 CFR 1037.150(a), respectively.

[7] It is ARB staff's goal to continue the practice of harmonizing with U.S. EPA's standards. In the future, however, due to California's unique air quality challenges and state mandates for aggressive GHG reductions, staff may propose that California adopt heavy-duty engine and/or vehicle standards more stringent than U.S. EPA's.

below, ARB's existing Tractor-Trailer GHG regulation requires new and existing long-haul tractors pulling 53-foot or longer box-type trailers and 53-foot and longer box-type trailers operating on California highways to be equipped with U.S. EPA SmartWay approved aerodynamic technologies and low-rolling resistance tires. The voluntary U.S. EPA SmartWay Partnership Program certifies tractors and trailers that have been demonstrated to be more fuel efficient than their traditional counterparts.

The Phase 1 GHG regulations partially overlap with the Tractor-Trailer GHG regulation because they set emission standards for the tractors covered by the Tractor-Trailer GHG regulation. However, unlike ARB's Tractor-Trailer GHG regulation, the U.S. Phase 1 regulations do not regulate trailers. As described in greater detail below in Section B, staff is proposing to amend the the Tractor-Trailer GHG regulation (with no amendments to the trailer portion of the regulation) in conjunction with the proposed adoption of the Phase 1 GHG regulations to ensure that California's GHG requirements are consistent with the U.S. Phase 1 GHG requirements.

2. Summary of Proposed Regulation Requirements and Deadlines

a. Proposed Regulation Overview

The intent of the proposed regulations is to harmonize with U.S. EPA's Phase 1 GHG program by adopting the same federal GHG emissions standards in California for medium- and heavy-duty engines and vehicles. The federal program is designed to reduce GHG emissions by establishing CO2, CH4, N2O, and HFC standards for new engines and vehicles (U.S. EPA, 2011e). Staff proposes to align with federal standards that begin with MY 2014, and increase in stringency through 2019. There are separate engine standards for compression-ignition versus spark-ignition engines. Vehicle standards are established within three regulatory categories: Class 7 and 8 tractor-trailers,[8] Class 2b to 8 VVs, and Class 2b and 3 pickup trucks and vans (PUV). Additionally, U.S. EPA has provided regulated entities with a variety of compliance methods and credit opportunities, including an alternative compliance path that starts in 2013, an opportunity to average, bank, and trade credits, as well as recognition of advanced technologies and early credits. Staff is proposing to maintain the same compliance flexibility as in the federal program to minimize manufacturers' compliance burden. Thus, staff's proposal would recognize those manufacturers that comply with the federal Phase 1 GHG program (Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles published in 40 Code of Federal Regulations (CFR) Parts 86, 1036, 1037, 1065, and

[8] In some of U.S. EPA 's Phase 1 GHG rulemaking materials, U.S. EPA uses the term "HD Tractor-Trailer" to mean a class 7 or class 8 motor vehicle designed to pull a semitrailer on a highway. For consistency with ARB's Tractor-Trailer GHG regulation, this staff report uses the term "tractor-trailer" for that purpose.

1066, dated July 2013), as "deemed to comply" with the California standards (U.S. EPA, 2013a; U.S. EPA, 2013b). This will enable manufacturers to pursue one compliance strategy to meet both the federal and California requirements.

b. Applicability

The proposed rulemaking applies to motor vehicles with a GVWR of 8,500 pounds or greater, and the engines that power them, except for medium-duty passenger vehicles already covered by ARB's LEV program.

Staff is proposing that the applicability of the Phase 1 GHG requirements be identical to the U.S. Phase 1 GHG program. The federal Phase 1 GHG program applies to all businesses that manufacture, sell, or import new heavy-duty and medium-duty engines, incomplete and complete vehicles including new Class 2b through 8 vehicles, trucks, tractors, school and transit buses, VVs such as utility service trucks, and three-quarter ton and 1-ton PUVs. Staff is proposing that the Phase 1 GHG regulations apply to the same medium- and heavy-duty sector effective with 2014 MY engines and vehicles.

c. Requirements and Compliance Deadlines

Staff is proposing to establish California GHG standards identical to those in the federal Phase 1 program, including standards for CO2, CH4, N2O, and HFC emissions, to create a nationally harmonized program. Federal GHG standards are established separately for diesel and gasoline engines, with different stringency points and effective dates. The GHG standards are also separately established for three distinct regulatory vehicle classes: tractor-trailers, VVs, and heavy-duty PUVs. U.S. EPA's GHG engine and vehicle standards generally begin with MY 2014 engines and increase in stringency through 2019.

i. CH4 and N2O Engine and Vehicle Standards

Staff is proposing to adopt engine and vehicle standards for N2O and CH4 that are equivalent to those of the federal Phase 1 GHG program. The Phase 1 GHG standards include CH4 and N2O limits applicable only to engines and PUV vehicles. There are no separate CH4 or N2O standards for tractor-trailers or VVs since the standards will already apply to the engines used in these vehicles. U.S. EPA's CH4 and N2O standards are intended to function as a cap, and are not intended to reduce emissions beyond today's levels (U.S. EPA, 2011b). The federal standards help to ensure that manufacturers do not employ GHG emission reduction technologies that increase the current amount of emissions (ibid). U.S. EPA's Phase 1 GHG standards require that medium- and heavy-duty engines meet a N2O and CH4 engine emission standard that does not exceed 0.10 g/bhp-hr for N2O and 0.10 g/bhp-hr for CH4 for the applicable useful life of the engine. For

diesel engines, the N2O and CH4 standards apply to 2014 and subsequent MYs. Separately, for spark-ignited engines (i.e., gasoline and other engines derived from gasoline engines, such as natural gas engine derived from gasoline engines), the N2O and CH4 standards apply to 2016 and subsequent MY engines. For PUVs, the CH4 and N2O standards apply to MY 2014 and subsequent vehicles. The N2O standard for PUVs is 0.05 g/mile, and the CH4 vehicle standard is 0.05 g/mile. As described further in 13 CFR 1036.705(d) and 1037.104(c), manufacturers may apply CO2 emission credits to meet CH4 and N2O standards, if needed (CFR, 2013).

ii. HFC Refrigerant Vehicle Standards

To address vehicle-based GHG emissions released from air conditioning (a/c) systems caused by the extra load placed on the engine to provide power for the a/c system (as discussed in paragraph iii below), and by refrigerant leakage, U.S. EPA established HFC refrigerant standards (U.S. EPA, 2011b). Specifically, to address refrigerant leakage, manufacturers are required to meet a low leakage rate for a/c systems installed in 2014 MY and subsequent PUV and tractor-trailer vehicle classes. As further explained in the Federal Register, there are no leakage standards established for Class 2b to 8 VVs because of the numerous parties that are involved in the production and installation of the a/c system. For a/c systems with a refrigerant capacity greater than 733 grams, staff is proposing to match U.S. EPA's standard of a 1.5 percent leakage rate per year. Staff is proposing to also adopt U.S. EPA's final standard of 11.0 grams per year for a/c systems with a refrigerant capacity of 733 grams or less.

iii. CO2 Vehicle Standards

Staff is proposing to use the same metrics as U.S. EPA for CO2 vehicle standards. For PUVs, U.S. EPA finalized a standard based on grams of CO2 emitted per mile travelled (g/mile), consistent with the current metric used for criteria pollutant requirements for these vehicles (U.S. EPA, 2011f). For tractor-trailers and VVs, U.S. EPA's final standards are expressed as the mass of emissions from carrying a ton of cargo over a distance of one mile (g/ton-mile). In other words, the unit is expressed as a measure of freight movement or tons of payload miles travelled (U.S. EPA, 2011h).

1. Class 7 and 8 Tractor-Trailer CO2 Standards

The U.S. Phase 1 GHG standards for tractor-trailers are based on several key attributes related to GHG emissions: the vehicle's GVWR, the roof height of the cab, and associated day cab or sleeper cab characteristics. U.S. EPA finalized two sets of CO2 standards for class 7 and 8 tractor-trailers. In addition to vehicle-based standards, as discussed further in section iv below, there are

separate performance standards for the engines manufactured for use in these tractors. Tractor/truck manufacturers are required to install the appropriate certified engine in their vehicle. That is, a VV engine must be used in a VV, and an engine designed for tractors may only be used in tractor vehicles. To harmonize California's program with the U.S. Phase 1 GHG program, staff is proposing to establish the same concept of two separate standards for tractor-trailers: one set of vehicle-based standards and one set of engine standards for engines used in these tractors.

U.S. EPA created nine subcategories for Class 7 and 8 tractor-trailers to recognize the differences in expected emissions associated with the various tractor cab attributes (U.S. EPA, 2011b). To align with U.S. EPA requirements, staff proposes to adopt these same nine subcategories. As shown in Table 4, the proposed standards would begin with vehicles produced for the 2014 MY and then become more stringent for 2017 and subsequent MYs.

Table 4 - Proposed CO2 Standards for Class 7 and 8 HD Tractor-Trailers

HD Tractor-Trailer Vehicle Standards (gCO2/ton-mile)						
	2014-2016 MY			2017 MY and beyond		
	Class 7	Class 8		Class 7	Class 8	
		Day Cab	Sleeper Berth		Day Cab	Sleeper Berth
Low Roof	107	81	68	104	80	66
Mid Roof	119	88	76	115	86	73
High Roof	124	92	75	120	89	72

2. Class 2b through Class 8 VVs CO2 Standards

The U.S. Phase 1 GHG program establishes CO2 standards for VVs that fall within three regulatory subcategories, distinguished by GVWR: LHD vehicles that range from 8,500 to 19,500 pounds, MHD vehicles that range from 19,501 to 33,000 pounds, and HHD vehicles with a GVWR of 33,001 pounds and above. These three groupings were established by U.S. EPA to maintain consistency with the same breakdown of weight classes used for engine

standards. Examples of VVs include delivery, refuse, cement, and tow trucks, as well as transit, shuttle and school buses, motor homes, and recreational vehicles. All medium- and heavy-duty vehicles not covered by the tractor-trailer or PUV regulatory classes are to be considered VVs. U.S. EPA has established separate standards for the engines used in Class 2b through 8 VVs, as described further in section iv below. Chassis manufacturers are required to install certified engines in their chassis. The federal Phase 1 program explicitly regulates the chassis manufacturers and not the body builders of VVs. To align with U.S. EPA's program, staff is proposing to adopt identical California standards for chassis manufacturers. As shown in Table 5, proposed standards would begin with VVs produced for the 2014 MY and then become more stringent for 2017 and subsequent MYs.

Table 5 - Proposed CO2 Standards for Class 2b to 8 Vocational Vehicles

Vocational Vehicle CO2 Standard (gCO2/ton-mile)			
	LHD Class 2b-5	**MHD Class 6-7**	**HHD Class 8**
2014-2016 MY	388	234	226
2017 MY and beyond	373	225	222

3. Class 2b to 3 PUVs CO2 Standards

To create a harmonized national program, staff is also proposing to adopt the federal standards established for medium- and heavy-duty vehicles with a GVWR between 8,501 pounds and 14,000 pounds (i.e., PUVs). Examples of PUVs are three-quarter ton and 1-ton pickup trucks, 12- and 15-passenger vans, and large work vans, while medium-duty passenger vehicles are excluded from this category. Unlike the separate engine and vehicle standards established for VVs and tractor-trailers (as discussed in subsection iv below), PUVs are required to meet a combined vehicle/engine, or "whole-vehicle" standard. As explained in the Federal Register, U.S. EPA finds that approximately 90 percent of PUVs are sold by manufacturers as complete vehicles (U.S. EPA, 2011b). Additionally, the technologies used for this segment of the market are similar to light-duty vehicles that require both engine and vehicle efficiency improvements to significantly reduce GHG emissions (ibid). Therefore, establishing a whole-vehicle based standard for PUVs is appropriate, and staff is proposing to adopt the same approach.

Each vehicle manufacturer must meet the PUV standards on a fleet average basis for its entire produced fleet. As described further in

Appendix II, the individual fleet average targets for each engine family vary based on several factors, including whether the vehicle is gasoline- or diesel-fueled, and its payload and towing capabilities.

iv. GHG Standards for Heavy-Duty Engines

In addition to creating GHG heavy-duty vehicle standards, the U.S. Phase 1 GHG program also establishes GHG standards for medium- and heavy-duty engines used in those vehicles. The standards differ for gasoline and diesel engines, with gasoline engine standards effective beginning with the 2016 MY, and diesel engine standards effective beginning with the 2014 MY and increasing in stringency through 2017 (Natural gas engines derived from gasoline engines must comply with the gasoline engine standards, and those derived from diesel engines must comply with the diesel engine standards. (U.S. EPA, 2011g)) As described in 40 CFR 1036.140, U.S. EPA is using the existing four service classes (three for diesel engines and one for gasoline engines), currently established for criteria pollutant emission regulations to define engine subcategories. To align with the U.S. Phase 1 GHG regulations, staff is proposing to adopt the same medium- and heavy-duty engine standards for the four prescribed regulatory engine classes, shown in Table 6, to ensure that the proper engine is installed in the vehicle for which it is designed.

Table 6 - Proposed Engine Service Classes

Engine category	Intended application
Light Heavy-duty (LHD) Diesel.	Class 2b through Class 5 trucks (8,501 through 19,500 pounds GVWR).
Medium Heavy-duty (MHD) Diesel.	Class 6 and Class 7 trucks (19,501 through 33,000 pounds GVWR).
Heavy Heavy-duty (HHD) Diesel.	Class 8 trucks (33,001 pounds and greater GVWR.
Gasoline	Incomplete vehicles less than 14,000 pounds GVWR and all vehicles (complete or incomplete) greater than 14,000 pounds GVWR.

All medium- and heavy-duty engines of a manufacturer's produced fleet may be grouped together into subfleets, if they have similar engine and emission components throughout their useful life in accordance with 40 CFR 86.24 (CFR, 2013). Hybrid engines and hybrid powertrains must be grouped together as a fleet of hybrid engines. Additionally, MHD and HHD diesel engines designed specifically for use in either tractor-trailer or VV functions are to be

grouped together based on their intended application. Staff intends to keep U.S. EPA's subgroup definitions to ensure that the proposed CO2 engine standards apply to the same existing subgroups.

1. **CO2 Standards for Medium- and Heavy-Duty Gasoline Engines**
   Staff is proposing to align with U.S. EPA's CO2 standard of 627 g/bhp-hr for 2016 and subsequent MY gasoline engines.[9] The number of gasoline engines federally certified for heavy-duty vehicle use is limited, and has ranged between three and five engine models (U.S. EPA, 2011b). Heavy-duty gasoline engines are developed primarily for heavy-duty PUVs, but are also sold as loose engines for VV manufacturers (ibid).

2. **CO2 Standards for Medium- and Heavy-Duty Diesel Engines (Primary Phase-In Option)**
   The federal CO2 standards for diesel and other similar engines are based on a vehicle group's weight class as defined above in Table 6. To match U.S. EPA's engine requirements, Table 7 outlines the proposed CO2 standards which would begin with 2014 diesel engine MYs, and then become more stringent for 2017 and subsequent MYs.

Table 7 - Proposed CO2 Standards for Class 2b to 8 Diesel Engines

Final HD Diesel Engine Standards (gCO2/bhp-hr)					
	LHD (2b-5)	MHD (Class 6-7)		HHD (Class 8)	
		Vocational Veh	Tractors	Vocational Veh	Tractors
2014-2016 MY	600	600	502	567	475
2017 and Later	576	576	487	555	460

Appendix II outlines alternate phase in schedules allowed for the engine CO2 standards and provides additional detail on the standards.

d. Distinctions between California and Federal Phase 1 Programs
As discussed above, staff intends to align California's GHG requirements for medium- and heavy-duty engines and vehicles with those of the U.S. Phase 1 GHG regulations, to allowing manufacturers to use harmonized compliance strategies to meet both federal and state requirements. Staff expects that almost all engine and vehicle manufacturers would comply with the proposed Phase 1 GHG regulations by demonstrating compliance

[9] Engines derived from gasoline engines, such as natural gas engines derived from gasoline engines, must comply with the gasoline engine standards.

with the U.S. Phase 1 GHG requirements, and then be considered "deemed to comply" with California's requirements.

However, the proposed Phase 1 regulation does incorporate minor distinctions from the U.S. Phase 1 GHG regulation:

i. GHG Urban Bus Definition

For the federal Phase 1 GHG program, U.S. EPA added a new definition in section 4086.012-2 to redefine an urban bus as one that "means a passenger-carrying vehicle with a load capacity of fifteen or more passengers and intended primarily for intracity operation, i.e., within the confines of a city or greater metropolitan area. Urban bus operation is characterized by short rides and frequent stops." This new section 86.012-2 allows manufacturers to install engines other than HHD diesel engines in hybrid bus applications (CFR, 2013).

Staff is proposing to include this new definition of urban bus in California's GHG program to allow for streamlined compliance strategies among manufacturers, but is proposing to change the federal term "urban bus" to "GHG urban bus." This difference in terminology is necessary to maintain California's existing definition for urban bus in 13 CCR 2023(a)(13) "Fleet Rule for Transit Agencies," which requires urban buses to be powered by heavy-duty diesel engines, and therefore conflicts with the federally added new definition (CCR, 2013). California's current definition of an urban bus is: "a passenger-carrying vehicle powered by a HHD diesel engine, or of a type normally powered by a HHD diesel engine, with a load capacity of fifteen (15) or more passengers and intended primarily for intra-city operation."

ii. Fuel Usage for Certification

Engine manufacturers certifying with the U.S. EPA are required to use an ultra-low sulfur diesel (ULSD) grade test fuel as specified in Table 1 of 40 CFR 1065.703 (CFR, 2013). For California, engine manufacturers must follow the test procedures and certification guidelines in "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel-Engines and Vehicles." The California test procedures allow manufacturers to certify engines in California using either ULSD fuel or a cleaner fuel as described in 13 CCR 1065.703(b)(2) Subpart H (CCR, 2013). Staff recognizes that manufacturers creating California-only engine families may use California-specific diesel fuel for the purposes of certification testing.

iii. "Deemed to Comply," Reporting Data

Manufacturers would be "deemed to comply" with the Phase 1 GHG regulation if they demonstrate compliance with the requirements of the U.S. Phase 1 GHG program. Manufacturers must submit end of year final reports to U.S. EPA as described in the Reporting Requirements of Section g. Copies of all data submitted to U.S. EPA in accordance with the reporting requirements of 40 CFR 1036.205, 1036.250, 1037.205, and 1037.250 would also be required to be submitted to ARB for certification purposes (CFR, 2013). For California engine or vehicle GHG certification, a manufacturer would be required to submit an application for certification for each engine family or vehicle subfamily. An Executive Order would then be issued by ARB's Executive Officer for any engine or vehicle family that has demonstrated compliance with the proposed California Phase 1 GHG regulations or the federal Phase 1 GHG regulation. Staff is proposing that engine and vehicle manufacturers submit California values, rather than national values, for the number of engines and vehicles sold and produced in California. The California-specific data will be used to determine the level of manufacturer compliance, and emissions reductions achieved in CA.

iv. Certification of Medium-Duty Vehicles from 8,500 to 10,000 Pounds GVWR for 2020 and Subsequent MYs

For 2020 and subsequent MY criteria pollutant emission standards, California requires chassis certification for medium-duty vehicles from 8,500 to 10,000 pounds GVWR. This means manufacturers seeking to certify to California's Phase 1 GHG standards in MY 2020 and later would need to use chassis certification.

In the federal Phase 1 GHG program, a manufacturer may certify medium-duty vehicles from 8,500 to 10,000 pounds GVWR either to the emission standards of 40 CFR 1037.104 or 1037.105, depending on whether the vehicle is certified as a complete or incomplete vehicle for criteria emission standards (i.e., whether it is chassis certified or engine certified). If the vehicle is chassis certified for criteria standards, GHG certification requires compliance with the applicable chassis emission standards (40 CFR 1037.104(f)). However, if the vehicle is certified to incomplete vehicle emission standards through an engine dynamometer, the manufacturer must certify the vehicle to the vocational vehicle GHG emission standards of 40 CFR 1037.105 (CFR, 2013).

In California, the option to certify incomplete medium-duty vehicles (8,500 to 10,000 pounds GVWR) to criteria emission standards will sunset beginning MY 2020. This provision was primarily made to

facilitate in-use verification of vehicle emissions by avoiding the need to remove the engine for in-use emission testing of vehicles certified to engine dynamometer emission standards. To harmonize GHG emissions compliance testing requirements with ARB's criteria emission testing requirements, manufacturers would be required to chassis certify their medium-duty vehicles from 8,500 to 10,000 pounds GVWR, beginning in the 2020 MY to demonstrate compliance with applicable GHG standards..

v. Automatic Engine Shutdown System Requirements

U.S. EPA's Phase 1 GHG regulations contain optional carbon dioxide emission credit provisions for engine manufacturers certifying with automatic engine shutdown systems as shown in 40 CFR 1037.660 that are less stringent and that differ from the engine shutdown requirements in the Idling ATCM (13 CCR 1956.8 (a)(6)(A)) (CCR, 2013; CFR, 2013). Specifically, the federal regulation allows an engine manufacturer to remove the automatic engine shutdown system once the vehicle has accrued 1.29 million miles whereas California's Idling ATCM does not allow the removal of the automatic engine shutdown system for the life of the vehicle. In addition, California's Idling ATCM does not include engine shutdown override provisions for low battery state of charge and ambient temperature conditions.

Engine manufacturers planning to certify diesel-fueled engines in California with federal Phase 1 GHG optional automatic engine shutdown systems must comply with California's 13 CCR 1956.8 (CCR, 2013). Such manufacturers have two options. First, they may comply with the California engine shutdown system requirements in 13 CCR 1956.8(a)(6)(A), which are more stringent than the requirements in 40 CFR 1037.660. Alternatively, they may comply with the optional clean idle emission standards found in 13 CCR 1956.8(a)(6)(C) and utilize the less stringent federal engine shutdown system provisions specified in 40 CFR 1037.660.

e. Amend Definition of "Emission Standard"

On August 23, 2012, ARB approved the adoption of amendments to California's On- Board Diagnostic System Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD II) and Heavy Duty Engine On-Board Diagnostic System Requirements (HD OBD) that included new definitions of the terms "emission standard," "evaporative emission standards," and "exhaust emission standards." The amendments to the OBD II and the HD OBD requirements were approved by the Office of Administrative Law, filed with the Secretary of State, and became effective on July 31, 2013. ARB adopted the revised definition of

"emission standard" as set forth in Health and Safety Code section 39027, pursuant to the statutory authority of HSC sections 39010 and 39601(b), which provide that ARB may revise certain definitions of terms set forth in Chapter 2 of the HSC (commencing with section 39010) in order "to conform those definitions to federal laws and rules and regulations."

In 2004, the U.S. Supreme Court clarified that the definition of standard as it applies to emissions from motor vehicles and motor vehicle engines under Title II of the federal CAA, relates to the emission characteristics of vehicles or engines and requires motor vehicles or motor vehicle engines to emit no more than a certain amount of a given pollutant, be equipped with a certain type of pollution-control device, or have some other design feature related to the control of emissions. *Engine Manufacturers Association v. South Coast Air Quality Management District* (2004) 541 U.S. 246, 253, 124 S.Ct. 1756, 1762 (*EMA)*.

Staff is proposing to add a definition of "emission standard" to the Phase 1 GHG regulations, title 13 CCR section 1900(b), the Tractor-Trailer GHG regulation, and the airborne toxic control measure (ATCM) to limit idling from diesel-fueled commercial motor vehicles to be consistent with the definition set forth in *EMA* for purposes of clarity, consistency, and conformity. The new definition is needed to ensure that California's authority to adopt and to enforce emission standards and other emission-related requirements for mobile sources is coextensive with those provisions of section 209 of the federal CAA that establish the parameters of California's unique authority to regulate new on-road mobile sources.

Section 209(a) of the CAA preempts states and local governments from enacting any standard related to the control of emissions from new motor vehicles and engines. However, Section 209(b) of the CAA specifically provides a special exception for California that allows it to request a waiver from section 209(a)'s preemption, which must be granted unless the Administrator of the U.S. EPA makes certain findings. The authority of ARB, acting on behalf of California, to adopt standards related to control of emissions (i.e., emission standards) is effectively circumscribed by the waiver authority of CAA. Amending the definition to conform to the Supreme Court's interpretive definition of standard as it applies to emissions from motor vehicles and motor vehicle engines appropriately recognizes the interplay between federal and state law and the breadth of California's authority.

It is also appropriate to revise and update the definition of "emission standard" from that set forth at section 39027 because the latter definition was enacted by the Legislature in 1975, before significant advancements in vehicular and engine emission control technologies, such as on-board computers and OBD systems, had occurred. Also, significant recent developments in law have also occurred since 1975, including the enactment of the California Clean Air Act of 1988 (AB 2595, Sher), which directed ARB to continue to achieve substantial reductions in new vehicle emissions and substantial improvement in durability of vehicle emission systems, and the U.S. Supreme Court's decision in *Massachusetts v. EPA* (2007) 549 U.S. 497, that greenhouse gases are pollutants subject to regulation under the federal Clean Air Act. (549 U.S. at 1460).

The new, federally conforming definition effectively recognizes the present state of engine technology and the need to clarify that emission discharges into the atmosphere are more than quantitative emission limits, but also include pollution control equipment and other design features of the engine that ensure that emission reductions are achieved. For purposes of consistency and clarity, staff is also proposing to add new definitions of the terms "exhaust emission standards" and "evaporative emission standards" to clarify, where needed, previous references to emission standards. These proposed terms are subcategories of emission standards and are used to specifically identify the specified subcategories, as opposed to the broader term of emission standard that encompasses all standards, including Phase 1 GHG regulation requirements relating to the control of emissions and tailpipe and evaporative numerical limits.

Because the proposed Phase 1 GHG regulation consists of requirements applicable to the engines installed in medium and heavy-duty vehicles and of related, but separate requirements applicable to the vehicles that are powered by those engines, staff is proposing to incorporate the new definitions into two separate provisions of the California Code of Regulations (CCR). Staff is proposing to add definitions of "emission standard," "evaporative emission standards," and "exhaust emission standards" to title 13, CCR section 1956.8(i) to clarify that the Phase 1 GHG requirements applicable to engines are emission standards, and is proposing to add the proposed definition of "emission standard" to proposed new section title 17, CCR section 95662 to clarify that the Phase 1 GHG requirements applicable to vehicles are emissions standards.

The proposed rulemaking action also encompasses proposed amendments to establish optional NOx emission standards for heavy-duty engines. Staff's proposal to add the definitions of "emission standard," "evaporative emission standards," and "exhaust emission standards" to title 13, CCR section 1956.8(i) will also serve to clarify that those

amendments are emissions standards to the extent that they require motor vehicles or motor vehicle engines to emit no more than a certain amount of a given pollutant, be equipped with a certain type of pollution-control device, or have some other design feature related to the control of emissions.

ARB's existing on-road motor vehicle and motor vehicle engine standards are set forth in Article 2, Chapter 1, Division 3 of Title 13, CCR, and the standards and related requirements as set forth in those regulations likewise constitute emission standards under the *EMA* court's definition, as they require on-road motor vehicles or motor vehicle engines to emit no more than a certain amount of a given pollutant, be equipped with a certain type of pollution-control device, or have some other design feature related to the control of emissions. Staff is therefore also proposing to add new definitions of the terms "emission standard", "evaporative emissions standard" and "exhaust emissions standard" into title 13, CCR section 1900(b) to clarify that the requirements applicable to on-road motor vehicles and motor vehicle engines set forth in Article 2, Chapter 1, Division 3 of Title 13, CCR, and the associated remedies provided in the HSC for noncompliance, constitute "emission standards," "evaporative emission standards," or "exhaust emission standards."

3. Technical Feasibility

U.S. EPA thoroughly evaluated the technical feasibility of its Phase 1 GHG standards as part of its 2011 rulemaking and concluded that the technologies likely to be used to comply with the standards are currently available in the marketplace. Because ARB is proposing to harmonize with U.S. EPA's Phase 1 GHG standards, U.S. EPA's technical feasibility analysis is applicable to ARB's proposal. U.S. EPA's technical feasibility analysis is presented in the following documents: Final Rulemaking to Establish Greenhouse Gas Emission Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles, Regulatory Impact Analysis, U.S. EPA-420-R-11-901, August 2011 (U.S. EPA, 2011b) and Final Rule, Greenhouse Gas Emission Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles, published in the Federal Register on September 15, 2011 (U.S. EPA, 2011c).

The following section provides a brief summary of the technical feasibility analysis for each of the three vehicle categories covered by staff's proposal and for the engines that power these vehicles.

a. CO2 Standards for Tractor-Trailers and Heavy-Duty Engines

Strategies to reduce CO2 emissions from tractor-trailers and engines include use of aerodynamic improvements, low rolling resistance (LRR) tires, weight reduction technologies, idle reduction, and engine and

drivetrain efficiency improvements. According to U.S. EPA's analysis, the GHG standards for tractor-trailers and engines can be met with a combination of these technologies which are already available and demonstrated to be effective, in part through U.S. EPA's SmartWay program (U.S. EPA, 2011c).

- Aerodynamic technologies: Improvements to a tractor's aerodynamics reduce the drag forces acting on the tractor, which results in reduced CO2 emissions. Improved aerodynamic packages are already available in the marketplace. All major truck manufacturers already offer at least one SmartWay certified truck model.

- LRR tires: The rolling resistance of tires can be reduced with changes in tread and casing materials, tread design, tire manufacturing process, and maintaining good operating conditions (e.g., inflation pressure). LRR tires, which reduce fuel consumption and CO2 emissions, are already available in the marketplace.

- Weight reduction: Reducing the weight of a vehicle through use of different materials can reduce fuel consumption and CO2 directly and indirectly by increasing vehicle payloads, which can allow additional cargo to be carried by fewer trucks, producing lower emissions on a ton-mile basis. Possible weight reduction strategies considered by U.S. EPA include, but are not limited to, use of aluminum wheels instead of steel wheels, use of single wide tires instead of double wide tires, and use of light-weight aluminum or high strength steel for other body and chassis components.

- Extended idle reduction: Technologies such as auxiliary power systems (APSs) and battery-powered a/c, are already available in the marketplace to reduce extended main engine idling from sleeper cabs which reduces fuel consumption and CO2 emissions. ARB already has an idling reduction requirement in place for California. That regulation is discussed further in Section D of this chapter.

- Vehicle speed limiters: Because fuel consumption and CO2 emissions increase with a vehicle's speed, limiting the maximum speed of a vehicle can reduce fuel consumption and GHG emissions. Vehicle speed limiters are already available in the marketplace.

- Powertrain/transmission efficiency improvements: Fuel consumption and CO2 emissions can be reduced through use of hybrid powertrains which are now commercially available, transmission improvements, and use of low friction lubricants for the drivetrain.

- Engine efficiency improvements: Fuel consumption and CO2 emissions can be reduced by improving engine performance through the use of the following technologies evaluated in U.S. EPA's feasibility assessment: improved combustion process, improved efficiency turbochargers, higher efficiency air handling processes, low temperature exhaust gas recirculation (EGR), engine friction reduction, reduced parasitic loads, optimization of selective catalytic reduction (SCR), mechanical turbocompounding, electric turbocompounding, and bottom cycling. These technologies have all been demonstrated to improve engine performance. It should be noted that not all of these approaches are compatible with one another.

b. CO2 Standards for Heavy-Duty Pickups and Vans

The heavy-duty PUV category includes both diesel and gasoline powered vehicles, with separate standards set for diesel vehicles and gasoline vehicles. Standards are in the form of fleet average standards for each manufacturer, similar to the approach used for light-duty vehicle standards. In setting the standards, U.S. EPA considered over 35 different technologies that could be used to reduce CO2 emissions. The majority of these are already commercially available, and others are beyond the research stage and expected to be in production over the next few years within the timeframes needed to meet the standards. U.S. EPA did not consider technologies still in the research stage because of concerns over the time needed for those technologies to reach the production stage. U.S. EPA's analysis built upon the technical analysis that was used to support its earlier light-duty vehicle GHG rulemaking and considered the potential application of these technologies to heavy-duty PUVs considering the longer timeframes for the heavy-duty standards. Strategies to reduce CO2 emissions from heavy-duty pickups and vans fall into five broad categories summarized below: engine technologies, transmission technologies, vehicle technologies, electrification/accessory technologies and hybrid technologies. Some of these are applicable to diesel engines only, some to gasoline engines only, and some to both. U.S. EPA concluded that the technologies it considered feasible and appropriate could be consistently applied across the heavy-duty PUV category by the 2019 MY when the fleet average standards are fully phased in.

- Engine technologies: Fuel consumption and CO2 emissions can be reduced with the use of low-friction lubricants, reduction of engine friction losses, and cylinder deactivation during light-load operation, variable valve timing, stoichiometric gasoline direct-injection technologies, and diesel engine and after-treatment improvements. Some of these technologies are already available in the heavy-duty engine market.

- Transmission technologies: Fuel consumption and CO2 emissions can be reduced with improved automatic transmission controls and use of six, seven, and eight speed transmissions.

- Vehicle technologies: Fuel consumption and CO2 emissions can be reduced through the use of LRR tires, aerodynamic drag reducing technologies, and vehicle weight reduction.

- Electrification, accessory, and hybrid technologies: Technologies evaluated include electric and electro-hydraulic power steering, high efficiency alternators, electrically driven on-demand water pumps and cooling fans, and improving a/c system efficiency thereby reducing engine load to power the a/c system.

c. CO2 Standards for VVs

VVs falling into weight classes 2b through 8 (i.e., those above 8,500 pounds GVWR) are powered by both gasoline and diesel powered engines. In developing the standards for VVs, U.S. EPA acknowledged that these vehicles cover a wide variety of applications which influences both vehicle design and usage patterns. Accordingly, U.S. EPA set standards that would not adversely impact how these vehicles operate. The strategies to reduce CO2 emissions from VVs are similar to those for tractor-trailers, including aerodynamic improvements, use of LRR tires, idle reduction, vehicle weight reduction, use of hybrid powertrains, and engine efficiency improvements, each of which is described above.

Because VVs have different duty cycles than tractor-trailers, the mix of technologies used to meet the standards may be different than for the tractor-trailers. For example, VVs typically drive fewer miles at lower speeds with more stops and starts than tractor-trailers. Because of these differing duty cycles, aerodynamic improvements would not have as much impact on VVs. The VV standards set by U.S. EPA are based on readily available improvements in tire and engine technologies.

d. HFC Standards for Tractor-Trailers and Heavy-Duty PUVs

A vehicle's a/c system can contribute to GHG emissions through leakage of HFC. The federal Phase 1 program sets HFC emission standards for tractor-trailers and heavy-duty PUVs to limit a/c leakage emissions. Strategies to reduce HFC emissions include use of leak-tight components or use of alternative, low-global warming potential refrigerants. Availability of low leakage a/c components is being driven by the light-duty GHG regulation, so these technologies are already commercially available.

e. N2O and CH4 Standards for Heavy-Duty PUVs and Heavy-Duty Engines

In addition to CO2 standards, the federal Phase 1 program also sets N2O and CH4 standards for heavy-duty PUVs and all heavy-duty engines. These standards are set at levels to cap N2O and CH4 emissions at current levels based on emission control technologies already in use and available. The intent of these standards is to prevent future emission increases of these pollutants.

4. Environmental Impacts Analysis

This section provides an environmental analysis for the proposed Phase 1 GHG regulations described above. Based on staff's review, staff has determined that implementing the proposed Phase 1 GHG regulations would not result in any potentially significant adverse impacts on the environment. This analysis provides the basis for reaching this conclusion. This section of the staff report also discusses environmental benefits expected from implementing the proposed regulation.

a. Methods of Compliance

The proposed regulation would harmonize with the existing federal regulation and, other than minor labeling and reporting requirements would place no new or additional demands upon the regulated community. Regardless of ARB's proposed regulation, the regulated community is already certifying lower-emitting engines and vehicles in order to meet the existing federal regulation. While this regulation will merely mirror the same requirements found in the federal Phase 1 program, it does have several administrative distinctions from the federal regulation, which are described in section IV.A.2.d. of this staff report.

b. Beneficial Impacts

No additional direct emission benefits are expected with staff's proposed Phase 1 GHG regulations because the proposed regulations are being adopted to harmonize with existing federal requirements and no additional actions to reduce emissions are expected beyond what is already being carried out to comply with the federal Phase 1 GHG program. Staff quantified the emission benefits of the federal Phase 1 program in California, as shown below in Table 8. Appendix III provides a more detailed discussion of the assumptions and methodology used in estimating the emission impact of the federal Phase 1 program.

Table 8 – California Phase 1 CO2 Benefits[10]

CO2 Emissions from Affected Vehicles (in million metric tons per year)			
Calendar Year	**Baseline CO2 Emissions**	**CO2 Emissions with Phase 1**	**CO2 Reductions**
2020	43.2	40.1	7.18%
2035	55.5	48.6	12.5%

c. Resource Areas with No Impacts

Staff concludes that the proposed Phase 1 regulations would not result in any significant or potentially significant adverse impacts on the environment because compliance with the regulation does not involve or result in any new activities that could affect the environment other than what is already being carried out by the regulated community to comply with the federal Phase 1 program. The proposed Phase 1 regulations are being adopted to harmonize with existing federal requirements and no additional actions are expected.

No discussion of alternatives or mitigation measures is necessary because no significant adverse environmental impacts were identified.

5. Economic Impact Assessment/Cost Analysis

The following economic impact assessment/cost analysis has been prepared for the proposed Phase 1 regulations rulemaking action in accordance with the provisions of Government Code section 11346.3b(1)(A)-(D).

California's proposed Phase 1 GHG regulations harmonize with the federal Phase 1 GHG regulations. Complying with the federal GHG requirements will have associated costs, which are outlined in the federal rulemaking package. Compliance is or will already be required of engines and vehicles in California due to the federal program. Therefore, no additional costs would be incurred should California adopt these requirements, other than the requirement for manufacturers to provide a copy of submitted materials and some California-specific reporting data to California. This is expected to cost no more than $1000 per manufacturer for report reproduction and postage. The adoption by California of the federal program would not result in tangible benefits at this time, so a cost-benefit calculation cannot be made. The purpose of adopting this program is to enable California enforcement of the Phase 1 GHG standards, to keep California's requirements at least as stringent as

[10] Baseline CO2 emissions shown in Table 8 are without the Tractor-Trailer GHG regulation. The Tractor-Trailer GHG regulation (without the amendments proposed in this staff report) was estimated to achieve 0.7 million metric tons carbon dioxide equivalent (MMTCO2e) in 2020 and 0.9 MMTC02e in 2035, which is equivalent to about a 1.6 percent reduction.

federal requirements, to ensure continued compliance in the event that the federal program were to be terminated, and to pave the way for additional requirements in the future.

a. Creation or Elimination of Jobs and New and Existing Businesses within the State

Minimal impacts to the creation or elimination of jobs and businesses within California are anticipated. This is because nearly all affected engine and vehicle manufacturers are located outside of California, and because the costs to such manufacturers are so small as to be absorbed without changing the number of staff or driving any businesses out of business.

b. Competitive Advantages or Disadvantages for Businesses Currently Doing Business within the State

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

6. Regulatory Alternatives

In developing the proposed Phase 1 GHG regulations, staff also considered alternative proposals. No alternative considered by the agency would be more effective in carrying out the purpose for which the regulation is proposed or would be as effective as or less burdensome to the affected private persons than the proposed regulation. Brief descriptions of the alternative proposals, including the reasons they were rejected, are listed below.

a. No Action

One alternative staff considered was to take no action, i.e., not to adopt the Phase 1 GHG regulations. Taking no action would not appear to significantly impact emission reductions since engine and vehicle manufacturers are already certifying lower-emitting engines and vehicles in order to meet the existing federal Phase 1 program. Staff rejected this option because existing law requires all new vehicles and engines to be certified by ARB before they can be sold or offered for sale in California, and because staff's proposal would allow ARB to verify and enforce these regulatory standards, thereby potentially leading to higher levels of compliance. In addition, by adopting the proposed regulation, California would harmonize with the federal requirements and assure engine manufacturers that California will not create separate/different Phase 1 standards compared to the federal standards.

b. More Stringent Emissions Requirements

Another alternative considered by staff was to set stricter emissions requirements than the federal Phase 1 program. By requiring more

stringent standards for GHG emissions, specifically CO2, CH4, N2O, and HFC, California could obtain greater emissions benefits. Staff rejected this alternative because the implementation dates for Phase 1 are so imminent (beginning in 2014 and ratcheting down in 2017); there would not be adequate lead time for engine and vehicle manufacturers to design and deploy new engines and vehicles. Imposing California-only standards now would also disrupt engine and vehicle manufacturers' federal compliance strategies that are already underway. Instead of proposing stricter Phase 1 GHG standards, staff is opting to work with U.S. EPA on the next, more stringent, phase of GHG standards, Phase 2. This rulemaking development effort is expected to be completed within two to three years.

c. Do Not Adopt a "Deemed to Comply" Provision

A third alternative proposal considered was to require manufacturers to certify their vehicles and engines for California, without adopting a "deemed to comply" provision. Requiring manufacturers to certify their vehicles and engines specifically for California could provide ARB more ability to verify compliance separately from U.S. EPA. However, staff rejected this alternative because staff determined that the additional level of assurance was outweighed by additional time needed by ARB staff to evaluate and process applications, and the additional time that manufacturers would be required to wait before obtaining executive orders if the deemed to comply provision was not available.

d. Create Separate Emissions Averages for California

As described above in Section 2, the federal Phase 1 GHG program includes fleet average standards for manufacturers of heavy-duty PUVs, as well as averaging, banking and trading provisions for engine and vehicle manufacturers. One alternative staff considered was to require manufacturers to meet the averaging requirements specifically for the vehicles produced for California, separate from the nationwide average. For example, a VV manufacturer could be required to show that it met 388 g/ton-mile CO2 for MY 2014 just for vehicles sold for use in California. Although requiring a separate average for California could result in lower emissions in California, this alternative was rejected primarily because it could, as previously discussed, disrupt engine and vehicle manufacturers' federal compliance strategies, with little or no overall emissions benefit.

e. No Early Credits

The last alternative considered by staff was to harmonize with the federal Phase 1 GHG program from this point forward in time, but not to recognize the early credits already granted by the federal Phase 1 GHG program. Staff rejected this alternative because it believes that recognizing any early credits granted by the U.S. EPA would ensure that manufacturers have the same compliance flexibility in California as the federal program

and that manufacturers can comply as planned with the aligned regulations, rather than having to create a separate compliance plan for California.

B. Tractor-Trailer GHG (Amendments)

The proposed amendments would harmonize the tractor requirements of the Tractor-Trailer GHG regulation (ARB, 2010) with the existing federal Phase 1 program (U.S. EPA, 2011c) and the proposed California Phase 1 regulations, without loss of GHG emission benefits from the vehicles being regulated. Staff is also proposing to modify the Tractor-Trailer GHG regulation to clarify the requirements for tractors retrofitted with sleeper-cab compartments, add a definition of "emission standard," and make other minor clarifying and corrective changes. The text of the proposed amended Tractor-Trailer GHG regulation is contained in Appendix I.B.

1. Background

a. Tractor-Trailer GHG Requirements for 2011 and Subsequent Tractors

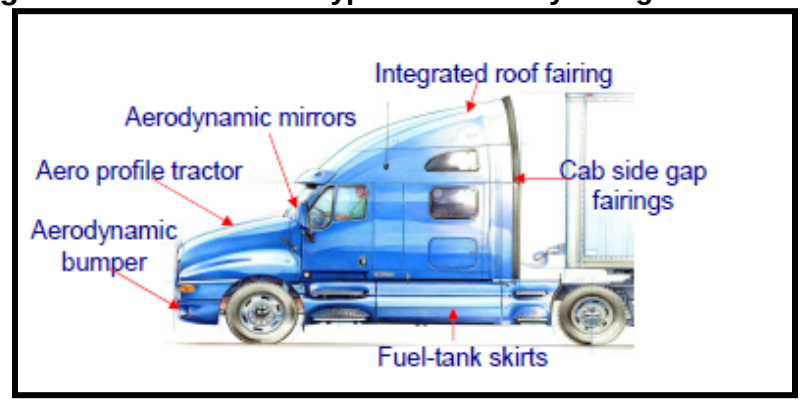
In December 2008, the Board approved the Tractor-Trailer GHG regulation, which became effective January 1, 2010 (ARB, 2010). The regulation reduces the GHG emissions from long-haul tractors and trailers by improving the aerodynamic performance and reducing the rolling resistance of tractor-trailers. The requirements specified in the regulation are based on elements of the U.S. EPA SmartWay program. Currently, the Tractor-Trailer GHG regulation requires 2011 and subsequent MY sleeper-cab tractors pulling 53-foot or longer box-type trailers on California highways to be SmartWay designated tractor models. SmartWay designated tractors are sleeper-cab tractors that have been outfitted at the point of sale with equipment that significantly reduces GHG emissions and improves fuel efficiency. This equipment includes aerodynamic improvements such as a streamlined hood, integrated high-roof fairings, fuel tank fairings, cab side gap fairings, aerodynamic mirrors, and aerodynamic bumpers. It also includes the use of SmartWay verified LRR tires. Figure 2 illustrates the aerodynamic features of a typical SmartWay designated tractor.

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.

SmartWay designated tractors must also demonstrate, using the Interim Test Method for Verifying Fuel-Saving Components for SmartWay: Modifications to SAE J1321 (U.S. EPA SmartWay, 2012), that they meet

or exceed the fuel efficiency performance of at least one current SmartWay designated sleeper-cab tractor model.

Figure 2 - Features of a Typical SmartWay Designated Tractor



The Tractor-Trailer GHG regulation also requires 2011 and subsequent day-cab[11] tractors pulling 53-foot or longer box-type trailers on California highways to be equipped with SmartWay verified LRR tires. The regulation does not establish aerodynamic equipment related requirements for day-cab tractors because the SmartWay program does not designate day-cab models.

b. Phase 1 Program Certification Requirements for 2014 and Subsequent Tractors

As discussed above, the federal Phase 1 GHG program establishes national GHG emission certification standards for heavy-duty engines and vehicles, beginning with the 2014 MY and increasing in stringency through the 2019 MY. For tractors, these standards are summarized in Table 4 above in Section A (U.S. EPA, 2011b).

In establishing the federal Phase 1 GHG program, U.S. EPA developed an emissions model, called the "GHG Emissions Model" or "GEM," that provides vehicle manufacturers with options on how to achieve the required emission reductions (U.S. EPA, 2011c). GEM includes several input parameters, including aerodynamic performance and tire rolling resistance. The stringency of the required emission reductions is based on vehicle type. For example, tractors equipped with a sleeper cab are required to meet more stringent requirements than are day-cab tractors. Certifying vehicles using the GEM model gives manufacturers the flexibility of making significant GHG emission reductions with some of their vehicles in order to produce other vehicles that meet higher emission

[11] The requirement for SmartWay verified LRR tires is applicable to a "2011 or subsequent MY heavy-duty tractor, including but not limited to sleeper-cab heavy-duty tractors," but this is effectively a requirement for day-cab tractors since sleeper-cab tractors are required to be SmartWay designated models (which include low-rolling resistance tires).

levels. This flexibility enables the manufacturer to meet customer demands by allowing them to produce vehicles that meet specific job function needs.

As shown in Figure 3 below in the Environmental Impacts Analysis section, the California emission benefits of the federal Phase 1 GHG program are projected to be greater than those of the Tractor-Trailer GHG regulation. Most of the additional benefits would be achieved based on three key factors. First, the federal Phase 1 GHG emission reduction requirements for sleeper-cab tractors are more stringent, in aggregate, than the sleeper-cab tractor requirements in the Tractor-Trailer GHG regulation. Second, the federal Phase 1 GHG program includes aerodynamic performance requirements for day-cab tractors that are not required in the Tractor-Trailer GHG regulation. Third, the federal Phase 1 GHG program covers all heavy-duty vehicle vocations and weight classes, not just Class 7 and 8 tractors hauling 53-foot box trailers covered by the Tractor-Trailer GHG regulation.

The federal Phase 1 GHG program introduces additional regulatory requirements on tractor owners subject to the Tractor-Trailer GHG regulation. The federal Phase 1 GHG program (which is mirrored in the proposed Phase 1 regulations) and the Tractor-Trailer GHG regulation overlap in that they both require tractors to meet vehicle aerodynamic and tire rolling resistance requirements. Therefore, amendments to the Tractor-Trailer GHG regulation are needed to remove duplicative requirements.

2. Summary of Proposed Amendments

a. Harmonization with the Phase 1 GHG Regulations

Staff is proposing to amend the Tractor-Trailer GHG regulation by sunsetting the requirements of the regulation for 2014 and subsequent MY tractors.

i. Sunsetting Sleeper-Cab Tractor Requirements

For sleeper-cab tractors, the proposed amendment would eliminate the requirement for 2014 and subsequent model tractors to be SmartWay designated models. However, in conjunction with the proposed adoption of the Phase 1 GHG regulations, these tractors will be required to meet the requirements that are aligned with the requirements for such tractors set forth in the U.S. Phase 1 GHG regulations that are more comprehensive and stringent than the Tractor-Trailer GHG requirements for these tractors. Thus, the proposal to sunset the 2014 and subsequent model sleeper-cab tractor requirements in the Tractor-Trailer GHG regulation would not reduce the emission benefits of the existing regulation but would instead

remove unnecessary duplication of regulatory requirements on fleets operating in California.

The proposed amendment would also result in 2014 and subsequent model sleeper-cab tractors no longer being subject to the provisions of the Tractor-Trailer GHG regulation requiring tractor aerodynamic technologies to be maintained in good operating condition. However, the Phase 1 GHG regulations have provisions that address this issue by prohibiting the modification of a tractor from its certified configuration during its useful life, and restricting modifications during its post-useful life. At the end of a tractor's useful life (435,000 miles or 10 years, whichever comes first), certified tractors can only be modified if the modification results in reduced GHG emissions (U.S. EPA, 2011c). The U.S. Phase 1 GHG regulations also require manufacturers to provide tractor purchasers with written instructions for properly maintaining the tractor (U.S. EPA, 2011c). In addition, ARB deploys enforcement staff in the field throughout California to ensure that all vehicles comply with adopted regulations; ARB's adoption of the Phase 1 standards will allow ARB's enforcement staff to enforce the Phase 1 program. Staff believes these provisions will ensure 2014 and subsequent model Phase 1 certified tractor aerodynamic technologies will be maintained in good operating condition.

The U.S. Phase 1 GHG regulations also allow tractor manufacturers to certify 2013 MY tractors to the 2014 MY U.S. Phase 1 GHG standards for the purpose of obtaining emission credits (U.S. EPA, 2011c). Staff is proposing to exempt 2013 MY tractors certified to the U.S. 2014 MY Phase 1 standards from the tractor requirements of the Tractor-Trailer GHG regulation to harmonize the requirements between the U.S. Phase 1 GHG regulations and the Tractor-Trailer GHG regulation.

Regarding the applicability of local-haul and short-haul exemption status, staff is proposing to continue to allow 2014 and subsequent model heavy-duty tractors to be eligible for the short-haul tractor and local-haul tractor exemptions. The trailers they pull would continue to be exempt as well.

ii. Sunsetting Day-Cab Tractor Requirements

The proposed amendments would eliminate the requirement for 2014 and subsequent model day-cab tractors to use SmartWay verified LRR tires. As with sleeper-cab tractors, these tractors will be certified to the Phase 1 GHG emission standards. As discussed above, the affected day-cab tractors under the Tractor-Trailer GHG regulation will be meeting more stringent requirements under the Phase 1 GHG program. In addition to meeting requirements for tire rolling resistance, day-cab tractors certified to Phase 1 GHG requirements will also have

to meet aerodynamic performance requirements that are not found in the Tractor-Trailer GHG regulation. Thus, the proposal to sunset the 2014 and subsequent model day-cab tractor requirements in the Tractor-Trailer GHG regulation would not reduce the emission benefits of the existing regulation and would remove unnecessary duplication of regulatory requirements on fleets operating in California.

b. Amend Definition of Sleeper-Cab Tractor

Staff is proposing to replace the definition of '"sleeper-cab" with a definition of "sleeper-cab tractor" that, for purposes of this regulation, defines a sleeper-cab tractor as a tractor originally manufactured with a tractor body that has a compartment, typically containing a bed, located behind the driving compartment.

The Tractor-Trailer GHG regulation currently requires 2011 and subsequent model heavy-duty sleeper-cab tractors pulling 53-foot or longer box-type trailers in California to be SmartWay designated models. This requirement was adopted in 2008 and became effective January 1, 2010. Staff's intention in establishing this requirement was to ensure that new tractor purchasers subject to the regulation select SmartWay designated tractors when purchasing new sleeper-cab tractors. For all other 2011 and subsequent model tractor configurations, such as day cabs, the regulation only requires the use of SmartWay verified LRR tires. Staff recognizes that owners may retrofit pre-owned 2011 and subsequent model tractors to meet their specific job-related needs. This may include the installation of a sleeper-cab compartment in a day cab tractor. In these instances, staff believes it is not appropriate to require the tractor to be a SmartWay designated tractor. Instead, the tractor originally purchased as a day cab should only be required to meet requirements of the regulation applicable to day cabs. To this end, staff is proposing amendments to modify the definition of a sleeper-cab tractor.

With the proposed harmonization amendments implemented, owners that have 2011 and subsequent model day-cab tractors that retrofit them with after-market sleeper-cab compartments would only be required to meet requirements of the regulation applicable to day cabs.

c. Add Definition of "Emission Standard"

In 2004, the U.S. Supreme Court clarified that the definition of standard as it applies to emissions from motor vehicles and motor vehicle engines under Title II of the federal CAA, relates to the emission characteristics of vehicles or engines and requires motor vehicles or motor vehicle engines to emit no more than a certain amount of a given pollutant, be equipped with a certain type of pollution-control device, or have some other design feature related to the control of emissions (EMA, 2004).

Staff is proposing that the Tractor-Trailer GHG regulation add a definition of "emission standard" to be consistent with the definition set forth in *EMA* for purposes of clarity, consistency, and conformity. Under the federal definition, requirements to equip tractors and trailers with specified aerodynamic equipment and LRR tires relate to a requirement that a vehicle be equipped with a certain type of pollution-control device or a design feature related to the control of emissions, and are emission standards. The proposed amendments are intended to make clear that the definition of emission standard as used in the Tractor-Trailer GHG regulation conforms to the federal definition. The proposed definition, which modifies the definition of "emission standard" as set forth in HSC section 39027, is authorized by HSC sections 39010 and 39601 in that the proposed definition conforms with existing federal definitions (HSC, 2013). For purposes of consistency and clarity, staff is also proposing to add new definitions of the terms "exhaust emission standards" and "evaporative emission standards" to clarify, where needed, previous references to emission standards. These proposed terms are subcategories of emission standards and are used to specifically identify the specified subcategories, as opposed to the broader term of emission standard that encompasses all standards, including Tractor-Trailer GHG regulation requirements relating to the control of emissions.

3. Environmental Impacts Analysis

This section provides an environmental analysis for the proposed amendments to the Tractor-Trailer GHG regulation. Based on staff's review, staff has determined that implementing the proposed amendments to the Tractor-Trailer GHG regulation described above would not result in any potentially significant adverse impacts on the environment. This analysis provides the basis for reaching this conclusion. This section of the staff report also discusses environmental benefits expected from implementing the proposed amendments.

a. Prior Environmental Analysis

On December 11, 2008, the Board approved the Tractor-Trailer GHG regulation set forth in 17 CCR 95300-95312, and later amended it on December 17, 2010 (CCR, 2013). This regulation reduces GHG emissions from long-haul tractor-trailers by requiring them to utilize U.S. EPA SmartWay verified or designated technologies that will improve fuel efficiency. The environmental analyses for the regulation and its amendments found the regulation would result in no significant adverse impacts to the environment and would result in beneficial impacts to air quality. As discussed in Appendix C of the original staff report for the regulation (ARB, 2008a), staff estimated that the statewide GHG emission benefits of the regulation would be 1.0 MMTCO2e in 2020. From 2010 to

2020, the cumulative GHG emission benefits were estimated to be 7.8 MMTCO2e statewide.

On December 17, 2010, the Board approved amendments to the regulation that provided additional flexibility to affected fleets, providing them more time to comply with the tire requirements of the regulation and allowing more large fleets the opportunity to retrofit their trailers with appropriate aerodynamic technologies. At the time, staff lowered the emission benefit estimates associated with the regulation to reflect the economic downturn experienced nationwide and in California. The 2020 GHG emission benefits from the regulation were adjusted from 1.0 to 0.7 MMTCO2e, and the 2010 to 2020 cumulative benefits were adjusted down from 7.8 to 5.1 $MMTCO_2e$ to reflect the economic downturn. Also, because the amendments provided delays in tractor-trailer compliance deadlines, the 2010 to 2020 cumulative statewide GHG emission benefits were estimated to drop by approximately 6 percent, from 5.1 $MMTCO_2e$ to 4.8 MMTCO2e. This loss of emission benefit was minimal compared to the emission benefits of the program overall and the necessary flexibility it provided fleets to help facilitate compliance.

b. Methods of Compliance

Staff's proposal would, in conjunction with the proposed Phase 1 GHG regulation, align the California requirements with the requirements of the U.S. Phase 1 GHG regulations and places no new or additional demands upon the regulated community.

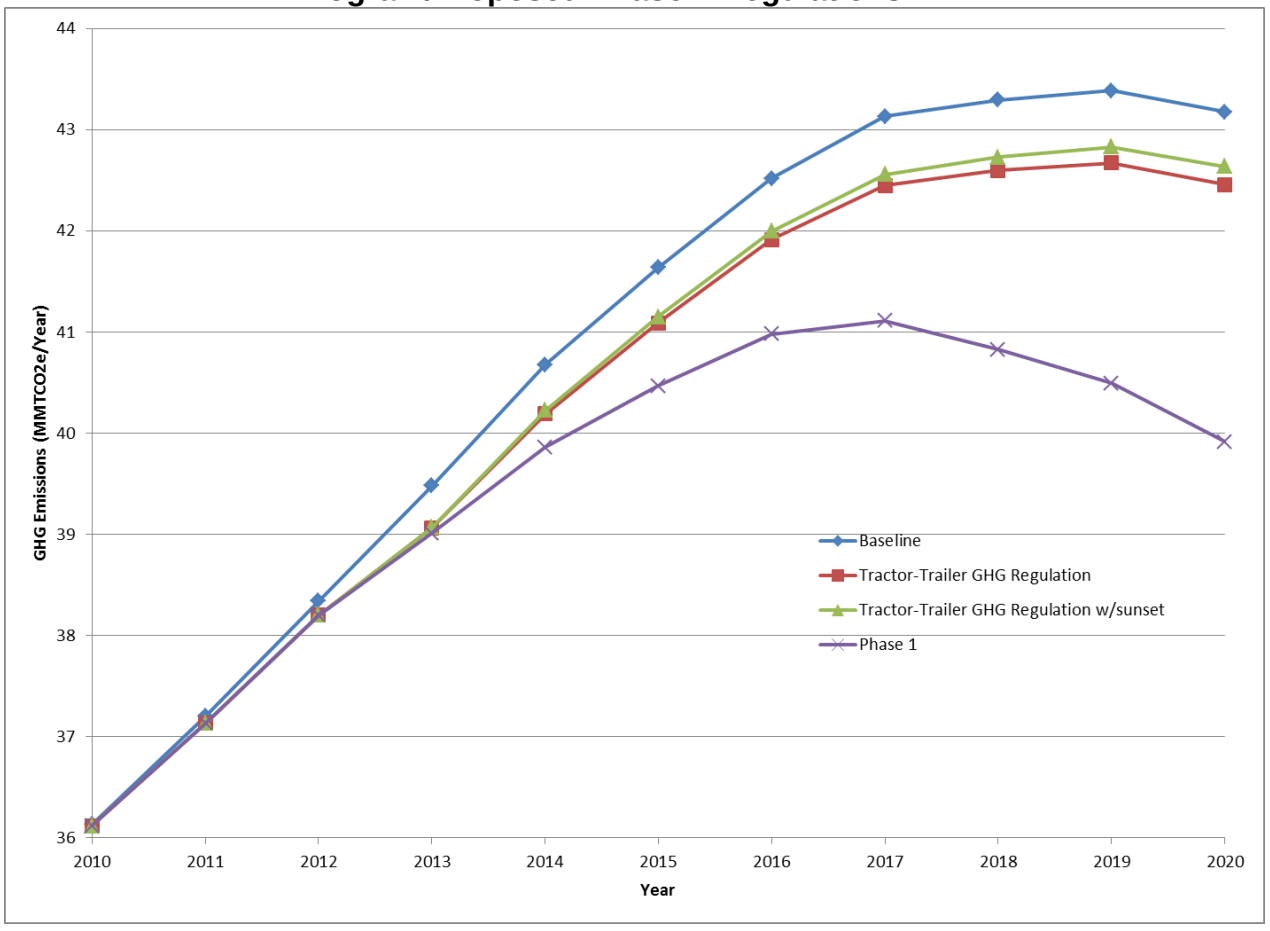
c. Beneficial Impacts

The proposed amendments would not require any additional compliance requirements beyond what is already being required in California. No direct emissions benefits are associated with staff's proposal because these changes largely correspond with the existing federal Phase 1 GHG program and would not generate additional emission reductions, but rather enable ARB regulations to be consistent with federal regulations. However, as discussed previously in Chapter IV.B.2.a, the federal Phase 1 GHG program is more stringent and projected to result in greater emission benefits than those of the existing Tractor-Trailer GHG regulation.

The amendments to sunset the requirements for 2014 and subsequent MY tractors, intended to remove unnecessary duplication of regulatory requirements on fleets operating in California, taken alone could result in emission reductions decreasing from 0.7 to 0.5 MMTCO2e statewide in the year 2020. However, as discussed above in section B.2.a., Summary of Proposed Amendments, this reduction in emission benefits will be offset by the requirement for 2014 and subsequent model tractors to meet the more stringent federal Phase 1 GHG standards. Staff estimates

implementation of the federal Phase 1 GHG program would result in an emission reduction benefit of 3.1 MMTCO2e statewide in the year 2020. Figure 3 shows the statewide baseline and controlled GHG emissions for calendar years 2010 through 2020. As seen in Figure 3, the emission benefit of the existing Tractor-Trailer GHG regulation is slightly decreased by the sunsetting of the 2014 and subsequent MY tractor requirements. However, this is more than offset with the implementation of the federal Phase 1 program during the same timeframe, which will result in significant emission reductions that would not be realized from the Tractor-Trailer GHG regulation. Taken together, there will be an overall emissions benefit in 2020 of about 2.5 MMTCO2e. A more detailed discussion of the assumptions and methodology used in estimating the emission benefits of the proposed amendments and the federal Phase 1 program is provided in Appendix III.

Figure 3 - Statewide GHG Emissions without Regulation (Baseline), with the Tractor-Trailer GHG Regulation, with the Amended Tractor-Trailer GHG Regulation, and with the Federal Phase 1 Program/Proposed Phase 1 Regulations



d. Resource Areas with No Impacts

Staff concludes that the amendments would not result in any significant or potentially significant adverse impacts on the environment because the proposed amendments primarily modify language and regulatory requirements to be consistent with the language already found in federal regulation. They do not involve or result in any new requirements other than what is currently required by the federal Phase 1 program or the existing Tractor-Trailer GHG regulation.

Therefore, the proposed amendments would not require any action by regulated parties that could adversely affect, either directly or indirectly, any of the resource areas: aesthetics; agriculture and forest resources; air quality; biological resources; cultural resources; geology and soils; GHG emissions; hazards & hazardous materials; hydrology and water quality; land use planning; mineral resources; noise; population and housing; public services; recreation; transportation/traffic; or utilities/service systems.

No discussion of alternatives or mitigation measures is necessary because no significant adverse environmental impacts were identified.

4. Economic Impact Assessment/Cost Analysis

The following economic impact assessment/cost analysis has been prepared for this rulemaking action in accordance with the provisions of Government Code section 11346.3b(1)(A)-(D).

The proposed amendments to the Tractor-Trailer GHG regulation would remove the equipment requirements on 2014 and subsequent MY tractors and clarify the definition of "sleeper-cab tractor." No additional costs would be incurred by the affected regulated entities: driver, tractor owner, motor carrier, California-based broker, California-based shipper, and California-licensed vehicle dealer.

a. Creation or Elimination of Jobs and New and Existing Businesses within the State

No significant impacts to the creation or elimination of jobs and businesses within California are anticipated. This is because the proposed amendments do not involve or result in any new requirements other than what are currently being required by the federal Phase 1 program or the existing Tractor-Trailer GHG regulation.

b. Competitive Advantages or Disadvantages for Businesses Currently Doing Business within the State

No significant impacts to the competitive advantages or disadvantages for businesses currently doing business within the state are anticipated because the amendments would not result in any additional costs to affected regulated entities.

c. Potential Costs to Local and State Agencies

The proposed amendments are not anticipated to have any cost impacts to local or state agencies since they would not result in any additional costs to affected regulated entities.

5. Technical Feasibility

The proposed amendments to the Tractor-Trailer GHG regulation all consist of clarifying or deleting existing requirements. Because the existing Tractor-Trailer GHG regulation is technically feasible, the proposed amendments are therefore also technically feasible.

6. Regulatory Alternatives

No alternative considered by the agency would be more effective in carrying out the purpose for which the regulation is proposed or would be as effective as or less burdensome to the affected private persons than the proposed Tractor-Trailer GHG regulation amendments.

The primary alternative considered by staff was not to amend the Tractor-Trailer GHG regulation, but this alternative was rejected in part because it would result in duplicative California-only requirements for owners of Phase 1 GHG certified tractors that would also be subject to the regulation. Also, making no changes to the regulation would require 2011 and subsequent MY day-cab tractors that are later retrofitted with sleeper-cab compartments to be SmartWay designated models. Day-cab tractors cannot readily be retrofitted to meet the SmartWay designation requirements since many of the required components are major design elements incorporated at the time of manufacture. It was never staff's intention to require day-cab tractors retrofitted with sleeper-cab compartments to meet SmartWay designation requirements.

C. Optional Low NOx Emission Standards (New Proposal)

The proposed new regulation would establish the next generation of optional NOx standards for heavy-duty engines, and consists of three optional NOx emission standards of 0.1 g/bhp-hr, 0.05 g/bhp-hr, and 0.02 g/bhp-hr (i.e., 50 percent, 75 percent, and 90 percent lower than the current mandatory NOx emission standard of 0.2 g/bhp-hr). The text of the proposed Optional Low NOx engine emission standards is contained in Appendix I.C.

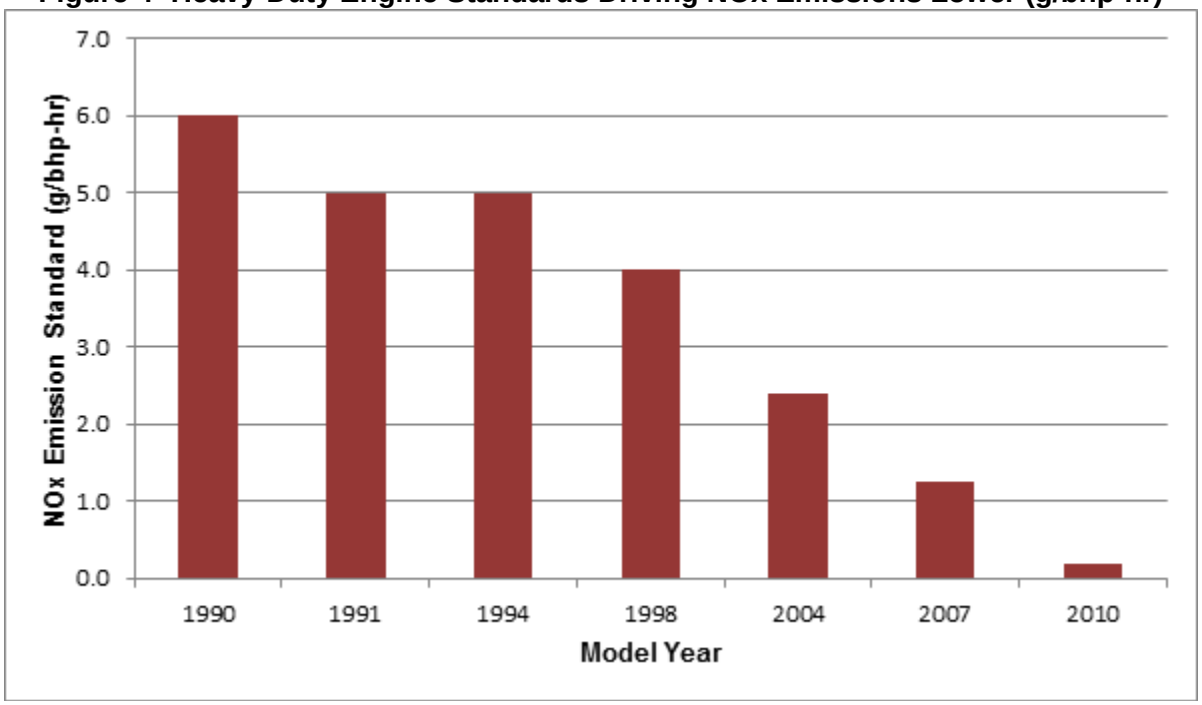
1. Background

California is the only state with the authority to adopt and enforce emission standards and test procedures for new motor vehicles and new motor vehicle engines that differ from federal emission standards and test procedures (FCA, 2004). This proposal would establish optional exhaust emission standards for NOx that are more stringent than current federal and California standards to further reduce emissions from a significant emissions source.

California has a long history of progress to reduce harmful air contaminants in order to protect the health of its citizens. Since the 1960's ARB has controlled mobile and stationary sources by establishing increasingly more stringent fuel and motor vehicle emission standards. Although reducing California's heavy-duty engine emission standards has been effective in reducing fleet emissions for trucks whose operations are limited to California, a sizable portion of the California vehicle miles traveled are from interstate trucks, and ARB has therefore needed to develop lower emission standards in conjunction with U.S. EPA. Since 1990, ARB has typically aligned California's heavy-duty engine emission standards with U.S. EPA standards (California Achievements, 2006).

Since 1990, heavy-duty diesel engine manufacturers have adopted several technologies and strategies to meet increasingly stringent NOx emission standards, as illustrated in Figure 4. In the early 1990's most manufacturers implemented injection timing retard, increased fuel injection pressure, and reduced the intake manifold temperature. To meet the 1998 emission standards, engine manufactures built on the previous technologies and added improved combustion chamber design, electronic controls, EGR and charge air cooling. To meet the even lower 2004 standards, manufacturers used the previous technologies and added cooled EGR, variable geometry turbocharger (VGT), and common rail fuel injection. For meeting the 2007 emission standards, previous technologies were used plus ULSD fuel, and higher EGR rates (in addition to a diesel oxidation catalyst (DOC), and a diesel particulate filter (DPF) to reduce PM). To meet the current 2010 standards, SCR was added to further control NOx. Not all engine manufacturers used all these techniques at the specific times noted, but in general these are the emission controls that were employed to dramatically lower heavy-duty engine NOx (and PM) emissions over the past 20 years.

Figure 4- Heavy-Duty Engine Standards Driving NOx Emissions Lower (g/bhp-hr)



In addition to the mandatory NOx standards shown in Figure 4, ARB in the past has also established optional, lower standards. From 1998 to 2003, optional NOx standards were in place for diesel-cycle engines. The optional standards ranged from 2.5 g/bhp-hr to 0.5 g/bhp-hr, at 0.5 g/bhp-hr increments. This range of standards was substantially lower than the mandatory 4.0 g/bhp-hr NOx engine emission standard. Starting in 2004, engine manufacturers could choose to certify at an optional NOx+ NMHC standard ranging from 1.8 g/bhp-hr to 0.3 g/bhp-hr, at 0.3 g/bhp-hr increments for heavy-duty vehicles. This was significantly lower emissions than the standard at the time of 2.4 g/bhp-hr NOx+NMHC (or 2.5 g/bhp-hr with 0.5 NMHC cap) standard. The optional standards allowed local air districts and ARB to preferentially provide incentive funding to buyers of trucks with engines certified to the optional standards and enabled buyers of such trucks to generate marketable emission reduction credits for use in local air district mobile source emission credit programs. They also helped to advance the development of emission reduction technology to prepare for the next round of mandatory ARB and U.S. EPA emission standards. A number of natural gas engines were certified to the 2004 optional standards, and funding agencies including the South Coast Air Quality Management District provided incentive monies to encourage deployment of natural gas powered heavy-duty vehicles.

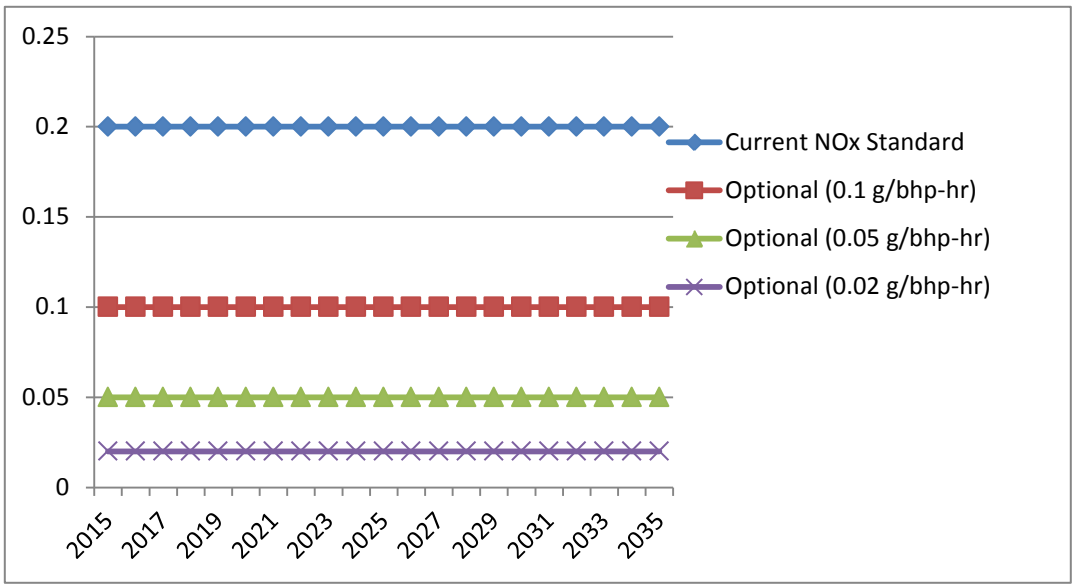
The remainder of this section provides details of staff's proposal for a new round of optional NOx emissions standards. Section 2 provides a summary of the proposed voluntary standards, Section 3 reviews technological feasibility, Section 4 discusses the environmental impacts of the proposed

optional standards, Section 5 estimates the cost of the proposal, Section 6 discusses regulatory alternatives that were considered but rejected in favor of the proposed standards, and Section 7 discusses a number of issues that arose during development of the proposed standards.

2. Summary of Proposed Voluntary Standards

The proposed regulation establishes three optional NOx emission standards for heavy-duty engines, as shown in Figure 5. The proposed standards are 0.1 g/bhp-hr, 0.05 g/bhp-hr, and 0.02 g/bhp-hr. Manufacturers can elect to certify to any of the optional NOx standards or to instead certify to the existing mandatory 0.2 g/bhp-hr NOx standard.

Figure 5 - Optional NOx Engine Emission Standards (g/bhp-hr)



The test procedures associated with the proposed optional standards are set forth in "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines" and "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles," as incorporated by reference in 13 CCR 1956.8 (CCR, 2013). On-board diagnostic requirements for the optional standards are discussed in both the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines" and California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel-Engines and Vehicles" and in 13 CCR 1971.1 and 1971.5.

The proposed optional standards are designed to achieve some near-term, as well as long-term emission benefits resulting from new heavy-duty engines with near-zero NOx emissions. This proposal is intended to incentivize manufacturers to develop engines with lower NOx emissions, which would help California meet its obligations to improve ambient air quality and meet its SIP commitments.

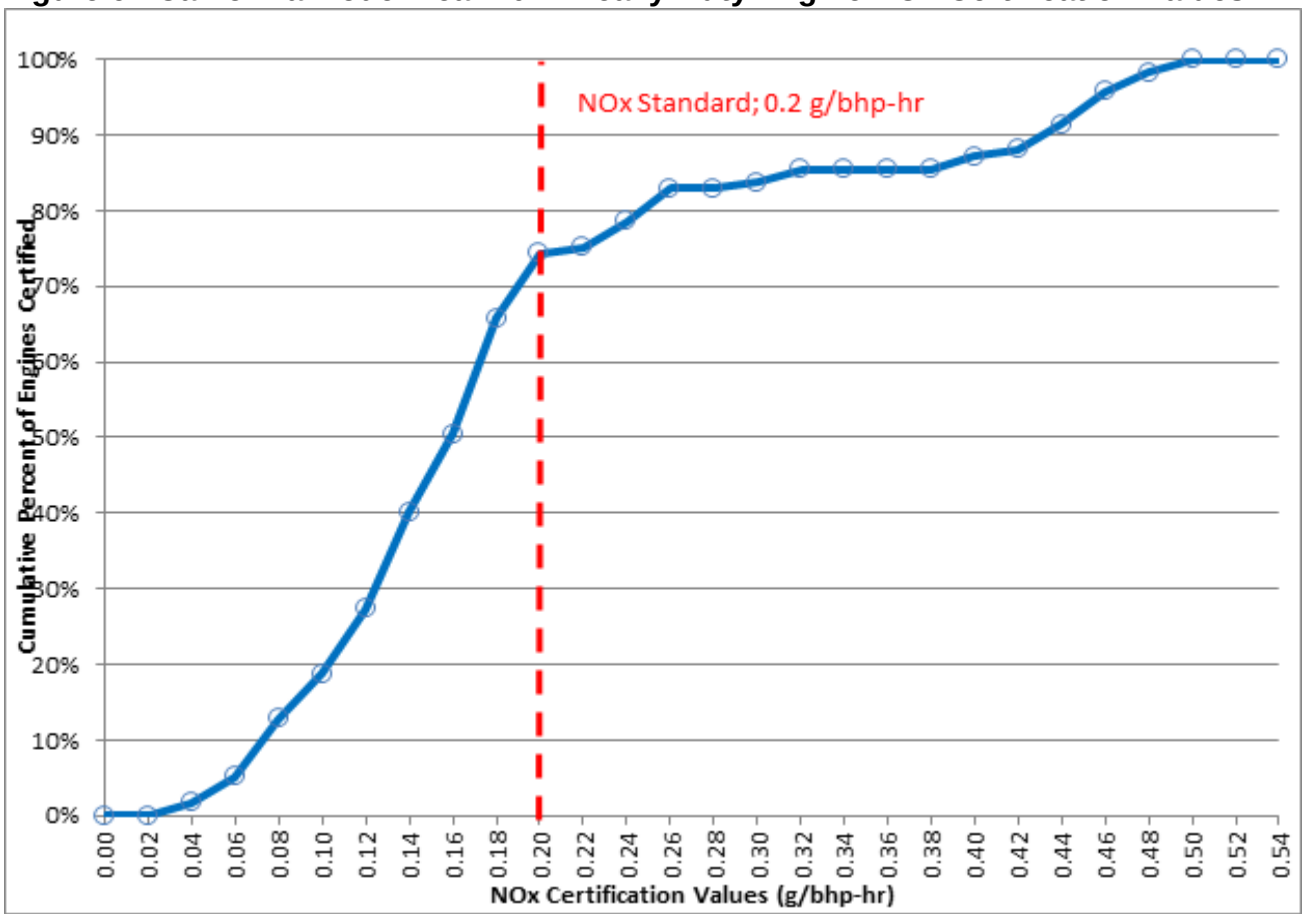
3. Technical Feasibility

As discussed below, staff believes that the optional low NOx emission standards are technically feasible. However, other factors prevent staff from proposing mandatory NOx standards at this time. Such factors include cost and fully demonstrating the durability of the emission control technologies needed to achieve the lower NOx levels. However, given the proper incentives, staff believes that some manufacturers will "rise to the occasion," as they have in the past, and produce complying products.

a. Certification Levels

A number of existing certified heavy-duty engines have certification levels, (i.e., the emission level at the end of the required testing period for certification) that are at or below the proposed optional levels. While this is in itself noteworthy, manufacturers typically certify to levels below the standard (with a "compliance margin") to provide them assurance that the engine will comply with the standard for its useful life. Compliance margins vary by manufacturer and engine, but a compliance margin of 50 percent below the standard is common.

Figure 6 - California Model Year 2012 Heavy-Duty Engine NOx Certification Values



As shown in Figure 6, over 70 percent of MY 2012 engines are certifying below the current 0.2 g/bhp-hr standard. About 8 percent of the MY 2012 engines are already certifying at levels 30 percent or more below the optional 0.1 g/bhp-hr standard, at 0.03 to 0.07 g/bhp-hr. See Appendix IV for a summary of certification data for engines with certification levels below the current 0.2 g/bhp-hr NOx standard.

b. Advances in Heavy-Duty Engine Technology

There have been major advances in heavy-duty engine technology to meet the current 0.2 g/bhp-hr standard, and staff believes it likely that

such progress will continue, particularly with the existence of the optional standards and the widespread knowledge of California's need for lower-NOx heavy-duty engines. Some technologies that could enable manufacturers to meet the optional levels are described briefly below. Staff is confident that advances or expanded use of one or more of the technologies described below will enable manufacturers to certify to the optional NOx standards.

i. Cooled EGR

EGR is one of the most effective methods of reducing NOx emissions at low levels. Spent combustion gasses recirculated back into the intake system serve as a diluent to lower the oxygen concentration and also increase the heat capacity of the air/fuel charge. Cooled EGR, (cooled through the aftercooler) is used to minimize combustion temperatures. This reduces peak combustion temperatures and the rate of combustion, thus reducing NOx emissions.

ii. EGR By-Pass Valve

An EGR by-pass valve routes the exhaust gasses around the EGR cooler to achieve the desired temperature for reduced emissions and optimum engine performance.

iii. Low and High Pressure EGR

New turbocharger design and turbine blade coatings are providing the opportunity for low and high pressure EGR. The new turbocharger design and coatings allow exhaust gasses to pass through the turbocharger, providing engine designers with more mixing opportunities to mix fresh and exhaust gasses thereby reducing emissions and improving fuel economy and engine response.

iv. Close Coupled Catalysts

One way to reduce high emissions at cold start is to physically locate the catalyst closer to the exhaust manifold. Moving the catalyst closer to the hot exhaust manifold will heat up the catalyst faster, thereby reducing cold start emissions.

v. Dual Wall Pipes and Exhaust Pipe Insulation

Dual wall and exhaust pipe insulation insulates the exhaust gas, allowing hotter exhaust temperatures to reach the catalyst, thereby helping reduce emissions during cold start conditions.

vi. NOx Exhaust After-treatment

The above technologies by themselves are unlikely to enable manufacturer to meet the low NOx standards being proposed. Engines currently being certified to low levels tend be natural gas

engines with a three-way catalyst, but there are also some very clean diesel engines that use SCR, DPF, and EGR or enhanced EGR. This is a reasonable starting point for others wishing to pursue the low NOx standard, but these approaches may not be suitable for all engines and all duty cycles. Further reductions in NOx emission levels could be achieved through fine-tuning of current SCR systems, close-coupling the SCR system to the engine, adding a passive lean NOx filter to a DPF/SCR system, switching to ammonia from urea and improving delivery metering and responsiveness (ammonia starts controlling NOx at lower temperatures than does urea.), improving catalysts or catalyst efficiency, increasing the coating on the SCR catalysts, and increasing filter volume. Using multi-metal zeolite catalysts or vanadia-based catalysts or improving other NOx adsorption approaches (NOx trap system, or lean NOx trap (LNT)) to trap NOx formed at low operating temperatures experienced before the engine is fully warmed up or during low load operations will help to further reduce NOx over the entire duty cycle.

vii. Homogeneous Charge Compression Ignition

Lawrence Livermore National Laboratory recently completed a project to develop homogeneous charge compression ignition (HCCI) engines that emit only 0.015 g/bhp-hr NOx. HCCI technology uses thermal auto ignition of a premixed air/fuel mixture with no flame propagation. This results in a low combustion temperature, and very low NOx emissions. The technology shares some characteristics of traditional gasoline-powered engines and other characteristics of traditional diesel-powered engines.

viii. Natural Gas

Very low NOx levels can be achieved by natural gas-powered engines. In fact, staff expects heavy-duty natural gas engines to be the primary technology used to meet the proposed optional 0.05 g/bhp-hr and 0.02 g/bhp-hr NOx standards, at least initially.

Current technology for heavy-duty natural gas engines has enabled natural gas engines to approach diesel-like fuel economy and performance, while emitting less NOx and PM emissions compared to diesel engines (Wisconsin, 2013).

There are two main methods for allowing natural gas engines to operate with very low NOx emissions - lean burn combustion and stoichiometric combustion with exhaust after-treatment. Under lean burn combustion, excess air is introduced into the combustion chamber with the fuel; the excess air reduces the combustion chamber temperature and thereby reduces NOx production (Cummins, 2007). Stoichiometric engines are designed to burn the air and fuel mixture

completely with the use of an external combustion source such as a spark plug. Typically, exhaust after-treatment for stoichiometric engines includes a three-way catalyst (TWC) and EGR (Cummins, 2012).

Examination of current certification levels for natural gas versus diesel engines illustrates how natural gas engines are currently achieving lower NOx levels than diesel engines. For MY 2012, of the 23 engine families with California NOx certification levels less than 0.1 g/bhp-hr, 11 are powered by natural gas engines equipped with a TWC, whereas only three are powered by diesel engines.

c. Current Low NOx Demonstration Projects

As enumerated below, a number of current demonstration projects evaluating technologies have a goal of achieving NOx emissions lower than the current standard.

i. ARB Low NOx Research Project

Evaluating Technologies and Methods to Lower Nitrogen Oxide Emissions from Heavy-Duty Vehicles

This is a $1.6 million project involving two heavy-duty engines: one stoichiometric natural gas engine with a three-way catalyst, and one diesel engine with SCR. The project is currently under way, with a goal to demonstrate the feasibility of a 0.02 g/bhp-hr NOx standard. The completion date for the project is projected to be late 2015 (ARB, 2013b).

ii. South Coast Air Quality Management District (SCAQMD) Research Project

Low NOx Engine Demonstration

This project focuses on engine and after-treatment technology that has the potential to attain a 0.02 g/bhp-hr NOx emission level and that can be put “on the road” in commercial service soon after completion of the project. The project is expected to begin by December 2013, and be completed by the end of 2016 (SCAQMD, 2013).

iii. Southern California Gas Company (SCGC) Projects

Next Generation Refuse/Transit

Three refuse vehicles with near-zero emission natural gas engines are currently in the planning stage. The goal is to achieve a 75 percent NOx reduction while keeping the cost and efficiency the same as diesel. The plan is to modify 11 liter Doosan engines with SCR, stoichiometric operation, three-way catalyst, cool exhaust gas

recirculation, advanced ignition system and improved turbo efficiency. On-road testing is scheduled to start in late 2014 (SCGC, 2013).

Low Emission Turbine Drive

The goal of this project is to demonstrate a Class 8 truck with an existing 350 kW gas turbine engine to emit near-zero emissions using a dual liquid/natural gas combustor. The project aims to keep NOx less than 0.05 g/bhp-hr and CO at or below 0.02 g/bhp-hr. The initial chassis testing started in July 2013, and truck chassis testing is scheduled for late 2013 (SCGC, 2013).

4. Environmental Impacts Analysis

This section provides an environmental analysis for the proposed optional NOx emissions standards regulation. Based on staff's review, staff has determined that implementing the proposed optional NOx standards would not result in any potentially significant adverse impacts on the environment. This analysis provides the basis for reaching this conclusion. This section of the staff report also discusses environmental benefits expected from implementing the proposed regulation.

a. Methods of Compliance

The proposed optional low NOx emission standards are completely optional, and hence there are no mandatory compliance responses. Engine manufacturers could choose to certify to the proposed optional standards beginning with MY 2015. As discussed further in section C.7.c. below, manufacturers that choose to certify engines to the proposed optional standards would need to meet ARB's on-board diagnostics (OBD) requirements as well. More detailed information on the technologies likely to be used by the regulated community to meet the optional standards can be found in section C.3 above.

b. Beneficial Impacts

The proposed optional standards are voluntary in nature and do not require any compliance response. To the extent that the regulated community chooses to certify to the proposed optional standards and build and deploy lower-emitting engines, NOx emissions will be reduced, resulting in air quality benefits. Certifying to low NOx levels would enable manufacturers to have a more complete product line, and, for marketing purposes, advertise their environmental performance. Trucks with engines certified to the proposed optional low NOx standards could be attractive to truck buyers interested in government clean air incentive monies, as discussed further in subsection 7 below.

As discussed further below, staff estimates NOx emission benefits of 0.6 to 1.2 TPD in 2020, and 3.3 to 6.9 TPD in 2035 could result from the

proposed optional standards. Such NOx emission reductions are needed to attain federal air quality standards, and lessen the localized impacts to public health and the environment directly related to NOx emissions.

To estimate the emission reductions that could result from the proposed optional standards, staff estimated the percent of new engines that manufacturers will choose to certify to the proposed standards. Because it is unknown to what extent manufacturers will choose to certify to the optional standards, staff evaluated two bounding scenarios, a high adoption rate scenario and a low adoption rate scenario. The two adoption scenarios are shown in Table 9 for 2015 through 2035 MYs.

The high adoption scenario was an optimistic scenario, where low emission NOx engines would be offered starting in 2015 and their market penetration would increase steadily over the years. In the high adoption scenario, staff assumed eight percent of 2015 MY vehicles would certify to the 0.1 g/bhp-hr standard. The eight percent was based on examination of MY 2012 certification data, presented above in Figure 6, where approximately 8 percent of MY 2012 vehicles had certification levels below 0.07 g/bhp-hr and so were assumed to be promising candidates for meeting the 0.1 g/bhp-hr standard. For each scenario, staff chose an annual increase in certifications to the optional low NOx standards of 5 percent per year from 2015 through the 2035 MY.

The low adoption scenario is meant to represent relatively low engine manufacturer participation. The low adoption scenario assumes that only four percent of new engines sold in California will certify to the 0.10 g/bhp-hr standard in MY 2015. Certifications to the 0.05 g/bhp-hr optional standard would be delayed until the 2020 MY. No certifications at the 0.02 g/bhp-hr optional standard are assumed.

Table 9 - Percent of Heavy Duty Engines Projected to Meet the Proposed Optional Low NOx Engine Emission Standards

Estimated High Adoption Scenario

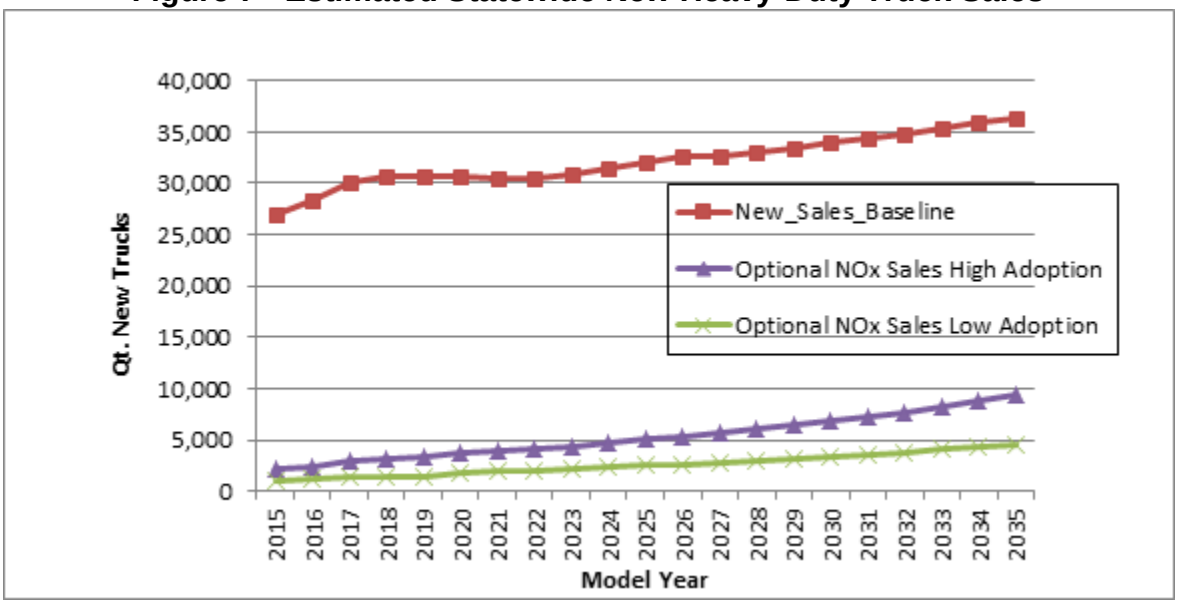
Optional Low NOx Standard	% 2015	% 2016	% 2017	% 2018	% 2019	% 2020	% 2021	% 2022	% 2023	% 2024	% 2025	% 2026	% 2027	% 2028	% 2029	% 2030	% 2031	% 2032	% 2033	% 2034	% 2035
0.10	8.0	8.4	8.8	9.3	9.7	10.2	10.7	11.3	11.8	12.4	13.0	13.7	14.4	15.1	15.8	16.6	17.5	18.3	19.3	20.2	21.2
0.05	0	0	1.0	1.1	1.1	1.2	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4
0.02	0	0	0	0	0	1.0	1.1	1.2	1.2	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.7	1.8	1.9	2.0	2.1
Total	8.0	8.4	9.8	10.3	10.8	12.4	13.0	13.6	14.3	15.0	15.8	16.6	17.4	18.3	19.2	20.1	21.2	22.2	23.3	24.5	25.7

Estimated Low Adoption Scenario

Optional Low NOx Standard	% 2015	% 2016	% 2017	% 2018	% 2019	% 2020	% 2021	% 2022	% 2023	% 2024	% 2025	% 2026	% 2027	% 2028	% 2029	% 2030	% 2031	% 2032	% 2033	% 2034	% 2035
0.10	4.0	4.2	4.4	4.6	4.9	5.1	5.4	5.6	5.9	6.2	6.5	6.8	7.2	7.5	7.9	8.3	8.7	9.2	9.6	10.1	10.6
0.05	0.0	0.0	0.0	0.0	0.0	1.0	1.1	1.1	1.2	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.7	1.8	1.9	2.0	2.1
0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	4.0	4.2	4.4	4.6	4.9	6.1	6.4	6.7	7.1	7.4	7.8	8.2	8.6	9.0	9.5	9.9	10.4	11.0	11.5	12.1	12.7

Figure 7 below shows the projected increase in California heavy-duty truck sales through 2035 based on the EMFAC 2011 model, along with the two adoption scenarios modeled. As can be seen, after a level period from 2017 through 2022 MY, truck sales are expected to continue to increase annually through 2035. By 2035, between 13 and 26 percent of these new heavy-duty vehicles are anticipated to have optional low NOx engines installed.

Figure 7 - Estimated Statewide New Heavy-Duty Truck Sales



Appendix III provides further detail on the methodology used to estimate emission benefits.

c. Resource Areas with No Impacts

Staff concludes that implementation of the proposed optional standards would not result in any significant adverse impacts on the environment. The proposed amendments are optional and would not require any activity that could result in a physical change to the existing environment. The proposed amendments would encourage engine manufacturers to deploy new technologies and certify their engines to the optional low NOx standards.

Should engine manufacturers choose the option to pursue new NOx emission reduction technologies, it is anticipated that no new facilities will need to be constructed, no existing facilities will need to be expanded beyond their current capacity, and no significant changes in the operation of existing facilities is likely to occur. Therefore, the proposed amendments would not require any action by regulated parties that could adversely affect the following resource areas: aesthetics, air quality, agricultural and forestry resources, biological resources, cultural

resources, geology and soils, greenhouse gases, hazardous material, hydrology and water quality, land use planning, mineral resources, noise, population and housing, public services, recreation, or traffic and transportation, and utilities and service systems.

As discussed above in section 3, staff expects natural gas engines to be the primary technology used to meet the proposed optional 0.05 g/bhp-hr and 0.02 g/bhp-hr NOx standards, at least initially (although it is possible that some diesel-powered engines may certify to these levels as well). In turn, clean air incentive programs that provide funding to engines certified to the optional standards may encourage greater deployment of natural gas powered heavy-duty vehicles in California. Greater deployment of natural gas-powered trucks could then in turn lead to additional natural gas use and production which has methane emissions associated with its production, transport, and distribution. However, any significant increase in the use of natural gas trucks, and hence increase in methane emissions from natural gas use and production, would be driven by a variety of factors in including economics, market dynamics, and market incentives that would occur with or without ARB's proposed optional standards. Hence, staff concludes it is too speculative to determine whether any potential increase in methane emissions would result from a potential greater deployment of natural gas engines that meet the optional NOx standards.

No discussion of alternatives or mitigation measures is necessary because no significant adverse environmental impacts were identified.

5. Economic Impact Assessment/Cost Analysis

The following economic impact assessment/cost analysis has been prepared for this rulemaking action in accordance with the provisions of Government Code section 11346.3b(1)(A)-(D).

This section discusses the estimated costs associated with implementation of the optional low NOx standards. The expected capital and recurring costs for potential compliance options, the cost and associated economic impacts on businesses, as well as an analysis of the cost-effectiveness of the proposed regulation are presented. Estimates in this section are based on the costs incurred and emissions reductions expected during the years 2015 to 2035. Generally, costs contained in this section are in 2013 dollars.

Even though the proposed standards would be optional, to the extent manufacturers choose to certify to the standards, there would be costs. Under the high adoption scenario, more of these costs would be incurred than under the low adoption scenario, but additional benefits would also be achieved.

a. Creation or Elimination of Jobs and Effect on New and Existing Businesses within the State

Any business that is involved in manufacturing on-road heavy-duty engines may be affected by the proposed optional low NOx emission standards. ARB has identified about 35 such engine manufacturers with California certified on-road engines.

The proposed standards are not expected to either create or eliminate jobs or businesses in California. Additional businesses could be created to manufacture technologies to help reduce NOx emissions from heavy-duty engines, but the number of such potential new businesses cannot be quantified at this time. To the extent that manufacturers opt to comply using technologies currently manufactured in California, California businesses may be able to expand their operations. No significant impacts to the competitive advantages or disadvantages for businesses currently doing business within the state are anticipated

b. Estimated Costs to Engine Manufacturers

Although costs would be incurred if a manufacturer chooses to certify an optional low NOx engine, it is difficult to quantify these costs because the cost varies significantly depending on the starting point of the particular engine. If the engine is already meeting the optional low NOx 0.1 g/bhp-hr emission standard, as is seen for around eight percent of current certifications, the costs are largely limited to confirmatory testing to ensure compliance and reporting costs. Such testing and reporting would be expected to cost $10,000 to 30,000 per engine family (Olson-EcoLogic, 2013). However, some redesign is likely to be required for the lowest optional low NOx standard. If an engine redesign is required, costs may exceed $500,000. These costs would be spread over all engines sold in that engine family. For manufacturers not choosing to comply with the optional standards, there will be no additional monetary cost.

For those engines not already meeting the standards, discussions with interested parties indicate that the initial standards could be achieved at a cost of hundreds of dollars per engine for natural gas to thousands of dollars per engine for diesel.

An example of how the costs were estimated for 2035 under the low adoption scenario is shown below:

In 2035, 12.69% of the new sales fleet of 36,424 engines certify to the optional standards, resulting in sales of 4,623 Low NOx engines. Manufacturer-submitted 2012 model year engine family data and projected sales volumes were used to identify NOx levels by engine family. Projected sales of each engine family were adjusted to actual

sales using an overall ratio of total projected sales of all engine families to actual sales of all engine families. These sales were then grown to the 2035 model year using EMFAC2011. Thus, the 1,048 adjusted sales of two low NOx gasoline engine families were grown to 1,936 engines in 2035. These engines could likely certify under this program for little or no additional per engine cost. Projected sales of an engine family with reported emissions of 0.09 g/bhp-hr NOx were adjusted to sales of 497 in 2035. It was estimated that these engines would require up to $1,000 in additional technology for certification at 0.10 g/bhp-hr NOx. The remaining 2,190 engines were drawn from those with currently reported NOx levels of 0.1 g/bhp-hr through 0.14 g/bhp-hr. These engines were assumed to require up to $3,500 in additional technology. Thus, the total cost estimated for 2035 under this low adoption scenario is:

1,048*$0 + 497*$1,000 + 2,190 * $3,500 = $8,162,000

Based on assumed participation in 2035 of 12.7 to 25.7 percent of the fleet, 2035 sales of 36,424 engines, and costs varying between $500 and $10,000 per engine, this corresponds to a total cost of $36 to 279 million over 20 years fleet-wide. In 2035 costs were estimated to range from $6 to $35 million, which when combined with estimated 2035 benefit of 3.3 to 6.9 TPD NOx, yields a cost-effectiveness of between $2 and $7/pound NOx reduced (i.e., between $5,000 and $14,000/ton NOx). This cost-effectiveness is well within the range of cost-effectiveness of mandatory measures that ARB has adopted in the past and below the cost-effectiveness threshold used for funding of Carl Moyer program projects.

Based on the assumed annual participation rates, staff has estimated that manufacturers would incur hardware costs ranging from $0 to $6,000 per engine to modify engines to meet the low optional NOx standard, plus certification costs of approximately $20,000 per engine family, with the anticipated cumulative cost for the fleet over the 20 year life of the regulation estimated at $36 to $279 million. Re-certifications of existing technology for future MYs should not result in any additional testing or reporting costs beyond those that would be incurred to certify engines not participating in the program. Overall, because the program is optional, it is not anticipated to have significant costs to manufacturers because a projected cost that is overly onerous would result in a business decision to not participate in the program.

6. Regulatory Alternatives

Staff evaluated various alternatives to the proposed optional standards. A brief description of the alternatives and staff's reasoning for rejecting them in favor of staff's proposal follows. The first alternative entails not adopting any optional low NOx standard, the second and third are alternative forms of the

optional NOx standard, and the fourth includes additional provisions that could be included in an optional NOx standard.

No alternative considered by the agency would be more effective in carrying out the purpose for which the regulation is proposed or would be as effective as or less burdensome to the affected private persons than the proposed optional standards.

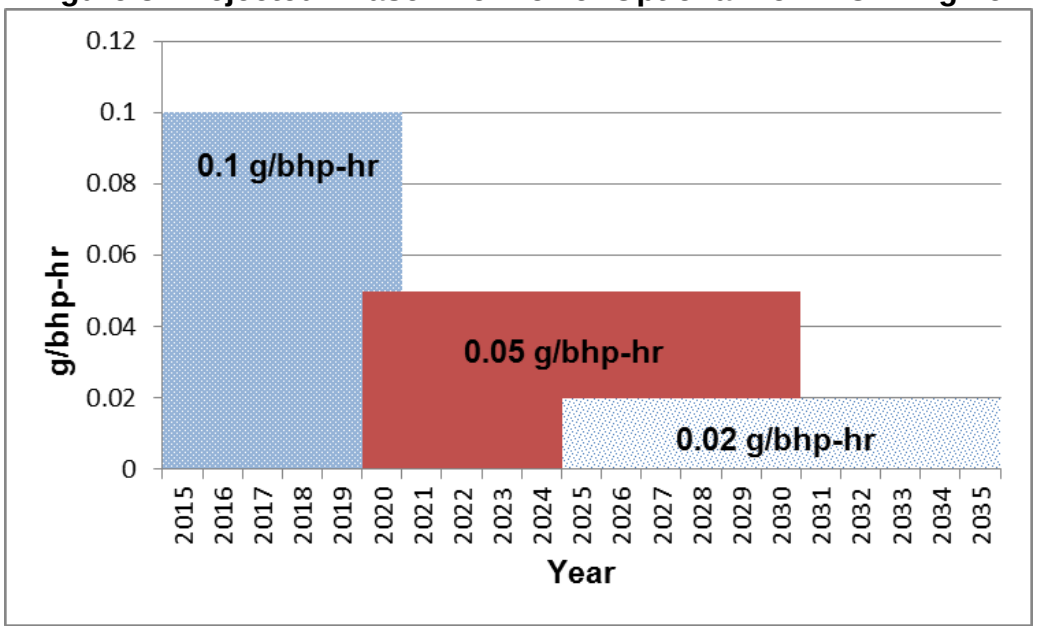
a. No Action

Staff considered a no action alternative under which no optional low-NOx standards for heavy-duty engines would be proposed. However, as described in Chapter II, the state has a great need for NOx reductions, which means an even cleaner generation of heavy-duty diesel engines beyond engines meeting the current 0.2 g/bhp-hr standard is needed. Staff envisions the optional NOx emission engine standards as a way to usher in this next generation of lower NOx engines and help demonstrate the feasibility of future lower mandatory standards. Hence, staff rejected the no action alternative.

b. Propose Three Optional Low NOx Standards to Start, but Phase Out the Higher Optional Levels Over Time

As shown in Figure 8, instead of proposing three standards that are constant over time, staff could propose three standards but after a few years phase out the highest standard (0.1 g/bhp-hr) and possibly phase out the 0.05 g/bhp-hr level later as well. Disadvantages of phasing out the highest standard include the risk of reducing participation in the overall voluntary standard program. For example, if an engine manufacturer's engine could meet the 0.1 g/bhp-hr standard but not the 0.05 g/bhp-hr standard, there would be less incentive to certify to the 0.1 g/bhp-hr standard with its finite lifetime.

Figure 8 - Rejected Phase-In of Lower Optional Low NOx Engine



c. Propose Only One or Two Lower NOx Engine Standards

Staff could propose only one optional lower NOx engine emission standard, or two standards, rather than the three proposed optional standards. During the workshop for the proposed optional NOx standards, representatives from the SCAQMD advocated, for example, proposing just two optional NOx standards – 0.05 g/bhp-hr, and 0.02 g/bhp-hr. Having only two or just one optional standard would be simpler than the proposed three standards.

However, because of the uncertainty about what NOx emissions standards are achievable, the desire to provide an incentive for manufacturers to certify to lower and lower NOx standards over time, and the desire to allow both natural gas and diesel engine manufacturers to participate, staff recommends the proposed three standards. If there were just one optional standard at 0.1 g/bhp-hr (50 percent below the current standard), for example, once manufacturers had produced an engine certified to 0.1 g/bhp-hr, there would be no incentive to go further. If there were just one optional standard at 0.02 g/bhp-hr (90 percent below the current standard), it is possible that for many years, no manufacturers would certify to the optional standard, because achieving it would pose such a technical challenge compared to certifying to the mandatory 0.2 g/bhp-hr standard. With three standards, manufacturers could initially aim for the 0.1 g/bhp-hr standard and then in future years aim to achieve the 0.05 and then the 0.02 g/bhp-hr standard. In addition, as discussed above in section 3, staff expects diesel engine manufacturers to have a relatively difficult time meeting the proposed optional standards as compared to natural gas engine manufacturers. If staff proposed only the 0.02 g/bhp-hr standard or only the 0.02 and 0.05 g/bhp-hr standards, it is possible that

only natural gas engines would be able to meet the standards, and staff would forego the opportunity to encourage the development and certification of lower-NOx diesel engines.

d. Include an Optional Warranty to the Optional Low NOx Engine Emission Standards

As discussed at the March 11, 2013, workshop, staff originally considered including an optional warranty along with the optional low NOx engine emission standards. The current warranty for a heavy-duty engine is 5 years or 100,000 miles. Staff considered proposing an optional warranty of 5 years and 250,000 miles. This optional warranty would have provided an opportunity for engine manufacturers to ensure the extra emission reductions offered by the optional low NOx engine emission standards would remain in effect for much of the life of the engine. Staff decided that meeting an optional warranty would not likely be attractive to engine manufacturers and could reduce overall participation in the optional NOx standards program, and that it was more important to encourage manufacturers to certify to the optional standards, at least initially, than to require them to meet greater warranty commitments.

A discussion of possible longer warranty periods for future mandatory standards is included below in subsection 7.

7. Issues

This section discusses several issues that arose during development of the optional low NOx standard proposal. Subsection a addresses concerns over whether current measurement techniques are adequate to certify engines down to the proposed optional NOx standards. Subsection b discusses concerns over whether current warranty periods for heavy-duty engines are too short and explains why staff opted not to include a longer warranty period as part of the optional standards.

One of the most critical issues staff considered during development of the optional low NOx standards was what incentives could be provided for manufacturers that choose to certify to them. As described above in section 4, the optional low NOx standards will only provide emission benefits and pave the way for future cleaner engines if manufacturers choose to certify to them. Subsections c through f discuss existing programs that provide some incentive for optionally certified engines and offer potential ways those programs could be modified to provide further incentives.

a. Emission Calibration/Analysis

Current certification emission measurements are adequate to measure NOx levels down to the proposed optional low NOx emission standards for heavy-duty engines, but improvements in instrumentation to increase its sensitivity, specificity and linearity over a wide NOx dynamic range would make such measurements more robust. Staff evaluated this issue after several stakeholders expressed concern that the optional low NOx emission limits proposed by staff, particularly the lowest 0.02 g/bhp-hr level, are extremely low and could challenge current laboratory instrumentation.

Measuring NOx emissions has been and will continue to be performed by following the procedures in 40 CFR 1065.270 (CFR, 2013). These procedures require NOx emissions to be measured with a chemiluminescence detector (CLD). Typical CLD measurements are in the 0 to 10 parts per million (ppm) range. For reference, a 500 horsepower diesel engine emitting 0.02 g/bhp-hr NOx would have an exhaust concentration of about 1.41 ppm[12], which is well within the range of a standard CLD instrument.

As evidence that current emission measurement techniques are adequate to certify engines to levels as low as 0.02 g/bhp-hr, some engines are already certified at comparable levels. For example, a 2013 MY engine was recently certified to a level of 0.01 g/bhp-hr (Executive Order DGKTE06.8FM1, 2013). In addition, twenty-five 2009 to 2012 engines were certified at levels between 0.03 and 0.05 g/bhp-hr, further demonstrating that low NOx instrumentation detection is achievable

[12] (Yorke, 2008) basic conversion of g/bhp-hr to ppm (g/bhp-hr*70.6).

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b. Longer Engine Warranty

The current required heavy-duty engine warranty is 5 years or 100,000 miles. Mileage accrual data indicate that heavy-duty vehicles typically travel 100,000 miles in their first year of operation, accruing between 500,000 and 600,000 miles by the end of their fifth year (ARB, 2013e). This means that heavy-duty vehicles effectively exceed their warranty coverage in one year (i.e., the current required 5 year/100,000 mile warranty is effectively a 1 year/100,000 mile warranty).

To encourage participation in the optional NOx standard program, staff decided to forgo requiring extended warranty coverage to provide engine manufacturers more time to focus on NOx emission reduction technologies. However, for future mandatory standards, staff anticipates proposing requiring warranty coverage beyond 100,000 miles, potentially to 5 years or 250,000 miles.

c. On-Board Diagnostics

OBD systems utilize software designed into the vehicle's on-board computer to detect emission control system malfunctions as they occur by monitoring virtually every component and system that can cause an increase in emissions. When an emission-related malfunction is detected, the OBD system alerts the vehicle owner by illuminating the malfunction indicator light (MIL) on the instrument panel. By alerting the owner of malfunctions as they occur, repairs can be sought promptly, which results in lower emissions from the vehicle. Additionally, the OBD system stores important information, including identification of the faulty component or systems and the nature of the fault, which allows for quick diagnosis and proper repair of the problems by technicians. This helps owners achieve less expensive repairs and provides greater assurance that the repairs are done correctly the first time.

Passenger cars, light-duty trucks, and medium-duty vehicles and engines have been required to be equipped with OBD systems since MY 1996 (referred to as OBD II). Requirements for OBD systems on heavy-duty vehicles have taken effect more recently, as emission standards for heavy-duty vehicles have begun to require after-treatment systems. Such after-treatment systems require monitoring to ensure low emissions are maintained in-use and for the life of the vehicle.

Beginning with the 2007 MY, ARB required some diagnostic systems for heavy-duty engine emission controls. Specifically, the Engine Manufacturer Diagnostic (EMD) system regulation, as in 13 CCR 1971, requires heavy-duty engine manufacturers to implement diagnostic systems on all 2007 and subsequent MY on-road heavy-duty Otto-cycle (gasoline) and diesel engines (CCR, 2013). However, the EMD regulation

is much less comprehensive in comparison to the OBD II regulation, containing no standardized requirements and requiring rudimentary monitoring of just a few systems.

In 2005, ARB adopted comprehensive OBD requirements for heavy-duty engines, seen in 13 CCR 1971.1 (CCR, 2013). The heavy-duty OBD requirements began phasing in with MY 2010 and are scheduled to be fully phased in on all heavy-duty engines by the 2016 MY. The heavy-duty OBD requirements include monitoring of all emission-related systems and components and both emission threshold-based monitoring (i.e., detection of a component/system fault before a specific emission level is exceeded) and non-emission threshold-based monitoring. For the most important emission control systems such as the PM filter and SCR system, the regulation specifies malfunction criteria and emission thresholds for detecting a malfunction and illuminating the MIL based on emission increases (defined by additive and multiplicative factors) relative to the emission standard. For example, on 2016 and subsequent MY engines, the OBD system must be designed to detect an SCR catalyst malfunction when the catalyst conversion capability has deteriorated to the point that the engine's emissions are exceeding the NOx standard by more than 0.2 g/bhp-hr (e.g., cause emissions to exceed 0.4 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr). Using EGR as another example, the OBD system must be designed to detect an EGR system malfunction when the EGR flow rate has decreased to the point that NMHC, CO, or NOx emissions are exceeding 2.0 times any of the applicable standards, or PM emissions are exceeding the applicable PM standard by more than 0.02 g/bhp-hr.

For heavy-duty engines certified to the optional low NOx emission standards, staff is proposing that manufacturers meet the OBD requirements for heavy-duty engines as seen in 13 CCR 1971.1 and monitor for the same types of malfunctions, but with some added flexibility for defining the emission thresholds (CCR, 2013). Because the emission thresholds are often defined as a multiple of the emission standard (e.g., 2.0 times the standard for the EGR malfunction example above), if staff proposed full compliance with 13 CCR 1971.1, the required emission thresholds for detecting faults with respect to absolute emission levels would be lower, and as such more stringent, for engines certified to the optional standards than for engines certified to the mandatory 0.2 g/bhp-hr NOx standard. Engine manufacturers' current sensors and OBD system technologies may not be able to reliably detect faults at such low absolute emission levels. In recognition of the added challenge of monitoring at these lower emission levels, staff's proposal includes the ability for manufacturers to seek approval from the Executive Officer to use alternate emission thresholds that are determined by the manufacturer. In determining the emission thresholds and in order to obtain Executive

Officer approval, the manufacturer would be required to use the best available monitoring technology to design its monitors to detect malfunctions at the lowest feasible tailpipe emission levels while concurrently preventing incorrect malfunction detection of components that are still within their useful life performance specifications (i.e., components that are still "good parts"). Further, manufacturers would have to ensure the monitors execute frequently during typical in-use vehicle operating conditions so malfunctions would be detected within an appropriate time frame. Lastly, the manufacturer would have to provide emission data showing the fault detection below the proposed thresholds. Staff's proposal also includes a process of designing and calibrating the monitors to detect at the lowest feasible emission levels. Specifically, the manufacturer would not have to set the malfunction criteria below the emission thresholds specified for each monitor in section 1971.1 except for additive NOx malfunction criteria (e.g., NOx standard plus 0.2 g/bhp-hr), in which case the malfunction criteria may not be lower than 2.0 times the applicable NOx standard. The process outlined above is the same as the one manufacturers follow today when designing monitors to meet the existing OBD regulations for engines certified to the 0.2 g/bhp-hr NOx standard.

Some manufacturers have expressed concerns that this proposal does not provide an OBD design target and that ARB may end up not allowing manufacturers to use these provisions during certification. Staff believes these concerns are unfounded given that similar provisions exist in the current OBD regulations. The heavy-duty OBD regulation, as seen in 13 CCR 1971.1(g), currently includes an allowance for ARB to revise the emission threshold for any monitor if "the most reliable monitoring method developed requires a higher threshold to prevent false indications of a malfunction" (CCR, 2013). Further, section (f)(17.1.5) of the OBD II regulation, seen in 13 CCR 1968.2, has provisions similar to those staff is proposing here (CCR, 2013). The provisions in the OBD II regulation allow engine manufacturers certifying medium-duty diesel vehicles to a chassis dynamometer tailpipe emission standard to propose emission thresholds based on the monitoring requirements defined for medium-duty diesel engines certified to an engine dynamometer tailpipe emission standard. These provisions in the OBD II regulation were used by engine manufacturers during the phase-in and early years of the 0.2 g/bhp-hr NOx emission standards. Staff's OBD proposal would allow manufacturers to take their current and best OBD practices and apply them to the lower NOx engines. Staff believes its OBD proposal for the lower NOx standards would provide enough flexibility to manufacturers to certify to the heavy-duty OBD requirements and would encourage development and improvement of these systems. It is staff's intent that the proposed OBD requirements will not deter manufacturers from certifying engines to the optional lower NOx standards.

d. Carl Moyer Memorial Air Quality Standards Attainment Program

The Carl Moyer Program is a grant program that funds the incremental cost of cleaner-than-required engines, equipment, and other sources of air pollution. The Carl Moyer Program complements California's regulatory program by providing incentives to obtain early or extra emission reductions, especially from emission sources in environmental justice communities and areas disproportionately impacted by air pollution. The Carl Moyer Program can fund replacement of older vehicles as well as new vehicle purchases.

In order to receive Carl Moyer Program funding, each project must meet the specified maximum cost-effectiveness limit (ARB, 2011). To calculate Carl Moyer Program cost-effectiveness, the project grant amount is annualized based upon the project's life and an appropriate discount rate. This annual cost is divided by the project's estimated emission reductions to determine the overall cost-effectiveness of the covered emissions reduced.

Under the current guidelines, the Carl Moyer Program could fund a vehicle with an optional low NOx-certified engine either as a vehicle replacement or as a new vehicle purchase project (ARB, 2011). However, given the current guidelines, the funding available for a vehicle with an optional low NOx-certified engine is likely not enough to provide adequate incentive for many fleets to purchase such vehicles.

As shown in Table 10, replacing an old vehicle with one with an optional low NOx-certified engine would provide the same or only slightly more possible funding than replacing it with a vehicle with an engine certified to the mandatory standard of 0.2 g/bhp-hr. Also shown in Table 10, the Carl Moyer Program could currently provide some funding for the new purchase of a vehicle with an optional low NOx-certified engine (when not replacing an old truck). The maximum funding available for such a new vehicle purchase would range from about $3,000 to about $5,000, which is unlikely to be sufficient incentive for purchase of such a vehicle.

Based on the example amounts in Table 10, it is clear that, although the Carl Moyer Program could currently provide some funding for optional low NOx-certified engines, changes to the program will be needed for it to provide adequate incentive for purchases of vehicles with such engines.

Table 10 - Estimated Carl Moyer Maximum Funding Amounts for Standard and Optional Low NOx Engines Using Current Carl Moyer Guidelines†

Projects	Original Engine MY	New Engine NOx Level	Maximum Funding Amounts
Vehicle Replacement Projects ($250,000)	1998 - 2001 MY Engine	0.2	$60,000
		0.1	$60,000
		0.05	$60,000
		0.02	$60,000
Vehicle Replacement Projects ($250,000)	2007-2009 MY Engine	0.2	$35,690
		0.1	$38,862
		0.05	$40,448
		0.02	$41,399
New Vehicle Purchase Projects*	2013/14	0.2	N/A
		0.1	$2,728
		0.05	$4,314
		0.02	$5,265

† Generic values were used to calculate these estimated cost numbers; individual projects and similar projects will vary in cost effectiveness and funding amounts.
*Maximum funding is 25 percent of the incremental cost.

Possible changes to the Carl Moyer Program guidelines to further incentivize optional low NOx-certified engines could include the following:

- Increase Carl Moyer Voucher Incentive Program (VIP) funding for optional low NOx certified engines. Currently, VIP allows up to $45,000 for vehicles with 0.2 g/bhp-hr NOx engines. This cap could be raised for optional low NOx-certified engines.
- Expand VIP fleet size to more than 10 for optional low NOx-certified engines, which would allow more fleets to receive funding for such engines.
- Use a weighting factor to increase the calculated benefits when calculating cost effectiveness for projects involving optional low NOx-certified engines. This would recognize the benefit of deploying optional low NOx-certified engines in advancing future low NOx technology (and going beyond just the mass emission benefits achieved by any one project).

The recently adopted Assembly Bill 8 requires ARB in conjunction with local air districts to evaluate Carl Moyer policies and goals (AB-8, 2013). This will provide an opportunity to consider how the Carl Moyer Program could support the deployment of optional low NOx-certified engines to advance future low NOx technology.

In addition to ARB changing the overall Carl Moyer Program guidelines to favor optional low NOx-certified engines, local air districts could choose to

preferentially fund vehicles with such engines using locally available funds. Staff will work with local air districts regarding implementing this idea.

e. Proposition 1B

The Proposition 1B: Goods Movement Emission Reduction Program (Prop 1B) is a $1 billion bond program created by voter-approved Proposition 1B in 2006, and clarified by Senate Bill (SB) 88 (Chapter 181, Statutes of 2007), that provides financial incentives to owners of equipment used in freight movement to upgrade to cleaner technologies. ARB in partnership with local air districts administers the program with the goal of quickly reducing emissions and human health risk due to movement of freight or "goods" along California's four main trade corridors -- Los Angeles/Inland Empire, Central Valley, Bay Area, and San Diego/Border.

Heavy-duty diesel truck projects eligible for Prop 1B funding include the replacement, repower, or retrofit of heavy-duty diesel trucks. New truck purchases are only eligible as part of a replacement project. If ARB adopts optional low NOx emission standards, Prop. 1B funds could potentially be used to help owners purchase trucks certified to the optional, lower levels (ARB, 2013c).

The next update to the Prop 1B guidelines is expected in fall of 2014, with a focus on advanced technologies. Traditional diesel-to-diesel replacement projects are not likely to be included as a project category in future guidelines. However, staff may consider the potential for funding truck replacements and repowers that contain optional low NOx-certified engines if they become available.

f. Truck and Bus Regulation

On December 12, 2008, ARB approved the Truck and Bus regulation to significantly reduce PM and NOx from existing diesel vehicles operating in California. The regulation applies to nearly all diesel-fueled trucks and buses with a GVWR greater than 14,000 pounds that are privately or federally owned. Specific trucks such as other public fleets, solid waste collection trucks, transit buses, and drayage trucks are subject to other regulations.

Starting January 1, 2012, the regulation phases in requirements for fleet owners to reduce PM emissions from heavier trucks by installing exhaust retrofit filters that capture pollutants before they are emitted to the air or by replacing vehicles with newer vehicles that are originally equipped with PM filters. Starting January 1, 2015, the regulation requires accelerated replacements of both lighter and heavier vehicles that do not have PM filters installed. By 2023, under the current Truck and Bus regulation,

nearly all older vehicles will need to be upgraded to have exhaust emissions meeting 2010 MY engine emission levels.

Under the current Truck and Bus regulation, fleet owners that replace vehicles can earn credits to delay compliance for other vehicles in the fleet until 2017. For example, fleets can receive credits if they added more vehicles with 2007 MY or newer engines than normal by January 1, 2012. Also, fleets that purchase fuel efficient hybrid vehicles, alternative fueled vehicles, or vehicles equipped with pilot ignition engines any time prior to 2017 can earn credits to delay compliance for another vehicle in the fleet until 2017. If natural gas engine manufacturers certify engines to the optional low NOx standards, the Truck and Bus regulation's current provision allowing credit for purchase of alternative fueled vehicles could provide an incentive for purchase of such engines.

In the future, the Truck and Bus regulation could be amended to provide additional incentives for optional low NOx certified engines, including diesel fueled engines. This would provide an avenue to distribute low NOx engines into California's truck and bus fleets.

D. Anti-Idling (Amendments)

The proposed amendments to the ATCM to Limit Diesel-Fueled Commercial Motor Vehicle Idling (idling ATCM) would expand responsibility for compliance beyond just the driver, to include the vehicle owner and the motor carrier that dispatched the vehicle. The text of the proposed amended idling ATCM is contained in Appendix I.D.

1. Background

On July 22, 2004, ARB adopted the initial idling ATCM (ARB, 2004) codified in 13 CCR 2485 (CCR, 2013). As adopted in 2004, the idling ATCM applies to diesel-fueled commercial motor vehicles including trucks and buses with a GVWR greater than 10,000 pounds that operate in California. It requires the driver of an applicable vehicle to manually shut off the engine before exceeding five minutes of idling. The idling ATCM also identifies circumstances under which the idling limitations would not apply, including servicing, testing, and inspection of vehicles, idling to perform work for which the vehicle was designed, idling the main engine or operating an auxiliary power system (APS) to prevent a safety or health emergency, idling of military tactical vehicles, workover rigs, and armored cars, and idling of sleeper trucks during resting or sleeping in the sleeper berth.

In October 2005, ARB adopted amendments to the idling ATCM and related amendments to 13 CCR 1956.8 and the incorporated California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles (ARB, 2005; CCR, 2013).

The 2005 amendments addressed both new and in-use vehicles and engines and emission performance of idle reduction technologies installed on sleeper trucks. New 2008 and subsequent MY heavy-duty diesel engines installed on vehicles with a GVWR greater than 14,000 pounds were required to be equipped with a non-programmable engine shutdown system that automatically shuts down the engine after five minutes of continuous idling. In lieu of the engine shutdown system, engine manufacturers may opt to certify the engine to a NOx idling emission standard of 30 grams per hour.

For in-use vehicles, the amendments required operators of both in-state and out-of-state registered sleeper berth-equipped trucks to manually shut down their engines when idling more than five minutes at any location within California, beginning January 1, 2008. Alternative idle reduction technologies such as diesel-fueled APSs and fuel-fired heaters were also required to meet emission performance requirements that ensure emissions are not exceeding the emissions of a truck engine operating at idle. Specifically, the regulation requires diesel-fueled APSs installed on trucks with 2007 and newer engines to control PM emissions by either routing the APS exhaust through the DPF of the truck engine or by retrofitting the diesel APS with a verified level 3 PM control device that reduces PM emissions by at least 85 percent. Fuel-fired heaters installed on trucks with 2007 and newer engines are also required to meet the Ultra-Low Emission Vehicle requirements specified in the Low Emission Vehicle regulations. These requirements became effective beginning in 2008. For trucks equipped with 2006 and older engines, any California or federally certified diesel-fueled APS or fuel-fired heater may be used.

2. Summary of Proposed Amendments

Staff is proposing to amend the idling ATCM, 13 CCR 2485, to extend the applicability of the regulation to include vehicle owners and motor carriers that dispatch affected vehicles to share some of the responsibilities of compliance with the existing requirements of the regulation (CCR, 2013). In addition, staff is proposing to include schools, hotels, and motels in the definition of restricted areas. The proposed amendments would provide ARB better enforcement capabilities, thereby improving the idling ATCM's effectiveness in reducing public exposure to diesel-PM and other contaminants from heavy-duty diesel vehicles and diesel-fueled APSs. Furthermore, the proposed amendments would add definitions of "emission standard" and other terms used in the proposed amendments and make other minor clarifying and corrective changes.

a. Expand Requirements to Include the Owner and Motor Carrier

Currently, the existing regulation applies only to the driver. Thus, when a violation of the idling ATCM occurs, a citation is issued to the driver. However, sometimes citations cannot be issued to the driver because, at the time the vehicle is idling, the driver may not be in the vehicle or may

be resting in the sleeper cab. In such situations, enforcement personnel issue the citation and leave it on the vehicle's window or windshield. A copy of the citation is also sent to the owner of the vehicle, later identified using the license plate of the vehicle or the motor carrier, identified by the motor carrier number displayed on the vehicle, but only for purposes of ultimately reaching the driver. Many such citations have been ignored by the driver, owner, and motor carrier, leaving ARB with no recourse for settling the citation. Such unresolved citations have significantly lowered the compliance rate of the regulation. For example, in 2012, approximately 359 (42 percent) of the 854 citations issued for violations of the idling ATCM remained unsettled as of December 31, 2012 (ARB, 2012b).[13] Under staff's proposal, a copy of the citation would be sent to any one or all of the parties, depending on the information collected at the time of citation. Once the citation is settled by any one of the three responsible parties, the citation would be cleared. This would provide ARB enforcement personnel with the authority to pursue the settlement of open citations with the drivers, owners, and motor carriers associated with the vehicle in violation. Staff is proposing that these requirements become effective beginning January 1, 2015.

b. Add Schools, Hotels, and Motels to the Definition of "Restricted Area"

In addition to expanding the applicability of the idling ATCM to vehicle owners and motor carriers, staff is also proposing to expand the definition of "restricted area," which previously only included individual and multifamily housing units, to include schools, hotels and motels. Restricting idling of both diesel-fueled commercial motor vehicles and APSs to 5 minutes when within 100 feet of schools, hotels and motels would provide additional protection to the public from exposure to diesel PM and other TAC, and reduce potential cancer risk and other adverse health effects associated with diesel emissions. Also, adding schools to the definition of "restricted area" makes the regulation consistent with the requirements in the school bus idling ATCM (CCR, 2013). Staff is proposing that these requirements become effective beginning January 1, 2015.

c. Add Definition of "Emission Standard"

In 2004, the U.S. Supreme Court clarified that the definition of standard as it applies to emissions from motor vehicles and motor vehicle engines under Title II of the federal CAA, relates to the emission characteristics of vehicles or engines and requires motor vehicles or motor vehicle engines to emit no more than a certain amount of a given pollutant, be equipped

[13] Of the citations that remained unsettled at the end of 2012, approximately 87 percent were not signed by the driver, indicating they were left when the driver was not present or was inaccessible. (Nunes, 2013).

with a certain type of pollution-control device, or have some other design feature related to the control of emissions (EMA, 2004).

Staff is proposing that the idling ATCM add a definition of "emission standard" to be consistent with the definition set forth in *EMA* for purposes of clarity, consistency, and conformity. Under the federal definition, requirements to certify engines to the clean idle standard or automatic engine shutdown system relate to a requirement that a vehicle be equipped with a certain type of pollution-control device or a design feature related to the control of emissions, and are emission standards. The proposed amendments are intended to make clear that the definition of emission standard as used in the idling ATCM conforms to the federal definition. The proposed definition, which modifies the definition of "emission standard" as set forth in HSC section 39027, is authorized by HSC sections 39010 and 39601 in that the proposed definition conforms to existing federal definitions.

The definition set forth at section 39027 was enacted by the Legislature in 1975. The new, federally conforming definition effectively recognizes the present state of engine and vehicle design technology and the need to clarify that emission discharges into the atmosphere are more than quantitative emission limits but also include pollution control equipment and other design features of the engine or vehicle that ensure that emission reductions are achieved. For purposes of consistency and clarity, staff is also proposing to add new definitions of the terms "exhaust emission standards" and "evaporative emission standards" to clarify, where needed, previous references to emission standards. These proposed terms are subcategories of emission standards and are used to specifically identify the specified subcategories, as opposed to the broader term of emission standard that encompasses all standards, including the idling ATCM requirements relating to the control of emissions.

d. Other Changes

Staff is also proposing other minor and non-substantive changes to add clarity to the existing regulation. Such modifications include:

i. Adding alternative idle reduction technologies to the "Applicability" section.
ii. Adding applicable HSC references to the "Penalties" section.
iii. Adding "title 13, CCR, section 1956.8" to the subsection "Relationships to Other Laws"
iv. Defining the existing term "Executive Officer" and new terms introduced in the proposed amendment such as "motor carrier," "owner" and "person."
v. Adding a new subsection, "Severability," to indicate that if for any reason a portion of the section becomes invalid by a court, then that

portion is considered a separate provision and such decision does not affect the validity of the remaining portions of the sections.

3. Environmental Impacts Analysis

This section provides an environmental analysis for the proposed amendments. Based on staff's review, staff has determined that implementing the proposed amendments to the idling ATCM described above would not result in any potentially significant adverse impacts on the environment. The analysis below provides the basis for reaching this conclusion. This section of the staff report also discusses environmental benefits expected from implementing the proposed amendments.

a. Prior Environmental Analysis

The environmental analyses performed for the original idling ATCM regulation and its amendments found no significant adverse impacts to the environment and beneficial impacts to air quality and CO2 emissions.

The initial regulation focused on reducing PM and NOx emissions by limiting engine idling of diesel-fueled commercial motor vehicles with a GVWR greater than 10,000 pounds. Drivers of affected vehicles operating in California were required to not idle the vehicle's engine for greater than five minutes at any location unless they met specified exemption criteria. The idling restriction could be achieved by manually shutting off the engine before the five-minute idle time limit expires.

As mentioned above, the initial staff report projected statewide emission reductions from implementing the regulation to be approximately 14 TPD of NOx emissions and 0.5 TPD of PM emissions in 2005 and approximately 51 TPD of NOx emissions and 0.7 TPD of PM emissions in 2009. The staff report also indicated that limiting idling would, as a consequence of reducing targeted diesel exhaust emissions from heavy-duty diesel-fueled vehicles, decrease these vehicles' GHG emissions and thereby reduce the state's contribution to climate change.

The 2005 amendments focused primarily on further reducing NOx emissions from PM filter-equipped diesel-fueled engines and expanded the applicability of the idling ATCM to sleeper-cab trucks. It also established emissions performance requirements for alternative idle reduction technologies such as diesel-fueled APSs and fuel-fired heaters. The 2005 amendments also required 2008 and newer MY heavy-duty diesel engines with a GVWR greater than 14,000 pounds to be equipped with an automatic engine shutdown timer that shuts off the engine after five consecutive minutes of idling or optionally meet a NOx idling emission standard of 30 grams per hour.

The 2005 staff report estimated statewide emission reductions to be approximately 46 TPD of NOx emissions and 0.4 TPD of PM emissions in 2010 and approximately 56 TPD of NOx emissions and 0.1 TPD of PM emissions in 2020.

b. Methods of Compliance

The proposed amendments provide clarity and enhanced enforcement provisions to the current regulation. Implementation of the proposed amendments will require the following actions from the regulated community:

- Requires the vehicle owner, motor carrier that dispatched the vehicle, and the driver to:
  - Not idle or cause to idle the main engine for more than five minutes at any location;
  - Not idle or cause to idle an engine certified to the optional NOx idling standard of 30 grams per hour when within 100 feet of a restricted area;
  - Not operate or cause to operate a diesel-fueled APS for more than five minutes within 100 feet of a restricted area;
  - Not operate or cause to operate a diesel-fueled APS not equipped with a level 3 verified PM control device when installed on a vehicle equipped with an engine certified to the 2007 or newer heavy-duty diesel engine standards;
  - Not operate or cause to operate a fuel-fired heater that is not certified to the fuel-fired heater emission standards established in the Low Emission Vehicle regulations when installed on a vehicle equipped with an engine certified to the 2007 or newer heavy-duty diesel engine standards;
- Requires vehicle operators to not idle more than five minutes within 100 feet of schools, hotels, and motels.

c. Beneficial Impacts

The proposed amendments clarify and expand upon definitional and procedural provisions and enhance enforcement provisions in the existing regulation. The proposed amendments would ensure better compliance by the regulated community and better enforcement capabilities by ARB, thereby improving the idling ATCM's effectiveness in reducing public exposure to diesel PM and other contaminants from heavy-duty diesel vehicles and diesel-fueled APSs.

The existing idling ATCM reduces criteria pollutant emissions by reducing unnecessary idling of diesel-fueled commercial motor vehicles with a GVWR greater than 10,000 pounds. In the 2004 and 2005 rulemakings, statewide emission benefits from the idling ATCM were estimated to be approximately 51 tpd of NOx emissions and 0.7 tpd of PM emissions in

2009 and approximately 56 TPD of NOx and 0.1 TPD of PM emissions in 2020 (ARB, 2004; ARB, 2005). The proposed amendments would not provide additional emission benefits but will ensure that emission benefits from the existing idling ATCM are realized by increasing the regulation's compliance rate. The proposed amendments would also provide those members of the public who attend schools, or work or reside at hotels and motels, additional protection from exposure to diesel particulate matter and other toxic air contaminants, and the associated potential cancer risks and other adverse health effects associated with diesel emissions.

d. Resource Areas with No Impacts

The proposed amendments are administrative in nature in that they consist of minor administrative and procedural changes that would clarify definitions, provide enhanced enforcement by expanding upon the applicability of the rule to not only the vehicle driver, but also the owner and motor carrier, and provide additional information about these responsible parties to facilitate enforcement. These, therefore, and would not result in any activity that could adversely affect the physical environment.

No discussion of alternatives or mitigation measures is necessary because no significant adverse environmental impacts were identified.

4. Economic Impact Assessment/Cost Analysis

The following economic impact assessment/cost analysis has been prepared for this rulemaking action in accordance with the provisions of Government Code section 11346.3b(1)(A)-(D).

The proposed amendments to the idling ATCM would specify that the driver, the owner of the vehicle, and the motor carrier that dispatched the vehicle are liable for any violations of the requirements of the idling ATCM. Compliance with the proposed amendments does not require any new actions to be taken by the driver, owner, or motor carrier since the requirements not to idle the main engine of the vehicle for more than five minutes and/or not to operate non-compliant APSs and fuel-fired heaters have been in effect since February 2005. All the driver has to do is continue to comply with the existing requirements. In addition, owners and motor carriers should have already included idling ATCM information as part of their driver training to comply with the existing regulation. Thus, staff believes that the owner of the vehicle and the motor carrier that dispatched the vehicle will incur no additional cost to comply with the proposed amendments.

Without the proposed amendments, some drivers would continue to violate the existing requirements of the regulation, thereby impacting the health and welfare of California residents and the state's environment. Staff believes that the proposed amendments would significantly reduce noncompliance

with the existing requirements and consequently the expected emission benefits from the existing requirements would be realized. This would also contribute to the state's efforts to meet the emission reduction goals for attaining the National Ambient Air Quality Standards (NAAQS) as required by the federal CAA.

a. Potential Impact on Businesses

Businesses that may be affected by the proposed amendments include owners of commercial diesel-fueled motor vehicles and/or motor carriers that dispatch these vehicles. Based on an analysis of the motor carrier permit registration data obtained from the California Department of Motor Vehicles, there are approximately 265,000 owners and motor carriers affected by the proposed amendments. According to a publication by the American Trucking Association, approximately 90.5 percent of the trucking businesses with 6 or fewer trucks are considered small businesses (ATA 2013). As discussed above, ARB staff has concluded that the proposed regulatory action will have no significant cost impact on directly affected persons or businesses.

b. 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 amendments would not result in any additional costs to affected regulated entities.

c. Potential Impact on Jobs and Business Creation, Elimination, or Expansion

As discussed previously, the proposed amendments are intended to improve compliance with existing requirements by extending compliance responsibility to include the owner and motor carrier, thereby providing ARB enforcement personnel with greater authority to pursue the settlement of pending citations. The proposed amendments do not impose any new compliance costs on the driver, owner, or motor carrier. As a result, the proposed amendments would not have any impact on the creation or elimination of jobs within the state, or the creation, expansion, or elimination of businesses within California.

d. Potential Costs to Local and State Agencies

The proposed amendments are not anticipated to have any cost impacts to local or state agencies since they would not result in any additional costs to affected regulated entities.

5. Regulatory Alternatives

The alternative considered by staff was to not amend the idling ATCM. This alternative was rejected because it would not resolve the ongoing enforcement issue associated with unsettled citations. Currently, the idling ATCM requires that citations be issued to the driver of a noncompliant

vehicle. Many times, the driver is not present or accessible when the idling vehicle is observed by enforcement personnel. In those cases, the driver's identity is unknown. The citation is left on the vehicle, but many times it goes unsettled with no way to identify the offending driver. As discussed above, in 2012, nearly one-half the idling citations remained unsettled at the end of the year (ARB, 2012b). The proposed amendments to the idling ATCM would make the driver, the owner of the vehicle, and the motor carrier that dispatched the vehicle directly responsible for compliance. This would provide ARB enforcement personnel with greater authority to pursue the settlement of pending citations with the owners and motor carriers associated with the vehicle in violation. ARB believes this will greatly reduce the number of unsettled citations.

Furthermore, the idling ATCM currently prohibits main engine idling or operation of a diesel-fueled APS within 100 feet of a restricted area which the existing ATCM defines as "any real property zoned for individual or multifamily housing units that has one or more of such units on it", which would also include schools, hotels and motels. However, the existing idling ATCM does not explicitly include schools, hotels and motels in the definition of "restricted area". Although the school bus idling ATCM (13 CCR 2480) has a provision that prohibits idling of diesel-fueled commercial motor vehicles within 100 feet of a school, a no-action alternative would not prohibit drivers from idling near schools, hotels and motels thus exposing the public who attend schools, or work or reside at hotels and motels to harmful emissions. Modifying the definition of "restricted area" to include schools, hotels, and motels would clarify the provisions of the idling ATCM and also would make it consistent with the provisions in the school bus idling ATCM. In addition, the proposed amendments would serve to ensure that the emission benefits of the existing ATCM are realized.

No alternative considered by the agency would be more effective in carrying out the purpose for which the regulation is proposed or would be as effective as or less burdensome to the affected private persons than the proposed idling ATCM amendments.

E. Heavy-Duty Hybrid-Electric Vehicles Certification Procedures (Amendments)

Staff is proposing amendments to the California Interim Certification Procedures for 2004 and Subsequent Model Hybrid-Electric Vehicles in the Urban Bus and Heavy-Duty Vehicle Classes. The text of the proposed amended procedures, which would remain voluntary, interim procedures, is contained in Appendix I.E.1

1. Background

In 2002, ARB adopted California Interim Certification Procedures for 2004 and Subsequent Model Hybrid-Electric Vehicles in the Urban Bus and Heavy-

Duty Vehicle Classes (Interim Procedure) (ARB, 2002). This Interim Procedure was adopted in conjunction with modifications to the Public Transit Bus Fleet Rule, as seen in 13 CCR 2023-2023.4, to reflect advances in technology that could not be captured in ARB's existing heavy-duty certification procedures (CCR, 2013). The Board approved these Interim Procedures with the intention of revisiting the procedures if needed in future years.

Due to expanding commercialization and advancement of hybrid technology into more sectors of the heavy-duty market, and the need to better quantify emission reductions from existing and future heavy-duty hybrid vehicles, staff believes that updates to the existing Interim Procedures are warranted.

Before manufacturers can legally sell or offer for sale new engines or new motor vehicles in California, manufacturers must certify those engines or vehicles with ARB in accordance with ARB developed test procedures. The proposed amendments to the Interim Procedures are designed for heavy-duty hybrid-electric vehicle manufacturers seeking voluntary vehicle-based (as opposed to engine-based) certification. The proposed amendments to the interim procedure are based on a modified version of the Society of Automotive Engineers (SAE) J2711 Recommended Practice (SAE, 2012). The interim procedure was developed to test the emissions of heavy-duty hybrid-electric vehicles using a chassis dynamometer.

Conventional heavy-duty engines are certified on an engine dynamometer. Heavy-duty hybrid vehicles are typically manufactured by coupling a conventional engine with a hybrid-drive system.[14] For most heavy-duty hybrid vehicles, the manufacturers of the conventional engine and the hybrid drive system are generally separate entities; one exception is a recently certified vertically-integrated heavy-duty hybrid vehicle where both the engine and the hybrid-drive system were designed and manufactured as an integrated unit by a manufacturer.

The proposed amendments to the Interim Procedures require that the conventional engine that is used in the hybrid vehicle must be a certified engine. Under the proposed amendments, the complete hybrid vehicle must be tested on a chassis dynamometer. The ARB certification value for a heavy-duty hybrid-electric vehicle is determined through calculations using chassis dynamometer test results and engine certification values for both the hybrid-electric vehicle and a comparable conventional vehicle. Once certification is obtained, an Executive Order is issued to the entity that applied

[14] After a one year delay in implementation, 2014 MY HDDEs intended for use in heavy-duty hybrid vehicles need to show compliance with OBD requirements. As such, HDDE certification includes hybrid systems now.

for certification and is responsible for complying with emissions and other requirements.

A number of financial incentive programs require that heavy-duty hybrid vehicles be certified or be able to demonstrate emissions and/or fuel economy benefits over comparable conventional vehicles as one condition to be eligible for receiving grants. The proposed amendments were designed to allow a manufacturer to certify its heavy-duty hybrid vehicles, in order for the vehicle to be eligible for grants. The Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP), for example, offers fleets extra incentive money to purchase vehicles that have obtained ARB vehicle certification (ARB, 2012c).

2. Description of Proposed Amendments

Staff is proposing amendments to the existing Interim Procedures focused on the chassis dynamometer testing portion of the overall certification process. The goal of the proposed amendments is to ensure that the revised test procedures are applicable to a wider range of vehicle classes and vocations. It is ARB's intention to revisit the approved certification procedures in the future if needed.

The proposed amendments are designed to reflect the state of technology and provide appropriate emission test procedures for heavy-duty hybrid technologies. Since the Board's adoption of the Interim Procedure in 2002, advances in hybrid technology have led to its application in more diverse vocational applications, other than just urban buses, such as beverage, package, and linen delivery vehicles. The proposed amendments are needed to ensure that the Interim Procedures adequately measure emissions from these different vocational hybrid vehicles and to account for new heavy-duty hybrid-electric technologies such as plug-in hybrid-electric vehicles. The variety of vocational hybrid vehicles as well as the development of different types of hybrid technologies has also prompted SAE to amend its recommended practice (J2711), which is referenced in the amended Interim Procedure, for testing heavy-duty hybrid vehicles.

Other proposed changes are intended to clarify and enhance specific program requirements. Some key amendments are as follows:

- The applicability was amended to apply to a wider range of heavy-duty vehicles including hydraulic, turbine, flywheel, or fuel cell hybrid vehicles.
- A number of new definitions were added based on SAE J2711 such as the average loaded vehicle weight, charge depleting mode, and curb weight.
- Some existing definitions such as that for "baseline urban transit bus," were amended.

- Reference documents, such as SAE J2711, were reviewed and updated.
- Existing requirements on testing facilities, equipment, and procedures were updated to provide detailed information on the test instruments, charge-depleting and charge-sustaining evaluation procedures, etc.
- Clarification was added that the calculation of emission factors is based on the larger value of the two emission results.

It is staff's intent that the amended test procedures will remain voluntary, interim procedures. Future revisions to the procedures may be incorporated into the Phase 2 GHG standards, on which staff is working jointly with U.S. EPA.

3. Environmental Impacts Analysis

This section provides an environmental analysis for the proposed amendments. Staff concludes the proposed amendments to the California Interim Certification Procedures described above would not result in any significant adverse impacts on the environment. The analysis below provides the basis for reaching this conclusion. This section of the staff report also discusses environmental benefits expected from implementing the proposed amendments.

a. Prior Environmental Analysis

In October 2002, ARB adopted California Interim Certification Procedures for 2004 and Subsequent Model Hybrid-Electric Vehicles, in the Urban Bus and Heavy-Duty Vehicle Classes (Interim Procedure). This Interim Procedure was adopted in conjunction with modifications to the Public Transit Bus Fleet Rule and Emission Standards for New Urban Buses, originally adopted in February 2000, to reflect advances in technology that could not be captured in ARB's existing heavy-duty certification procedures. The staff reports for the Interim Procedure did not identify any adverse environmental impacts.

b. Methods of Compliance

The proposed amendments are intended to assist applicants in their certification process and to address compliance issues by ensuring that each applicant's certified vehicle will stay in compliance over the vehicle's specified useful life. As with the current Interim Procedure, the proposed amendments would continue to be voluntary. Truck assemblers or manufacturers would not be required to do anything beyond current engine certification. Test facilities, however, would be required to follow the new testing procedures and certification requirements, as amended. While voluntary, implementation of the proposed amendments would

entail the following administrative and procedural actions from the regulated community:

- Test procedures would be applicable to new heavy-duty, greater than 14,000 pounds GVWR hybrid-electric vehicles, including hybrid-electric urban buses, and other hybrid vehicles such as plug-in, hydraulic, turbine, flywheel, and fuel cell vehicles.
- Test facilities would amend calculations of exhaust emissions by calculating the weighted mass emission level for each drive cycle.
- Test facilities would follow the new testing procedure as amended in reference to SAE J2711.
- Heavy-duty vehicle manufacturers may test and certify heavy-duty vehicles, but must certify engines prior to selling in California.

c. Beneficial Impacts

The proposed amendments expand on the scope of the interim certification procedures. In the long term, the expanded certification procedures could enable more hybrid-electric vehicles to be certified and produced, which could provide air quality emission benefits.

d. Resource Areas with No Impacts

The proposed amendments to the regulation consist of minor administrative and procedural changes to definitions, test procedures, and the certification process currently used to certify heavy-duty hybrid vehicles. These amendments do not change the stringency or effectiveness of the current certification process. The proposed amendments would not result in any significant or potentially significant adverse impacts on the environment because compliance with the proposed regulation would not cause any activity, either directly or indirectly that could affect the physical environment.

No discussion of alternatives or mitigation measures is necessary because no significant adverse environmental impacts were identified.

4. Economic Impact Assessment/Cost Analysis

The following economic impact assessment/cost analysis has been prepared for this rulemaking action in accordance with the provisions of Government Code section 11346.3b(1)(A)-(D).

In February 2000, ARB adopted the Public Transit Bus Fleet Rule, a new regulation establishing a public transit bus fleet rule and emission standards for new urban buses (ARB, 2000). In October 2002, the Public Transit Bus Fleet Rule was modified in conjunction with the adopted Interim Procedure - California Interim Certification Procedures for 2004 and Subsequent Model Hybrid-Electric Vehicles in the Urban Bus and Heavy-Duty Vehicle Classes.

Staff estimates that the cost due to the implementation of the proposed amendments would have no impact on the costs already estimated in the existing Interim Procedures. The amendments are mostly updates and clarifications that would not affect the certification costs of hybrid-electric vehicles. However, in the long term, the proposed amendments may potentially provide more emissions benefits if more heavy-duty hybrid vehicles are certified than through the existing interim procedures. Additionally, the proposed amendments may potentially provide more cost benefits because of the increased production of hybrid vehicles, which could result in lower hybrid vehicle costs due to economies of scale. Thus, the proposed amendments would enable California to continue to meet the state's criteria pollutant standards, help reduce public exposure to toxic exhaust emissions, and reduce GHG emissions.

The proposed amendments are voluntary but could impact up to approximately 40 businesses. The affected businesses are manufacturers of heavy-duty hybrid-electric buses and vehicles, hybrid-electric drive system manufacturers, engine manufacturers, transmission manufacturers, battery manufacturers, and manufacturers of components/parts that sell their products in California. These manufacturers are mostly large businesses and are mostly located outside California. There are approximately 19 businesses that manufacture diesel or gasoline California-certified heavy-duty engines and approximately 11 businesses that manufacture natural gas California-certified heavy-duty engines (ARB, 2013d). Approximately four heavy-duty hybrid drive system manufacturers have had their hybrid drive systems certified for California's market.

The incremental increase in retail price of a new hybrid-electric vehicle is estimated to range from $40,000 to $80,000 compared to the new conventional heavy-duty vehicles (ARB, 2012c). Staff expects that even with a relatively modest increase in the production volumes of heavy-duty hybrid vehicles, the retail price may be reduced from the current level (Hybrid Truck Users Forum, 2009). If this occurs, the purchase of hybrid vehicles could become more economical from a life-cycle cost perspective; possibly to the point that consumers could be purchasing hybrid vehicles on the basis of fuel savings, without additional state financial incentives (such as HVIP) or federal (Diesel Emission Reduction Act (DERA)) financial incentives.

a. Costs to Certify Hybrid-Electric Vehicles

The proposed amendments to the existing Interim Procedures are largely to update and improve clarity, and should not result in any increased costs for hybrid-electric vehicle manufacturers over those costs identified in the existing Interim Procedures.

b. Creation or Elimination of Jobs within the State

Minimal impacts to the creation of jobs within California are anticipated because of the small number of businesses that could be affected by the proposed amendments. The proposed amendments could create an additional market for manufacturers of hybrid-electric vehicles, if they want to take advantage of the opportunity to certify heavy-duty hybrid vehicles for sale in California. Additional jobs could be created at laboratory or testing facilities if manufacturers decide to certify their hybrid-electric vehicles using facilities located in California. However, since the amended Interim Procedures are voluntary, the job creation may or may not occur. Most likely, there would be no elimination of existing jobs within the state.

c. Creation of New Businesses or the Elimination of Existing Businesses within the State

Minimal impacts to the creation of new businesses within the state are anticipated because the proposed amendments would still be voluntary. A few businesses such as manufacturers of hybrid-electric vehicles and components or parts, laboratories or testing facilities may be created or expanded if the demand for vehicle purchases and chassis testing increases. Most likely, there would be no elimination of existing businesses within the state.

d. Competitive Advantages or Disadvantages for Businesses Currently Doing Business within the State

No significant impacts to the competitive advantages or disadvantages for businesses currently doing business within the state are anticipated because the proposed amendments to the existing Interim Procedures are relatively minor and voluntary. As a result, staff believes that the proposed amendments would not cause noticeable adverse impacts on California employment, business status, and competitiveness.

e. Testing Costs

Truck assemblers or manufacturers voluntarily choosing to certify their hybrid-electric vehicles would not be required to do anything beyond current interim certification procedures. Therefore, there are no additional costs relative to the existing interim certification procedures because the required number of drive cycles, cycle length, repetitions of cycles, test equipment, and analyzers remain the same.

f. Financial Opportunities

Although there is no additional cost relative to the interim certification procedures, the retail price of a hybrid-electric vehicle is still higher compared to a conventional vehicle due to the increase in component costs as well as the increase in design and manufacturing costs. The current purchase cost for hybrid-electric vehicles may already be higher

for consumers; however, consumers incur these costs voluntarily because there are no purchasing requirements for hybrid-electric vehicles. Also, consumers do not typically have to pay for the total incremental cost of purchasing a new hybrid-electric vehicle because of existing incentive programs. For example, HVIP provides funding to offset about one-half of the incremental cost of an eligible hybrid-electric vehicle using a voucher. The remaining incremental costs may be covered by other funding sources such as federal funds, local incentive programs, and other applicable funding. The increased cost of purchasing a hybrid-electric vehicle due to the hybrid drive system components and/or testing costs are not considered an economic impact because the costs attributable to those factors were already estimated in the existing interim certification procedures.

5. Regulatory Alternatives

Staff considered the following regulatory alternatives to the proposed amendments. No alternative considered by the agency would be more effective in carrying out the purpose for which the regulation is proposed or would be as effective as or less burdensome to the affected private persons than the proposed amendments.

a. Do not amend current procedure

The existing Interim Procedure for heavy-duty hybrid vehicles was originally adopted to serve the needs of the Public Transit Urban Bus Fleet Rule, which was adopted in 2002, where the availability of certified heavy-duty hybrid urban buses would play an important role for transit agencies to comply with the required fleet average emission standards. Thus, although the Interim Procedure could be used to certify other heavy-duty hybrid vehicles, it was tailored for use in the urban bus application. The advancements of hybrid technologies have resulted in the commercialization of more types of hybrid systems for heavy-duty vehicles as well as more vocational applications. In addition, industry's testing procedures for heavy-duty hybrid vehicles have also advanced, resulting in more accurate assessments of the performance and efficiency of hybrid systems. Because of these reasons, it would become increasingly more difficult to use the existing Interim Procedures, if not amended, to certify the expanding vocational applications of different types of heavy-duty hybrid technologies.

Although no additional costs would result if the existing Interim Procedure was not amended, an increasing number of vocational heavy-duty hybrid vehicles may not be able to be certified appropriately, and emissions benefits not properly quantified. Because of these reasons, this alternative was rejected since the needs of the fleets for certified heavy-duty hybrid vehicles in vocation-specific applications would not be met. The targeted emission reductions and goals outlined from both a federal

and state perspective could not be accurately measured with any confidence with outdated testing procedures that do not apply to these categories of vehicles.

b. Adopt more stringent test procedures and require mandatory certification

Consideration of more stringent standards or procedures could potentially make it too difficult or costly for heavy-duty hybrid vehicle manufacturers to be able to certify their products, resulting in fewer certified hybrid vehicles, thereby resulting in lost opportunities for potential additional emission reductions. Additionally, if ARB requires the proposed amendments to the interim test procedures to be mandatory, this could cause many manufacturers to leave California's heavy-duty hybrid vehicle market due to its relatively small market share (relative to the sales of conventional vehicles) in relation to certification costs. Although the heavy-duty hybrid technology market has evolved significantly since the interim certification procedures were originally adopted in 2002, this market is still very fragmented and relatively immature compared to the technology and market of conventional combustion heavy-duty engines. The possible absence of heavy-duty hybrid vehicles in California, including the likely reduction in product availability if the requirements for certification are too onerous (e.g., more drive cycles and test data requirements) would have a negative impact on California's efforts to attain air quality standards as well as potentially detrimental effects on the advancement of heavy-duty hybrid-electric technology. Because of the expected higher costs associated with more stringent requirements and because of other possible negative impacts as discussed, this alternative was rejected.

V. Summary of Economic Impacts

Due to the voluntary nature of the proposed regulations and regulatory amendments in addition to what is already required due to federal rules and regulations, the proposed regulations and regulatory amendments will impose minimal or no associated costs to affected parties as well as minimal or no economic impacts on businesses, as explained below.

Complying with the federal Phase 1 GHG standards will impose costs on engine and vehicle manufacturers; however, California's harmonization with the federal Phase 1 GHG standards, as proposed in this staff report, will add only minimal costs for manufacturers to provide a copy of submitted materials to California. Staff expects this to cost no more than $1,000 per manufacturer, with no impact on new vehicle prices. Overall, compliance with the federal Phase 1 program and proposed Phase 1 regulations will result in overall cost savings to fleets, due to the associated reductions in fuel use and therefore fuel costs.

The proposed amendments to the Tractor-Trailer GHG regulation consist of relaxing or removing existing requirements rather than creating additional requirements. Therefore, they impose no additional costs.

Because the proposed new, optional low NOx standards are voluntary, their associated costs depend on the level of participation by engine manufacturers, i.e., whether each engine manufacturer decides to include an optional low NOx engine in their product line-up. Costs for participating manufacturers are expected to range from $10,000 to $30,000 per engine family for engine families that do not need redesign up to more than $500,000 when redesign is required. For manufacturers that do not choose to comply with the optional standards, there are no additional costs. Based on two scenarios with low and high manufacturer participation rates, staff estimates total costs of $36 to 279 million over 20 years and a cost-effectiveness of $2 to 7 per pound of NOx reduced.

The proposed amendments to the idling ATCM will not impose any new requirements on affected parties, beyond those requirements that have already been in effect since February 2005. Therefore, staff believes that the proposed amendments to the idling ATCM will impose minimal or no additional compliance costs.

The proposed amendments to the Heavy-Duty Hybrid-Electric Vehicles Certification Procedures will impose minimal or no additional compliance costs because they are voluntary and consistent with the existing interim certification procedures, and implementing the amendments will have no impact on the costs already associated with certifying hybrid-electric vehicles in California. Instead, the proposed amendments may in the long term provide cost benefits if more heavy-duty hybrid vehicles are certified using the amended procedures.

VI. Summary of Environmental Impacts Analysis

The proposed regulations and regulatory amendments included in Appendix I are designed to reduce GHG and criteria emissions from medium-duty and heavy-duty vehicles and engines and ensure compliance with existing regulations. Staff has summarized the air quality emissions reduction benefits below:

- The proposed Phase 1 regulations do not contain any additional compliance requirements besides what are already being required by the federal Phase 1 GHG rule. Therefore it would not result in any additional direct emissions benefits. Staff quantified the emissions benefits of the federal Phase 1 program in California and calculated CO2 reductions of 3.1 MMTCO2e in 2020 and 7.0 MMTCO2e in 2035. This corresponds to a 7.2 percent reduction in 2020 and 12.5 percent reduction in 2035.

- The amendments to sunset the requirements for 2014 and subsequent MY tractors, when considered in isolation, could potentially result in a decrease in

emissions reductions from the Tractor-Trailer GHG regulation by 0.2 MMTCO2e statewide in the year 2020. However, when the amendments are considered in conjunction with the proposed adoption of the California Phase 1 GHG regulations, this reduction in emission benefits is offset by the requirement for 2014 and subsequent model tractors to meet the more stringent federal Phase 1 program which staff estimates will result in an emission reduction benefit of 3.1 MMTCO2e statewide in the year 2020.

- The emissions benefits associated with the Optional Low NOx emission standard regulation depend on the level of participation by engine manufacturers since the proposed regulation is optional. Staff estimated NOx emission benefits for two different scenarios based on low and high participation rates from manufacturers and calculated a NOx emission reduction benefit of 0.6 to 1.2 TPD statewide in 2020, and 3.3 to 6.9 TPD in 2035.

- In the 2004 and 2005 rulemakings for the idling ATCM, staff estimated emissions reduction benefits of 51 TPD of NOx and 0.7 TPD of PM in 2009 and 56 TPD of NOx and 0.1 TPD of PM in 2020. The proposed amendments to the idling ATCM would not result in any additional emissions benefits, but would ensure that the emissions benefits from the existing regulation are more fully realized by increasing the compliance rate.

- The proposed amendments to the Heavy-Duty Hybrid- Electric Vehicles Certification Procedures would provide a more comprehensive certification process. If more heavy-duty hybrid vehicle manufacturers voluntarily use these procedures and more heavy-duty hybrid vehicles are certified and produced, this could provide potential emissions benefits.

The five regulatory proposals would not result in any significant adverse impacts on the environment since they would not lead to any activity that may result in an adverse physical change to the existing environment. The proposed regulations and amendments would not require any actions that involve or adversely affect the following environmental resource areas: aesthetics, air quality, agricultural and forestry resources, biological resources, cultural resources, geology and soils, greenhouse gases, hazardous material, hydrology and water quality, land use planning, mineral resources, noise, population and housing, public services, recreation, traffic and transportation, and utilities.

VII. Summary of Environmental Justice Impacts

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 (California Government Code Section 65040.12(c)). ARB has committed to making environmental justice an integral part of its activities and policies.

Over the past thirty years, ARB, local air districts, and federal air pollution control programs have made substantial progress towards improving air quality in California. This progress has reduced the exposure of California's residents to air pollution.

The emissions reductions resulting from the adoption of the proposed regulations and amendments, described in detail above, will help reduce public exposure to toxic exhaust emissions from the heavy-duty vehicles that operate throughout the State. The reductions should be particularly helpful in environmental justice communities, which, due to their proximity to roadways and industrial facilities, often experience relatively high volumes of heavy-duty truck traffic (U.S. EPA, 2003).

VIII. List of Acronyms and Abbreviations

AB	Assembly Bill
a/c	Air conditioning
ABT	Averaging, banking and trading
APS	Auxiliary power system
ARB	Air Resources Board
ATCM	Airborne Toxic Control Measure
BACT	Best Available Control Technology
Board	Air Resources Board
CA	California
CAA	Clean Air Act
CCR	California Code of Regulations
CD	Coefficient of drag
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CH4	Methane
CLD	Chemiluminescence detector
CNG	Compressed natural gas
CO	Carbon monoxide
CO2	Carbon dioxide
CRR	Coefficient of rolling resistance
DERA	Diesel Emission Reduction Act
DOC	Diesel oxidation catalyst
DPF	Diesel particulate filter
ECM	Engine control module
EGR	Exhaust gas recirculation
EMA	*Engine Manufacturers Association v. South Coast Air Quality Management District*
EMFAC	Emission Factors (model)
EPA	Environmental Protection Agency
FCL	Family certification limit
FEL	Family emission limit
FR	Federal Register
FTP	Federal test procedure
g/bhp-hr	Grams per brake horsepower –hour
g/mile	Grams emitted per mile travelled
g/ton-mile	Grams emitted from carrying a ton of cargo over a distance of one mile
GEM	Greenhouse gas emissions model
GHG	Greenhouse gas(es)
GVWR	Gross vehicle weight rating
GWP	Global warming potential
HC	Hydrocarbon
HCCI	Homogeneous charge compression ignition

HD	Heavy-duty
HDDE	Heavy-duty diesel engine
HDV	Heavy-duty vehicle
HFC	Hydrofluorocarbons
HHD	Heavy heavy-duty
HSC	Health and Safety Code
HVIP	Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project
ISOR	Initial Statement of Reasons
LHD	Light heavy-duty
LNT	Lean NOx trap
LNG	Liquefied natural gas
LPG	Liquefied petroleum gas
LRR	Low rolling resistance
MHD	Medium heavy-duty
MMT	Million metric tons (separate from MMTCO2e)
MMTCO2e	Million metric tons carbon dioxide equivalent
MY	Model year
NAAQS	National Ambient Air Quality Standard
NHTSA	National Highway Traffic Safety Administration
NMHC	Non-methane hydrocarbon
N20	Nitrous oxide
NOx	Oxides of nitrogen
OBD	On-board diagnostics
Phase 1	Greenhouse Gas Emission Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles
PM	Particulate matter
PM2.5	Particles up to 2.5 microns in diameter
ppm	Parts per million
PUV	Pickup trucks and vans
RIA	Regulatory Impact Analysis
SAE	Society of Automotive Engineers
SB	Senate Bill
SCAQMD	South Coast Air Quality Management District
SCGC	Southern California Gas Company
SCR	Selective catalytic reduction
SET	Supplemental emission test
SIP	State Implementation Plan
TAC	Toxic air contaminants
TPD	Tons per day
TT	Tractor-trailer
TWC	Three-way catalyst
ULSD	Ultra-low sulfur diesel
U.S. EPA	United States Environmental Protection Agency
VDECS	Verified diesel emission control strategy
VGT	Variable geometry turbocharger
VIP	Carl Moyer Voucher Incentive Program

VMT	Vehicular miles traveled
VV	Vocational vehicle
WF	Work factor

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