California Environmental Protection Agency

Air Resources Board

STAFF REPORT: INITIAL STATEMENT OF REASONS

NOTICE OF PUBLIC HEARING TO CONSIDER REQUIREMENTS TO REDUCE IDLING EMISSIONS FROM NEW AND IN-USE TRUCKS, BEGINNING IN 2008

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EXECUTIVE SUMMARY

California's plan for reducing reactive organic gases (ROG) and oxides of nitrogen (NOx), which contribute to both ozone and particulate matter (PM) formation, is set forth in the 2003 State and Federal Strategy for the California State Implementation Plan (2003 SIP). Diesel engines produce a significant portion of the state's air pollution and toxic emissions. Controlling these emissions is therefore an important element of California's strategy for attaining air quality standards and constitutes a significant part of the 2003 SIP. Staff's proposal reduces emissions resulting from the idle operation of diesel trucks, and is part of the 2003 SIP's proposed on-road heavy-duty vehicle control measure "ON-ROAD HEAVY DUTY 3". Staff's proposal will contribute to fulfillment of the committed emission reductions from this control measure.

Impacts of Idling

In California, emissions generated by idling trucks pose a significant air quality problem. Truck operators generally idle their engines at truck stops and rest areas during layover hours to provide heat or cooling to the sleeper berth, to operate on-board electrical accessories, to maintain battery charge, and to warm the engine for easy start-up during cold weather. Truck idling is also significant at warehouse/distribution centers and port terminals where loading and unloading freight require long waiting periods. The high density of idling trucks at such locations for extended periods of time can produce highly localized and concentrated emissions, which adversely affect the health of the drivers and the neighboring communities. The health concerns become more serious when these idling centers are located in low income communities that are already disproportionately impacted by air pollution. Truck idling also consumes fuel, produces greenhouse gas emissions, and increases engine maintenance costs.

Existing Regulations

The Air Resources Board (ARB) on December 12, 2002 adopted requirements that operators of school buses, transit buses, and other commercial vehicles manually shut off their engines upon arriving at a school. Restarting the engines is limited to no more than 30 seconds before departing. The ARB subsequently adopted at its public hearing of July 22, 2004 more general requirements to limit emissions from idling trucks and buses. Operators of commercial trucks and buses are required to manually shut off their engines before the idling time limit of five minutes is reached. However, this requirement does not apply to idling sleeper berth equipped trucks unless they are located within 100 feet from residential homes or schools.

Proposed Regulation

Staff's proposal would limit the amount of time sleeper berth equipped trucks are operated at idle and provide other options to accommodate driver comfort during times when the truck is not being driven. The proposal will also reduce fuel consumption and engine maintenance costs, thereby benefiting owners of compliant trucks. The proposal consists of two major components, affecting new engines and trucks, and existing engines and trucks.

Proposed Requirements for New Trucks

The new engine requirements apply to 2008 and subsequent model year diesel engines in trucks with a gross vehicle weight rating greater than 14,000 pounds. The proposal requires that they be equipped with a non-programmable engine shutdown system that automatically shuts down the engine after five minutes of continuous idling. The system would activate when the truck is stopped, the transmission is set in the "neutral" or "park" position, and the parking brake is engaged. If the parking brake is not engaged, the shutdown system would automatically shut down the engine after 15 minutes of continuous idling. This avoids undesirable or frequent engine shutdowns, such as when a truck is stopped in traffic congestion. In addition, the proposal allows the driver to reset the engine shutdown system timer as long as he or she is present inside the truck. It also includes override provisions when the engine is operating power take-off equipment.

Trucks with an engine that utilizes the idle shutdown system would need to provide other methods for heating/cooling the cabin and powering accessories when the truck is not being driven. To meet those needs the truck manufacturer may install an auxiliary power system (APS), fuel-fired heater, thermal energy storage system, and/or a power inverter/charger with an electrically driven heating and air conditioning system. These systems are currently commercially available.

If cab comfort devices such as those listed above are not offered by the engine or truck manufacturer, the owner may choose to equip his/her truck with *aftermarket* cab comfort devices. Other alternatives include parking at a truck stop that offers an off-board air conditioning or heating system, such as offered by IdleAire Technologies.

To avoid incorporating a new engine shutdown system, an engine manufacturer may certify an engine to a NOx idling emission standard of 30 grams per hour. This option is proposed because it may be possible to control NOx emissions during idling. However, this option isn't likely to become available prior to 2010 because that is when more advanced NOx controls are expected to be used for all heavy-duty engines.

If manufacturers succeed in developing engines which meet the NOx idling emission standard, operators would be allowed to idle the main engine continuously to provide cab comfort and electrical power during rest periods, and would not need to install alternative cab comfort devices. However, they would still be subject to the existing five minute idling restriction when the truck is located within 100 feet of a restricted area.

The proposed new engine requirements do not apply to gasoline engines or engines produced for use in buses (commercial buses as well as school buses), and recreational vehicles.

Proposed Requirements for Existing Trucks
Starting on January 1, 2008, operators of sleeper berth equipped trucks would be required to shut down their engines before a five-minute idle time limit is reached. This would apply to trucks registered in California and out-of-state.

Owners of pre-2008 model year sleeper berth equipped trucks where drivers rest for extended periods in California, may need to retrofit their trucks to provide cab comfort during these rest periods. These cab comfort devices include, but are not limited to, APSs, fuel-fired heaters, thermal energy storage systems, and power inverter/chargers with electrically driven heating and air conditioning systems. Owners may also choose to park at a truck stop and plug in to on-shore electrical power to run an on-board electrically driven climate control system and accessories or use an off-board air conditioning or heating system, such as offered by IdleAire Technologies.

Owners of 2008 and subsequent model year sleeper berth equipped trucks may also need to retrofit their trucks to provide cab comfort for rest periods if cab comfort devices are not offered by the engine or truck manufacturer at the time the truck is initially offered for sale.

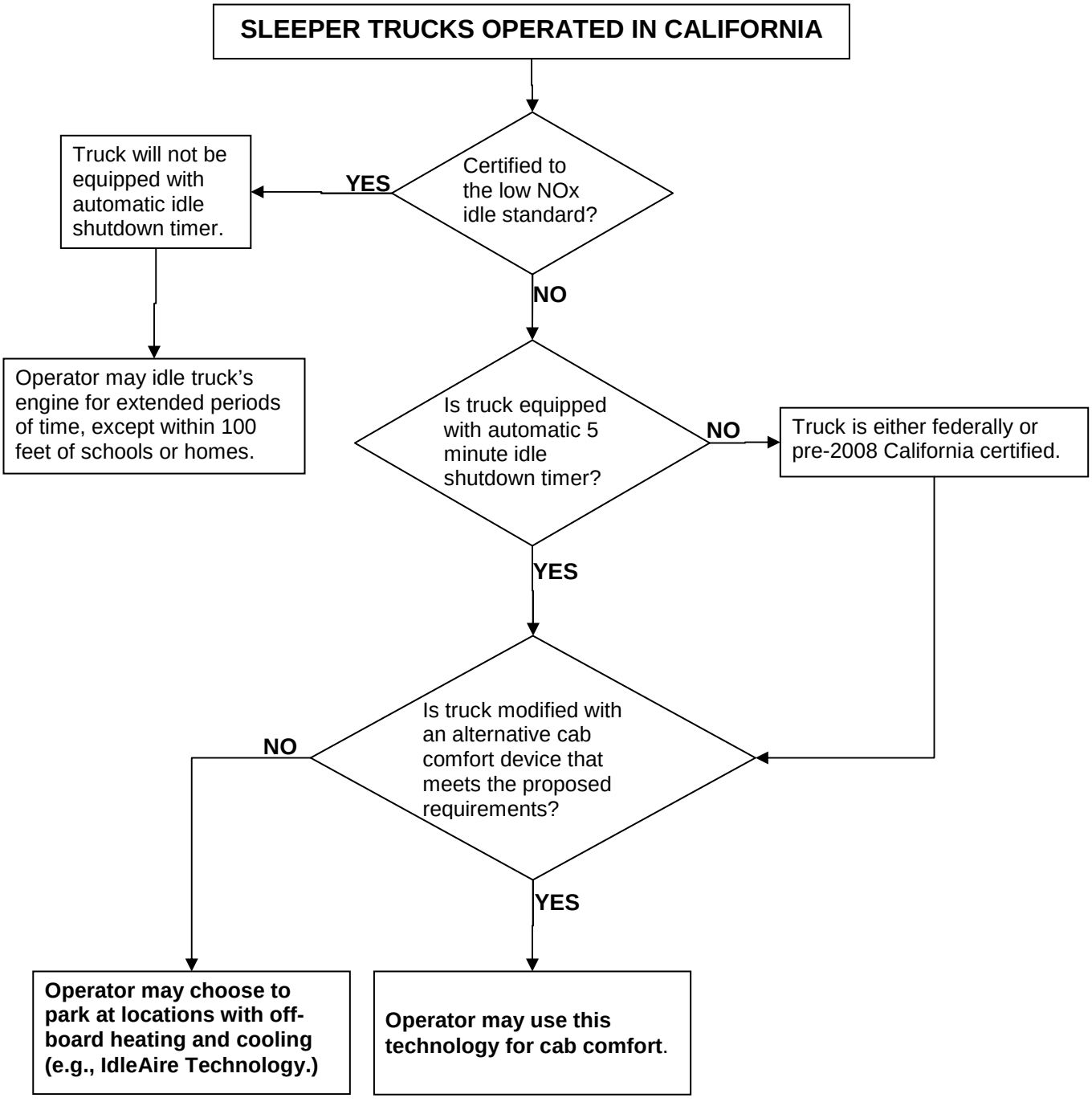
Proposed Emission Performance Requirements for Cab Comfort Devices
Some of the cab comfort devices, such as internal combustion APSs and fuel-fired heaters, produce emissions. Performance requirements are proposed for these systems which differ depending on whether the truck's engine is a 2007 or later model.

All APS engines will have to be certified to the off-road emission standards. Currently available APSs are already doing this. Beginning in 2008, trucks with 2007 and subsequent model year engines equipped with a PM filter, or "trap", will have the additional requirement to either route the APS's exhaust through the PM trap of the main truck engine or to retrofit the APS separately with a "level 3" PM reducing device (likely to be a PM trap) which achieves an 85% reduction in emissions. Because of warranty issues, staff believes connecting main engine and APS exhaust systems together to control PM emissions will occur at the engine or truck manufacturer level rather than by aftermarket APS manufacturers.

Trucks equipped with 2006 or older model year engines do not have PM aftertreatment systems and so owners may use a diesel-fueled APS without adding PM control devices.

Beginning in 2008, all 2007 and subsequent model year trucks equipped with fuel-fired heaters will need to comply with the fuel-fired heater emissions requirements specified in the Low Emission Vehicle Program to operate in California. Several manufacturers currently produce fuel-fired heaters for heavy-duty trucks that meet the proposed requirement.

The following flow chart summarizes in general staff's proposed requirements and their impacts on truck operators.


SLEEPER TRUCKS OPERATED IN CALIFORNIA
Certified to the low NOx idle standard?
YES
Truck will not be equipped with automatic idle shutdown timer.
NO
Operator may idle truck's engine for extended periods of time, except within 100 feet of schools or homes.
Is truck equipped with automatic 5 minute idle shutdown timer?
NO
Truck is either federally or pre-2008 California certified.
YES
Is truck modified with an alternative cab comfort device that meets the proposed requirements?
NO
YES
Operator may choose to park at locations with off-board heating and cooling (e.g., IdleAire Technology.)
Operator may use this technology for cab comfort.

Proposed Label Requirements
Beginning in 2008, trucks equipped with 2007 and subsequent model year PM-trap equipped engines and meeting the NOx idling emission standard or equipped with an internal combustion APS will be required to have a label affixed to the hood of the truck in order for these engines to operate during rest periods in California. The label requirements are being proposed to help enforce the idling requirements in the field by enforcement personnel.

Economic Impacts to Businesses
When the proposed amendments to the new engine and in-use idling ATCM requirements take effect in 2008, trucking businesses that own or purchase new trucks with sleeper berths may incur additional expenses due to the need to buy cab comfort devices to provide sleeper berth climate control and power for accessories. Similarly, owners of out-of-state trucks that frequently operate in California may also need to buy cab comfort devices to provide sleeper berth climate control and power for accessories. However, these expenses will be offset by the savings resulting from reduced fuel use and reduced maintenance requirements. Staff estimates these additional costs can be recovered within 1 to 2.5 years, depending on the number of idle hours reduced and the type of technology used. Therefore, overall the proposed requirements will benefit truck owners and operators because of reduced operating costs.

Air Quality Impacts and Cost-Effectiveness
To estimate the emission reductions from the proposal, staff assumed pre-2007 model year sleeper berth equipped California and out-of-state trucks will use California certified off-road or federally certified non-road diesel-fueled APSs and that diesel-fueled APSs retrofitted with a level 3 verified PM control strategy will be used for 2007 and subsequent model year sleeper berth equipped California and out-of-state trucks. Statewide emission reductions are estimated to be approximately 46 tons per day (tpd) of NOx, 4.2 tpd of ROG, 1930 tpd (0.7 million tons per year) of carbon dioxide (CO_2), and 0.42 tpd of PM emissions in 2010. For the South Coast Air Basin, the corresponding emission reductions are estimated as 18 tpd of NOx, 1.6 tpd of ROG, 740 tpd (0.3 million tons per year) of CO_2, and 0.15 tpd of PM in 2010.

Staff's proposal is expected to provide a cost savings to truck owners over the useful life of the cab comfort device by reducing the amount of fuel consumed and the truck's maintenance requirements. Under these circumstances, the emission reductions would be "free", and the cost-effectiveness could not be calculated. If cost savings were set to zero as a worst case, cost-effectiveness can be estimated and compared to other emission control regulations adopted by the ARB.

For a 2008 and subsequent model year California certified truck equipped with a non-programmable engine shutdown system which uses a diesel fueled APS with a level 3 verified PM trap, the cost-effectiveness is estimated to be $2.00 per pound of NOx plus ROG reduced.

For a 2007 model year truck, the engine would not have the automatic shutdown system but the truck would have a PM trap. Thus, use of an APS would subject it to the 2008 requirement. Retrofitting a 2007 truck with a diesel-fueled APS with a level 3 verified PM trap produces a cost-effectiveness estimate of $1.98 per pound of NOx plus ROG reduced.

For a 2006 and older model year California truck equipped with a certified diesel-fueled APS with no additional PM control, the cost-effectiveness is estimated to be $1.44 per pound of NOx plus ROG reduced.

Fleets have a distribution of truck model years. Taking this into account produces a fleet average cost-effectiveness estimated to be $1.51 per pound of NOx plus ROG reduced in 2008. These worst-case estimates all compare favorably to the cost-effectiveness of other ARB regulations recently adopted.

I. INTRODUCTION

Over the last thirty years, the California Air Resources Board (ARB or the "Board") has adopted a number of emission control regulations that have resulted in significant emission reductions from both on- and off-road mobile sources. While these regulations have greatly improved air quality, many regions of California continue to exceed state and federal air quality standards for ozone and fine particulate matter. Therefore, more measures need to be taken to improve California's air quality and to protect the health of its citizens.

California's plan for reducing the reactive organic gases (ROG) and oxides of nitrogen (NOx) emissions that contribute to both ozone and particulate matter (PM) formation, is set forth in the 2003 State and Federal Strategy for the California State Implementation Plan (2003 SIP).

In 2010, on-road heavy-duty diesel trucks are estimated to account for as much as 28 percent, or 559 tons per day (tpd), of the statewide mobile source NOx emission inventory and nine percent, or 12 tpd, of the statewide mobile source PM emission inventory[1]. This is of particular concern since these estimates already take into account the stringent 2007 on-road heavy-duty diesel engine (HDDE) exhaust emission standards recently adopted by the ARB and the United States Environmental Protection Agency (U.S. EPA). Therefore, more reductions are needed from these sources.

The proposed regulation has two related, yet distinct, goals. One goal is to reduce idling emissions primarily from new sleeper berth equipped trucks (hereinafter referred to as "sleeper trucks") starting with the 2008 model year. Specifically, the proposed regulation would require new trucks to meet an emissions standard when idling or have a timer system that would automatically shut the engine off after five minutes of continuous idling. The manufacturers using timers may provide heating and cooling for driver comfort using an alternative technology such as an auxiliary power system (APS). Such an alternative technology would have to be comparable, from an emissions standpoint, to the proposed idling requirements.

The other goal of staff's proposal targets the existing fleet of sleeper trucks, registered in both California and out-of-state. For these trucks, the proposed regulation would require the truck operator to manually shut down his/her engine after five minutes of continuous idling. To provide for cab comfort, the operator may choose to retrofit his/her truck with an alternative technology such as an APS which meets specific emissions standards. A more detailed description of staff's proposal is provided below.

Staff's proposal amends sections 1956.8 and 2485 of title 13, California Code of Regulations (CCR). Section 1956.8 of the CCR specifies exhaust emissions standards and test procedures applicable to 1985 and subsequent model year HDDEs. Staff's

[1] Based on California Almanac Emissions Projection Data (Published 2005). Idle emissions from heavy-duty diesel vehicles were adjusted to reflect revised average idle times for medium heavy-duty diesel vehicles.

proposal would modify this section by requiring new 2008 and subsequent model year on-road diesel engines with a gross vehicle weight rating (GVWR) greater than 14,000 pounds to be equipped with an engine shutdown system that automatically shuts down the engine after five minutes of continuous idling. In lieu of the engine shutdown system requirement, manufacturers may optionally certify their engines to a NOx idling emission standard of 30 grams per hour under loaded, low and high idle operating conditions. For purposes of discussion in this document, staff's proposed modifications to section 1956.8 are hereinafter referred to as "new engine requirements".

Section 2485 of the CCR is an airborne toxic control measure (ATCM) that limits idling to no more than five minutes for in-use diesel-fueled commercial vehicles with a GVWR greater than 10,000 pounds. However, the ATCM currently exempts sleeper trucks when the operator is resting in the sleeper berth and idling the main engine for climate control or to power on-board accessories. Starting in 2008, staff's proposal would extend section 2485's applicability to existing and future sleeper trucks. For purposes of discussion in this document, staff's proposed modifications to section 2485 are hereinafter referred to as "in-use idling ATCM requirements".

The proposal also allows the use of alternative technologies to supply power needed for cab/sleeper comfort and/or other on-board accessories that would otherwise have been generated by the continuous idling of the truck's main engine. These technologies include, but are not limited to, internal combustion engine driven APSs and fuel-fired heaters. Such technologies would need to comply with defined performance requirements set forth in this proposal to operate in California and are also supported by the proposed modifications to section 2402, 2424, and 2425 of the CCR. Other technologies that do not directly produce emissions, such as battery electric APSs, fuel cell APSs, thermal energy storage devices, and power inverter chargers for use with battery and grid-supplied electricity are also allowed. Any technology that is not identified in this proposal may also be used provided it is approved by the Executive Officer. The use of these devices in lieu of operating the truck's main engine at idle will result in significant NOx and carbon dioxide (CO_2) emission reductions. Reductions in ROG and PM emissions are also expected, but to a lesser degree, depending on the alternative technology used.

The following chapters of the staff report provide background information, a summary of the proposed amendments, regulatory alternatives evaluated, an economic impact analysis, environmental impact and cost-effectiveness analysis, and conclusions and recommendations.

II. BACKGROUND

This chapter provides an overview of the applicable vehicle classes included in this proposal, a brief description of the truck idling concern, associated emissions, existing regulations, and the 2003 SIP commitments.

A. VEHICLE CLASSES

The proposed new diesel engine requirements apply to trucks with a GVWR greater than 14,000 pounds. Examples of trucks subject to the proposal are line-haul trucks, delivery trucks, trash trucks, bulk-hauling trucks, tankers, utility trucks, and construction vehicles.

The proposed changes to the in-use idling ATCM apply to sleeper trucks with a GVWR greater than 10,000 pounds. The majority of the sleeper trucks are in the heavy-heavy duty diesel vehicle class category (over 33,000 pounds GVWR).

B. TRUCK IDLING EMISSIONS CONCERNS

Emissions from idling trucks pose a significant air quality problem. Idling emissions are particularly significant at locations such as truck stops, travel centers, rest areas, and at warehouse/distribution centers and port terminals where loading and unloading freight require long waiting periods. Such locations can experience a very high density of trucks idling together for extended periods of time, thereby producing highly localized and concentrated emissions. These emissions affect the health of the drivers, truck stop, warehouse, and ports personnel, and the neighboring community. The health concerns in particular become more serious when such locations are located in low income communities that are already disproportionately impacted by air pollution.

C. EXTENT OF IDLING

Diesel trucks operate significant periods of time at idle. The amount of idling varies widely among trucks depending on season, location, company policy, and driver needs. The U.S. EPA estimates a typical long haul sleeper truck to idle approximately 2,400 hours over the course of a year (U.S. EPA, 2004). While a report by the United States Department of Energy (Stodolsky et al., 2000) estimates that long-haul sleeper trucks idle for about 1,800 hours per year. Based on these studies, staff used the average of the U.S. EPA and the Department of Energy estimates, and thus has assumed that sleeper trucks idle for 2,100 hours per year. Normalized over 365 days, the average idling time is therefore assumed to be approximately six hours per day.

The reasons for truck idling vary greatly. Drivers often operate their engines at idle to provide cab climate control, to power on-board accessories and/or to keep the engine warm to avoid cold-start problems during winter months. Many drivers of sleeper and non-sleeper trucks also operate the main engine at idle for extended periods of time simply because of habit and to mask outside noise. But according to a pilot survey on

truck idling trends conducted in Northern California, the majority of drivers operate their engines at idle mainly for heating (67 percent) and air conditioning (83 percent) purposes (Brodrick et al., 2001). These survey results suggest that if heating and air conditioning can be maintained using an alternative idle reduction strategy, truck idling emissions in California can be significantly reduced.

D. FUEL CONSUMPTION

Besides generating emissions, engine idling also increases fuel consumption, engine wear and maintenance costs. Studies have shown that during idling, trucks consume approximately 0.4 to 1.6 gallons per hour of fuel depending on engine size, engine speed, heating, air conditioning and electrical loads (Lambert et al., 2001; Lim, 2002). It should also be noted that during idle operation, drivers sometimes operate their engines at elevated engine speeds to provide more power to operate climate control devices and on-board accessories, to reduce cab noise and vibration, and to reduce engine wear associated with low speed idling. Tests have also shown that as engine speed increases, fuel consumption increases proportionally (Lambert et al., 2001; Lim, 2002). Assuming an average fuel consumption of one gallon per hour for an idling diesel truck engine, staff estimates that in 2005 the diesel fuel consumption due to idling of California registered sleeper trucks is approximately 162,000 gallons per day statewide.

E. EMISSIONS INVENTORY

Diesel trucks are major contributors to California's air quality problems. On a per truck basis, they emit relatively high levels of NOx and PM emissions, both of which contribute to serious public health problems. As previously mentioned, it is projected that in 2010, both California and out-of-state registered diesel trucks will contribute approximately 28 percent of the statewide mobile source NOx emissions and nine percent of the statewide mobile source PM emissions.

California's emissions inventory model, EMAFC2002 version 2.2, estimates that, in 2010, the number of diesel tucks (GVWR greater than 33,000 pounds) on the road on a typical day in California to be approximately 180,000 and that 25 percent of these trucks come from out-of-state. Furthermore, based on an analysis of the 2002 Vehicle Inventory and Use Survey database (U.S. Census Bureau, 2005) 20 percent of the California registered diesel trucks are estimated to be sleepers. The majority of the out-of-state trucks are sleeper trucks idling for an extended period of time. Staff assumes that 90 percent of the out-of-state diesel trucks in California are sleepers.

Thus, statewide emissions in 2010 from extended idling of California registered sleeper trucks are estimated to be 20 tpd of NOx and 0.39 tpd of PM emissions. Similarly for the South Coast Air Basin, the 2010 idling emissions from California registered sleeper trucks are estimated to be approximately 8 tpd of NOx and 0.14 tpd of PM emissions.

Statewide emissions in 2010 from extended idling of out-of-state sleeper trucks are estimated to be 33 tpd NOx and 0.34 tpd of PM emissions. Similarly for the South

Coast Air Basin, the 2010 idling emissions from out-of-state trucks are estimated to be approximately 13 tpd of NOx and 0.12 tpd of PM emissions.

F. EXISTING REGULATIONS

ARB's 2004 diesel engine standards reduced NOx emissions from these engines by 50 percent from the 1998 levels (ARB, 1998a). ARB's 2007/2010 diesel engine aftertreatment forcing emission standards will reduce both NOx and PM emissions from new engines by another 90 percent (ARB, 2001a). In addition, California also has a heavy-duty vehicle inspection program aimed at reducing emissions from the existing fleet[2].

While ARB has successfully adopted regulations to reduce emissions from heavy-duty diesel engines, it has not, until recently, specifically sought to control idling emissions. In December of 2002, ARB adopted an ATCM to limit school bus idling at or near schools[3]. This ATCM requires a driver of a school bus, transit bus, or other commercial vehicle to manually turn off the bus or vehicle engine upon arriving at a school and to restart it no more than 30 seconds before departing. In July 2004, ARB adopted an in-use idling ATCM that limits idling of diesel-fueled commercial vehicles and buses to no more than five minutes[4]. However, this ATCM does not apply to idling sleeper trucks that are located further than 100 feet from any restricted area (residential homes and schools).

Section 40720 of the Health and Safety Code requires marine terminals to limit truck idling to no longer than 30 minutes. Failure to comply with this requirement subjects the marine terminal to a fine of $250 per vehicle per violation. The local air pollution control district with jurisdiction over the terminal has the responsibility of enforcing this requirement.

The ARB has also initiated voluntary incentive and demonstration programs to reduce idling. For example, the Carl Moyer Program[5] promotes the introduction of APSs as an idle reduction device for sleeper trucks by providing monetary incentives for the installation costs of APSs. In addition, ARB also provides funds to accelerate the deployment of truck stop electrification. One such grant, for example, is the $2 million grant fund awarded to IdleAire to subsidize the use of 200 new advanced truck stop electrification spaces in the San Joaquin Valley.

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[2] California currently has two heavy-duty vehicle inspection programs, the Heavy-Duty Vehicle Inspection Program (HDVIP) and the Periodic Smoke Inspection Program (PSIP). Under the HDVIP, heavy-duty diesel trucks and buses are tested for excessive smoke emissions and inspected for tampering at random roadside locations, weigh stations and fleet facilities. The PSIP compliments the HDVIP by requiring California-based truck and bus fleets with two or more HDDVs to annually test their own vehicles to measure smoke opacity and to check for tampering. Title 13, California Code of Regulations sections 2180 et seq. and 2190 et seq., respectively.

[3] Title 13, California Code of Regulations, section 2480.

[4] Title 13, California Code of Regulations, section 2485.

[5] An ARB program, implemented in 2000, that provides incentive money to help promote the introduction of emission reduction technologies into California.

G. STATE IMPLEMENTATION PLAN (SIP)

Although many of the measures in the 1994 ozone SIP have been adopted, federal air quality standards will not be attained in many areas of the state by the statutory deadlines. As a result, ARB updated the 1994 SIP and generated a revised 2003 SIP. The 2003 SIP includes new measures to further reduce emissions and to move towards achieving the federal air quality standards for ozone and PM. One on-road heavy-duty vehicle measure contained in the 2003 SIP is measure "ON-ROAD HEAVY-DUTY-3." This measure in turn consists of several other control measures such as PM In-Use Emission Control, Engine Software Upgrade, On-Board Diagnostics, Manufacturers' In-Use Compliance, and Reduced Idling. It commits to achieve between 1.4 and 4.5 tpd of ROG reductions and between 8 and 11 tpd of NOx reductions in the South Coast Air Basin in 2010. This proposal is part of measure ON-ROAD HEAVY-DUTY-3 and will contribute towards fulfillment of the committed emission reductions in the 2003 SIP.

III. NEED FOR CONTROL

As previously mentioned, on-road heavy-duty diesel trucks contribute significantly to the statewide NOx and PM emissions inventory. NOx is one of the two primary contributors to the formation of ozone and contributes to serious public health issues (ARB, 2001b). Diesel PM has been identified by ARB as a toxic air contaminant based on its potential to cause cancer (ARB, 1998b), and can also result in other serious health problems such as asthma and reduced lung function (ARB, 2001b).

Besides generating excess ROG, NOx, CO and PM emissions, unnecessary engine idling also produces undesirable CO_2 emissions. CO_2 is one of the major greenhouse gas emissions responsible for global warming (ARB, 2002b).

Staff's proposal would significantly reduce NOx emissions and associated health risks by reducing the time sleeper trucks are operated at idle. The benefits from this proposal are particularly significant in low-income communities located close to truck stops, travel centers, rest areas, ports, warehouse/distribution centers, and other locations where extended truck idling activity occurs. The proposal will also help reduce CO_2 emissions and the state's dependence on foreign oil (via reduced fuel consumption). It will also result in a net benefit for trucking businesses over the useful life of the truck by saving money through improved fuel economy and reduced maintenance requirements.

IV. SUMMARY OF PROPOSED REQUIREMENTS

Staff recommends the Board amend Sections 1956.8, 2404, 2424, 2425, and 2485 of title 13, CCR, and the incorporated "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles", as set forth in Appendices A and B. Staff's proposal consists of two major components, affecting new engines and trucks, and existing engines and trucks. The component that targets new engines and trucks would require engine manufacturers to install on new 2008 and subsequent model year engines a non-programmable engine shutdown system or optionally certify engines to a low NOx idling emission limit. The second component involves changes to the in-use idling ATCM and affects existing as well as future sleeper trucks. The proposed changes would require operators of sleeper trucks to comply with the existing five minute idling restriction, beginning in 2008. The following sections discuss each element of the proposal in detail, including impacts on truck owners and operators, and the available options.

A. PROPOSED NEW ENGINE REQUIREMENTS

i. Applicability

The proposed new engine requirements apply to new California certified 2008 and subsequent model year diesel engines installed in trucks with a GVWR greater than 14,000 pounds.

The proposed new engine requirements do not apply to gasoline engines or engines produced for use in buses (commercial buses as well as school buses), and recreational vehicles. Gasoline fueled vehicles are excluded because the hot and cold start emissions associated with gasoline engines could cancel out or even exceed the benefits from reduced idling. Commercial buses and school buses are excluded because they have large volumes and window areas that necessitate operating the vehicle's main engine to power an air conditioning system with high heating and/or cooling capacity. The majority of recreational vehicles sold in California are gasoline-fueled and are equipped with generators[6]. Their contribution to idling emissions is negligible and thus these vehicles are also excluded from the proposed requirements.

ii. Engine Shutdown System

The effectiveness of anti-idling measures is largely dependent on the effectiveness of California's enforcement of such measures. However, effective enforcement of anti-idling measures is challenging since it requires considerable enforcement resources throughout the state. Staff believes that anti-idling rules can be an effective emission control strategy, if in addition to enforcement, engine technologies are also used. For example, a truck equipped with an engine that automatically shuts down after a

[6] According the Recreational Vehicle Industry Association, approximately 95 percent of the recreational vehicles sold in California in 2002 are equipped with generators (RVIA, 2003). Based on EMFAC2002 ver2.2, 93 percent of these vehicles are gasoline-fueled (ARB, 2003).

prescribed time period without the assistance of the operator can ensure compliance with statewide in-use idle requirements without depending solely on enforcement personnel. Requiring a non-programmable engine shutdown system on all new engines would significantly reduce extended idling of both new sleeper and non-sleeper trucks, and will help ensure compliance with the statewide in-use idling ATCM rule. As these new trucks eventually replace the older trucks, the resources needed for an effective idling enforcement program will be significantly reduced.

The proposed new engine requirements would require engine manufacturers to install, on new California certified 2008 and subsequent model year diesel engines, an engine shutdown system that automatically turns the engine off after five minutes of continuous idle operation, or, as an option, control engine emissions during extended idling (discussed in section iii below). Engines equipped with the engine shutdown system must have systems that are tamper resistant and non-programmable and must include the following provisions.

Conditions for Shutdown

The engine shutdown system must automatically activate when the truck comes to a stop, the transmission is set in the “neutral” or “park” position, and the parking brake is engaged. Upon activation, the system will shut down the engine after five minutes of continuous engine operation at idle. The requirement that the parking brake be engaged as a condition for the system’s activation eliminates the possibility of undesirable engine shutdown, such as when the truck is stopped in traffic idling for more than five minutes. However, there is a possibility that drivers may use this feature to override the engine shutdown system. That is, a driver could park a truck without engaging the parking brake and operate the engine at idle indefinitely. To prevent this, the proposal would require that the engine shutdown system be activated and shut down the engine after 15 minutes of continuous idling if the parking brake is not engaged but the truck is stopped and the transmission is in neutral or in park.

Engine Shutdown Reset

The truck operator would be allowed to reset the engine shutdown system timer before engine shutdown. A warning signal, such as a light or sound indicator inside the truck cabin, may be used to alert the operator up to 30 seconds prior to engine shutdown. The operator could then reset the engine shutdown system by momentarily changing the position of the accelerator, clutch, or brake pedal or any other mechanism only during the last 30 seconds of the five-minute shutdown time limit (or the last 30 seconds of the 15 minutes when the parking brake is not engaged). This will allow the truck operator to continue operating the engine at idle as long as the truck is being driven.

Power Take-Off Devices

The engine shutdown system could be overridden when the engine is operating power take-off (PTO) equipment. A PTO device uses the truck's engine to transfer power to auxiliary equipment. So during periods when the truck's engine is "working" while it is idling, the engine shutdown system would not be activated. Examples of trucks with PTO equipment include trash trucks, cement mixers, mobile cranes, dump trucks, and vehicles with conveyors or other loading or unloading devices. The proposal does not consider equipment such as the truck's air conditioning system and on-board accessories (e.g., a television, microwave, etc.,) as PTO equipment.

Engine Warm Up

The engine shutdown system could also be overridden to warm up the engine if the engine coolant temperature is below 60°F. Thus, the engine shutdown timer would be activated once the coolant temperature reaches 60°F. The engine coolant temperature must be measured using the engine's existing engine coolant temperature sensor designed for engine protection. However, a manufacturer may request the Executive Officer's approval to use other methods of measuring the engine coolant temperature.

Enforcement Mechanism

To discourage tampering and to detect malfunctions of engines, the Board, in July of 2005, adopted On-Board Diagnostic (OBD) system requirements for heavy-duty trucks that will include monitoring of all emission control systems, including tracking the truck engine run time at idle and monitoring proper performance of sensors controlling the engine shutdown system. The OBD system requirements will be implemented starting with 2010 and later model year diesel engines and will monitor the proper function of the engine shutdown system. The OBD system will log fault codes if any sensor malfunctions. The fault codes can then be downloaded from the OBD system and inspected by ARB field inspectors in current or future heavy-duty truck roadside inspection programs. Field inspectors that connect to the truck's OBD system will also be able to analyze the amount of engine run time at idle, providing another way to evaluate whether the engine shutdown system is malfunctioning or has been tampered with.

Furthermore, because engine manufacturers must include a statement in their applications for certification that their engines will comply with the engine shutdown system requirement, violations of this requirement are enforceable through applicable penalty provisions of the Health and Safety Code.

iii. Optional NOx Idling Emission Standard

During the development of this proposal, several engine manufacturers indicated that NOx aftertreatment devices may to some degree reduce NOx idling emissions[7] and requested an option to certify engines to a new NOx idling emission standard as an alternative to meeting the engine shutdown system requirements. Another method suggested by the manufacturers was to take advantage of other strategies, such as advanced combustion processes or operational controls such as cylinder deactivation, to reduce NOx emissions during idling.

To accommodate the engine manufacturer's request, staff's proposal includes an optional NOx idling emission standard and test procedure. To determine the appropriate emission standard, staff evaluated currently available technologies that could provide all the operator needs as an alternative cab comfort device. Staff identified the diesel-fueled APS as the most likely and cost-effective cab comfort technology in 2008, when this proposal is to be implemented. The standard was based on the average NOx emission level of 2005 certification test data of off-road diesel engines used in APSs (engines with power ratings between 5 to 19 kilowatts). The proposed standard takes into account what the average NOx emissions levels will be over the useful life of the engine by incorporating a deterioration factor as part of the certification emission level. Staff's analysis resulted in a proposed optional NOx emission standard of 30 grams per hour. This standard is based on an APS providing 5 kilowatts of power, typically the peak power demand to provide all the necessary cab comfort and on-board accessory demands. The 30 grams per hour standard will provide significant NOx emission reduction, when comparing average NOx idling emissions of 165 grams per hour from late model truck engines, and will be equivalent to trucks operating a diesel-fueled APS as an alternative cab comfort device. A truck equipped with an engine certified to the optional NOx idling emission standard would also be required to have a label affixed to its hood that would permit the truck engine to idle beyond the five-minute idle time limit requirement imposed by the amendments made to the in-use idling ATCM (discussed in section B below).

The test procedure was developed to account for the varied operation of truck engines at idle. Typically, truck operators elevate the idle speed to provide more power for cab comfort and accessory devices. Higher engine speed also reduces truck vibration when idling and thus provides more comfort for the operator during rest periods. The test procedure requires engine testing at "curb idle" and at 1100 revolutions per minute (rpm) idle speed, under loaded and unloaded conditions (described in more detail below).

[7] NOx aftertreatment devices, such as NOx adsorbers, typically operate most efficiently when exhaust temperatures are above 200°C (MECA, 2000). Exhaust temperatures during extended idling typically reach no more than 150°C (Hallstrom, 2005). Thus, while it is known that NOx adsorbers can significantly reduce NOx emissions, it is unclear at this time what level of reductions can be achieved by using NOx adsorbers during extended idling conditions.

Certification Test Procedure

The proposed test cycle for demonstrating compliance with the optional NOx idling standard utilizes an engine dynamometer operated in accordance with a 2-mode steady-state test cycle summarized in Table 1. Staff believes this test cycle accurately represents the range of sleeper and non-sleeper truck idling operations commonly practiced by truck operators.

Mode 1 involves operating the engine at its manufacturer's recommended curb idle speed. An engine load is applied and must include truck power demands for operating engine accessories, such as the engine cooling fan, alternator, coolant pump, air compressor, engine oil and fuel pumps and any other engine accessory operated during engine curb idle. Mode 1 does not include truck power demands to operate the air conditioning compressor or on-board electrical accessories such as a television, refrigerator, microwave, computer, etc.

Mode 2 involves operating the engine on a dynamometer at a speed of 1100 rpm. The engine load applied must include truck power demands to operate engine accessories at 1100 rpm, power demands to operate the air conditioning compressor at maximum capacity, and an additional load of 2kW to account for power demands for operating on-board accessories such as a television, refrigerator, microwave, computer, etc.

Table 1: Certification Test Cycle

Mode	Engine Speed (rpm)[a]	Time in mode (seconds)	Engine Load
1	Manufacturer Recommended Curb idle	1800	Vehicle power demands to operate engine accessories at curb idle. Engine accessories include, but are not limited to, cooling fan, alternator, fuel and oil pumps, coolant pump, air compressor, etc., (excluding air conditioning compressor and on-board accessories)
2	1100	1800	Vehicle power demands to operate (1) engine accessories (same as for mode 1) at 1100 rpm, (2) the air conditioning compressor operating at maximum capacity, and (3) an additional 2 kW to take into account on-board electrical accessories such as television, computer, etc.

[a] revolutions per minute

Exhaust emissions measurements are taken under hot stabilized conditions. If the engine is cold, the engine would be preconditioned prior to taking any emission measurements by operating it on an engine dynamometer at any speed above peak-torque speed and between 65 to 85% of mapped power until the engine coolant temperature stabilizes. Once the engine coolant temperature stabilizes, emission measurements would be taken continuously for a minimum of 30 minutes for each mode. For each test mode, modal average emissions are then calculated for each regulated pollutant. The calculated average NOx emissions must then be less than 30 grams per hour. Further details on this procedure can be found in Appendix B.

iv. Impact on Truck Operators

2008 and Subsequent Model Year California Certified Truck Engines

If the truck engine is equipped with the non-programmable engine shutdown system, the truck operator would not be able to idle the truck engine for long periods of time, regardless of whether the truck operator's engine idling needs occur in California or out-of-state. This means that sleeper trucks equipped with the engine shutdown system would need to provide other methods for heating/cooling the cabin and powering accessories when the truck is not being driven and the operator is resting in the sleeper berth. Currently available methods include the use of an internal combustion APS, battery electric APS, fuel-fired heater, thermal energy storage system, and/or a power inverter charger with an electrically driven air conditioning system. The engine or truck manufacturer may equip the truck with such a cab comfort device. If not offered by the manufacturer, the owner may choose to equip his/her truck with an aftermarket cab comfort device. However, in order to operate in California, cab comfort devices that produce emissions would need to comply with defined performance requirements set forth in this proposal (see section C.i., below). Other alternatives, that do not require installation of any cab comfort device, include parking at a truck stop that offers an off-board air conditioning, heating and power, such as offered by IdleAire Technologies (see section C.ii.2., below).

If an owner purchases a truck equipped with a diesel engine meeting the optional NOx idling emission standard, the engine would not have an engine shutdown system. Operators of such trucks would be allowed to idle the main engine continuously to provide cab comfort and electrical power during rest periods and would not need to install alternative cab comfort devices. However, they would still be subject to the existing five minute idling restriction when the truck is located within 100 feet of a restricted area and the truck would be required to have a label affixed to its hood (see section D, Label Requirements). It should be noted that staff does not expect this option to become widely available to truck owners/operators before the 2010 timeframe since NOx aftertreatment devices are not anticipated to be employed until 2010 and other engine idling controls/strategies have not yet been fully demonstrated.

2008 and Subsequent Model Year Federally Certified Truck Engines

It is expected that most of the 2008 and subsequent model year out-of-state trucks will be equipped with a federally certified truck engine that does not incorporate the non-programmable engine shutdown system requirements or meet the optional NOx idling emission standard. Operators of such trucks would be able to operate their truck engine continuously at idle outside of California. However, they would not be able to continuously idle their truck engine in California as he/she would also be subject to the five minute idling restriction under the proposed changes to the in-use idling ATCM requirements, discussed in section B, below. As a result, 2008 and subsequent model year federally certified trucks that operate and rest for extended periods in California would also need an alternative cab comfort device to provide for cab cooling/heating and power for accessories during these rest periods. These cab comfort devices are the same as the ones identified above for California certified trucks, and include an internal combustion APS, battery electric APS, fuel-fired heater, thermal energy storage system, and/or a power inverter charger with an electrically driven air conditioning system. Other alternatives, that do not require installation of any cab comfort device, include parking at a truck stop that offers off-board air conditioning, heating and power, such as offered by IdleAire Technologies. Similarly as required for California certified truck engines, in order to operate in California, cab comfort devices that produce emissions would also need to comply with defined performance requirements set forth in this proposal (see section C below for details). Also, to comply with the in-use idling ATCM requirements, a truck equipped with internal combustion engine APS will be required to have a label affixed to the hood of the truck in order to operate the APS in California (see section D below for details).

B. PROPOSED AMENDMENTS TO IN-USE IDLING ATCM AFFECTING EXISTING TRUCKS

i. Applicability

The proposed amendments to the in-use idling ATCM apply to existing and future sleeper trucks greater than 10,000 pounds GVWR, beginning in January 1, 2008. The in-use idling ATCM also applies to out-of-state registered trucks that operate in California. Emergency vehicles performing emergency services, military tactical vehicles during training, and vehicles with engines operating power take-off (PTO) equipment (a more detailed description of a PTO device is provided in section A.ii of this Chapter) are exempted. Other exemptions are specified in the existing in-use idling ATCM, section 2485 of the CCR.

ii. Idling Restriction

The existing in-use idling ATCM, section 2485 of the CCR, prohibits the driver of a diesel-fueled commercial truck with a GVWR greater than 10,000 pounds from idling the truck's main engine for more than five minutes at any location. The existing rule

exempts sleeper trucks from this prohibition if they are located more than 100 feet from a restricted area. This exemption was provided at the time the rule was adopted because although staff had identified the diesel-fueled APS as a reliable cab comfort technology that would provide emission benefits on 2006 and older model year trucks, there were unresolved issues related to what these benefits might be when compared to "cleaner" 2007 and subsequent model year trucks. Therefore, staff recommended to the Board to delay consideration of sleeper trucks until 2005 in order to thoroughly evaluate all commercially available options to main engine idling.

Staff is now proposing to remove this exemption so that sleeper trucks would have to comply with the five-minute idling restriction at all times and at any location starting on January 1, 2008. Staff's proposal to remove the exemption is based on the current availability of cost-effective alternatives to truck idling and the resulting emission benefits.

Starting in 2007, trucks will be "cleaner" as a result of new emission standards that will reduce PM emissions by 90 percent or more using exhaust aftertreatment devices such as particulate traps. However, when the proposed no-idling requirements take effect in 2008, diesel-fueled APSs will be certified to the Tier 4 off-road standards, which are less stringent than the 2007 aftertreatment based diesel PM emission standards. Thus, to control the expected excess PM emissions that may result from operating a diesel-fueled APS as an alternative to idling the truck's trap-equipped engine, the proposal requires, starting January 1, 2008, that diesel-fueled APSs installed on trucks equipped with 2007 and subsequent model year diesel engines be retrofitted with a PM control strategy verified as a "level 3" device (i.e., achieve 85% PM reduction efficiency). Based on discussions with PM trap manufacturers, staff also believes that the proposed additional PM control requirement for diesel-fueled APSs is feasible within the timeframe of the proposed regulation.

Staff's proposal also allows the use of other strategies in combination with a diesel-fueled APS that result in an equivalent reduction in PM emissions. This could include, for example, installing a power inverter/charger with an electrically driven air conditioning and heating system in combination with the use of a diesel-fueled APS. A truck equipped with such an APS would also be required to have a label affixed to its hood to operate the APS. As previously mentioned, the labeling requirements are described in Section D of this chapter.

PM emissions from Tier 4 certified APSs are usually lower or, at worst, are the same as idling PM emissions from 2006 or older model year truck engines[8]. Therefore, the proposal allows the use of any Tier 4 certified APS with no additional PM emission control requirements with pre-2007 model year truck engines.

[8] A Tier 4 certified diesel-fueled APS emitting at the certification PM emission standard of 0.4 g/kW-hour and providing an average power of 2.7 kW produces about 1.08 grams per hour of PM emissions. This is lower than the estimated average idling PM emission rate of 1.59 grams per hour for a 2006 model year truck engine.

iii. Impact on Truck Operators

The proposed changes to the in-use idling ATCM will apply to existing and future sleeper trucks, including those registered out-of-state. Starting on January 1, 2008, it will require operators of sleeper trucks to shut down their engine before the five-minute idle time limit is reached and will affect truck operators of California and federal certified engines in different ways. The discussion that follows provides details on how truck operators will be impacted. Following the discussion, a summary of these impacts is graphically depicted in two flow chart diagrams, Figures 1, 2 and 3.

Operators of 2008 and Subsequent Model Year California Certified Diesel Engines

Under staff's proposal, California certified trucks with 2008 and subsequent model year diesel engines will be equipped with either 1) a non-programmable engine shutdown system, or 2) an engine certified to the optional NOx idling emission standard.

Trucks equipped with the engine shutdown system will automatically shut down the engine after five minutes of continuous idling, regardless of whether the truck is in California or in another state. In cases where owners of such trucks rest for extended periods (such as owners of sleeper trucks), it is likely that the owner will want to equip his/her truck with cab comfort devices. Currently available cab comfort devices include the use of an internal combustion APS, battery electric APS, fuel-fired heater, thermal energy storage system, and/or a power inverter charger with an electrically driven air conditioning system. The engine or truck manufacturer may equip the truck with such a cab comfort device. If not offered by the manufacturer, the owner may choose to equip his/her truck with an *aftermarket* cab comfort device. However, in order to operate in California, cab comfort devices that produce emissions would need to comply with defined performance requirements set forth in this proposal (see section C.i., below). Also, to comply with the in-use idling ATCM requirements, a truck equipped with an internal combustion engine APS will be required to have a label affixed to the hood of the truck in order to operate the APS in California. Other alternatives, that do not require installation of any cab comfort device, include parking at a truck stop that offers off-board air conditioning, heating, and power, such as offered by IdleAire Technologies (see section C.ii.2., below).

Trucks equipped with engines certified to the optional NOx idling emission standard will not be equipped with an automatic engine shutdown system. Those trucks will not shut down during continuous idling and will not require the owner to have any alternative cab comfort device installed when he/she rests in their truck during layover hours. Thus, the operator of such a truck will not be required to change the way they currently operate their truck during layover hours. However, to comply with the in-use idling ATCM requirements in California, the engine or truck manufacturer will need to ensure that a label is provided and properly affixed to the hood of the truck in order to operate the main engine at idle for more than five minutes.

Also, all 2008 and subsequent model year trucks equipped with fuel-fired heaters will be required to meet the LEV II fuel-fired heater emission requirements (see section C below) to operate them in California.

Operators of 2008 and Subsequent Model Year Federal Certified Diesel Engines

Trucks equipped with federal certified engines will not be equipped with an automatic engine shutdown system or have engines that meet the optional NOx idling emission standard. Those trucks will not shut down during continuous idling and will not be affected by staff's proposal when they are operated outside of California. However, when operating in California, the operators will also be subject to the in-use idling ATCM requirements. The in-use idling ATCM rule will require the operator of a federally certified truck to manually shut down his/her engine after five minutes of idling. Thus, operators of out-of-state trucks that want to rest in their truck during layover hours in California will need an alternative cab comfort device to provide for cab cooling/heating and power for accessories during these rest periods. These cab comfort devices are the same as the ones identified above for California certified trucks, and include an internal combustion APS, battery electric APS, fuel-fired heater, thermal energy storage system, and/or a power inverter charger with an electrically driven air conditioning system. Other alternatives, that do not require installation of any cab comfort device, include parking at a truck stop that offers off-board air conditioning, heating and power, such as offered by IdleAire Technologies.

Similarly as required for 2008 and subsequent model year California certified trucks, in order to operate in California, cab comfort devices that produce emissions would also need to comply with defined performance requirements set forth in this proposal (see section C below for details). A truck equipped with an internal combustion engine APS will be required to have a label affixed to the hood of the truck in order to operate the APS in California.

Also, all 2008 and subsequent model year trucks equipped with fuel-fired heaters will be required to meet the LEV II fuel-fired heater emission requirements (see section C below) to operate them in California.

Operators of 2007 Model Year California or Federal Certified Diesel Engines

Beginning in 2008, operators of trucks equipped with California or federal certified 2007 model year diesel engines will be required to manually shut down their idling engines after five minutes in California to comply with staff's proposed amendments to the in-use idling ATCM rule. These trucks will not be equipped with a non-programmable engine shutdown system, nor will they be equipped with engines meeting the optional NOx idling emission standards. Owners will need to retrofit their truck with a cab comfort device if they plan to rest in their truck during layover hours in California. Currently available cab comfort devices, as previously mentioned include the use of an internal combustion APS, battery electric APS, fuel-fired heater, thermal energy storage system, and/or a power inverter charger with an electrically driven air conditioning system.

Other alternatives, that do not require installation of any cab comfort device, include parking at a truck stop that offers off-board air conditioning, heating, and power, such as offered by IdleAire Technologies (see section C.ii.2., below).

Because a truck equipped with a 2007 model year diesel engine is also equipped with a PM aftertreatment system, an owner who chooses to install a diesel-fueled APS as a cab comfort device will also need to make sure the APS meets additional PM emission control requirements, specified in section C below, if it is to be operated in California. This requirement is meant to prevent an over-all increase in PM emissions from trucks equipped with 2007 diesel engines if owners choose to meet the proposed in-use idling ATCM by installing a diesel-fueled APS. A truck equipped with an internal combustion engine APS will be required to have a label affixed to the hood of the truck in order to operate the APS in California.

Also, beginning in 2008, all 2007 model year trucks equipped with fuel-fired heaters will be required to meet the LEV II fuel-fired heater emission requirements (see section C below) to operate them in California.

Operators of 2006 and Older Model Year California or Federal Certified Diesel Engines

Beginning in 2008, operators of trucks equipped with California or federal certified 2006 and older model year diesel engines will be required to manually shut down their idling engines after five minutes in California to comply with staff's proposed amendments to the in-use idling ATCM rule. These trucks will not be equipped with a non-programmable engine shutdown system, nor will they be equipped with engines meeting the optional NOx idling emission standards. As with owners of 2007 trucks, owners of 2006 and older trucks will need to retrofit their truck with a cab comfort device if they plan to rest in their truck during layover hours in California. As previously mentioned, currently available cab comfort devices include the use of an internal combustion APS, battery electric APS, fuel-fired heater, thermal energy storage system, and/or a power inverter charger with an electrically driven air conditioning system. Other alternatives, that do not require installation of any cab comfort device, include parking at a truck stop that offers an off-board air conditioning, heating, and power, such as offered by IdleAire Technologies (see section C.ii.2., below).

Unlike the requirements for 2007 and subsequent model year PM trap-equipped trucks, owners of trucks with 2006 and older model year diesel engines who choose to install diesel-fueled APSs will not need to comply with any additional PM emission requirements. As previously mentioned, this is because trucks equipped with 2006 and older model year diesel engines are not equipped with a PM aftertreatment system and thus the PM idling emissions from those engines are the same or greater than the emissions from diesel-fueled APSs. Also, 2006 and older trucks will not be required to have a label on the truck hood to operate their APS. For those trucks equipped with fuel-fired heaters, they will also not be required to meet the LEV II fuel-fired heater emission requirements.

As previously mentioned, the following flow chart diagrams (Figures 1, 2, and 3) graphically summarize how truck operators will be impacted by staff's proposal. As shown, the impacts will differ somewhat, depending on the model year of the truck/engine and whether the truck is registered in California or out-of-state.

Figure 1: Impacts on Operators - 2008 or Newer California Truck

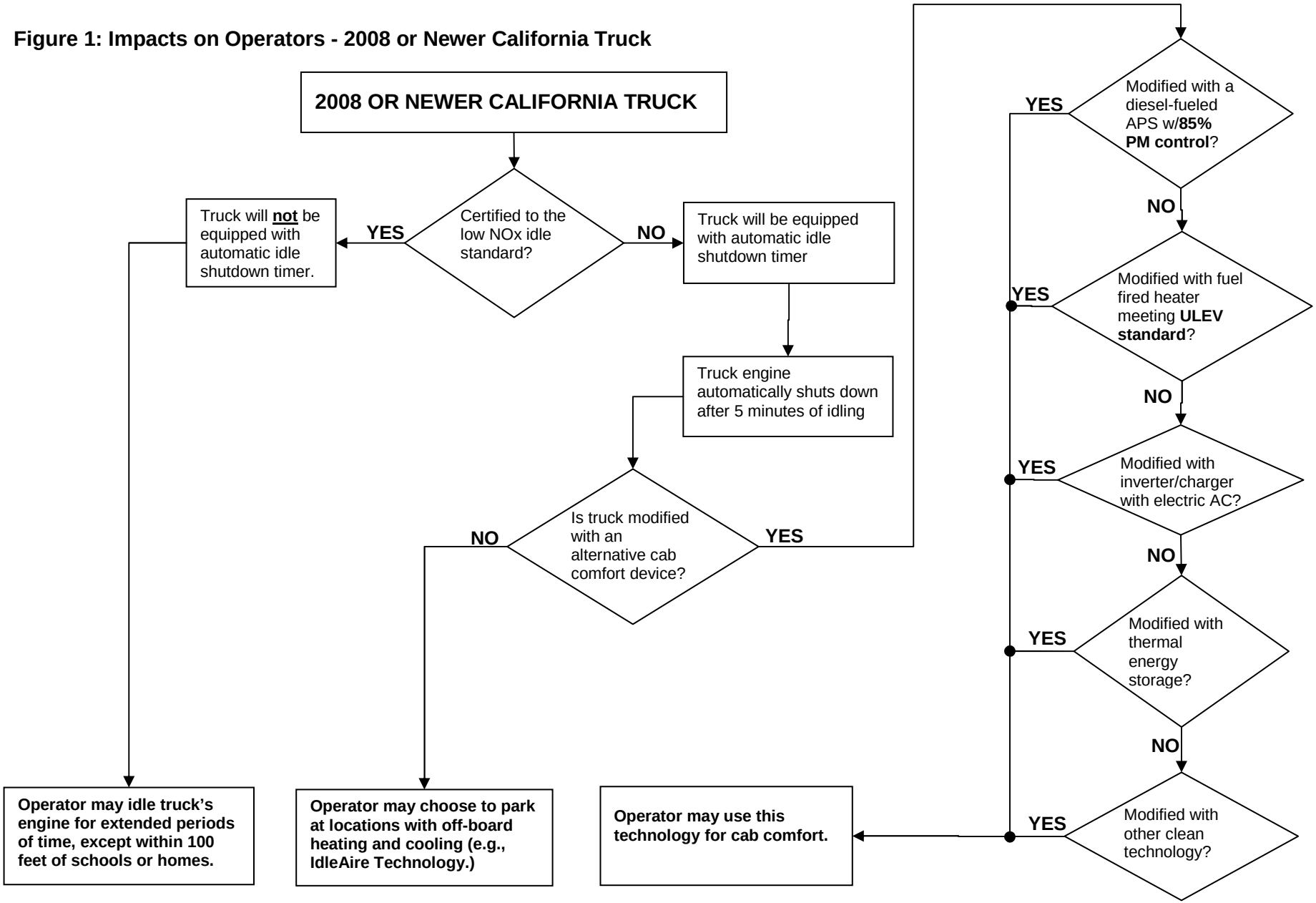


Figure 2: Impacts on Operators –
2007 and Newer Out-of-State Trucks and 2007 California Trucks

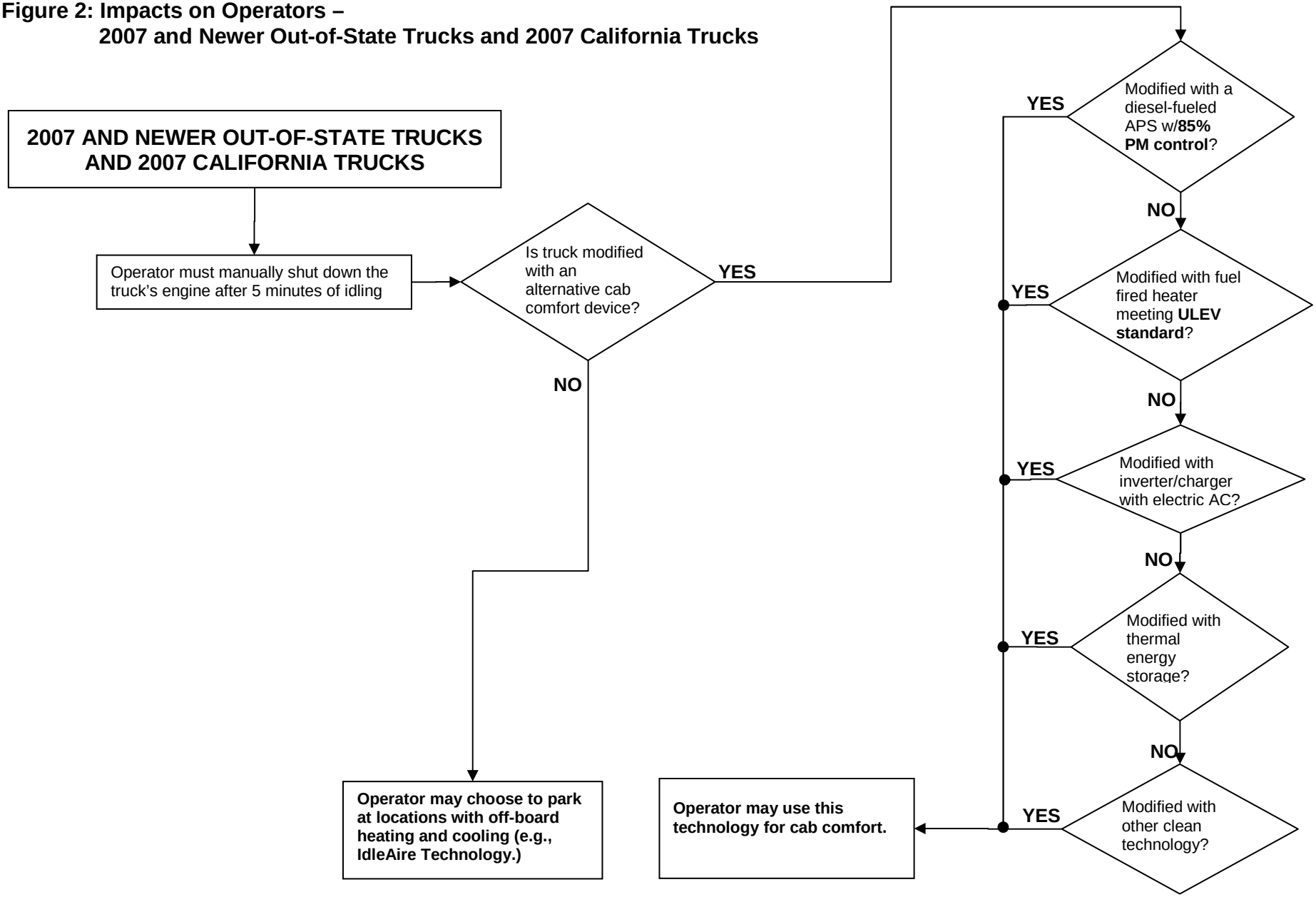
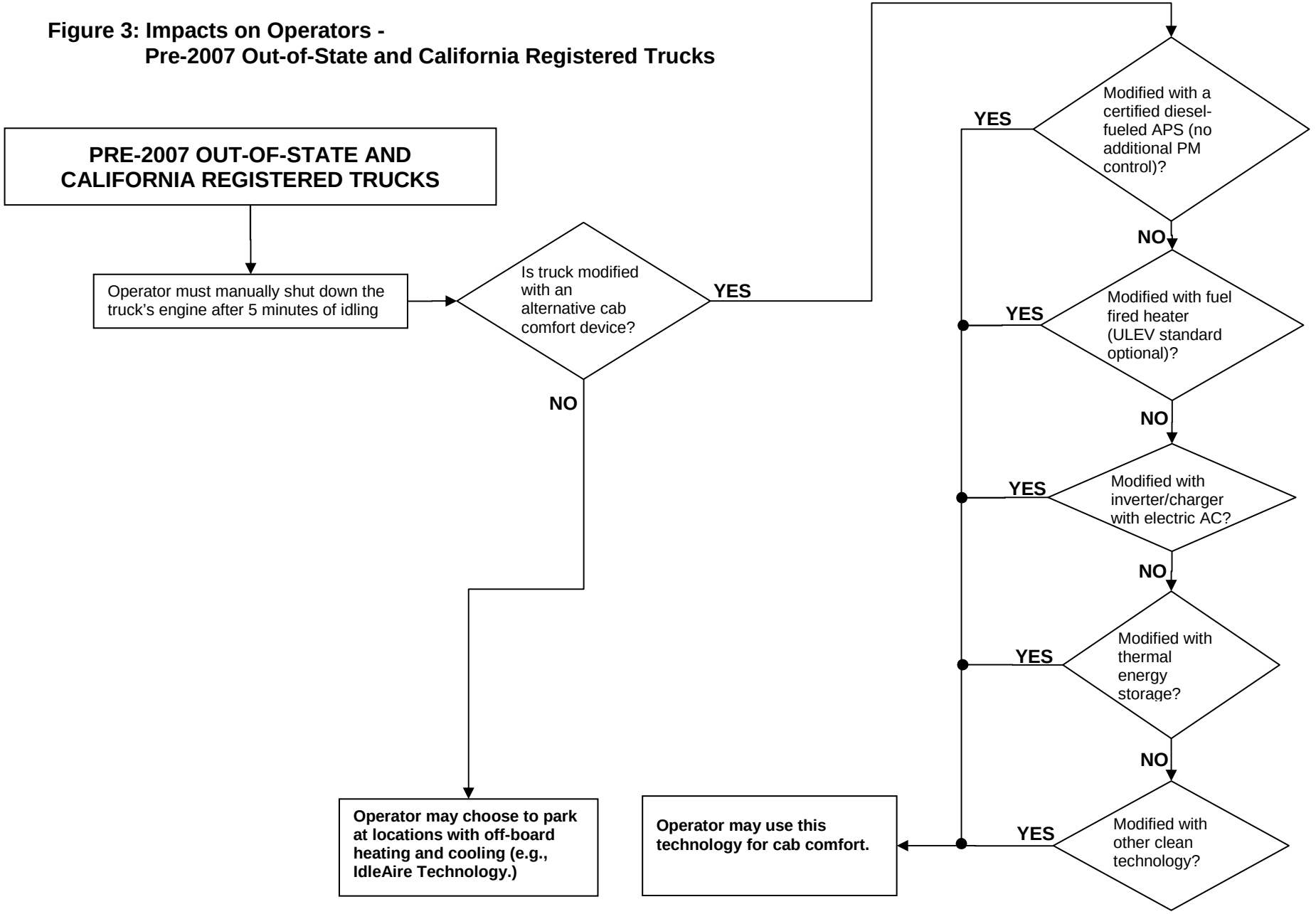


Figure 3: Impacts on Operators -
Pre-2007 Out-of-State and California Registered Trucks



C. PROPOSED EMISSION PERFORMANCE REQUIREMENTS FOR CAB COMFORT DEVICES

When the proposed in-use idling and new engine requirements take effect in 2008, staff expects operators of sleeper trucks will use some type of alternative cab comfort technology to provide power for sleeper berth climate control, engine heating, and electrical power to charge batteries and operate on-board accessories. Some of the commonly used, presently commercially available cab comfort technologies capable of providing some or all of this power include devices such as an internal combustion APS, battery electric APS, fuel-fired heater, thermal energy storage system, and/or a power inverter charger and electrically driven air conditioning system with truck stop electrification[9] (U.S. EPA, 2005). The proposal allows the use of such alternative cab comfort devices. However, some of these devices have associated emissions that must be evaluated and compared to emissions generated from the main engine under idling conditions to ensure the devices do not emit greater emissions than operating the main engine. Thus, staff proposes the following emissions performance requirements for some of the cab comfort devices.

Auxiliary Power Systems

In order to operate in California, internal combustion engines used in APSs must currently comply with applicable California off-road or federal non-road emission standards and test procedures for their fuel type and horsepower category. Staff proposes that diesel-fueled APSs installed on PM trap-equipped 2007 and subsequent model year diesel trucks must also meet additional PM controls because PM emissions from Tier 4 certified off-road diesel engines (less than 19 kW ratings) are expected to be higher than the PM emissions from an idling PM trap-equipped 2007 model year diesel engine[10]. Therefore, diesel-fueled APSs installed on trucks equipped with 2007 and subsequent model year diesel engines will be required to control emissions by either equipping the APS with a level 3[11] verified PM control strategy or by integrating the APS's exhaust system with that of the truck's so that the APS's PM emissions are controlled by the truck's PM trap. Subject to the Executive Officer's advance approval, manufacturers may also use other procedures to demonstrate an equivalent level of emissions compliance (compared to a level 3 verified PM control strategy).

Battery electric and fuel cell APSs have recently been developed and are inherently emissions free. Battery electric APSs, in particular, are currently commercially available and can provide the same performance as diesel-fueled

[9] A comprehensive list with detailed information of commercially available alternative technologies is available at the U.S. EPA website at http://www.epa.gov/otaq/smartway/idlingtechnologies.htm.

[10] 2007 and subsequent model year on-road HDDEs must comply with a PM exhaust emission standard of 0.01 gram per brake-horsepower-hour.

[11] The PM trap verification procedure and in particular, the level 3 verification level, are specified in sections 2700 to 2710 of title 13, CCR.

APSs. For example, Idling Solutions 9000 is a heavy-duty battery powered APS reportedly capable of providing power for cab comfort and on-board accessories for 8 to 15 hours between charges. Approximately 120 of these systems are currently installed on various fleets including J.B. Hunt Transportation Services, Swift Transportation, John Christner Trucking, Motor Lines, Inc., Wild West Express, etc. (Jay, 2005). Fuel cell APSs are presently not commercially available but are being demonstrated with some truck fleets.

Fuel-Fired Heaters

Beginning in 2008, staff proposes that 2007 and subsequent model year trucks operate only fuel-fired heaters that comply with the requirements specified in the Low Emissions Vehicle program (LEV II) regulations[12] in California. The LEV II regulations require fuel-fired heaters to meet the Ultra Low Emission Vehicle exhaust emission standards for light duty vehicles. However, unlike the LEV II program requirement that limits the operation of fuel-fired heaters to ambient temperatures of 40ºF or less, the proposed regulation would allow the operation of fuel-fired heaters at any ambient temperature. Several manufacturers currently produce fuel-fired heaters for heavy-duty trucks that meet the proposed requirement.

Other Idle Reduction Devices

In addition to the above mentioned technologies, other devices may also be used to supply power that would otherwise be generated by idling the truck's main engine. Such devices could include, for example, thermal energy storage devices or power inverter chargers for use with batteries and/or grid supplied electricity. Other devices, not identified here, could also be used, subject to the Executive Officer's advance approval.

D. LABELING REQUIREMENTS

Engine Labeling Requirements

In order to clearly identify compliant diesel engines, staff proposes that each truck engine be equipped with a permanent label indicating that the subject engine complies with the California regulations. Currently, engine manufacturers produce the same engine for all 50 states and therefore produce and affix the same engine label on all diesel engines. The existing engine label indicates that the engine conforms to both U.S. EPA and California regulations. Staff's proposed requirement would not modify a manufacturer's existing engine labeling practice for diesel engines sold in California, but will indirectly require a modification of the engine label placed on federally certified diesel engines for sale outside of California, unless federally certified engines also

[12] The standards are specified in title 13, CCR, section 1961(a)(15) and (d), or in Part I.E.1.13 of the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" (adopted August 5, 1999, last amended in May 28, 2004)

comply with the proposed requirements. Therefore, unless federally certified diesel engines also meet the proposed requirements, engine labels for federally certified engines cannot state that the engine conforms to California regulations. This requirement is proposed to serve as an effective tool for in-use compliance testing and other enforcement programs.

Vehicle Labeling Requirements

The proposal would also require that engine manufacturers, original vehicle equipment manufacturers (OEM), or internal combustion engine APS manufacturers, as applicable, to produce and affix a standardized permanent label to the hood of the truck. This vehicle label would aide enforcement personnel in clearly and easily identifying diesel engines and diesel trucks equipped with APSs that comply with the proposed requirements. Staff therefore proposes that a standardized label be affixed on: (1) trucks equipped with an engine certified to the proposed optional NOx idling emission standard, and (2) trucks produced or retrofitted with an internal combustion engine APS that meets the proposed requirements applicable to APSs.

The standardized labels would be required to have the following characteristics:

1. oval in shape
2. minimum dimensions of 6 inches wide and 4 inches high
3. permanently attached and easily destroyed or defaced upon removal
4. includes a hologram (to prevent counterfeit labels)

Figures 4 and 5 are facsimiles of the proposed labels. Figure 6 shows an example of the hologram that would be embedded within the proposed labels. For new engines certified to the proposed optional NOx idling emission standard or engines equipped with an integrated engine-APS exhaust system for which the engine manufacturer is responsible, the engine manufacturer will be responsible for producing the labels and supplying them to the OEM. The OEM would then affix the label to the hood of the truck. For aftermarket internal combustion engine APSs that meet California requirements, the aftermarket manufacturer would be responsible for producing the label and affixing it to the hood of the truck if installed by the APS manufacturer. If the APS manufacturer does not install the APS, the APS manufacturer would supply the label to the party that installs the APS (OEM or any other APS installer).

Figure 4. Label for an engine meeting the optional NOx standard

Figure 5. Label for an APS with additional PM control

Figure 6. Hologram

V. TECHNOLOGICAL FEASIBILITY

Truck idling can be significantly reduced by using currently available idle control technologies. Some of these technologies can also provide sleeper/cab heating and cooling, heat for engine warming, and electrical power for battery charging and on-board accessories. Each technology has its advantages and drawbacks. These technologies include electronically controlled idle engine limiters, on-board auxiliary devices, and grid-supplied electrical power.

A. ENGINE SHUTDOWN DEVICES

Electronic engine shutdown devices are software based idle limit controls and are standard features in most commercially available on-road heavy-duty engines. These systems are built into the engine's electronic control software and enable the engine to shut down automatically if the engine idles more than the programmed time. For example, Detroit Diesel Corporation's system can be programmed to shut down automatically between 2 to 100 minutes, Cummins' system can be programmed to shut down between 2 to 1440 minutes, and Caterpillar's system can be programmed to shut down between 3 to 60 minutes. These systems can also electronically turn off the ignition switch to avoid battery discharge that may occur if accessories, such as lights and/or the radio, were left in the "on" position during engine shutdown. Although shutdown systems are available as standard features in modern electronically controlled engines, in most cases fleet owners and operators do not activate or program these systems to limit idling. All features of the engine shutdown system required by this proposal, such as overriding the system by pressing the gas or clutch pedal, overriding the system if the engine is in PTO mode, conditions for activation of the system, etc., are currently available in modern electronically controlled engines. Therefore, with only minor modifications in the programming of the electronic control software to prevent adjustment or tampering, the key requirement in staff's proposal can already be met with currently available engine shutdown systems.

B. OPTIONAL NOx IDLING STANDARD

The proposed optional NOx emission standard may be met with engines equipped with NOx catalysts. However, this may require a supplemental heat source to raise the exhaust temperatures to a level that would enable the catalyst to sufficiently reduce NOx emissions, since exhaust temperatures during extended idling are generally lower than the catalyst's light-off temperatures. Advanced combustion processes, operational controls such as cylinder deactivation and/or other idling emission control strategies may also be used to achieve the proposed NOx idling emission standard. An engine manufacturer would be required to demonstrate its engines' compliance with the proposed optional NOx idling standard, on average, using the test cycle described in section A of Chapter IV, without increasing other criteria pollutant emissions such as PM, ROG, and CO.

Staff does not expect that engine manufactures will certify to the optional NOx idling emission standard before the introduction of 2010 model year diesel engines. This is because, until that time, it is unlikely that manufacturers will equip their engines with NOx aftertreatment devices capable of meeting the proposed emission standard. Nevertheless, the option to certify to a NOx idling emission standard is being proposed at the request of several engine and truck manufacturers as an alternative to requiring a non-programmable engine shutdown system.

C. ALTERNATIVES TO IDLING

i. On-Board Auxiliary Devices

On-board auxiliary devices are truck mounted and can supply some or all of the power for necessities that would otherwise be generated by idling the truck's engine. The most widely used on-board auxiliary devices on sleeper trucks are diesel-fueled APSs, fuel-fired heaters, and inverter chargers. However, newer on-board based auxiliary devices are also currently being developed and introduced to the market. Examples include battery electric APSs and cold storage systems. Fuel cell-based APSs are also being developed and are currently in the demonstration stage.

1. Auxiliary Power Systems

Most currently available APSs use a small internal combustion engine equipped with a generator/alternator to provide climate control, heat to the engine for cold weather starting, 12-volt DC electrical power to charge the batteries and 110-volt AC power for on-board accessories. Most of the APSs currently used as alternatives to idling are diesel-fueled and typically use fuel from the truck's fuel system. The fuel consumption of diesel-fueled APSs ranges from 0.08 to 0.3 gal/hr (Stodolsky et al., 2000). This represents a significant fuel savings (and lower CO_2 emissions) compared to the truck's main engine idling fuel consumption rate of one gallon or more per hour for trucks (Lambert et al., 2001; Lim, 2002). Drawbacks to diesel APSs are their initial cost, additional weight, and maintenance requirements. The cost for an APS ranges from $5,000 to $8,000 (U.S. EPA, 2005). Opponents of this approach argue that the added weight of an APS reduces the capacity of the truck to carry a full load, resulting in the potential loss of revenue. The APS typically weighs 250 to 400 pounds, which is less than 0.5 percent of the 80,000 pounds a fully laden truck can weigh, so this impact is minor. APSs can have shorter maintenance intervals than the main engine, requiring the operator to modify its periodic maintenance schedules to include APS maintenance. Some engine manufacturers such as Cummins and Caterpillar are currently developing integrated main engine/APS systems that they expect to offer as factory options in 2006. Such systems are expected to significantly minimize the perceived APS drawbacks associated with the high initial cost, shorter maintenance intervals, and the added weight.

Currently, internal combustion engine APSs provide significant NOx emission reductions, ranging from 89 to 94 percent less than NOx emissions generated when the

truck's main engine is idling and the air conditioning system is engaged (Lim, 2002). Other criteria pollutants such as CO and ROG are also reduced. PM emissions may be greater or less than the main engine depending on the model year of the truck engine on which the APS is installed. That is, if the APS is installed on pre-2007 model truck engine, PM emissions are usually lower or, at worst, are the same as main engine idle emissions. However, diesel-fueled APSs installed on 2007 and subsequent model year PM trap-equipped truck engines are expected to produce higher PM emissions than the main engine. Therefore, staff is proposing additional diesel-fueled APS PM emission requirements for those APS engines installed on trucks with 2007 and subsequent model year diesel engines.

Staff's proposed PM emission reduction requirement could be met by retrofitting the APS with a level 3 verified particulate trap. The trap may require an active regeneration scheme, since the APS exhaust temperature may not be high enough for passive regeneration to occur. Based on verbal communication with a manufacturer developing PM traps for diesel engines less than 25 hp, it is likely that PM traps for APSs could be used to achieve the level 3 verification requirements with modifications. The modifications would require the design of an active system that would increase the exhaust temperature periodically to reduce the captured PM emissions. These PM trap systems are currently designed for applications in generator sets and transportation refrigeration units, but can readily be adapted for diesel-fueled APSs since they use the same engines and also operate in a similar way as generator sets.

Integration of main engine/APS exhaust systems and passing the APS exhaust through the trap of the main engine may also be used to control PM emissions from the APS. Because of warranty issues, staff believes integration of main engine/APS exhaust systems to occur at the engine or vehicle manufacturer level rather than by aftermarket APS manufacturers. The cost of retrofitting an APS with a diesel-particulate trap is estimated to be approximately $1,200 to $1,500 (Lambe, 2005). However, staff's analysis assumes a conservative incremental cost of $2,000 to comply with the additional PM requirements. With the current average diesel fuel prices of approximately $2.40 per gallon[13], the payback period is estimated to be 1.5 to 2.5 years for a truck that idles approximately 2,100 hours per year.

2. Fuel-Fired Heaters

Fuel-fired heaters are used to provide heat to the cab/sleeper berth and/or to preheat the engine block for easy engine start-up during cold weather. Different models exist for a variety of applications, such as pick-up trucks, buses, and marine vessels. They can operate 20 or more hours on a gallon of diesel fuel, and typically use the fuel from the truck's fuel tank. They are relatively small, inexpensive, and consume much less fuel than an idling truck engine. A report by the U.S. EPA estimates that compared to the truck's main engine, diesel fuel-fired heaters reduce NOx emissions by approximately 99 percent and fuel consumption (and CO_2 emissions) by 50 to 80 percent (U.S. EPA,

[13] Average weekly on-highway diesel price for the weeks from January 1 to August 1, 2005. (http://tonto.eia.doe.gov/oog/info/wohdp/diesel.asp)

2002). The only drawback of this technology is its inability to provide cooling. Costs of fuel-fired heaters range from $1,000 to $3,000 per unit (U.S. EPA, 2005).

For applications in light-duty and medium-duty vehicle classes, fuel-fired heaters must meet the Ultra Low Emission Vehicle (ULEV) standards found in the LEV II regulations (13 CCR 1961(a)(15) and (d)). Staff's proposed requirement that fuel-fired heaters meet the ULEV standards in sleeper trucks can be met with existing, commercially available, fuel-fired heaters, since many models used for sleeper truck applications are currently meeting the ULEV standards. For example, all of Espar's and Webasto's fuel-fired heaters currently meet the ULEV standards.

3. Battery Electric and Fuel cell APS

Battery electric APSs provide cooling and heating for sleeper berth climate control without the need to idle the main engine or operate a diesel powered APS. Such systems include an independent electrically driven heating and air-conditioning system and an inverter to provide 120 Volt AC electrical power for on-board accessories. They are capable of providing more than ten hours of continuous cab comfort between charges. Depending on the number of batteries installed and alternator capacity, such systems typically require two to six hours of charging time. Fuel consumption and emissions from the truck engine will increase slightly when the batteries are being charged during engine operation. However, the overall emissions from the truck will be reduced by eliminating the need to idle the truck engine during layover hours. The cost of the commercially available battery systems ranges between $4,000 to $10,000 per unit, the higher amount corresponding to a system with an advanced battery system (higher capacity and longer life), higher capacity heating and air conditioning system, and an inverter charger. Staff estimates that this system would pay for itself in 1 to 2.5 years. Examples of commercially available battery electric APS systems include Idling Solutions' Idling Solutions 9000 and Bergstrom's Nite System.

An auxiliary power source that appears to offer a promising possibility of eliminating truck idling emissions is the fuel cell APS. A fuel cell produces electricity by converting the chemical energy of fuel directly to electrical power in a controlled chemical reaction. Fuel cells are clean and efficient. They can provide sufficient power to heat or cool a cab/sleeper compartment and run on-board electrical equipment. However, technical and economic issues, such as availability and infrastructure of a suitable fuel, the production costs of the units, and integration of the units with other on-board truck systems need to be resolved before such systems can become cost-effective for commercial truck operators.

4. Thermal Energy Storage

Cold storage systems utilize the truck's air conditioning system to store cooling energy when the truck is operated which is later used to cool the sleeper berth when the truck is stopped and the driver is resting. Some aftermarket systems are currently, commercially available. These systems may be used in conjunction with a fuel-fired

heater to provide both heating and cooling. As with battery electric APSs, these systems must routinely be recharged (approximately 4 to 6 hours of truck operation is required). Also, fuel consumption will increase slightly due to the need to operate the air conditioning system compressor continuously. However, staff believes that the fuel savings from reducing idling of the main engine will offset this potential drawback. An example of a cold storage system that is currently commercially available is Webasto's BlueCool Truck system. The system costs, including installation, $3,600 per unit, or $4,600 if it includes a heater.

ii. On-Shore Electrical Power

The development of an electrical power infrastructure at truck stops and other locations is another option to reduce engine idling emissions. On-shore electrical power involves the electrification of truck parking spaces to provide power for heating, cooling and on-board accessories. It provides significant emissions benefits at the truck stop area or the site where it is installed. However, it is not available everywhere and may take many years before the system becomes widely available at truck stops. Even if such systems become widely available in the future, truck operators located away from such installations may still need an alternative cab comfort technology that is portable with the truck. There are currently two methods of using on-shore electrical power today. One method allows the truck to "plug-in" to the electrical power grid to power on-board air conditioning and heating systems, referred to as "on-board power infrastructure." The other method relies on heating and air conditioning provided at the location where the infrastructure is installed, referred to as "off-board power infrastructure."

1. On-Board Power Infrastructure

This technology provides trucks with 110-volt AC electrical power at truck stops, or other locations, to run the air conditioning, heating and on-board accessories. This requires truck stops to be equipped with electrical outlets throughout the parking spaces and trucks need to be equipped or retrofitted with inverter/chargers, electrical power connections and electrically driven heating and air conditioning units. The inverter/chargers are used to charge the truck batteries from grid supplied electricity and to convert the truck batteries' 12-volt DC to 120-volt AC power for all on-board accessories. The drawbacks of this system include the high initial infrastructure cost, cost for equipment add-ons to trucks, and its availability, which is limited to where the infrastructure is installed. The aftermarket cost for add-on parts and installation including inverter/chargers, electrical air conditioning system, wiring, outlets, circuit breakers, etc., is approximately $4,000 per truck (Perrot et al., 2004). Power infrastructure installation cost is approximately $3,500 to $6,000 per truck parking space depending on number of pedestals installed (Perrot et al., 2004). The payback period for the truck owner is estimated at about 1.5 years (Perrot et al., 2004)[14].

[14] The payback period was estimated assuming a diesel fuel cost of $1.50 per gallon and idling 1800 hours per year. With the current higher diesel fuel prices ($2.40 per gallon, California average for the weeks from January 1 to August 1, 2005) the payback period would be much shorter than the period estimated by Perrot.

2. Off-Board Power Infrastructure

An alternative to the on-board power infrastructure has been recently introduced by IdleAire Technologies. This system provides 110-volt AC electrical power for on-board accessories, an externally installed heating and air conditioning unit and hook-ups for basic telephone, internet and television (access to cable/satellite) services at each truck parking space. The unit is connected to the truck through a console installed to the truck window using a template insert. The console contains all the necessary connections and controls, including a card reader for the billing system. Currently, the basic services cost about $1.25 to $1.50 per hour. The drawbacks are the high infrastructure installation and maintenance costs and its availability limited to where the infrastructure is installed. The off-board power infrastructure installation cost is approximately $12,000 to $ 20,000 per parking space depending on the number of parking spaces installed (Antares, 2005). The advantage of this type of infrastructure is that the truck does not need to be modified with any alternative cab comfort technology, resulting in immediate benefits to the truck owner using the service through reduced fuel consumption and maintenance savings.

VI. REGULATORY ALTERNATIVES

Staff evaluated several alternatives to the proposed requirements. The first alternative considered was taking no action and solely relying on ARB's existing anti-idling regulatory programs and on voluntary compliance. The second alternative considered was requiring engine/vehicle manufacturers to either certify their engines to a low NOx idling emission standard or to install a compliant APS system on every sleeper truck sold in California. The third alternative considered was staff's current proposal except that the available heating and cooling options for sleeper trucks would be limited to zero emission alternative technologies such as battery electric APSs, fuel cells or truck stop electrification. A description of the alternatives and the rationale for rejecting them are as follows:

A. NO ACTION

This alternative would rely on educational and incentive programs to encourage sleeper truck owners and operators to *voluntarily* reduce idling and use cab comfort devices. It would not require engine shutdown systems on new trucks nor mandate the five-minute idle time limit on sleeper trucks.

Educational programs would require considerable on-going state resources, and the effectiveness of reducing idle emissions is unknown. ARB's Carl Moyer Program has offered incentives to reduce emissions from truck idling by encouraging the purchase and installation of cab comfort devices. It offers funds to cover APS installation costs of up to $1,600 per diesel-fueled APS installation and up to $3,100 per alternative fuel, electric motor, or fuel cell APS installation. To date no applications have been received for this incentive program. Although the cost of currently available cab comfort devices can be recovered within 1 to 2.5 years from fuel savings and reduced maintenance requirements, trucking businesses have not been motivated to use these technologies. Hence, the emission reductions expected from voluntary programs that target truck idling have not been realized. Staff therefore believes that reducing truck idling only through voluntary programs will not be sufficient to achieve ARB's emission reduction goals.

B. IN LIEU OF ENGINE SHUTDOWN SYSTEMS, *REQUIRE* ENGINE MANUFACTURERS TO CERTIFY ENGINES THAT MEET THE LOW IDLE EMISSION STANDARD OR BE EQUIPPED WITH A COMPLIANT APS. INCLUDE THE PROPOSED AMENDMENTS TO THE IN-USE IDLING ATCM AFFECTING SLEEPER TRUCKS

This alternative provides only two options for compliance. Beginning with 2008 model year diesel engines, an engine manufacturer would be required to either certify its main engine to the low NOx idling emission standard or to install an APS on all sleeper trucks sold in California. As in the proposed requirements, the engine's NOx idling emission standard would be comparable to that of a diesel-fueled APS. If the engine or vehicle

manufacturer instead chooses to install an APS, the APS would meet additional PM reduction requirements if it were a diesel-fueled APS.

This alternative would also amend the in-use ATCM, consistent with staff's proposal, to include all sleeper trucks beginning in 2008. Thus, California and out-of-state trucks resting during layover hours in California would need to purchase alternative cab comfort devices that meet all the emission performance requirements for their applicable model year and/or technology selected (see section IV.C. and D. above).

Staff did not pursue this alternative primarily because of how it would impact buyers of California certified trucks. Specifically, although this alternative would require all trucks resting during layover hours in California to control idling emissions, it presumes that all California certified sleeper trucks undergo and need extended idling operation in California. This may not be the case; some California trucking companies only idle for extended periods outside of California, or if they do need heating and/or cooling in California for extended rest periods, their drivers may either sleep in a hotel or they rely on available off-board power infrastructure for their needs. Thus, this alternative would force California truck buyers to pay a higher price for a new or used (i.e., 2008 and subsequent model year) truck equipped with cab comfort systems they may never need or use, resulting in their inability to recover their initial cost which would put them in an economic disadvantage with businesses operating out-of-state.

C. REQUIRE ENGINE SHUTDOWN SYSTEMS AND ONLY ZERO-EMITTING ALTERNATIVE TECHNOLOGIES. INCLUDE THE PROPOSED AMENDMENTS TO THE IN-USE IDLING ATCM AFFECTING SLEEPER TRUCKS

Similar to staff's proposal, this alternative would require 2008 and subsequent model year trucks to be equipped with engine shutdown systems that would shut down the engine after five minutes. It would also require, consistent with staff's proposal, that all sleeper trucks control idling emissions beginning in 2008 (see the previous alternative B). This alternative would allow the option of using alternative cab comfort devices but, unlike staff's proposal, it would only allow zero emitting technologies such as battery electric APSs, fuel cell APSs, thermal storage systems, truck stop electrification, or any other zero emitting technology. In other words, it would not allow manufacturers to certify their engines to an optional NOx idling standard or use cab comfort devices such as diesel or gasoline powered APSs, fuel-fired heaters or any other on-board device that produces emissions during its operation. Staff considered this alternative but does not recommend it for the following reasons:

- Truck stop electrification is currently not available everywhere and would take beyond the 2008 timeframe before it is widely available. Thus, truck operator needs could not be met at every location and would require other alternatives.
- Battery electric APS technology would likely be the only available near-term technology that could provide for all the truck operator heating and cooling needs as long as the truck is in operation long enough to recharge the system

after layover periods (typically up to 6 hours of operation is needed to fully charge the APS). However, this technology has only just recently been introduced commercially and acceptance by the industry will be limited until enough units have been placed into service and the technology is proven to be a durable and cost-effective solution. Several fleets are currently evaluating this technology with promising results.

- Fuel cell APSs are a promising technology but are still in the development and demonstration phase and may not be commercially available or cost-effective until after 2010.

Staff believes that most of these alternatives are viable options to comply with staff's regulatory proposal, but availability and commercial acceptance may be limited within the time period of the current proposal. However, as these technologies mature, production volumes increase, and more experience is gained, they will likely be widely used in the future. Thus, while they are certainly viable options, they should not, for the reason cited above, be the only options made available to truck operators.

D. PURSUE REQUIREMENTS THAT ONLY TARGET NEW TRUCKS STARTING IN 2008 (DO NOT PROPOSE REQUIREMENTS THAT WOULD IMPACT THE EXISTING IN-USE FLEET)

This alternative would only impact California certified trucks beginning in 2008. California trucks would be equipped with either the proposed engine shutdown system or the engine would meet an optional NOx idling emission standard. Also, this alternative would not modify the current in-use ATCM to include sleeper trucks.

Under this alternative, owners of 2008 sleeper trucks with engines meeting the NOx idling standard, pre-2008 California sleeper trucks, and federal sleeper trucks would be allowed to idle their engines during layover hours. Owners of 2008 California sleeper trucks equipped with an engine shutdown system would be the only ones that may need to purchase cab comfort devices, regardless of whether they idle their trucks in California or in other states.

This alternative would be effective in controlling idle emissions from California sleeper trucks beginning with the 2008 model year. However, because it can take as long as 30 years before the fleet is fully turned over, the near-term emission benefits would be small. Also, this alternative would not address idling from existing California and out-of-state sleeper trucks. In 2010, the existing pre-2008 model year California sleeper trucks will contribute 30 percent to the total sleeper truck idling emissions in California, while out-of-state sleeper trucks will contribute 63 percent. The remaining 7 percent would be due to idling of new 2008 and subsequent model year California registered sleeper trucks. Therefore, because the idling emissions from existing California and out-of-state sleepers are significant, and controlling these emissions is both feasible and cost-effective, staff rejected this alternative.

VII. ECONOMIC IMPACTS

A. LEGAL REQUIREMENTS

Government Code Sections 11346.3 and 11346.5(a) require state agencies adopting or amending any administrative regulations to identify and assess the potential for adverse economic impacts on California businesses and individuals. The assessment must include a consideration of the impact of the proposed regulation on California jobs, business expansion, elimination or creation of business, and the ability of California businesses to compete with those of other states. State agencies are also required to estimate the cost or savings to any state or local agency, and school districts. The estimate must include any non-discretionary cost or savings to local agencies and the cost or savings in federal funding to the state.

B. AFFECTED BUSINESSES

Businesses that may be affected by the proposed regulation include heavy-duty engine and vehicle manufacturers, manufacturers of alternative idle reduction devices and trucking businesses. Based on certification data, ARB has identified 21 heavy-duty engine manufacturers worldwide that manufacture and certify their engines for sale in California. Approximately eight heavy-duty vehicle manufacturers manufacture and sell heavy-duty vehicles in California. However, none of the heavy-duty engine or vehicle manufacturing businesses is located in California, and none is considered to be small business.

The exact number of manufacturers of idle reduction devices is unknown. However, staff estimates that there are at least 21 manufacturers that produce internal combustion APSs, fuel-fired heaters, truck stop electrification, battery electric APSs, inverter chargers, etc.[15] Approximately 48 percent of these manufacturers produce diesel-fueled APSs and the remaining 52 percent produce other cab comfort devices such as fuel-fired heaters, truck stop electrification, battery electric APSs, etc. Some of the APS manufacturers are part of bigger companies that design and manufacture specialty engineered products for the automotive, marine, industrial, medical and aerospace industries. Such APS manufacturers are not considered small businesses. Staff estimates that about 70% of the internal combustion APS manufacturers are small businesses. However, none of these manufacturers are based in California.

The number of California trucking businesses affected by the proposal was estimated from California Highway Patrol's Biennial Inspection of Terminals [16] Program database. Approximately 98 percent of California trucking businesses have fleet sizes of 24 trucks

[15] The number of idle reduction technology manufacturers is determined from a listing of idle reduction technologies at the U.S. EPA website (http://www.epa.gov/otaq/smartway/idlingtechnologies.htm) and from a listing at http://www.truckinginfo.com .

[16] California Vehicle Code Section 34501.12 requires any person or organization directing the operation of trucks or trailers to participate in an inspection program conducted by the California Highway Patrol to inspect California truck terminals every two years.

or less. Assuming the fleet size of a small business to consist of 24 trucks or less, approximately 98 percent of the California trucking businesses are in the small business category.

The number of out-of-state based trucking businesses that operate in California is difficult to determine. However, staff analyzed the 2002 Vehicle Inventory and Use Survey database (U.S. Census Bureau, 2005) to get a rough estimate of the fleet composition of the 49-states. Based on this analysis, staff assumes that the out-of-state fleet mix is representative of those trucks operating in California. Similar to California trucking businesses, 99 percent of out-of-state businesses have fleet sizes of 20 trucks or less, and thus could be considered small businesses[17].

C. POTENTIAL COSTS TO ENGINE MANUFACTURERS

The proposal would require engine manufacturers to install a non-programmable and tamper-proof engine shutdown system on new 2008 and subsequent model year California heavy-duty engines. As previously discussed, an engine shutdown system is a standard feature on current electronically controlled on-road diesel engines, but are presently not programmed to shut the engine down after five minutes of idling. Setting the idle time is left to the truck owner, and the system can easily be overridden to allow the engine to idle continuously. Staff therefore, expects engine manufacturers to comply with this requirement through a minor change in the programming of the electronic engine software. As a result, staff expects that engine manufacturers will not incur any significant additional cost in developing the engine shutdown technology to comply with the proposed requirement, as no additional hardware costs should be needed.

In addition, engine manufacturers that certify engines meeting the proposed optional NOx idling emission standard or install a California compliant APS system may incur additional cost due to the proposed vehicle labeling requirements. However, staff believes this incremental cost to be negligible and absorbable within the purchase price of the main engine or the APS system, whichever is applicable.

Since the proposed new engine requirement is a California only requirement, it is projected to have a minimal cost impact on engine manufacturers. This cost is due to additional administrative costs related to the need to separately manufacture and track those engines destined for sale in California from those for sale in the other 49-states. However, these costs may be further reduced should engine manufacturers elect to also incorporate engine shut down systems in engines destined for sale in the other 49-states. Staff has assumed a minimal price increase of $100 per engine to cover the additional administrative costs and the minimal reprogramming costs.

[17] The reason for using fleet size of 20 trucks or less as a cut point for the 49-state fleet analysis as opposed to 24 trucks or less for the California fleet is because the 2002 Vehicle Inventory and Use Survey database bins fleet sizes as 1 to 5, 6 to 10, 11 to 20, 21 to 50, etc., and therefore, it was not possible to use 24 trucks as a cut-point for the 49-state analysis.

D. POTENTIAL COSTS TO TRUCK MANUFACTURERS

The proposed regulation is not expected to result in any significant increase in costs to truck manufacturers. Engine shutdown software is already present and integrated with the truck. Staff anticipates that current truck manufacturing practices will not be significantly affected by the proposed regulation. Manufacturers will continue to manufacture trucks according to their own or customer specifications. Staff's proposal may also create a demand for "factory installed" cab comfort devices but offering them would be a business decision that would also benefit the manufacturer. However, since the proposed regulation is a California only requirement, they may incur a minimal increase in administrative costs in assuring that the engines installed on the trucks meet the proposed requirements. The proposed vehicle labeling requirements may also add to the cost of the truck, in instances where the truck manufacturer is responsible for producing and affixing the label to the outside of the truck. Staff assumes these incremental costs are negligible and absorbable within current truck pricing since truck manufacturers already have to track engines, transmissions, and other customer order components in vehicle orders.

E. POTENTIAL COST TO DIESEL-FUELED APS MANUFACTURERS

The proposed regulation allows the use of any alternative technology provided that the APS complies with applicable California emission standards and test procedures for their fuel and horsepower category. However, the proposal requires diesel-fueled APSs produced for applications with 2007 and subsequent model year diesel engines to meet additional PM controls. Manufacturers of diesel-fueled APSs that comply with additional PM controls may incur an additional cost in developing a PM trap with an active regeneration scheme capable of reducing PM emissions by 85% from the off-road Tier 4 standards. Furthermore, trucks equipped with PM trap-equipped APSs would need a label affixed to the outside of the truck. According to one diesel PM trap manufacturer, the cost of retrofitting a diesel-fueled APS with an active PM trap is estimated to be $1,200 to $1,500 (Lambe, 2005). However, staff assumed a conservative incremental cost of $2,000 to comply with the additional PM control, including the cost of verifying the APS with a PM trap and creating a label.

F. POTENTIAL IMPACT ON TRUCKING BUSINESSES

The proposed requirements will affect both California and out-of-state trucking businesses that already own sleeper trucks and those that will purchase new ones in 2008. Although not required by the proposal, for purposes of this analysis, staff assumes that all trucking businesses will incur additional costs in purchasing alternative cab comfort technologies to provide for sleeper berth comfort and electrical power for accessories. Assuming businesses will use the most commonly used alternative today, the diesel-fueled APS, staff expects that businesses that own pre-2007 model year sleeper trucks will incur a cost of approximately $5,000 to $8,000, while businesses that purchase new 2007 and subsequent model year sleeper trucks will incur a cost of approximately $7,000 to 10,100 (cost of an APS with additional PM control and, for

California certified trucks, an engine shutdown system for 2008 and subsequent model year engines). These costs are based on purchasing an aftermarket diesel-fueled APS, which is expected to cost more than an APS offered by the vehicle manufacturer as a factory option.

While existing California and out-of-state trucking businesses will certainly be impacted by the proposed regulations, the impact will depend on how often their trucks require extended stays in California. For example, if extended stays for an owner/operator or a truck fleet rarely happen in California, a business decision would need to be made whether to equip its truck(s) with an alternative cab comfort device. This decision would be based on how soon they could recover this additional incurred cost. Depending on the amount of idling hours reduced and the type of alternative cab comfort technology used, these additional costs can be recovered within 1 to 2.5 years through reduced fuel consumption and maintenance requirements. Therefore, overall, the proposed requirements will benefit the truck owner because they will realize a net savings from improved operating costs. An example of how these savings will be achieved is shown below, in Table 2.

Table 2 shows the savings realized and the payback periods for a diesel-fueled APS. The savings were estimated assuming that a sleeper truck idling consumes one gallon per hour and idling is reduced by six hours per day. The cost of diesel fuel was estimated at $2.40 per gallon[18]. The Technology and Maintenance Council's Recommended Practice 1108 (RP 1108) provides a method for estimating preventive maintenance and engine overhaul costs due to long duration idling. Using RP 1108, reducing idling by one hour results in preventive maintenance savings of $0.07 per hour, and engine overhaul savings of $0.16 per hour. It should be noted that the maintenance savings shown in Table 2 account for the additional costs that would be incurred by the maintenance requirements of the diesel-fueled APS[19].

[18] The diesel fuel cost of $2.40 per gallon is obtained by averaging the weekly California diesel fuel prices for the weeks from January 1 to August 1, 2005. Historic weekly retail on-highway diesel prices are available from the U.S. DOE, Energy Information Administration at http://tonto.eia.doe.gov/oog/info/wohdp/diesel.asp.

[19] The APS maintenance cost is based on the AXP 1000 maintenance requirements of $420. AXP 1000 is a diesel-fueled APS manufactured and sold by Engine and Energy Technology Corporation (http://www.eent.net/).

Table 2: Net Fuel and Maintenance Savings

Vehicle	Fuel Savings (gallons/year)	Fuel Cost Savings $/year	Maintenance Savings $/year	Total Savings $/year
Truck with a sleeper berth using a diesel-fueled APS	1750	$ 4,200	$ 77	$ 4,280

Cost of APS	Payback Period
APS without PM aftertreatment - $ 5,000	~ 1.2 years
APS with PM aftertreatment + idle shutdown system - $10,100	≤ 2.5 years

G. POTENTIAL IMPACT ON BUSINESS COMPETITIVENESS

The proposed regulation is not expected to adversely impact the ability of California businesses to compete with businesses in other states. As previously discussed, although businesses owning or purchasing new trucks with sleeper berths will most likely require that they be equipped with an alternative cab comfort technology, resulting in higher initial purchase costs, those businesses will also realize net savings in operating costs for those trucks. Staff's proposal is expected to improve, over the useful life of the truck, California trucking businesses' competitiveness (compared to trucking businesses that do not have alternative cab comfort technology on their trucks) by significantly reducing operating costs. Also, out-of-state trucking businesses that operate in California and install alternative cab comfort technology will also benefit from the same competitiveness advantage.

H. POTENTIAL IMPACT ON JOBS AND BUSINESS CREATION, ELIMINATION, OR EXPANSION

The proposed regulation is not expected to have a significant effect on the creation, elimination or expansion of jobs and businesses in California. However, the regulation may result in an increase in demand for cab comfort devices, and this in turn may result in the creation or expansion of some businesses. The increased demand for alternative cab comfort technologies may also result in the creation of new jobs related to research and development to further improve these technologies, and jobs related to the manufacturing, distribution and marketing of these technologies. Most of the businesses and jobs created are expected to be located near the engine and/or vehicle manufacturing facilities outside of California but some may be created in California.

I. POTENTIAL COSTS TO LOCAL AND STATE AGENCIES

There are no additional net costs for local and state agencies associated with adopting the proposed regulation. Typically, local government and state agencies purchase trucks without sleeper berths, so those trucks only require minimal modifications to the engine's software, resulting in minimal cost to the purchaser. It is expected that agencies purchasing compliant trucks would realize net operating savings from reduced fuel consumption due to the engine shutdown technology. Other costs, such as implementation costs to the state as a result of this rulemaking, would be costs directed to the ARB to implement and enforce the requirements, which should be absorbable within the existing ARB programs and budget.

VIII. ENVIRONMENTAL JUSTICE

The ARB is committed to integrating environmental justice into all of its activities. State law defines environmental justice as the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies. On December 31, 2001, the Board approved “Policies and Actions for Environmental Justice”, which formally established a framework for incorporating environmental justice into the ARB's programs consistent with the directives of state law. The policies developed apply to all communities in California, but recognize that environmental justice issues have been raised more in the context of low income and minority communities.

These Policies are intended to promote the fair treatment of all Californians and cover the full spectrum of ARB activities. Underlying these Policies is a recognition that the ARB needs to engage community members in a meaningful way as it carries out its activities. People should have the best possible information about the air they breathe and what is being done to reduce unhealthy air pollution in their communities. The ARB recognizes its obligation to work closely with all stakeholders--communities, environmental and public health organizations, industry, business owners, other agencies, and all other interested parties to successfully implement these Policies (ARB, 2001c).

The proposed truck idling emission reduction requirements would benefit the people of California by reducing their exposure to harmful pollutants and diesel toxics. In particular, the proposed requirements will provide significant air quality benefits to communities located in proximity to truck stops, ports, distribution centers, and other truck idling centers where a high density of trucks idle together for extended periods of time. Furthermore, most of these locations are low-income areas that are already affected by the cumulative impact of air pollution from multiple mobile, commercial, industrial, areawide, and other sources. The adoption of this regulation, therefore, affirms the Board’s commitment to the fair treatment of all people throughout California.

IX. ENVIRONMENTAL IMPACTS AND COST-EFFECTIVENESS

This chapter presents the air quality benefits and cost-effectiveness resulting from the implementation of the proposed idle reduction requirements.

A. AIR QUALITY BENEFITS

The proposed regulations achieve emission reductions by reducing the idling operations of diesel engines and trucks through the use of existing, cost-effective technologies. For various reasons, it is difficult to precisely estimate the emission benefits of the proposed regulations because staff can not accurately predict at this time the type and distribution of alternative technologies used to comply with the proposed regulation.

Another major uncertainty is the idling emission rate estimates associated with aftertreatment-based NOx and PM control technologies to be used with the 2007 and later model year diesel engines. Staff is not aware of any data that describe the performance of trap-based technologies or NOx catalysts during extended diesel idling operation. However, based on staff's understanding of how these technologies work, the following assumptions have been made for estimating the baseline emissions of 2007 and later model year diesel engines:

1. PM traps by nature of their construction are expected to trap PM at the same efficiency during idling as when the truck is operating under other typical driving conditions. Thus, the 2007 and later model year PM idling emission rates reflect the use of highly efficient PM traps.

2. NOx catalysts require a minimum temperature (light-off temperature) before the catalytic reactions needed to reduce NOx occur. The light-off temperature for NOx catalysts is generally above 200°C (MECA, 2000), while exhaust temperatures during extended idling are typically below 150°C (Hallstrom, 2005). Thus, for purposes of estimating NOx catalyst effectiveness during extended idling, engine-out NOx emissions are assumed to be unaffected by NOx catalysts, unless the engine is idling immediately following over-the-road operation (explained below).

   The U.S. EPA, in laboratory testing to demonstrate the technical feasibility of the 2007 heavy-duty engine standards, observed NOx emission control for more than 10 minutes of idle operation following loaded (or high temperature) conditions due to the thermal inertia of the NOx catalyst (U.S. EPA, 2000). However, the size of the NOx catalyst system relative to the engine size tested was significantly larger than what is currently being developed for diesel engines. A smaller catalyst system would have less thermal inertia, which would correspondingly result in controlling NOx emissions for a shorter period of time than the 10 minutes observed in the U.S. EPA testing. Thus, due to limited data on NOx catalysts currently being developed, staff assumes that NOx control during idling resulting from the thermal inertia mass of the NOx catalysts will be

less than five minutes following over-the-road operation. Thus, NOx emission reduction estimates from the proposed requirements will remain unaffected, as the first five minutes of idling operation have not been included in staff's emission benefit estimates for this proposal.

Idle emission rates incorporated in California's emissions inventory model, EMFAC2002 ver 2.2 (ARB 2003), are based on test data from a limited number of trucks. In addition, the emission test data were obtained at "curb" idle speeds and did not include accessory loading. However, studies have shown that idling emissions are greatly dependent on ambient conditions, accessory loading, and engine speed (Lambert et al., 2001; Storey et al., 2003). As a result, staff modified the EMFAC2002 idle emission factors using emissions test data obtained from phase 1 of the Coordinating Research Council (CRC) project E-55/E-59 (Gautam et al., 2003) and emissions test data from a multi-agency study which included the U.S. EPA and Oak Ridge National Laboratory (ORNL) (Storey et al., 2003). The idle emission rates used in quantifying the air quality benefits from the proposed regulation are shown in Table 3.

Table 3: Fleet Average Idle Emission Factors

Weighted Average Idle Emission factors

Calendar Year	Model Year	NOx (grams/hour)	ROG (grams/hour)	PM (grams/hour)	CO_2 (grams/hour)
2010	Pre-1991	39.8	20.2	5.3	6228
	1991-2006	115.3	9.4	1.9	6228
	2007-10	115.3	8.3	0.16	6228
2020	Pre-1991	39.8	20.1	5.2	6228
	1991-2006	115.3	8.9	1.8	6228
	2007-20	115.3	8.3	0.16	6228

As shown, the PM emission rates for pre-2007 and 2007-10 model years differ greatly, as one would expect with the use of PM traps beginning in 2007. The NOx and ROG emission rates are assumed not to be impacted by a NOx catalyst at idle and thus are somewhat comparable for 1991-2006 and 2007-10 model years. The increase in the NOx emission rates for 1991 and later versus pre-1991 model years may be attributed to the high idling NOx emission rates associated with the post-1990 electronically managed engines which are likely to have advanced timing at low loads (or low temperatures) to avoid white smoke conditions (Clark et al., 2005).

Because of the engine shutdown requirements, the proposed regulation affects both sleeper and non-sleeper trucks. However, the emission benefits of staff's proposal consider only sleeper trucks. This is because the existing in-use ATCM already requires the operator of a non-sleeper truck to shut down his/her engine after five

minutes of continuous idling, and thus the emission benefits from non-sleeper trucks have already been accounted for. Staff's emission benefit analysis includes both California and out-of-state registered sleeper trucks, and assumes that all pre-2007 sleeper trucks will employ as an alternative to idling, diesel-fueled APSs certified to the California off-road or federal non-road standards. 2007 and subsequent model year sleeper trucks were assumed to employ diesel-fueled APSs verified to a level 3 or 85% PM reduction from the Tier 4 off-road standards shown in Table 4. Furthermore, the average power demand for an APS operating under extreme climate conditions is estimated to be approximately 2.3 kW for winter conditions and 3.1 kW for summer conditions (Wallace, 2003; Lutsey, 2003). Staff assumed that the diesel-fueled APS would provide an average of 2.7 kW power to provide sleeper berth comfort and electrical power for accessories. Also, 25 percent of all trucks on the road on a typical day in California are estimated to be out-of-state registered trucks (ARB, 2003). Staff estimates that 90 percent of those out-of-state registered trucks are sleeper trucks that idle an average of six hours per day in California.

Table 4: Off-Road Diesel Emission Standards (g/kW-hr)

Model Year	Horsepower Category	NOx+NMHC	CO	PM
2005 – 2008 (Tier 2)	hp < 11 (kW < 8)	7.5	8.0	0.8
	11 ≤ hp < 25 (8 ≤ kW < 19)	7.5	6.6	0.8
2008+ (Tier 4)	hp < 11 (kW < 8)	7.5	8.0	0.4
	11 ≤ hp < 25 (8 ≤ kW < 19)	7.5	6.6	0.4

In estimating the emission rates of diesel-fueled APSs, staff analyzed the 2005 emission certification test data of off-road diesel engines used in APSs (engines with power ratings between 5 to 19 kW). The gram per hour emission rates were estimated from the average of the certification test data (in grams per kW-hour) assuming that the APS provides an average power of 2.7 kW. The average of the certification data and the gram per hour emission rates are shown in Table 5. The certification test data does not include CO_2 emissions. Therefore, in calculating the CO_2 emission reductions, staff used CO_2 emission rates from an APS test data report published by U.S. EPA. (Lim, 2002).

Table 5: Diesel Fueled APS Emission Rates

	Number of Engines	NMHC+NOx	CO	PM	CO_2
Average of Certification Test Data (grams/kW-hour)	68	5.6	2.3	0.32	---
APS Emission Rate (grams/hour)		15.1[20]	6.2	0.87	2228

In addition to reducing emissions of criteria pollutants, the proposed regulation also reduces greenhouse gas (GHG) emissions, such as CO_2, methane (CH_4), and nitrous oxide (N_2O) emissions. CO_2 is by far the most prevalent GHG, and as such the major contributor to global warming. A major source of CO_2 emissions is human activity and in particular fossil fuel burning in the electric generation, industrial, and transportation sectors (see Figures 7 and 8) (Bemis, 2005). As discussed in Chapter II, truck idling consumes diesel fuel from 0.4 to 1.6 gallons per hour depending on engine speed and load. Therefore, reduced idling will result in reduced amount of fuel burned. Since CO_2 is the direct product of fuel burning, reducing fuel consumption also reduces CO_2 emissions.

Concerned about the impact on climate change, the state of California has set a target to reduce GHG emissions to 2000 levels by 2010, to 1990 levels by 2020, and to 80% below 1990 levels by 2050. The proposed regulation is estimated to reduce CO_2 emissions by nearly 1930 tpd (0.7 million tons per year) and 2280 tpd (0.8 million tons per year) statewide in 2010 and 2020, respectively. The resulting emission reductions for NOx, ROG, PM, and CO_2 for calendar years 2010 and 2020 for both statewide and the South Coast Air Basin are shown in Tables 6, 7, 8, and 9. The emission reductions assume full compliance with the proposed requirements.

[20] As discussed in Chapter IV, the proposed 30 gram per hour optional NOx idling emission standard was based on the average NOx emission level of 2005 certification test data of off-road diesel engines used in APSs (engine with power ratings between 5 to 19 kW). The difference between the 15.1 grams per hour NOx+NMHC emission rate of the APS (Table 5) and the 30 gram per hour optional NOx emission standard, discussed in Chapter IV, is a result of calculating the optional NOx emission standard based on the assumption that the APS provides the peak power of 5 kW, while the APS NOx+NMHC emission rate in Table 5 assumes that the APS provides an average power of 2.7 kW.

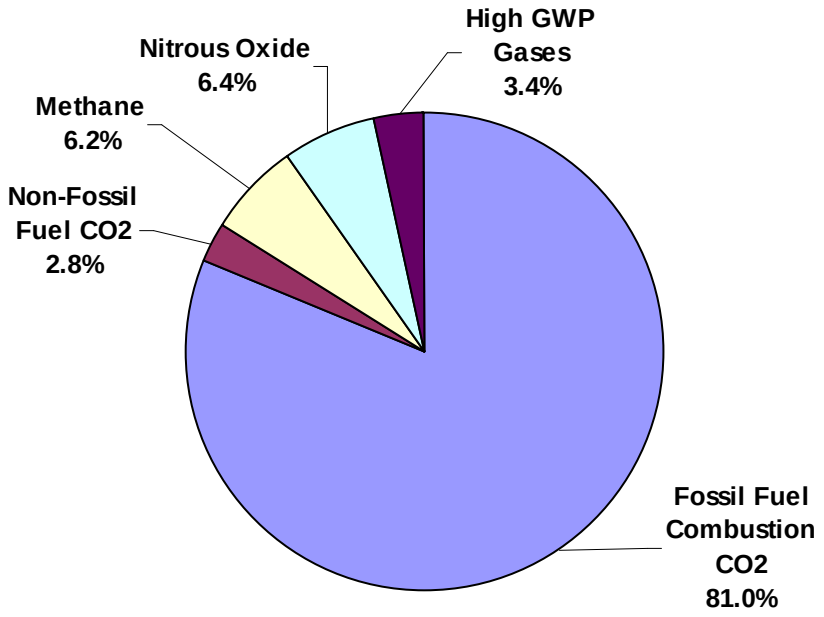


Figure 7. California GHG emissions by Type of Gas in 2003 (Bemis, 2005).

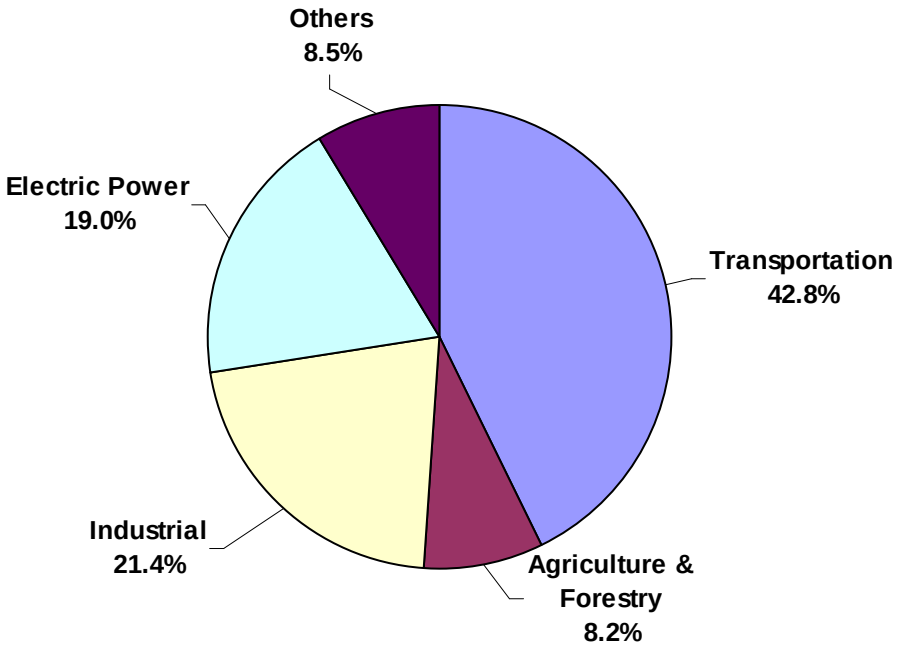


Figure 8. Sources of California's 2003 GHG Emissions (by End-Use Sector) (Bemis, 2005).

Table 6: 2010 Estimated Statewide Idling Emission Benefits Sleeper Trucks Only

	Vehicles	NOx	ROG	PM	CO2
Baseline Emissions (tpd)	**Calendar Year 2010**				
CA Registered Sleeper Trucks	30,161	20	2.1	0.39	1200
Out-of-State Sleeper Trucks	45,241	33	2.5	0.34	1800
Total Baseline	75,402	53	4.6	0.73	3000
Emission Reductions (tpd)	**Calendar Year 2010**				
CA Registered Sleeper Trucks	30,161	17	1.9	0.26	770
Out-of-State Sleeper Trucks	45,241	29	2.2	0.16	1160
Total Reductions	75,402	46	4.2	0.42	1930

Table 7: 2020 Estimated Statewide Idling Emission Benefits Sleeper Trucks Only

	Vehicles	NOx	ROG	PM	CO2
Baseline Emissions (tpd)	**Calendar Year 2020**				
CA Registered Sleeper Trucks	35,652	26	2.0	0.16	1420
Out-of-State Sleeper Trucks	53,478	39	2.8	0.08	2130
Total Baseline	89,130	65	4.8	0.24	3550
Emission Reductions (tpd)	**Calendar Year 2020**				
CA Registered Sleeper Trucks	35,652	22	1.8	0.08	910
Out-of-State Sleeper Trucks	53,478	34	2.6	0.02	1370
Total Reductions	89,130	56	4.4	0.10	2280

Table 8: 2010 Estimated South Coast Air Basin Idling Emission Benefits Sleeper Trucks Only

	Vehicles	NOx	ROG	PM	CO2
Baseline Emissions (tpd)	**Calendar Year 2010**				
CA Registered Sleeper Trucks	11,631	8	0.8	0.14	460
Out-of-State Sleeper Trucks	17,447	13	0.9	0.12	690
Total Baseline	29,078	21	1.7	0.26	1150
Emission Reductions (tpd)	**Calendar Year 2010**				
CA Registered Sleeper Trucks	11,631	7	0.7	0.09	300
Out-of-State Sleeper Trucks	17,447	11	0.9	0.06	440
Total Reductions	29,078	18	1.6	0.15	740

Table 9: 2020 Estimated South Coast Air Basin Idling Emission Benefits Sleeper Trucks Only

	Vehicles	NOx	ROG	PM	CO2
Baseline Emissions (tpd)	**Calendar Year 2020**				
CA Registered Sleeper Trucks	13,988	10	0.8	0.06	560
Out-of-State Sleeper Trucks	20,981	15	1.1	0.03	830
Total Baseline	34,969	26	1.9	0.08	1390
Emission Reductions (tpd)	**Calendar Year 2020**				
CA Registered Sleeper Trucks	13,988	9	0.7	0.03	360
Out-of-State Sleeper Trucks	20,981	13	1.0	0.01	520
Total Reductions	34,969	22	1.7	0.04	880

B. COST-EFFECTIVENESS

Staff's proposal is expected to provide a cost savings to truck owners over the useful life of the truck by reducing fuel consumption and truck's maintenance requirements. For example, as previously shown in Table 2, a truck that idles an average of approximately six hours per day and uses a diesel-fueled APS as an alternative to main engine idling would save approximately $4,300 per year. With such savings, the cost of the APS would be recovered within 1 to 2.5 years. Therefore, the cost-effectiveness of the proposed rule is in reality zero because it is a cost savings. However, staff estimated the cost-effectiveness of the proposal without considering the associated savings in order to see how it compares with cost-effectiveness estimates of other regulations adopted by the ARB.

The proposed rule would require new 2008 and subsequent model year California certified diesel engines to be equipped with a non-programmable engine shutdown system. Pre-2008 trucks would be required to comply with the proposed rule by manually turning the engine off. The staff's proposal does not include any retrofit requirement for these engines. Therefore, the cost of compliance with the proposed requirements should only be the cost incurred to comply with the engine shutdown requirements applicable to only 2008 and later diesel engines. However, although it is not required by the proposed regulation, staff expects that in practice, operators and owners of sleeper trucks of any model year will likely need an alternative cab comfort technology as a substitute to main engine idling. Thus, for new 2008 and subsequent model year sleeper trucks, the costs of complying with the proposed requirements would include costs associated with the engine shutdown system and costs associated with the alternative cab comfort technology/strategy used to replace main engine idling. For existing pre-2008 model year sleeper trucks and out-of-state trucks that frequently operate in California, the costs of complying with the proposed requirements would include costs associated with the retrofit of an alternative cab comfort technology/strategy used to replace main engine idling.

It is difficult at this time to assess to what extent each alternative cab comfort technology will be used when the proposed regulation takes effect. Staff has therefore estimated the cost-effectiveness of the proposed regulation based on the highest cost that a truck operator may incur to comply with the proposed regulation. Thus, our cost-effectiveness calculation for the proposed regulation assumes that a 2008 and subsequent model year California truck would have an engine shutdown system and uses, as an alternative to idling, a diesel-fueled APS equipped with a level 3 verified PM control strategy. A 2007 model year California truck or a 2007 and later model year out-of-state truck is also assumed to use, as an alternative to idling, a diesel fueled APS with a level 3 verified PM control strategy. A pre-2007 California or pre-2007 out-of-state truck is assumed to use a diesel-fueled APS with no aftertreatment. The calculation furthermore assumes the cost of a diesel-fueled APS with aftertreatment to be $10,000, and that of an engine shutdown system to be $100. The cost of a commercially available diesel-fueled APS with no aftertreatment varies from $5,000 to

$8,000. Thus, staff assumed an average cost of $6,500 for an APS with no aftertreatment. The lifetime of the APS is assumed to be 10 years.

As shown in Table 10, the cost-effectiveness of the proposed regulations is $2.00 per pound of NOx plus ROG reduced, for a new 2008 model year California truck; $1.98 per pound of NOx plus ROG reduced, for a 2007 model year California truck or a 2007 model year or newer out-of-state truck; and $1.44 for a pre 2007 California or out-of-state truck.

Table 10: Cost-Effectiveness in Dollars per Pound of NOx+ROG Reduced

		Sleeper Trucks		
		2008 CA Only	2007 CA and Non-CA	Pre 2007 CA and Non-CA
Fleet Average Idle Emission Factor (grams/hour)	NOx	115.3	115.3	99.6
	ROG	8.3	8.3	12.2
Lifetime Truck Emissions (10 years) (pounds per truck)	NOx+ROG	5758	5758	5210
APS Emission Rates (grams/hour)	NOx+ROG	15.1	15.1	15.1
Lifetime APS Emissions (pounds)	NOx+ROG	702	702	702
Lifetime Emission Reduction	NOx+ROG	5056	5056	4507
Cost Of Technology				
APS		$10,000	$10,000	$6,500[a]
Engine Shutdown		100	0	0
APS + Engine Shutdown		$10,100	$10,000	$6,500
Cost-Effectiveness ($ per pound of NOx+ROG)		**$2.00**	**$1.98**	**$1.44**
Fleet Distribution CY 2008		4%	7%	89%
Fleet Average Cost-effectiveness ($ per pound of NOx+ROG)		**1.51**		

The fleet average cost-effectiveness is difficult to estimate as it is difficult to predict the fraction of the fleet that will install cab comfort devices to substitute for main engine idling. In particular, it is more difficult to assess or predict the fraction of out-of-state trucks that will install a cab comfort device. Depending on how often out-of-state sleeper trucks frequent California and require an extended stay, a business decision on

the part of the truck fleet or owner/operator would be made whether to have cab comfort devices installed. However, for the purposes of this analysis, staff assumed the “worst”, that all out-of-state sleepers entering California would have cab comfort devices installed. Therefore, staff estimated the fleet average cost-effectiveness assuming that all California sleeper trucks and all out-of-state sleeper trucks entering California will be retrofitted with a diesel-fueled APS. Based on these assumptions, the fleet average cost-effectiveness is estimated to be $1.51 per pound of NOx plus ROG reduced, which compares favorably with recently adopted ARB emission reduction regulations.

X. CONCLUSIONS AND RECOMMENDATION

The proposed idle reduction requirements are necessary to achieve emission reductions needed to meet clean air goals as specified in the 2003 SIP. The proposed requirements can be met using existing, commercially available technologies. Such technologies would significantly reduce the idling time of sleeper trucks and result in a substantial reduction in emissions of NOx, ROG, PM, and CO2. The proposed requirements will result in a cost savings to the trucking industry and are therefore clearly cost-effective. But for comparative purposes (i.e., without accounting for the savings associated with reduced fuel consumption and maintenance costs), the cost-effectiveness of the proposed regulation compares favorably with other mobile source and fuels regulations adopted by the Board. In addition to reducing greenhouse gas emissions, it will also help reduce the state's dependency on foreign oil and is also consistent with the Board's policy regarding Environmental Justice. The staff therefore recommends that the Board adopt the proposed truck idling emission reduction requirements for on-road heavy-duty diesel engines/trucks.

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