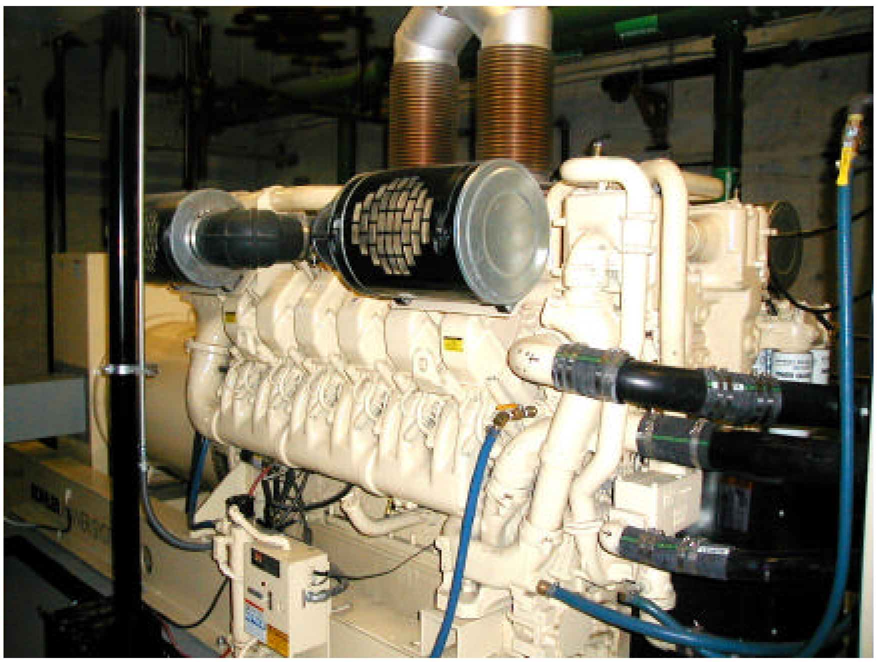
California Environmental Protection Agency

AIR RESOURCES BOARD

STAFF REPORT: INITIAL STATEMENT OF REASONS FOR PROPOSED RULEMAKING



AIRBORNE TOXIC CONTROL MEASURE FOR STATIONARY COMPRESSION-IGNITION ENGINES

Stationary Source Division
Emissions Assessment Branch

September 2003

State of California
AIR RESOURCES BOARD

STAFF REPORT: INITIAL STATEMENT OF REASONS FOR PROPOSED RULEMAKING

Public Hearing to Consider

ADOPTION OF THE PROPOSED AIRBORNE TOXIC CONTROL MEASURE FOR STATIONARY COMPRESSION-IGNITION ENGINES

To be considered by the Air Resources Board on November 13-14, 2003, at:

California Environmental Protection Agency
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AIR RESOURCES BOARD

PROPOSED AIRBORNE TOXIC CONTROL MEASURE FOR STATIONARY COMPRESSION-IGNITION ENGINES

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EXECUTIVE SUMMARY

The Air Resources Board (ARB or Board), in addition to maintaining long-standing efforts to reduce emissions of ozone precursors, is now challenged to reduce emission of diesel particulate matter. In 1998, the Board identified diesel particulate matter (diesel PM) as a toxic air contaminant (TAC). Because of the amount of emission to California's air and its potency, diesel PM is by far the number one contributor to the adverse health impacts of TACs.

Diesel exhaust is a complex mixture of thousands of gases and fine particles that contains more than 40 identified TACs. These include many known or suspected cancer-causing substances, such as benzene, arsenic and formaldehyde. In addition to increasing the risk of lung cancer, exposure to diesel exhaust can have other health effects as well. Diesel exhaust can irritate the eyes, nose, throat and lungs, and it can cause coughs, headaches, light-headedness and nausea. Diesel exhaust is a major source of fine particulate pollution as well and numerous studies have linked elevated particle levels in the air to increased hospital admissions, emergency room visit, asthma attacks and premature deaths among those suffering from respiratory problems.

To reduce public exposure to diesel PM, the Board approved in 2000 the Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles (Diesel Risk Reduction Plan). This comprehensive plan outlined steps to reduce diesel emissions from both new and existing diesel-fueled engines and vehicles. The goal of the Diesel Risk Reduction Plan is to reduce diesel PM emissions and associated potential cancer risks by 75 percent in 2010 and by 85 percent by 2020.

As part of the effort to reduce diesel PM, ARB staff is proposing an airborne toxic control measure (ATCM) to reduce diesel PM emissions from stationary diesel-fueled compression ignition engines. The proposed ATCM is one of many ATCMs that will be considered by the ARB over the next several months to fulfill the goals of the Diesel Risk Reduction Plan. The ATCMs being proposed include ATCMs to reduce emissions from residential and commercial solid waste collection vehicles, fuel cargo delivery trucks, transport refrigeration units, and portable engines.

Presented below is an overview which briefly discusses the emissions from new and existing stationary engines, the proposed ATCM and the potential impacts from implementation as well as what our plans are for future activities. For simplicity, the discussion is presented in question-and-answer format using commonly asked questions about the ATCM. It should be noted that this summary provides only brief discussion on these topics. The reader is directed to subsequent chapters in the main body of the report for more detailed information.

1. What is ARB staff proposing?

ARB staff is proposing an ATCM that will limit the emissions of diesel PM from many new and existing stationary diesel-fueled compression ignition (CI) engines. Unlike diesel-fueled CI engines used in on- and off-road applications, diesel-fueled engines used in stationary applications are currently not required to meet state or federal engine certification standards. Under Title I of the Federal Clean Air Act, states are fully authorized to establish standards for stationary engines, and these engines are not affected by Section 209(e) provisions of the Act, which may require a waiver from the United States Environmental Protection Agency (U.S. EPA) when establishing requirements for mobile non-road engines.

The proposed ATCM establishes emission standards, including a standard for diesel PM emissions, that sellers of stationary diesel-fueled engines would have to meet. The proposed ATCM also establishes emission standards and operational requirements that the owners or operators of stationary diesel-fueled CI engines that have a rated horsepower rating of greater than 50, would have to meet. The requirements can be grouped into three general categories: fuel use requirements, operational requirements and emission standards, and recordkeeping, reporting, and monitoring requirements. The proposed ATCM will also require specified classes of stationary engines to meet the off-road engine standards in title 13, California Code of Regulations (CCR), section 2423 for other pollutants that contribute to ground-level smog. In general, the goal of these requirements is to have the owners and operators of diesel-fueled engines use the cleanest fuels possible, limit the unnecessary operation of their engines, and control the emissions of diesel PM to the greatest extent possible, in consideration of technical and economic feasibility.

2. How did ARB staff develop the ATCM and this report?

The staff developed the proposed ATCM and this report through extensive consultations with industry, government agency representatives, environmental organizations, and members of the public. Over the course of two and a half years, the staff held 10 public workshops and meetings covering numerous drafts, regulatory concepts, and implementation issues. Participating in one or more of the workshops were representatives of local publicly-owned treatment works (POTWs), the California Council for Economic and Environmental Balance (CCEEB), agricultural community representatives, the Association of California Water Agencies, the American Lung Association, the Engine Manufacturers Association, Manufacturers of Emission Controls Association, National Resources Defense Counsel, Environmental Defense, the United States Navy, private businesses and others. Staff also met bimonthly with the California Air Pollution Control Officers Association’s Toxics Committee to gain the perspective and input of local air pollution control or air quality management district representatives. Numerous individual meetings were held with affected stakeholders, and staff also researched the literature to better understand retrofit control technologies available to reduce diesel PM emissions from stationary diesel-fueled engines. To further investigate the feasibility of retrofit controls, ARB funded a demonstration program to evaluate and demonstrate diesel PM control technologies for emergency back-up engines and to investigate test methods that can be used to measure PM from stationary engines.

3. What businesses and public agencies will be affected by the proposed ATCM?

Both private businesses and public agencies operating stationary diesel-fueled engines in California will be affected by the proposed ATCM. Examples of businesses that potentially will be affected include private schools and universities, private water treatment facilities, hospitals, power generation, communications, broadcasting, building owners, agricultural production, banks, hotels, refiners, resorts, recycling centers, quarries, wineries, dairies, food processing, and manufacturing entities. A variety of public agencies will also be affected including military installations, prisons and jails, public schools and universities, and public water and wastewater treatment facilities.

4. What are stationary compression ignition engines?

Stationary compression ignition engines (stationary engines) are engines that remain in one location for 12 months or longer. ARB staff estimates there are about 26,300 stationary diesel-fueled engines operating in California. Stationary engines are typically categorized as either prime engines or emergency standby engines. The majority of the engines, approximately 75 percent or 19,700, are used in emergency standby applications, while the remaining 6,600 engines are considered prime engines. Emergency standby engines are typically used for emergency back-up electric power generation or the emergency pumping of water. Prime engines are stationary engines that are not used in an emergency backup or standby mode. They can be used in a variety of applications including agricultural irrigation, compressors, cranes, and rock crushers. Prime engines can operate several hundred hours per year (i.e., small seasonal rock crushing operations) to several thousand hours per year (i.e., stationary cranes at ports/ship yards).

5. What are the emissions, exposures, and risk from stationary diesel-fueled engines?

Stationary engines are used in a variety of applications and are located throughout the State. ARB staff estimates stationary diesel engines emit approximately 2.6 tons per day or 950 tons per year of diesel PM emissions, 40 tons per day of oxides of nitrogen (NOx), and 6 tons per day of reactive organic gases (ROG) in 2002. Based on an average statewide NOx to PM conversion factor, we estimate the secondary formation of PM_{10} nitrate from NOx emissions from diesel-fueled stationary engines to be about four tons per day.

Prime engines account for the majority, about 90 percent, of diesel PM emissions. When all sources of diesel PM are considered, stationary engines account for about four percent of the total diesel PM emissions in California. Because ambient air monitoring techniques for diesel PM are still under development, it is difficult to measure the actual exposures to persons from the emissions of stationary diesel-fueled engines. However, because the engines are distributed throughout California and many of the engines are located in urban centers where the probability of a person living close to an engine is higher, we believe that many Californians are impacted by diesel PM emissions from the operation of stationary diesel-fueled engines in California.

Exposure to these emissions results in increased cancer risk and health risks from other non-cancer health impacts, such as irritation to the eyes and lungs, allergic reactions in the lungs, asthma exacerbation, blood toxicity, immune system dysfunction, and developmental disorders. Because monitoring results are not available for diesel PM, estimates of the level of cancer risk are made using emission factors and various modeling techniques. Based on a health risk assessment, using reasonable assumptions bracketing a fairly broad range of possible operating and exposure scenarios for stationary engines, we determined that exposures to the diesel PM emissions from stationary diesel-fueled engines can result in significant near source risks. For example, a typical emergency standby engine operating 100 hours a year for maintenance and testing can result in a potential cancer risk of over 30 potential cancer cases in a million for a nearby residence. A similar engine operating in a prime mode for 2000 hours a year can result in a cancer risk of over 650 potential cancer cases in a million. These risk values assume exposure duration of 70 years for a nearby individual.

6. What does the proposed ATCM require?

The proposed ATCM establishes requirements that affect the sellers, owners, and operators of diesel-fueled CI engines that are used in stationary applications. As required by State law, our approach in developing the emission standards and operational limits was to establish requirements that are based on the application of the best available control technology (BACT) and operational practices for diesel PM. The following paragraphs summarize the key requirements of the proposed ATCM.

Initial Reporting Requirements

- Owners or operators of existing stationary CI engines having a horsepower rating greater than 50 (> 50 hp) are required to submit information to the local air districts identifying each engine's make and model, fuel and fuel usage rate, general use and typical hours of operation. This information is due to the districts no later than July 1, 2005.
- Sellers of stationary diesel-fueled engines that are to be used in agricultural applications (i.e., pumps), or that have a rated horsepower of less than or equal to 50 (≤ 50), are required to submit to the ARB information identifying the types of engines sold and number of engines sold per year. This information is due to the ARB no later than January 1, 2006, and annually thereafter for the prior calendar year.

Fuel Use Requirements

- By January 1, 2005, all stationary diesel-fueled CI engines > 50 hp are required to use CARB diesel or a "clean" alternative. "Clean" alternative fuels include CARB diesel/CNG dual-fuel systems and alternative diesel fuels that have met the requirements of the ARB's Verification Procedure.

Emission Standards and Operating Requirements

The proposed diesel PM emission standards and operation limits for new and in-use stationary diesel-fueled engines are briefly discussed below and summarized in Tables E-1 and E-2.

- The proposed ATCM establishes emission standards for stationary diesel-fueled CI engines ≤ 50 hp, sold for use in California. BACT for these engines is the applicable Off-Road Engine PM Certification Standard in title 13, CCR, section 2423.
- For stationary diesel-fueled CI engines > 50 hp used in emergency standby applications (e.g., emergency generator sets and fire pumps), BACT consists of specific diesel PM emission standards and limits on the number of hours the engine must meet more stringent operate for maintenance and testing purposes. Generally, new engine applications must more stringent standards than in-use engine applications. As permitted under State law, the local air pollution control districts may establish more stringent alternative emission standards and hour limitations, on a site-specific basis.
- For stationary diesel-fueled CI engines > 50 hp used in prime applications (e.g., shipyard cranes and rock crushers), BACT consists of specific diesel PM emission standards. New engine applications are held to more stringent standards than in-use engine applications. In-use engines that are not certified off-road engines and for which highly effective PM retrofit controls are unavailable have the option of reducing diesel PM emissions by 30 percent in the near term and meeting a 0.01 g/bhp-hr (proposed Tier 4) PM emission standard in 2011. As permitted under State law, the local air pollution control districts may establish more stringent alternative emission standards and hour limitations.
- The proposed ATCM establishes emission standards for new stationary diesel-fueled CI engines sold for use in agricultural operations. BACT for these engines is 0.15 g/bhp-hr or the applicable Off-Road Engine PM Certification standard, whichever is more stringent.
- For new engines, both ≤ 50 and > 50 hp, the requirements are effective as of July 1, 2005. Owners and operators of in-use engines that elect to comply by reducing hours of operation must do so by January 1, 2005. For in-use engines that require the installation of add-on controls, the requirements are phased in over a four-year period (2006 to 2009), depending on the age and number of engines an owner has.

Table E-1: Summary of Proposed Diesel PM Standards and Operating Limits for <u>New</u> Engines

Engine Applications	Diesel PM Emission Limit (g/bhp-hr*)	Annual Hours of Operation Limit for Maintenance and Testing
• New Prime Engines	≤0.01	None
• New Emergency Standby Engines		100 (District Discretion)
• New Emergency Standby Engines	≤0.15	50
• New Agricultural Operation Engines		None
• New ≤ 50 hp	Applicable off-road standards	None

*grams per brakehorsepower-hour

Table E-2: Summary of Proposed Diesel PM Standards and Operating Limits for <u>In-Use</u> Engines

Engine Applications	Diesel PM Emission Limit (g/bhp-hr)	Annual Hours of Operation Limit for Maintenance and Testing
• In-Use Prime Engines	0.01 or 85% reduction from baseline levels	None
• In-Use Prime Engines (not off-road certified)	30% reduction from baseline levels **and** meet 0.01 by 2011	
• In-Use Emergency Standby Engines	>0.40	20
• In-Use Emergency Standby Engines	>0.15 and ≤ 0.40	30
• In-Use Emergency Standby engines	>0.01 and ≤0.15	50 (District Discretion)
• In-Use Emergency Standby Engines	≤0.01	100 (District Discretion)
• In-Use Emergency Standby Direct-Drive Fire Pumps	none	Hours needed to comply with NFPA 25 Standard (26-33 hours)
• In-Use ≤ 50 hp	none	none

7. Are the proposed diesel PM emission standards technologically feasible?

Yes. Based upon extensive analysis and discussions with numerous stakeholders, staff has determined that the proposed diesel PM emission standards are technologically feasible.

For engines ≤ 50 hp, the proposed diesel PM emission limit applies to engines sold after January 1, 2005, and is equal to the diesel PM emission limit defined in the Off-Road Compression Ignition Engine Standards (title 13, CCR, section 2423). Since equivalently sized off-road engines must meet these standards, ARB staff concludes that it is technologically feasible for stationary diesel-fueled engines to meet these same standards.[1]

For engines > 50 horsepower, ARB staff believes these standards are achievable for the following reasons:

- Currently, approximately 50 stationary diesel-fueled engines are operating successfully in California with diesel particulate filter control technologies. The engines controlled represent a wide range of engine types, model years (1997-2003), horsepower ratings, and applications.
- The results our stationary engine retrofit demonstration program showed successful application of diesel particulate filters, diesel oxidation catalysts, and emulsified fuels on engines ranging in age from 2 to 18 years old.
- California's Off-Road Compression Ignition Standards, which are equivalent to the Federal Non-Road Diesel Engine Emission Standards, have required newly manufactured off-road engines to meet diesel PM emission standards since 1996. Currently, all newly manufactured off-road diesel-fueled engines are meeting either Tier 1, Tier 2, or Tier 3[2] emission standards, depending on the size of the engine.
  - Newly manufactured off-road engines between 175 and 750 hp are currently required to meet a diesel PM emission standard of 0.15 g/bhp-hr.
  - Newly manufactured off-road engines greater than 750 hp are currently required to meet a diesel PM emission standard of 0.40 g/bhp-hr, but they will be required to meet a diesel PM emission standard of 0.15 g/bhp-hr by 2006.
  - Newly manufactured off-road engines less than 175 hp are held to less stringent standards, but certification data indicate that approximately 18 percent of the off-

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[1] In-use emission standards for engines ≤ 50 hp are not being proposed at this time. ARB staff believe there are a limited number of ≤ 50 hp stationary diesel-fueled engines, and because they have never been subject to permitting requirements, there is very little data available. The proposed ATCM will collect data that will allow the development of a more robust inventory, and ARB staff will reassess the need for in-use requirements once that data is available.

[2] Since 1996, manufacturers of diesel engines have been subject to U.S. EPA's nonroad diesel emission regulations (40 CFR Part 89). The nonroad diesel emission standards are tiered (i.e., Tier 1, 2, 3, 4), and the date upon which each tier takes effect depends on the engine size. As of January 1, 2000, all engine sizes were subject to Tier 1 standards. In 2006, all engines sizes will be subject to Tier 2, and in 2008, all engines sizes will be subject to Tier 3 standards. In May 2003, U.S. EPA proposed new Tier 4 emission standards, which will require most engines to meet a 0.01 g/bhp-hr emission rate in the 2011-2014 timeframe.

road certified engines emitted diesel PM at a rate less than or equal to 0.15 g/bhp-hr.

- The annual hour limitations for maintenance and testing of emergency standby engines range from less than 20 hours to 100 hours. ARB survey data and National Fire Protection Association (NFPA) standards indicate that, in most cases, 30 hours per year or less are sufficient to insure the proper operation of an engine when it is needed for emergency service.

8. How will the ATCM regulate stationary diesel-fueled engines used in agricultural operations?

The proposed ATCM affects only new agricultural engines at this time and establishes emissions performance standards for new agricultural engines similar to the requirements for new emergency standby engines. New engines meeting the 0.15 g/bhp-hr PM requirement are currently available “off-the-shelf” for all engine horsepower categories greater than 50 hp. However, since the certification standards for the engines in the 50-175 hp range are higher the 0.15 g/bhp-hr PM standard, only a subset of the engines certified in this category will be allowed in California.

At this time, for the reasons stated below, ARB staff is not proposing performance standards or operating hour restrictions for in-use agricultural engines. We are also not proposing to require that new engines in agricultural service meet the 0.01 g/bhp-hr PM standard for prime engines. Emission reductions from in-use agricultural engines have been realized, however, through the Carl Moyer Memorial Air Quality Standards Attainment Program (Carl Moyer Program). In its first three years (through fiscal year 2000/2001), the Carl Moyer Program funded the replacement of over 1,900 stationary agricultural pumps with lower emission engines. Based on local program data from the first three years provided by the districts, ARB staff estimates PM reductions from the Carl Moyer Program to be approximately 65 tons per year.[3] ARB staff will continue to work with the agricultural community to identify how best to further reduce PM and NOx emission from stationary diesel engines in agricultural service. We will be working to improve the agricultural engine inventory, identifying subset of agricultural engines that have the best potential for retrofits, and working with engine manufacturers and control equipment suppliers on a retrofit demonstration program. We anticipate that this effort will be completed January 2005, at which time we will return to the Board with a recommended approach.

Staff’s proposal would require new agricultural engines to be the cleanest currently produced by engine manufacturers, but it would not require the installation of retrofit and add-on controls for new or in-use agricultural engines. At this time, it is not practical to require retrofit and add-on controls on new or in-use agricultural engines for several reasons, including:

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[3] The San Joaquin Valley Unified Air Pollution Control District recently updated the inventory for agricultural irrigation pumps in the San Joaquin Valley. According to their estimates, as of May 2003, the district has provided funds under the Carl Moyer Program to replace 2,250 diesel-fueled agricultural irrigation pumps.

- Retrofit devices are not readily available for these applications. We believe it would be impractical to require individual owners to have to search out retrofit devices that may be available for his or her engine, obtain an installer, and service and maintain the retrofit device;
- The requirements for retrofits for prime engines need to be implemented via a district permit system to ensure proper design, implementation and enforcement. There is no such system in place for agricultural engines.[4]

We also believe that replacing diesel engines with electric power may be the best long term approach for reducing PM and NOx emissions from stationary agricultural engines. To this end, ARB staff is initiating an effort to work with the agricultural community to determine the feasibility and cost effectiveness of replacing agricultural irrigation pumps with electrically driven pumps. We expect this effort to be completed in the June 2004 timeframe. In addition, ARB staff intends to follow the development of retrofit technologies applicable to agricultural engines. When technically feasible and cost-effective retrofit controls become available, we will propose amendments to the ATCM.

9. How does the ATCM address stationary engines used in Interruptible Service Contracts (ISCs) or Rolling Blackout Reduction Programs?

Investor-owned utilities are authorized to offer optional “interruptible or curtailable” electric service to customers at discounted rates. In return, the customer agrees to reduce power consumption from the grid during periods when not enough power is available to meet all demand with an adequate reserve margin. In some cases, customers with ISC operate emergency standby engines to offset the reduction in electrical power from the grid, and in effect, become self-generators of electricity.

During the development of the ATCM, staff considered how the ATCM should address the continued use of emergency standby engines in interruptible programs. Some entities with existing contracts claimed that operating diesel-fueled emergency standby engines was justified because ISC contracts help prevent blackouts which could result in the widespread use of diesel-fueled emergency standby engines during rolling blackouts. Others argued against their use, raising concerns about public exposures to diesel PM and continued reliance on a power source that is orders of magnitude dirtier than a gas-fired plant in terms of pollution produced per megawatt of electricity generator.

A special type of ISC is the Rolling Blackout Reduction Program in San Diego County. Under this program, certain engines that have signed up to participate are asked to voluntarily reduce power when grid power reached critically low levels. In exchange for reducing power from the grid, the company is paid 20 cents a kilowatt for the power demand reduced.

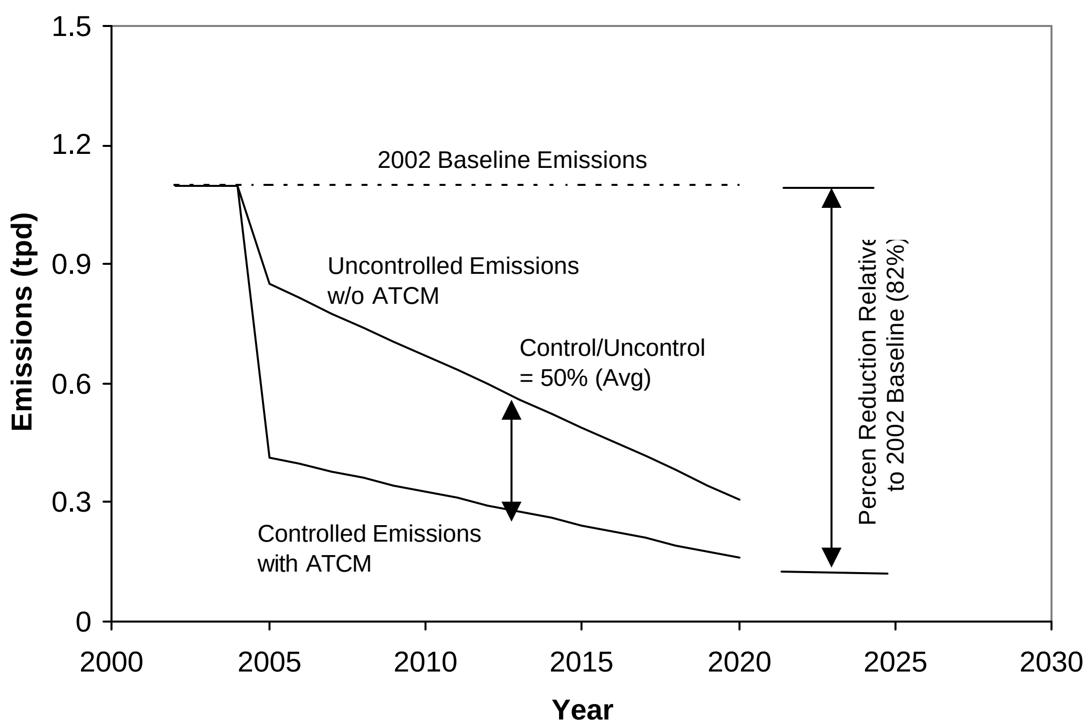
[4] H&SC Section 42310 prohibits Districts from requiring permits for equipment used in agricultural service. However, Senate Bill 700 (SB 700) considered in the 2003-2004 legislative session, would remove this prohibition. SB 700 was signed into law by Governor Davis on September 22, 2003.

While possible approaches were explored during the ATCM development, agreement on how this issue should be treated could not be reached prior to the beginning of the 45-day public comment period. ARB staff will continue to meet with interested parties on this issue and may propose an appropriate provision at the Board hearing with interested parties that would allow the continued use of some of these engines.

10. What are the environmental impacts of the proposed ATCM?

The proposed ATCM will reduce diesel PM emissions and resulting exposures from stationary engines throughout California. ARB staff estimates that, with implementation of the ATCM, diesel PM emissions from stationary diesel-fueled engines used in non-agricultural operations will be reduced by approximately 80 percent or 0.9 tons per day in 2020 relative to the 2002 baseline. These reductions are due to both the implementation of the ATCM and the expected normal turnover of engines. As shown in Figure E-1, ARB staff estimates that the ATCM will result in a 50 percent reduction in diesel PM emissions from the projected uncontrolled baseline.

Figure E-1: Projected Diesel PM Emissions with and without the ATCM



California's air quality will also experience benefits from reduced criteria pollutant emissions (e.g., NOx, ROG). ARB staff estimates that, as older engines are replaced with new engines or retrofitted with diesel PM control devices, between 2005 and 2020, approximately 2.2 tons per day NOx and 0.3 tons per day of ROG will be removed from California's air. We anticipate significant health cost savings due to reduced mortality, incidences of cancer, PM related cardiovascular effects, chronic bronchitis, asthma, and hospital admissions for pneumonia and asthma-related conditions. These directly emitted diesel PM reductions are expected to reduce the number of premature deaths in California. ARB staff estimates that 121 premature deaths (60-185, 95 percent confidence interval (95 CI)) will be avoided by 2020. Prior to 2020, cumulatively, it is estimated that 60 premature deaths (29-90, 95 CI) would be avoided by 2010 and 97 (48-146, 95 CI) by 2015. ARB staff has concluded that no significant adverse environmental impacts should occur under the proposed ATCM.

11. What are the economic impacts of the proposed ATCM?

ARB staff estimates the cost of the ATCM to affected businesses and government agencies to be approximately 47 million dollars for the total capital costs. This corresponds to 8.4 million dollars annually over the useful life of the control equipment. The useful life of the control equipment depends on the number of hours the engine is expected to operate annually. For prime engines, the useful life ranges from 4 to 25 years with a 10-year average. For emergency standby engines, the expected useful life is 25 years.

The majority of the costs will be borne by prime engine owners. In many cases, owners of emergency standby engines will have no cost or net savings due to the reduced operating hours. We estimate that only a small number of emergency standby engines will need to install diesel emission controls (DECS).

Most businesses in California do not own any diesel-fueled stationary engines. For those businesses that do have engines, the cost will vary depending on the number of engines operated and the engine size, activity and operating parameters. ARB staff estimated the costs to comply with the ATCM for a typical business with a 590 horsepower prime engine. The estimated capital cost is $22,400 for the installation of a DPF. For those engines installing a DOC and then later replacing that engine with a new Tier IV engine in 2011, the estimated capital cost is $60,800. For engines with a DPF, there will be an additional annual cost of approximately $550 for maintenance.

For businesses with emergency standby engines, we expect most operators to reduce their annual hours of operation to avoid installation of DECS, which should result in cost savings due to a reduction in the annual diesel fuel usage. For example, an operator with one engine (520 hp) could reduce maintenance and testing usage from 35 to 20 hours, thereby saving about $760 annually. While most operators will likely reduce their hours of operation to meet the ATCM requirements, we estimate that about one percent of operators will need to install a DOC.

Overall, most affected businesses will be able to absorb the costs of the proposed regulation with no significant adverse impacts on their profitability. This finding is based on the staff's analysis of the estimated change in "return on owner's equity" (ROE). The analysis found that the overall change in ROE ranges from negligible to a decline of about six percent. Generally, a decline of more than ten percent in ROE suggests a significant impact on profitability. Because the proposed ATCM would not alter significantly the profitability of most businesses, we do not expect a noticeable change in employment, business creation, elimination, or expansion, and business competitiveness in California. We also found no significant adverse economic impacts on any local or State agencies.

We estimate the overall cost effectiveness of the proposed ATCM to be about $15 per pound ($/lb) of diesel PM reduced, considering only the benefits of reducing diesel PM. Because the proposed ATCM will also reduce reactive organic gases (ROG) and NOx emissions, we allocated half of the costs of compliance against these benefits, resulting in cost effectiveness values of $8/lb of diesel PM and $1/lb of ROG plus NOx reduced.

With regard to mortality benefits, we estimate the cost of avoiding one premature death to be about $216,000 based on attributing half of the cost of controls to reduce diesel PM. Compared to the U.S. EPA's present assignment of $4.4 million as the value of an avoided death, this proposed ATCM is a very cost-effective mechanism for preventing premature deaths caused by diesel PM.

12. How does the proposed ATCM fulfill the goals of the Diesel Risk Reduction Plan as they pertain to stationary engines?

In the Diesel Risk Reduction Plan, ARB staff recommended an ATCM for new engines be developed to reflect the ARB's permitting guidance document, Risk Management Guidance for the Permitting of New Stationary Diesel-Fueled Engines (September 2000). For in-use engines, ARB staff recommended retrofit controls be installed. The overall goal was to achieve the maximum feasible reduction in emissions taking into account cost and risk. Similar to other applications, the target was to achieve an 85 percent reduction in the emissions from stationary engines by 2020.

The proposed ATCM is consistent with the goals in the Diesel Risk Reduction Plan. The requirements and standards in the ATCM are based on the application of BACT for diesel PM. ARB staff estimates that with implementation of the ATCM diesel PM emissions will be reduced by approximately 0.9 tons per year in 2020 relative to the 2002 baseline. This represents about an 80 percent reduction from the 2002 baseline emissions. For new engines used in agricultural applications, BACT is defined as an engine with a 0.15 g/bhp-hr emission rate. Requirements for in-use agricultural engines are not included in the ATCM; however, as discussed earlier, ARB staff are pursuing several avenues to achieve further diesel PM emission reductions from this category. Our analysis of how to further reduce PM and NOx emission from stationary diesel engines in agricultural service will be completed by January 2005.

13. How does the proposed ATCM relate to ARB's goals for Environmental Justice?

Environmental Justice is defined 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. ARB's Environmental Justice Policies are intended to promote the fair treatment of all Californians and cover the full spectrum of the ARB's activities.

The proposed ATCM is consistent with the environmental justice policy to reduce health risks from TACs in all communities, including those with low-income and minority populations, regardless of location. The ATCM will reduce diesel PM emissions from stationary CI engines by requiring the use of the best available control technologies or by reducing the hours of operation. The proposed ATCM will provide air quality benefits for all communities depending upon the number of existing emergency standby and/or prime engines currently operating in those communities.

14. How does the proposed ATCM affect sensitive receptors such as children and cumulative risk?

The goal of the proposed ATCM is to establish diesel PM emission standards and operating requirements for stationary engines that are based on the implementation of the best available diesel PM control technologies (BACT) and the use of the lowest-emitting diesel-fueled CI engines. The specific requirements for a given stationary diesel-fueled engine are dependant on a number of factors including, application (prime or emergency standby), hours of operation, and emission rate of the engine. In most cases, the residual cancer risk from each engine subject to the emission standards and operating requirements of the proposed ATCM is estimated to be less than 10 excess cancer cases in a million, which is consistent with the threshold risk level used by most districts when defining significant risk levels. When estimating the cancer risk to a receptor, the risk assessment methodology estimates the risk based on a lifetime of exposure (70 years), and it accounts for the periods in life when we are most susceptible to the health effects of exposure to diesel PM – both early and late in life. To further reduce children's exposure to diesel PM, the ATCM prohibits schools from operating stationary diesel engines, except for emergencies, when school activities are taking place.

Cumulative risk in this case refers to the cancer risk posed by more than one stationary diesel-fueled engine operating at the same facility or in the same general area. The proposed ATCM will reduce cumulative risk since it will require individual engines to implement BACT. However, ARB staff recognizes that there may be specific situations where the cumulative risk from engines located in close proximity of one another may be elevated, even after the proposed ATCM is fully implemented. Since these are site-specific situations, depending on many factors, the ATCM provides the Districts the authority to establish more stringent diesel PM emission standards and operating requirements on a site-specific basis. In addition to the requirements of the proposed ATCM, the Air Toxics "Hot Spots" program will also be used to determine if there is a need to reduce the cumulative risk from more than one stationary diesel-fueled engine operating at the same facility. The "Hot Spots" program will require facilities to evaluate the cumulative risks from engines at their facility and require additional reductions in diesel PM emissions to reduce excessive risks.

15. How are the AB 2588 "Hot Spots" requirements and the ATCM interrelated?

ARB staff is currently developing amendments to the Air Toxics “Hot Spots” Emission Inventory Criteria and Guidelines Regulation to address diesel engines. These amendments are being developed to align with the ATCM requirements with the goal of avoiding duplicative requirements and ensuring that potential risks from all engines are evaluated and mitigated where necessary. As currently envisioned, ARB staff believes that the initial reporting requirement in the ATCM will also fulfill the emission inventory requirement of "Hot Spots." In some cases, compliance with the ATCM will fulfill all requirements under "Hot Spots." For example, for owners of a single emergency standby diesel engine at a facility currently not in the "Hot Spots" program, compliance with the ATCM will also reduce the potential risk from that engine to below 10 in a million. For these engines, compliance with the ATCM will also fulfill the "Hot Spots" requirements provided the district has a 10 in a million significance level.

The proposed amendments to the "Hot Spots" Emission Inventory Criteria and Guidelines Regulation are tentatively scheduled to be considered by the Board at its December 2003 hearing. ARB staff expects to conduct additional workshops this fall to further define the necessary modifications to the regulation.

16. What future activities are planned?

After Board consideration and approval of the proposed ATCM, ARB staff will work on a number of projects related to the implementation of the proposed ATCM, the collection and processing of engine-related data, and the improvement of the stationary diesel-fueled engine emission inventory. Specifically, resources will be devoted to the following:

- Working with districts to implement the requirements of the ATCM

  After adoption, each district is required to either implement and enforce the ATCM or adopt its own rule that is as effective or more effective overall. ARB staff will work with each district to ensure these requirements are being met and will develop implementation guidance as appropriate.

- Monitoring implementation

  ARB staff will monitor implementation of the proposed ATCM. This will include monitoring advancements in emission control technologies and evaluating BACT. In the event implementation reveals amendments to the ATCM are warranted or that BACT has changed, ARB staff will propose amendments for the Board’s consideration.

- Monitoring the availability of retrofit devices for agricultural applications and high-use emergency standby engines

ARB staff will follow the development of retrofit technologies applicable to agricultural engines and high-use emergency standby engines. In the event technically feasible and cost-effective retrofit controls become available, we will propose amendments to the ATCM.

- Evaluating the feasibility of replacing agricultural diesel-fueled irrigation pumps with electrically driven pumps

  Significant environmental benefits could be realized from the replacement of diesel-fueled irrigation pumps with electrically driven pumps. Over the next several months, ARB staff intends to work with California's agricultural interests and other parties determine if such a transition could be a cost-effectiveness option that should be incorporated into the ATCM.

- Evaluating in-use experience with proposed test methods

  Because the proposed ATCM incorporates a new field method for stationary diesel-fueled engines, ARB staff will monitor application of the test method, work with the districts to develop appropriate in-use compliance testing protocols, and develop any necessary guidance for use of the testing results in health risk assessments.

- Integration of "Hot Spots" and the ATCM

  As stated previously, ARB staff will develop amendments to the "*Hot Spots" Emission Inventory Criteria and Guidelines Regulation* to address diesel PM with the goals of avoiding duplicative requirements and ensuring that potential risks from all engines are evaluated and mitigated as necessary. In addition, ARB staff also intends to determine if the risk assessment procedures can be streamlined by developing more simplified estimation methods that could be used in lieu of air dispersion modeling. Any simplified methodology would be incorporated into guidance for the "Hot Spots" evaluation and ARB guidance on conducting health risk assessments for stationary diesel-fueled engines.

- Updating inventory with the reporting data

  A key requirement of the ATCM is the initial reporting of information on the number of engines and their operating characteristics. This information will be used to update the ARB's emission inventory for stationary engines and will also be incorporated into the Community Health Air pollution Information System (CHAPIS), which will be made available to the public in the coming months. CHAPIS is a new web-based mapping tool that will provide maps of air pollution emission sources over the Internet.

17. What is staff's recommendation?

We recommend the Board approve the proposed ATCM presented in this report (Appendix A). The ATCM will reduce diesel PM emissions from new and in-use stationary CI engines by requiring the use of the best available control technologies or by reducing the hours of operation. The proposed ATCM will provide air quality benefits for all communities depending upon the number of existing emergency standby and/or prime engines currently operating in those communities. ARB staff believes the proposed ATCM is technologically feasible and necessary to carry out the Board's responsibilities under State law.

I. INTRODUCTION

In this chapter, the Air Resources Board (ARB or Board) staff provides an overview of the Staff Report, discusses the purpose of the ATCM, and discusses the regulatory authority the ARB has to adopt the ATCM.

A. Overview

This report presents the proposed Airborne Toxics Control Measure to reduce the emissions of diesel particulate matter (diesel PM) from stationary diesel-fueled compression ignition engines (stationary diesel-fueled engines). A detailed summary of the requirements of the proposed ATCM is found in Chapter V. The report also shares the information that ARB staff used in developing the proposed ATCM. This information includes:

- the health effects associated with exposure to diesel PM emissions (Chapter II);
- the requirements of current regulations that are designed to reduce emissions from stationary compression ignition engines (Chapter III);
- the diesel PM emission inventory and health risks posed by stationary diesel-fueled engines (Chapter IV);
- a discussion of the technical feasibility of the control technologies that can be used to comply with the emission standards defined in the proposed ATCM (Chapter VI),
- a discussion of the regulatory alternatives to the proposed ATCM and why they were not chosen (Chapter VII);
- the environmental impacts of implementing the proposed ATCM (Chapter VIII); and
- the economic impacts of the proposed ATCM (Chapter IX).

In developing the proposed ATCM, there were a number of technical and policy issues that had to be addressed. These included defining a test method for stationary diesel-fueled engines and integrating the requirements of the proposed ATCM with the AB 2588 “Hot Spots” Program. These and other key issues are discussed in Chapter X, Additional Considerations.

The text of the proposed ATCM and other supporting information are found in the Appendices.

B. Purpose

The primary purpose of the proposed ATCM is to reduce the general public's exposure to diesel PM from stationary diesel-fueled engines. The proposed ATCM establishes requirements that fall in four major categories: fuel use requirements; emission standards; operational requirements; and recordkeeping, reporting, and monitoring requirements.

The purpose of the fuel use requirements is to ensure that only the cleanest available diesel or alternative diesel fuels are used in stationary diesel-fueled engines. The purpose of the stringent diesel PM emission standards are to ensure that the sellers and owner/operators of both new and in-use stationary diesel-fueled engines are implementing the best available diesel PM control strategies. The purpose of the operational requirements is to ensure that owners/operators of both new and in-use stationary diesel-fueled engines reduce overall emissions and concurrently operate only when essential, thereby limiting the near-source risk associated with exposure to diesel PM to the maximum extent possible. An example of an operational requirement is the limit placed on the number of hours an owner of an emergency standby engine can run an engine for maintenance and testing purposes. Finally, the purpose of the recordkeeping, reporting, and monitoring requirements is to provide both the district and the ARB staff with information on where stationary diesel-fueled engines are located, how they are used, and what strategies sellers, owners, and operators are using to comply with the requirements of the proposed ATCM. Chapter V of this Staff Report contains a plain English discussion of the key requirements of the proposed ATCM, and Appendix A contains the full text of the proposed ATCM.

C. Regulatory Authority

Several sections of the California Health and Safety Code (H&SC) provide the ARB with authority to adopt the proposed ATCM. Sections 39600 (General Powers) and 39601 (Standards, Definitions, Rules, and Measures) of the H&SC confer to the ARB the general authority and obligation to adopt rules and measures necessary to execute the Board's powers and duties imposed by State law.

More specifically, California's Air Toxics Program, established under California law by AB 1807 (Stats. 1983, Ch. 1047) and set forth in Health and Safety Code sections 39650 through 39675, mandates the identification and control of TACs in California. The identification phase of the Air Toxics Program requires the ARB, with participation of other state agencies such as the Office of Environmental Health Hazard Assessment (OEHHA), to evaluate the health impacts of and exposure to substances and to identify those substances that pose the greatest health threat as TACs. The ARB's evaluation is made available to the public and is formally reviewed by the Scientific Review Panel (SRP) established under Health and Safety Code section 39670. Following the ARB's evaluation and the SRP's review, the Board may formally identify a TAC at a public hearing. Following the identification of a substance as a TAC, Health and Safety Code sections 39658 and 39665 requires the ARB, with the participation of the air pollution control and air quality management districts, and in consultation with affected sources and interested parties, to prepare a report on the need and appropriate degree of regulation for that substance (risk management phase).

In August 1998, the Board identified diesel PM as a TAC, and in September 2000, the ARB adopted the "Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-fueled Engines and Vehicles" (Diesel Risk Reduction Plan). (ARB, 2000) The Diesel Risk Reduction Plan was the first formal product of the risk management phase and serves as the needs assessment under the AB1807 process. In the Diesel Risk Reduction Plan, the ARB indentified the available options to reduce diesel PM and the recommended control measures to achieve reductions, including a measure to reduce diesel PM from stationary diesel-fueled engines.

In 1999, California's Air Toxics Program was amended by Senate Bill 25 (Stats. 1999, Ch. 731) to provide additional requirements for further consideration of health impacts to infants and children. As part of these requirements, the OEHHA was to identify up to five TACs as making children especially susceptible to illness. The OEHHA published the "Prioritization of Toxic Air Contaminants under the Children's Environmental Health Protection Act" in October 2001, identifying diesel PM as one of the five TACs. Additional requirements established by Senate Bill 25 in Health and Safety Code section 39669.5 directs the ARB to adopt control measures, as appropriate, to protect public health, particularly infants and children, from these specially identified TACs.

This ATCM is being proposed to fulfill the goals of the Diesel Risk Reduction Plan and to comply with the requirements of H&SC section 39666 and 39669.5 to prevent an endangerment to public health. To control criteria pollutant emissions, H&SC section 43013(b) directs the ARB to adopt standards and regulations for non-vehicle engines, which covers stationary diesel-fueled engines.

D. Public Outreach and Environmental Justice

Environmental Justice

The ARB is committed to integrating environmental justice in all of its activities. On December 13, 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 directive of California state law. (ARB, 2001) Environmental Justice is defined 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. These policies apply to all communities in California, but recognize that environmental justice issues have been raised more in the context of low-income and minority communities.

The Environmental Justice Polices are intended to promote the fair treatment of all Californians and cover the full spectrum of the ARB's activities. Underlying these Policies is a recognition that the agency 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 unhealthful air pollution in their communities. The ARB recognizes its obligation to work closely with all communities, environmental and public health organizations, industry, business owners, other agencies, and all other interested parties to successfully implement these Policies.

During the development process, the ARB staff proactively searched for opportunities to present information about the proposed ATCM at places and times convenient to stakeholders. For example, the meetings were held at times and locations that encouraged public participation, including evening sessions. Attendees included representatives from environmental organizations, military, communication companies and service providers, engine and diesel emission control associations, and other parties interested in prime or emergency standby stationary diesel-fueled engines. These individuals participated both by providing data and reviewing draft regulations and by participating in open forum workshops, in which staff directly addressed their concerns. Table I-1 below provides meeting dates that were made to apprise the public about the development of the proposed ATCM.

The proposed ATCM is consistent with the environmental justice policy to reduce health risks from TACs in all communities, including those with low-income and minority populations, regardless of location. The ATCM will reduce diesel PM emissions from all stationary diesel-fueled engines by requiring the use of the best available control technologies or by reducing the hours of operation. The proposed ATCM will provide air quality benefits for all communities depending upon the number of existing emergency standby and/or prime engines currently operating in those communities.

Outreach Efforts

Since the identification of diesel PM as a TAC in 1998, the public has been more aware of the health risks posed by the emissions of this TAC. At many of the ARB's community outreach meetings over the past few years, the public has raised questions regarding our efforts to reduce exposure to diesel PM. At these meetings, ARB staff told the public about the Diesel Risk Reduction Plan adopted in 2000 and described some of the measures in that plan, including those for stationary diesel-fueled engines.

The ARB has held 8 public workshops and 2 community outreach meetings since 2001 in developing this rule (see Table I-1). Over 700 individuals and/or companies were notified for each workshop through a series of mailings. Notices were posted to ARB's diesel risk reduction and public workshops web sites and e-mailed to subscribers of the stationary diesel risk reduction electronic list server. For the last six workshops, live audio broadcasts were also available to the public via the Internet. For the community outreach meetings, notices were send to individuals on our Neighborhood Assessment Program mailing lists.

Table I-1: Workshop/Outreach Meeting Locations and Times

Date	Meeting	Location	Time
February, 14 2001	Public Workshop	Cal/EPA Building, Sacramento	9:30 a.m.
January, 16, 2002	Public Workshop	Cal/EPA Building, Sacramento	9:30 a.m.
April, 4 2002	Public Workshop	Cal/EPA Building, Sacramento	9:30 a.m.
September 4, 2002	Public Workshop	Cal/EPA Building, Sacramento	9:30 a.m.
November 19, 2002	Public Workshop	Cal/EPA Building, Sacramento	9:30 a.m.
March 6, 2003	Public Workshop	Cal/EPA Building, Sacramento	9:30 a.m.
April 1, 2003	Community Outreach	Hollenbeck Middle School, Boyle Heights (ATCM Overview)	6:00 p.m.
April 30, 2003	Community Outreach	Wilmington Park Elementary School, Wilmington (ATCM Overview)	6:00 p.m.
June 5, 2003	Public Workshop	Cal/EPA Building, Sacramento	9:30 a.m.
August 26, 2003	Public Workshop	Cal/EPA Building, Sacramento	9:30 a.m.

In addition to the public workshops or community outreach meetings presented in Table I-1, ARB staff and management participated in numerous industry and government agency meetings over the past three years, presenting information on the Diesel Risk Reduction Plan and our proposed regulatory approach for stationary diesel-fueled engines. Some of the industry groups and environmental associations participating were the California Council for Economic and Environmental Balance, Association of California Water Agencies, Construction Materials Association of California, American Lung Association, Engine Manufacturers Association, Manufacturers of Emission Controls Association, Southern California Alliance of Publicly Owned Treatment Works, California Ski Industry Association, National Resources Defense Counsel, Environmental Defense, the United States Navy, California Healthcare Association, California Army National Guard, University of California Office of the President, agricultural community interests, and several publicly treated wastewater facilities. Several state agencies, including the Department of General Services, California Youth Authority, Department of Water Resources, and the California Department of Corrections were contacted and invited to meet with ARB staff to discuss the propose ATCM and how it relates to their agencies. Staff also participated in bi-monthly and sometimes monthly meetings of the California Air Pollution Control Officers Association (CAPCOA) and CAPCOA Engineering Managers, where current status reports were given on the progress of the proposed regulation, and feedback from CAPCOA was incorporated into the draft ATCM.

In February and March 2001, staff held eight public consultation meetings with the agricultural community to initiate dialogue on the implementation of the Diesel Risk Reduction Plan. Members of California's Farm Bureaus, the Nisei Farmers League, and other agricultural organizations were invited to attend. In addition, an agriculture working group was formed to provide a forum for discussing issues with the proposed ATCM unique to the agriculture industry. The working group met several times during 2002 and 2003 and provided valuable assistance in developing the ATCM as it relates to California's agricultural activities.

As a way of inviting public participation and enhancing the information flow between the ARB and interested parties, staff created a diesel risk reduction program Internet web site (http://www.arb.ca.gov/diesel/dieselrrp.htm) in December 2000. Since that time, staff has consistently made available on the web site all related documents, including meeting presentations and draft versions of the proposed regulatory language. The web site has also provided background information on diesel PM, fact sheets, workshop and meeting notices and materials, and other diesel related information, and has served as a portal to other web sites with related information.

Outreach efforts have also included hundreds of personal contacts via telephone, electronic mail, regular mail, surveys, facility visits, and individual meetings with interested parties. These contacts have included interactions with engine manufacturers and operators, emission control system manufacturers, local, national, and international trade association representatives, environmental, pollution prevention, and public health organizations, State agencies, military officials and representatives, and other federal agencies.

REFERENCES:

California Air Resources Board. *Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles*; October 2000. (ARB, 2000)

California Air Resources Board. *Policies and Actions for Environmental Justice*; December 2001. (ARB, 2001)

II. NEED FOR CONTROL OF DIESEL PARTICULATE MATTER

In 1998, the Air Resources Board identified diesel particulate matter (diesel PM) as a TAC. Diesel PM is by far the most important TAC and contributes over 70 percent of the estimated risk from air toxics today. In September 2000, the ARB approved the "Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles" (Diesel Risk Reduction Plan). The goal of the Diesel Risk Reduction Plan is to reduce diesel PM emissions and the associated cancer risk by 85 percent in 2020. In addition, in 2001, the Office of Environmental Health Hazard Assessment identified diesel PM as one of the TACs that may cause children or infants to be more susceptible to illness pursuant to the requirements of Senate Bill 25 (Stats. 1999, ch. 731). Senate Bill 25 also requires the ARB to adopt control measures, as appropriate, to reduce the public's exposure to these special TACs (H&SC section 39669.5).

This proposed ATCM, to reduce diesel PM emissions from stationary diesel-fueled engines, is one of a large group of regulations being developed to achieve the emission reduction goals of the Diesel Risk Reduction Plan of protecting the health of Californians by reducing the public's exposure to diesel PM. The proposed ATCM will also reduce emissions of ROG and oxides of nitrogen (NOx), precursors to the formation of ozone.

This chapter describes the physical and chemical characteristics of diesel PM and discusses the health effects of the pollutants emitted by diesel engines and environmental benefits from the proposed regulation. As discussed below, it is important that steps be taken to reduce emissions from all diesel-fueled engines, including stationary diesel-fueled engines, to reduce public exposures to diesel PM and ozone, further progress in meeting the ambient air quality standards, and to improve visibility.

A. Physical and Chemical Characteristics of Diesel PM

Diesel engines emit a complex mixture of inorganic and organic compounds that exist in gaseous, liquid, and solid phases. The composition of this mixture will vary depending on engine type, operating conditions, fuel, lubricating oil, and whether or not an emission control system is present. The primary gas or vapor phase components include typical combustion gases and vapors such as carbon monoxide (CO), carbon dioxide (CO_2), sulfur dioxide (CO_2), oxides of nitrogen (NOx), reactive organic gases (ROG), water vapor, and excess air (nitrogen and oxygen). For example, an uncontrolled 1988 500hp diesel engine could have a PM emission rate of over 0.5 g/bhp-hr, whereas a 2003 model year engine is required to meet a 0.15 g/bhp-hr emission rate and, under the proposed Tier 4 standards, that same size engine will be required to meet a 0.01 g/bhp-hr emission rate in the 2011-2014 timeframe.

The emissions from diesel-fueled engines also contain potential cancer-causing substances such as arsenic, nickel, benzene, formaldehyde, and polycyclic aromatic hydrocarbons (PAHs). There are over 40 substances that are listed by the U.S. EPA as hazardous air pollutants and by the ARB as TACs in emissions from diesel-fueled engines. Fifteen of these substances are listed by the International Agency for Research on Cancer as carcinogenic to humans, or as a probable or possible human carcinogen. The list includes the following substances: formaldehyde, acetaldehyde, 1,3-butadiene, antimony compounds, arsenic, benzene, beryllium compounds, inorganic lead, mercury compounds, bis(2-ethylhexyl)phthalate, dioxins and dibenzofurans, nickel, POM (including PAHs); and styrene.

Diesel PM is either directly emitted from diesel-powered engines (primary particulate matter) or is formed from the gaseous compounds emitted by a diesel engine (secondary particulate matter). Diesel PM consists of both solid and liquid material and can be divided into three primary constituents: the elemental carbon fraction; the soluble organic fraction, and the sulfate fraction.

Many of the diesel particles exist in the atmosphere as a carbon core with a coating of organic carbon compounds, or as sulfuric acid and ash, sulfuric acid aerosols, or sulfate particles associated with organic carbon. (Beeson, 1998) The organic fraction of the diesel particle contains compounds such as aldehydes, alkanes and alkenes, and high-molecular weight PAH and PAH-derivatives. Many of these PAHs and PAH-derivatives, especially nitro-PAHs, have been found to be potent mutagens and carcinogens. Nitro-PAH compounds can also be formed during transport through the atmosphere by reactions of adsorbed PAH with nitric acid and by gas-phase radical-initiated reactions in the presence of oxides of nitrogen. Fine particles may also be formed secondarily from gaseous precursors such as SO2, NOx, or organic compounds. Fine particles can remain in the atmosphere for days to weeks and travel through the atmosphere for hundreds to thousands of kilometers, while coarse particles deposit to the earth within minutes to hours and within tens of kilometers from the emission source.

Almost all of the diesel particle mass is in the fine particle range of 10 microns or less in diameter (PM_{10}). Approximately 94 percent of the mass of these particles are less than 2.5 microns ($PM_{2.5}$) in diameter. Diesel PM can be distinguished from noncombustion sources of $PM_{2.5}$ by the high content of elemental carbon with the adsorbed organic compounds and the high number of ultrafine particles (organic carbon and sulfate).

The soluble organic fraction (SOF) consists of unburned organic compounds in the small fraction of the fuel and atomized and evaporated lube oil that escape oxidation. These compounds condense into liquid droplets or are adsorbed onto the surfaces of the elemental carbon particles. Several components of the SOF have been identified as individual TACs.

B. Health Impacts of Exposure to Diesel PM, Ambient Particulate Matter, and Ozone

The proposed ATCM will reduce the public's exposure to diesel PM as well as reduce ambient particulate matter. In addition, the proposed ATCM is expected to result in reductions in emissions of NOx and ROG, which are precursors to the formation of ozone in the lower atmosphere. The primary health impacts of these air pollutants are discussed below.

Diesel Particulate Matter

Diesel PM is of specific concern because it poses a lung cancer hazard for humans as well as a hazard from noncancer respiratory effects such as pulmonary inflammation. (ARB, 1998a) Because of their small size, the particles are readily respirable and can effectively reach the lowest airways of the lung along with the adsorbed compounds, many of which are known or suspected mutagens and carcinogens. (ARB, 2002) More than 30 human epidemiological studies have investigated the potential carcinogenicity of diesel PM. On average, these studies found that long-term occupational exposures to diesel exhaust were associated with a 40 percent increase in the relative risk of lung cancer. (ARB, 1998b) However, there is limited specific information that addresses the variable susceptibilities to the carcinogenicity of diesel exhaust within the general human population and vulnerable subgroups, such as infants and children and people with preexisting health conditions. The carcinogenic potential of diesel exhaust was also demonstrated in numerous genotoxic and mutagenic studies on some of the organic compounds typically detected in diesel exhaust. (ARB, 1998b)

Diesel PM was listed as a TAC by ARB in 1998 after an extensive review and evaluation of the scientific literature by OEHHA. (ARB 1998c) Using the cancer unit risk factor developed by OEHHA for the TAC program, it was estimated that for the year 2000, exposure to ambient concentrations of diesel (1.8 $\mu g/m^3$) could be associated with a health risk of 540 potential cancer cases per million people exposed over a 70-year lifetime.

Another highly significant health effect of diesel exhaust exposure is its apparent ability to act as an adjuvant in allergic responses and possibly asthma. (Dab, 2000) (Diaz-Sanchez, 1996) (Kittelson, 1999) However, additional research is needed at diesel exhaust concentrations that more closely approximate current ambient levels before the role of diesel PM exposure in the increasing allergy and asthma rates is established.

Ambient Particulate Matter

The key health effects categories associated with ambient particulate matter, of which diesel PM is a component, include premature mortality; aggravation of respiratory and cardiovascular disease (as indicated by increased hospital admissions and emergency room visits, school absences, work loss days, and restricted activity days); aggravated asthma; acute respiratory symptoms, including aggravated coughing and difficult or painful breathing, chronic bronchitis, and decreased lung function that can be experienced as shortness of breath. (U.S. EPA 2000, U.S. EPA 2003)

Health impacts from exposure to the fine particulate matter ($PM_{2.5}$) component of diesel exhaust have been calculated for California, using concentration-response equations from several epidemiological studies. Both mortality and morbidity effects could be associated with exposure to either direct diesel $PM_{2.5}$ or indirect diesel $PM_{2.5}$, the latter of which arises from the conversion of diesel NO_x emissions to $PM_{2.5}$ nitrates. It was estimated that 2000 and 900 premature deaths resulted from long-term exposure to either 1.8 $\mu g/m^3$ of direct $PM_{2.5}$ or 0.81 $\mu g/m^3$ of indirect $PM_{2.5}$, respectively, for the year 2000. (Lloyd, 2001) The mortality estimates are likely to exclude cancer cases, but may include some premature deaths due to cancer, because the epidemiological studies did not identify the cause of death. Exposure to fine particulate matter, including diesel $PM_{2.5}$ can also be linked to a number of heart and lung diseases.

Ozone

Diesel exhaust consists of hundreds of gas-phase, particle-phase, and semi-volatile organic compounds, including typical combustion products, such as CO_2, hydrogen, oxygen, and water vapor, as well as CO, ROG, carbonyls, alkenes, aromatic hydrocarbons, PAHs, PAH derivatives, and sulfur oxides (SOx) - compounds resulting from incomplete combustion. Ozone is formed by the reaction of ROG and NOx in the atmosphere in the presence of heat and sunlight. The highest levels of ozone are produced when both ROG and NOx emissions are present in significant quantities on clear summer days. This pollutant is a powerful oxidant that can damage the respiratory tract, causing inflammation and irritation, which can result in breathing difficulties.

Studies have shown that there are impacts on public health and welfare from ozone at moderate levels that do not exceed the 1-hour ozone standard. Short-term exposure to high ambient ozone concentrations have been linked to increased hospital admissions and emergency visits for respiratory problems. (Peters, 2001) Repeated exposure to ozone can make people more susceptible to respiratory infection and lung inflammation and can aggravate preexisting respiratory diseases, such as asthma. Prolonged (six to eight hours), repeated exposure to ozone can cause inflammation of the lung, impairment of lung defense mechanisms, and possibly irreversible changes in lung structure, which over time could lead to premature aging of the lungs and/or chronic respiratory illnesses such as emphysema and chronic bronchitis.

The subgroups most susceptible to ozone health effects include individuals exercising outdoors, children and people with preexisting lung disease such as asthma, and chronic pulmonary lung disease. Children are more at risk from ozone exposure because they typically are active outside, during the summer when ozone levels are highest. Also, children are more at risk than adults from ozone exposure because their respiratory systems are still developing. Adults who are outdoors and moderately active during the summer months, such as construction workers and other outdoor workers, also are among those most at risk. These individuals, as well as people with respiratory illnesses such as asthma, especially asthmatic children, can experience reduced lung function and increased respiratory symptoms, such as chest pain and cough, when exposed to relatively low ozone levels during prolonged periods of moderate exertion.

C. Health and Environmental Benefits from the Proposed Regulation

Reducing diesel PM emissions from stationary diesel-fueled engines will have both public health and environmental benefits. The proposed ATCM will reduce localized potential cancer risks associated with stationary diesel-fueled engines that are near receptors and will contribute to the reduction of the general exposure to diesel PM that occurs on a region-wide basis due to collective emissions from diesel-fueled engines. Additional benefits associated with the proposed regulation include further progress in meeting the ambient air quality standards for PM_{10}, $PM_{2.5}$, and ozone, and enhancing visibility.

Reduced Diesel PM Emissions

The estimated reductions in diesel PM emissions and the associated benefits from reduced exposure and risk are discussed in detail in Chapter VIII.

Reduced Ambient Particulate Matter Levels

Reducing diesel PM will also help efforts to achieve the ambient air quality standards for particulate matter. Both the State of California and the U.S. EPA have established standards for the amount of PM_{10} in the ambient air. These standards define the maximum amount of PM that can be present in outdoor air. California's PM_{10} standards were first established in 1982 and updated June 20, 2002. It is more protective of human health than the corresponding national standard. Additional California and federal standards were established for $PM_{2.5}$ to further protect public health (Table II-1).

Table II-1: State and National PM Standards

California Standard		**National Standard**	
		PM_{10}	
Annual Arithmetic Mean	20 μg/m^3	Annual Arithmetic Mean	50 μg/m^3
24-Hour Average	50 μg/m^3	24-Hour Average	150 μg/m^3
		$PM_{2.5}$	
Annual Arithmetic Mean	12 μg/m^3	Annual Arithmetic Mean	15 μg/m^3
24-Hour Average	No separate State standard	24-Hour Average	65 μg/m^3

Particulate matter levels in most areas of California exceed one or more of current state PM standards. The majority of California is designated as non-attainment for the State PM_{10} standard (ARB 2002). Diesel PM emission reductions from diesel-fueled engines will help protect public health and assist in furthering progress in meeting the ambient air quality standards for both PM_{10} and $PM_{2.5}$.

The emission reductions obtained with low sulfur diesel and diesel engines equipped with aftertreatment systems will result in lower ambient particulate matter levels and significant reductions of exposure to primary and secondary diesel PM. Lower ambient particulate matter levels and reduced exposure mean reduction of the prevalence of the diseases attributed to diesel PM, reduced incidences of hospitalizations and prevention of premature deaths.

Reduced Ambient Ozone Levels

Emissions of NOx and ROG, precursors to the formation of ozone in the lower atmosphere, will also be reduced by the proposed regulation. In California, most major urban areas and many rural areas continue to be non-attainment for the State and federal 1-hour ambient air quality standard for ozone. Controlling emissions of ozone precursors would reduce the prevalence of the types of respiratory problems associated with ozone exposure and would reduce hospital admissions and emergency visits for respiratory problems. Ozone can also have adverse health impacts at concentrations that do not exceed the 1-hour NAAQS.

Table II-2: State and National Ozone Standards

	California Standard	National Standard
1 hour	0.09 ppm (180 $\mu g/m^3$)	0.12 ppm (235 $\mu g/m^3$)
8 hour	-	0.08 ppm (157 $\mu g/m^3$)

Improved Visibility

In addition to the public health effects of fine particulate pollution, inhalable particulates including sulfates, nitrates, organics, soot, and soil dust contribute to regional haze that impairs visibility.

In 1999, the U.S. EPA promulgated a regional haze regulation that calls for states to establish goals and emission reduction strategies for improving visibility in 156 mandatory Class I national parks and wilderness. California has 29 of these national parks and wilderness areas, including Yosemite, Redwood, and Joshua Tree National Parks. Reducing diesel PM from stationary diesel-fueled engines will help improve visibility in these Class I areas.

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III. STATIONARY COMPRESSION-IGNITION ENGINES: DEFINITIONS, USES, AND CURRENT REGULATIONS

A. Definitions and Uses

A compression-ignition engine is defined as any internal combustion, diesel-cycle engine. It is generally assumed that the engine will be using diesel fuel. However, compression ignition engines can also use alternative fuels (e.g., jet fuel, biodiesel, CNG, and diesel/water mixtures).

Stationary engines are generally those that remain in one location at a facility for 12 months or longer. The engines can be divided into two categories: emergency standby engines and prime engines, both of which are used in agricultural and non-agricultural applications.

Emergency Standby Engines: The most common use of an emergency standby engine is in conjunction with a generator set to provide back-up electrical power during emergencies or unscheduled power outages. Emergency generator engines can range from less than 50 horsepower to over 6,000 horsepower, depending on the end users' needs. Emergency standby engines are also used with fire pumps as part of fire suppression systems. Engines used in fire pump applications are seldom larger than 200 horsepower. Since emergency standby engines are used primarily for emergency situations, their use is generally limited and most hours of operation occur for the purposes of maintenance and testing to ensure the engines are operable when needed in an emergency. Most air districts in California limit the number of hours that an emergency standby engine can be used for non-emergency purposes to between 50 and 200 hours per year. Emergency standby engines represent the majority of all stationary engines (approximately 75 percent). There are over 19,000 diesel-fueled emergency standby engines in use in California. The engines are owned and operated by various facilities and businesses, including, but not limited to, hospitals, hotels, banks, office buildings, correctional facilities, airports, retail shopping centers, factories, military installations, schools, waste and water treatment facilities, and many other types of public agencies. The vast majority of emergency standby engines are diesel-fueled. Diesel engines provide reliable service, are easy to maintain, can easily have dedicated fuel supplies, and are required where failure of an emergency power supply is critical to human life and safety.

Prime Engines: Prime engines are used in a wide variety of applications, including compressors, cranes, generators, pumps (including agricultural irrigation pumps), and grinders/screening units. The engines are owned and operated by various facilities and businesses including recycling plants, ports, waste and recycling facilities, military installations, electrical generating companies in remote areas that are removed from the grid, and some public agencies. The size and operation of prime engines are highly variable, depending on the specific application. Prime engines can range in size from about 50 horsepower for an engine used with a screening plant used to sort wood waste, to 2,000 horsepower or more for an engine generator set that is the main source of power for a facility. Annual operation can be as low as 100 hours a year for a prime engine driving a compressor to several thousand hours a year for an irrigation pump. There are approximately 1,300 diesel-fueled prime engines currently in use in California in non-agricultural applications.

Agricultural stationary engines are also categorized as prime engines and are used for growing and harvesting crops or raising fowl or animals for the primary purpose of making a profit, providing a livelihood, or conducting agricultural research or instruction by an educational institution. Agricultural operations do not include activities involving the processing or distribution of crops or fowl. There are approximately 5,000 stationary agricultural irrigation pump engines in California. Of the prime engines operating throughout the State, about 80 percent are agricultural irrigation pump engines.

B. Summary of Existing Regulations and Programs

This section discusses the air pollution control laws that apply to stationary diesel-fueled engines. Health and Safety Code Division 26, Section 40000 specifies that the ARB has direct responsibility for controlling emissions from motor vehicles, and that districts have the responsibility of controlling air pollution from all sources other than motor vehicles.

New Source Review Rules

A new or modified stationary diesel-fueled engine may be subject to one or more federal, State or local air pollution control laws. The federal Clean Air Act established two distinct preconstruction permit programs (termed New Source Review (NSR)) governing the construction of major new and modifying stationary sources. NSR is intended to ensure these sources do not prevent the attainment or interfere with the maintenance of the ambient air quality standards. Sources constructing in nonattainment areas are required to apply the Lowest Achievable Emission Rate (LAER) control technology to minimize emissions and to “offset” the remaining emissions with reductions from other sources. Sources constructing in attainment or unclassified areas are required by the Prevention of Significant Deterioration (PSD) program to apply the Best Available Control Technology (BACT) and meet additional requirements aimed at maintaining the region’s clean air. In addition, the Federal Clean Air Act requires all major sources subject to federal NSR to obtain federal Title V operating permits governing continuing operations.

The Health and Safety Code requires districts with nonattainment areas for CO, NOx, ozone, and SOx to design permit programs for new and modified stationary sources with the potential to emit above specified levels to achieve no net increase in emissions. In these areas, districts must also require BACT on new and modified stationary sources above specified emission levels.

The Health and Safety Code allows local districts to establish a permit system that requires any person who builds, erects, alters, replaces or operates equipment or machinery which may cause the issuance of air contaminants to obtain a permit from the district. All districts in California have adopted permit programs. Generally, the local districts incorporate the State and federal permitting requirements into their preconstruction and operating permit programs. Some districts issue separate federal permits. Most of the emission control requirements that have been established for diesel-fueled engines have been set through the district permitting programs. In addition, for particulate matter, nothing restricts the authority of a district to adopt regulations to control suspended particulate matter or visibility reducing particles.

IC Engine Regulations

While most districts require some level of control to reduce NOx emissions from new and modified stationary and portable diesel-fueled engines, only 12 districts have adopted source-specific regulations affecting emissions from existing stationary and portable diesel-fueled engines. Engines used in agricultural operations, emergency standby applications, and low capacity engines are typically exempt from these regulations. All 12 regulations set NOx and carbon monoxide (CO) standards (three districts also have hydrocarbon (HC) standards). These regulations do not set standards for diesel PM emissions. However, South Coast Air Quality Management District (SCAQMD) Regulation 1110.2 is projected by SCAQMD staff to result in a number of diesel-fueled engines being taken out of service because of the cost of satisfying the regulation's NOx standard. Consequently, SCAQMD staff expects overall diesel PM emissions will be lower in the SCAQMD by the end of 2004.

Emergency Standby Requirements

In addition to local district regulation of emergency standby engines, there are other laws and regulations that affect the use of these engines. Certain types of facilities are required by either California law or local regulations to provide for emergency lighting and power. Examples of affected facilities include medical facilities, prisons, and certain office complexes. For medical facilities, State law requires that the equipment providing the emergency lighting and power must be tested at load for 30 minutes every 7 to 10 days.[5]

Toxic New Source Review

Currently, at least eight districts have adopted Toxic New Source Review rules, and many more districts have policies. A rule is a set of criteria that has been formally adopted. A policy is a set of guiding principles that has not been codified into a rule. These rules or policies were generally not specifically designed for permitting diesel-fueled engines. Most of these rules and policies use an approach that incorporates risk levels that trigger the installation of Toxic Best Available Control Technology (T-BACT) and permit denial.

[5] An Assembly Bill (AB 390) was considered by the State Legislature in the 2003/2004 session and was enrolled on August 28, 2003. If enacted, it would reduce the required testing frequency for emergency standby diesel-fueled generators operated by health facilities.

Diesel Risk Management Guidance

The *Risk Management Guidance for the Permitting of New Stationary Diesel-Fueled Engines, September 2000,* (Guidance) provides assistance to local air pollution control districts and air quality management districts (districts) in making risk management decisions associated with the permitting of new stationary diesel-fueled engines that are greater than 50 horsepower. The Guidance, approved by the Board in September 2000, identifies minimum technology requirements and performance standards for reducing particulate matter emissions from new stationary diesel-fueled engines. It identifies engine categories that may be approved without a site-specific health risk assessment (HRA), provided either the minimum technology requirements or performance standards are met. The Guidance also discusses diesel-specific adjustments that may be used when a site-specific HRA is required. (ARB, 2000a) (ARB, 2002)

The key recommendations in the Guidance are:

- Approve permits for diesel-fueled engines if they meet the appropriate performance standards or minimum technology requirements (see Table III-1). Meeting the appropriate minimum technology requirements or performance standards will result in the application of the best available control technologies (BACT) and the lowest achievable risk levels, in consideration of costs, uncertainty in the emissions and exposure estimates, and uncertainties in the approved health values. For these engines, a site-specific HRA is not required.

- Emergency standby engines are not required to meet add-on control or very-low sulfur fuel requirements until the stationary compression ignition ATCM is approved.

- Require a site-specific HRA prior to approval for prime diesel-fueled engines that operate over 400 hours per year (see Table III-1). If the HRA estimates a potential cancer risk greater than or equal to of 10 chances in a million, we suggest the district review additional site-specific information; e.g., site specific design considerations, location of sensitive receptors, and alternative technologies or fuels; before making a permitting decision. This information should be summarized in a Specific Findings (SF) Report. We further recommend the public be provided the opportunity to review and comment on the proposed permit action. The APCO would consider the public's comments in making the final permitting decision.

- Conduct risk assessments consistent with the *California Air Pollution Control Officers Association (CAPCOA), Air Toxics "Hot Spots" Program, Revised 1992 Risk Assessment Guidelines* (Risk Assessment Guidelines), dated October 1993[6], and the risk assessment guidance presented in the Guidance. Use diesel PM as a surrogate for all TAC emissions from diesel-fueled engines when determining the

[6] The Office of Environmental Health Hazard Assessment (OEHHA) has just completed new risk assessment guidelines and anticipates adoption in 2003.

potential cancer risk and the noncancer chronic hazard index for the inhalation pathway.

- ♦ Estimate risk using the Scientific Review Panel's (SRP) recommended unit risk factor of 300 excess cancers per million per microgram per cubic meter of diesel PM [$3 \times 10^{-4} (\mu g/m^3)^{-1}$] based on 70 years of exposure.

- ♦ Consider the overall benefit for the project and the uncertainty in the risk assessment information when making risk management decisions.

Table III-1: Recommended Permitting Requirements for New Stationary Diesel-Fueled Engines

Engine Category	Annual Hours of Operation	Group	Performance Standard[1] (g/bhp-hr)	Minimum Technology Requirements			Additional Requirements	
				New Engine PM Emission Levels[1] (g/bhp-hr)	Fuel Technology Requirements	Add-On Control	HRA Required	SF Report
Emergency/ Standby > 50 hp[2]	≤ 100 hours[3]	1	0.15[4]	0.15[4]	CARB Diesel or equivalent	No	No	No
All Other Engines > 50 hp	≤ 400 hours	1	0.02	0.15[4]	Very low-sulfur CARB Diesel or equivalent[5]	Catalyst-based DPF or equivalent	No	No
	> 400 hours	2	0.02	0.15[4]	Very low-sulfur CARB Diesel or equivalent[5]	Catalyst-based DPF or equivalent	Yes	If HRA shows risk > 10/million

HRA - Health Risk Assessment; SF - Specific Findings; DPF - Diesel Particulate Filter

1. *California Exhaust Emission Standards and Test Procedures for New 1996 and Later Off-Road Compression–Ignition Engines*, May 12, 1993, incorporating as referenced, ISO/DP 8178 Test Procedure, Part 1, June 3, 1992, Part 4, June 30, 1992, and Part 5, June 3, 1992.
2. The emergency standby engine category is valid until March 2002, or until the analysis supporting the Emergency Standby Retrofit ATCM is complete, whichever is sooner. At that time, emergency standby engines will be required to meet the A*ll Other Engine >50 hp* requirements. New emergency standby engines must be "plumbed" to facilitate the installation of a catalyst-based DPF at a later date.
3. The annual hours of operation for emergency standby engines include the hours of operation for maintenance and testing runs only.
4. Includes an update and clarification made to the Guidance in a letter to the Districts on March 29, 2002. (Venturini, 2002)
5. Very low sulfur (≤ 15 ppmw) CARB diesel or equivalent is only required in areas where the district determines it is available in sufficient quantities and economically feasible to purchase. CARB diesel is required to be used in all other areas.

Distributed Generation

Distributed generation (DG) refers to the electrical generation near the place of use. DG units can generate electricity using a variety of technologies- solar (photovoltaics); wind; fuel cells; diesel, natural gas, and gasoline fueled engines; and microturbines. A DG unit is usually sized to meet the power needs of the business or residence at which it is located. Because some DG units are relatively small, some of California's 35 air pollution control districts (districts) do not require that an air quality permit be obtained for this type of equipment.

Senate Bill 1298 (SB 1298), which was chaptered in September 2000, required the ARB to adopt emission standards and establish a certification program for distributed generation technologies that are exempt from air pollution control or air quality management district permit requirements. The ARB also developed guidance to the air districts on the permitting or certification of electrical generation technologies that are subject to district permit.

The following paragraphs summarize the requirements of both the certification regulation and the guidance.

DG Certification Regulation Requirements

- Distributed generation sources must be certified by the ARB before they can be sold in California *if they are exempt from district permit requirements.*
- The DG Certification emission standards for 2003 and 2007 are summarized in Tables III-2 and III-3 below.

Table III-2: Distributed Generation January 1, 2003 Emission Standards

Pollutant	DG Unit not Integrated with Combined Heat and Power	DG Unit Integrated with Combined Heat and Power
NOx	0.5 lb/MW-hr (0.17 g/bhp-hr)	0.7 lb/MW-hr (0.24 g/bhp-hr)
CO	6.0 lb/MW-hr (2.0 g/bhp-hr)	6.0 lb/MW-hr (2.0 g/bhp-hr)
VOCs	1.0 lb/MW-hr (.34 g/bhp-hr)	1.0 lb/MW-hr (0.34 g/bhp-hr)
PM	An emission limit corresponding to natural gas with fuel sulfur content no more than 1 grain/100scf	An emission limit corresponding to natural gas with fuel sulfur content no more than 1 grain/100scf

Table III-3: Distributed Generation January 1, 2007 Emission Standards

Pollutant	All DG Units
NOx	0.07 lb/MW-hr (.02 g/bhp-hr)
CO	0.10 lb/MW-hr (.03 g/bhp-hr)
VOCs	0.02 lb/MW-hr (.007 g/bhp-hr)
PM	An emission limit corresponding to natural gas with fuel sulfur content no more than 1 grain/100scf

The above standards are not currently achievable by diesel-fueled compression ignition engine technology. They are achievable by natural gas fired microturbine and fuel cell technology.

DG Guidance Document

The ARB developed guidance for electrical generation technologies *that are subject* to district permits. These technologies included reciprocating engines. The purpose of the guidance is to assist the air districts in making permitting decisions for electrical generation technologies that are subject to district permits. The guidance includes recommended Best Available Control Technology (BACT) levels and suggested permit conditions

The Table below summarizes the BACT recommendations for Reciprocating Engines used in Distributed Generation Applications.

Table III-4: Summary of BACT for the Control of Emissions from Reciprocating Engines Used in Electrical Generation

Equipment Category	NOx lb/MW-hr	VOC lb/MW-hr	CO lb/MW-hr	PM lb/MW-hr
Fossil fuel fired	0.5 (0.15 g/bhp-hr or 9 ppmvd*)	0.5 (0.15 g/bhp-hr or 25 ppmvd*)	1.9 (0.6 g/bhp-hr or 56 ppmvd*)	0.06 (0.02 g/bhp-hr)

* lb/MW-hr standard is equivalent to g/bhp-hr and ppmdv expressed at 15 percent O_2. Concentration (ppmdv) values are approximate.

<u>AB 2588 "Hot Spots" Information and Assessment Act</u>

The Air Toxics "Hot Spots" Information and Assessment Act (Assembly Bill (AB) 2588) was enacted in September 1987 (Health and Safety Code 44300-44394). AB 2588 requires inventories of certain substances that facilities routinely release into the air. Emissions of interest are those that result from the routine operation of a facility or that are predictable, including but not limited to continuous and intermittent releases and process upsets or leaks.

The goals of the Air Toxics "Hot Spots" Act are to collect emissions data, to identify facilities having localized impacts, to ascertain health risks, and to notify nearby residents of significant risks. In September 1992, the "Hot Spots" Act was amended by Senate Bill (SB) 1731 to address the reduction of significant risks. The bill requires owners of significant-risk facilities to reduce their risks below the level of significance.

Since the amendment of the statute in 1992 by enactment of SB 1731, facilities that pose a potentially significant health risks to the public are required to reduce their risks, thereby reducing the near-source exposure of Californians to toxic air pollutants. Owners of facilities found to pose significant risks by a district must prepare and implement risk reduction audit and plans within six months of the determination.

AB 2588 requires the ARB to compile and maintain a list of substances posing chronic or acute health threats when present in the air. The Air Toxics "Hot Spots" Act currently identifies by reference over 600 substances which are required to be subject to the program. The ARB may remove substances from the list if criteria outlined in the law are met. A facility is subject to AB 2588 if it: 1) manufactures, formulates, uses, or releases a substance subject to the Act (or substance which reacts to form such a substance) and emits 10 tons or more per year of total organic gases, particulate matter, nitrogen oxides or sulfur oxides; 2) is listed in any district's existing toxics use or toxics air emission survey, inventory or report released or compiled by a district; or 3) manufactures, formulates, uses, or releases a substance subject to the Act (or substance which reacts to form such a substance) and emits less than 10 tons per year of criteria pollutants and is subject to emission inventory requirements.

Guidance documents are currently available for conducting emission inventories, facility prioritizations, risk assessments, and public notifications. ARB developed the *Emission Inventory Criteria And Guidelines* for conducting emission inventories, while CAPCOA developed the *Facility Prioritization Guidelines*, *Risk Assessment Guidelines*, and the *Public Notification Guidelines*. In August 1998, the ARB approved the listing of diesel PM as a TAC and the SRP conclusion that a value of 3×10^{-4} $(ug/m^3)^{-1}$ is a reasonable estimate of unit risk from diesel-fueled engines. Now that a unit risk factor has been approved, districts are required to reevaluate the classification of facilities subject to the "Hot Spots" program, specified in Health & Safety Code section 44320, operating stationary diesel-fueled engines.

Currently, diesel-fueled engines or facilities with multiple diesel-fueled engines must meet AB 2588 requirements if they use 3,000 or more gallons per year of diesel fuel, but are exempt from AB 2588 if they use less than 3,000 gallons per year. As discussed in Chapter X of this report, ARB staff is currently developing amendments to the "Hot Spots" Emission Inventory Criteria and Guidelines regulation to address all diesel-fueled engines.

Carl Moyer Program

The Carl Moyer Memorial Air Quality Standards Program (Carl Moyer Program) is a grant program that funds the incremental cost of cleaner-than-required engines and equipment. Public or private entities that operate eligible engines and/or equipment in California can participate by applying directly to their local air pollution control or air quality management districts (districts). Examples of eligible engines and equipment include heavy-duty on-road and off-road, marine, locomotive, stationary agricultural pumps, forklifts, airport ground support equipment, and heavy-duty auxiliary power units.

The Carl Moyer Program provides funds for significant near-term reductions in emissions of oxides of nitrogen (NO_X), a smog-forming pollutant, and PM emissions. These reductions are necessary for California to meet its clean air commitments under the State Implementation Plan (SIP) and for air districts to meet commitments in their conformity plans, thus preventing the loss of federal highway funds for local areas throughout California. In 2000, the Carl Moyer Program guidelines were revised to set a statewide program goal to achieve a 25 percent emission reduction for PM for the third and future year program. Local air districts such as South Coast Air Quality Management District and San Joaquin Valley Unified Air Pollution Control District, which are in serious non-attainment for the federal PM standard, are required to meet a 25 percent PM emission reduction for the local program.

In its first three years (through fiscal year 2000/2001), the Carl Moyer Program has funded the replacement of over 1,900 stationary agricultural pumps, which constituted 28 percent of the total program funding. Based on local program data from the first three years provided by the districts, ARB estimates total PM reductions from the Carl Moyer Program to be approximately 65 tons per year. (ARB, 2002)

Environmental Quality Incentives Program

The Environmental Quality Incentives Program (EQIP) is a federally-funded incentive program administered by the United States Department of Agriculture (USDA). The EQIP regulatory language was chaptered in 1998. The EQIP program is a voluntary conservation program that promotes environmental quality and provides technical and financial assistance to agricultural producers to assist them in meeting local, state, and federal regulations.

Recently, EQIP funding has been directed towards the agricultural community’s efforts to reduce air emissions. Those efforts include replacing older, dirty agricultural engines with newer, cleaner models, oiling roads, and chipping orchard waste instead of burning it. On May 1, 2003, Agricultural Secretary Ann M. Veneman announced that California would be allocated approximately $38 million for the EQIP program. Of those monies, approximately $3.5 million has been set aside to fund the replacement of approximately 300 stationary agricultural irrigation engines throughout California. The Assistant State Conservationist (programs), with the United States Department of Agriculture’s Natural

Resources Conservation Service (NRCS), informed ARB staff that, in addition to the $3.5 million set aside to finance the replacement of agricultural irrigation engines, another $2 million has been allocated to fund additional air quality abatement methods, including oiling roads and chipping orchard waste. It was also reported that the NRCS would be recommending that $15 million be allocated for the EQIP Program next year. (Flach, 2003)

The EQIP funds can be used to replace existing stationary diesel-fueled agricultural engines with engines certified to the Tier II lower emission standards for nonroad engines, replace older diesel-fueled agricultural pump engines with pump motors powered by electricity, or install electric agricultural pump motors on new wells. The USDA will provide up to fifty percent of the cost to replace older, higher emitting stationary diesel engines.

Engines eligible for replacement are those in counties whose air has been classified as either severe or extreme non-attainment for ozone as defined by the federal Clean Air Act. This includes all, or a portion of, the following counties in California: El Dorado (except the Lake Tahoe Basin), Fresno, western Kern, Kings, Los Angeles, Madera, Merced, Orange, Placer (except the Lake Tahoe Basin), Riverside, Sacramento, northern and western San Bernardino, San Joaquin, eastern Solano, Stanislaus, southern Sutter, Tulare, and Ventura.

ARB staff worked with the USDA and U.S. Environmental Protection Agency staff to ensure that emission benefits associated with the EQIP were real, surplus, and quantifiable. In addition, ARB staff continues to work with the staff of the San Joaquin Valley Unified Air Pollution Control District to help implement the program.

C. Surveys for Emergency Standby and Prime Stationary Diesel-Fueled Engines

Emergency Standby Stationary Diesel-Fueled Engine Survey

In September 2002, ARB staff conducted an emergency standby diesel-fueled engine survey (ES Survey), using contact data acquired from local air pollution control and air quality management district (District) operating permits and the California Energy Commission's *Database of Public Back-Up Generators*. (CEC, 2001) Among other things, the intent of the Survey was to obtain a representative sampling of the average number of hours that emergency standby diesel-fueled engines were operated in California.

The Survey was distributed to private companies and facilities, as well as public entities, including county, city, state, and federal agencies throughout California. The ES Survey asked owners/operators to provide for each of their emergency standby diesel-fueled engines over 50 hp, the permit number (if the engine were permitted with the District), engine make, model, horsepower, model year or approximate age, and actual hours of operation for the calendar years 1999 through 2001. The hours of operation were broken down into the following three categories:

- Maintenance and testing
- Interruptable Service Contracts [7]
- Emergencies

Of the approximately 3,000 surveys distributed, over 800 were returned with data for approximately 3,200 engines. Responding facilities were sorted into categories, which included parks, banks, nuclear power plants, hotels/motels, agriculture (food growing and production facilities, wineries, and meat processing plants), police/fire, film/TV/radio, oil/fuel/refineries, correctional, schools, waste/sanitation, other power agencies, other government agencies, hospitals, water and publicly owned treatment works (POTWs), military, telecommunications, and other private business.

The "other private business" category included, but was not limited to, building property management companies (i.e., office buildings) and retail stores. Of the total responses, 50 percent were from private companies/facilities, 42.5 percent were from public agencies (county, city, state, and federal), and 7.5 percent were undetermined.

Hours of operation data was collected for 3,038 engines. The ES Survey engines operated, on average, about 31 hours per year. However, 77 percent of those hours were for maintenance and testing, with an average of 22 hours per year. Additionally, 95 percent of all engines operated less than 50 hours per year for maintenance and testing, while 85 percent operated less than 30 hours per year. Of the facility types determined for this survey, only four had average maintenance and testing operation that exceeded 30 hours per year: schools (63.71 hours),[8] nuclear power plants (42.49 hours), hospitals (35.42 hours), and correctional facilities (30.64 hours). The four facility types combined comprised approximately 15 percent of the survey engines.

The average annual hours of operation for each activity are reported in Table III-5 below. Additional data can be found in Appendix B.

[7] Interruptable Service Contracts, also known as Interruptable Loan Contracts/Programs, are contractual agreements between the engine owners/operators and electric supply companies to provide load reduction during periods of fuel or energy shortage in return for economic compensation or benefit.
[8] The hours may not be representative due to the low number of school responding (3 percent of the total number of responses).

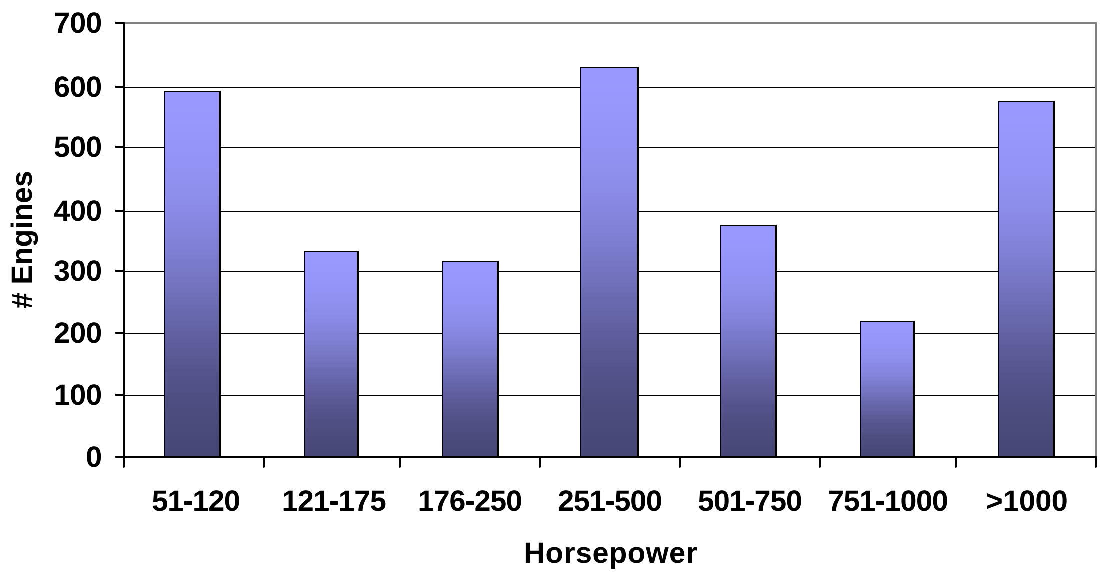
Table III-5: Average Annual Hours of Operation for Emergency Standby Engines

Activity	Year		
	1999	2000	2001
Maintenance and Testing	22	22	21
Interruptable Service Contract	1	3	4
Emergency	6	6	8
Total	29	31	33
Average Total Annual Hours of Operation	**31**		

The primary engine manufacturers reported in the ES Survey were Caterpillar, Cummins, and Detroit Diesel, which combined, comprised 72 percent of all survey engines. Other manufacturers included, but were not limited to John Deere, Ford, Generac, Isuzu, Onan, Perkins, Allis-Chalmers.

Survey engines ranged in horsepower from less than 50 to over 6,000. As shown in Figure 1, the largest numbers of engines were in the 251 to 500, 51 to 120, and greater than 1,000 horsepower ranges, respectively. The average engine horsepower was 604.

Figure III-1: Emergency Standby Engine Survey - Horsepower Distribution



Age or model year data was collected for 2,612 engines. Ages varied greatly, from new (model year 2002 or newer) to 57 years old. However, only 3 percent were more than 30 years old, and the largest number of engines (37 percent) were model years 1988 to 1995. Approximately 31 percent of the engines were model year 1996 or newer.

Only 236 engines, about 8 percent, reported hours of operation for ISC programs. Of those engines, the average annual operation for ISC purposes was approximately 26 hours. The average number of ISC hours increased during the three-year period (1999 through 2001), with a 245 percent increase from 1999 to 2000 and a 43 percent increase from 2000 to 2001. However, not all engines had increases in ISC hours. From 1999 to 2000, 56 percent of the engines experienced an increase and 62 percent showed an increase from 2000 to 2001.

Prime Stationary Diesel-Fueled Engine Survey

In March 2003, the Air Resources Board (ARB or Board) conducted the Stationary Diesel-Fueled Prime Engine Survey (Prime Survey) using contact data from District operating permits. The intent of the Prime Survey was to obtain a representative sampling of how prime stationary diesel-fueled engines are operated in California and the applications for which they are used. The information gathered would enable us to determine how many engines would potentially be affected by the proposed ATCM for stationary compression-ignition engines and would also, in combination with the ES Survey, aid in enhancing our statewide inventory of stationary diesel-fueled engines.

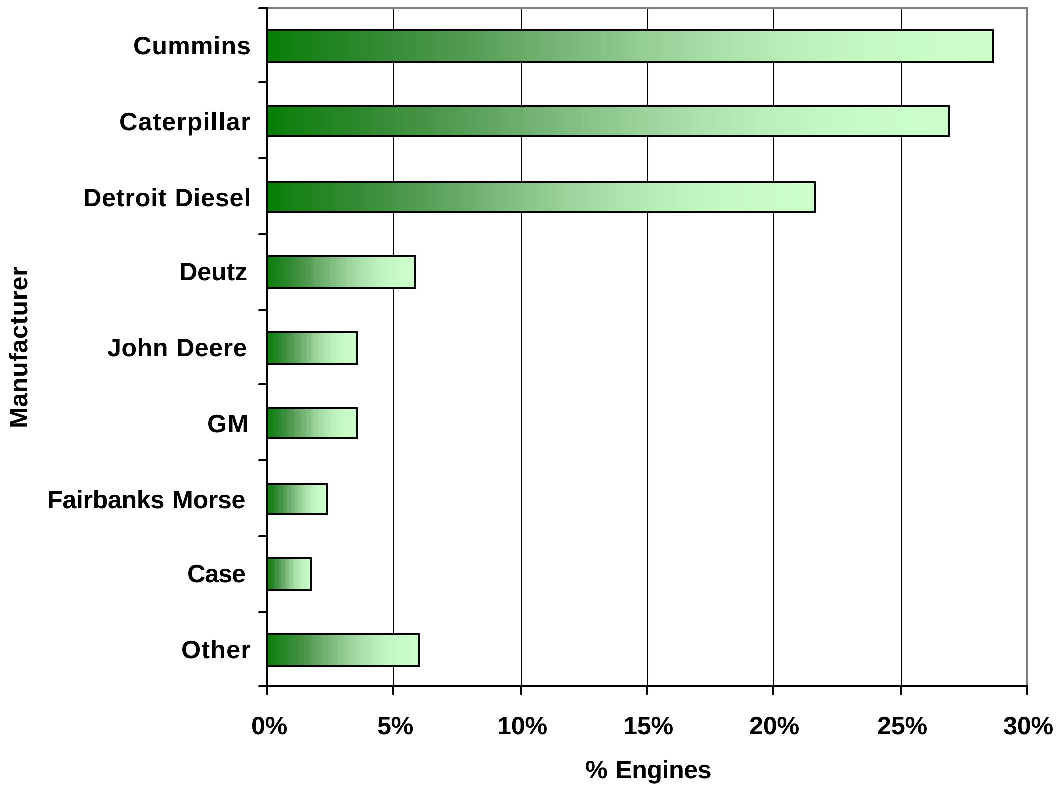
Like the ES Survey, the Prime Survey was distributed to private companies and facilities and public entities, including county, city, state, and federal agencies throughout California (approximately 560 in all). Respondents were asked to provide for each of their prime compression-ignition engines, the manufacturer, model, serial number, model year, rated horsepower, emission control equipment, fuel type and usage rate, application, typical load, average total hours operated per year, and normal operating hours (daily, weekly, etc.). Not all of the data fields were analyzed given the limited number of engines for which data was received.

As of this writing, 59 Prime Surveys were returned with data for 171 diesel-fueled engines. Several additional surveys were returned for engines that use natural gas as a fuel, and those were not included in our analysis. Responding facilities were sorted into categories, which included military, oil/fuel/refineries, power generating and distributing facilities, waste and recycling centers, rock/sand/gravel plants, manufacturing facilities, airlines, resorts, POTWs, agricultural facilities (food growing and production companies, wineries, and meat processing plants), construction companies, miscellaneous government agencies, and other private businesses.

The "other private businesses" included auto wrecking facilities, shipping container facilities, and other miscellaneous business types. Of the total responses, 63 percent were from private companies/facilities and 37 percent were from public agencies (county, city, state, and federal).

The most prominent engine manufacturers from the Prime Survey were Caterpillar, Cummins, and Detroit Diesel, totaling 77 percent of the engines (see Figure III-2). Engine models varied significantly and are presented in Appendix C. Other manufacturers included, but were not limited to, Deutz, Fairbanks-Morse, General Motors, John Deere, Case, Allis-Chalmers, Isuzu, and Perkins.

Figure III-2: Prime Engine Survey - Manufacturers

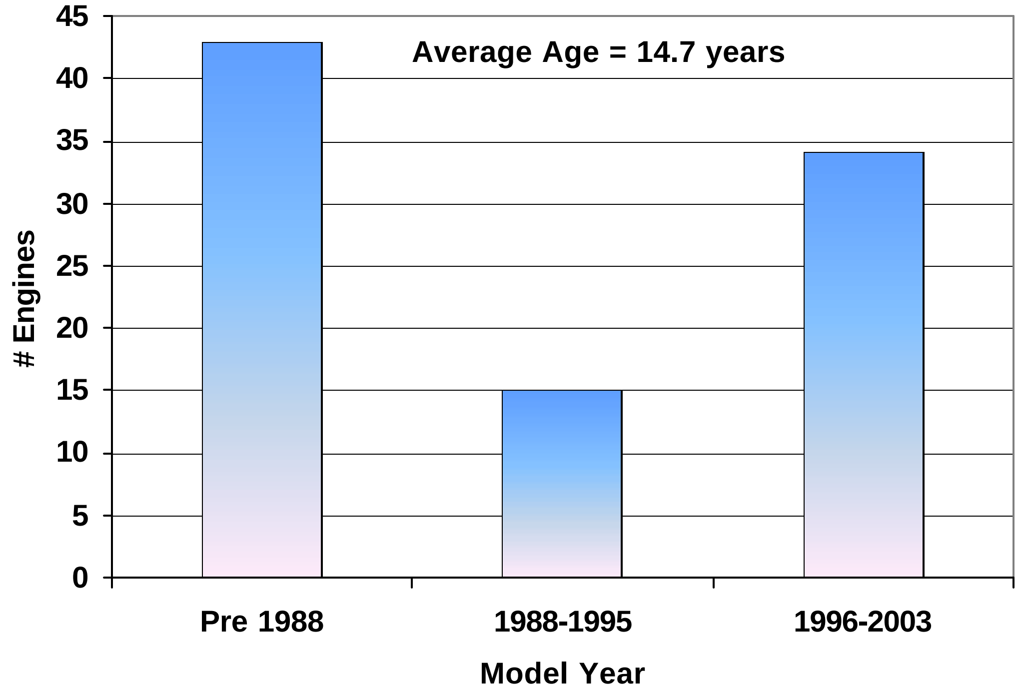


There were many different application types represented in the Prime Survey, such as air compressors, cranes, crushers, generators, grinders, hay compressors, pumps, turbine starters and wood chippers, to name a few. The largest number of engines were generators (33 percent), followed by cranes (15 percent).

Prime Survey engines ranged in horsepower from under 50 to over 2,000. The most populated categories were 300 to 599 horsepower, greater than 750 horsepower, and 100 to 174 horsepower, representing 66 percent of the survey engines. The average horsepower for all of the prime engines was 556.

Model year data was received for 92 of the 171 engines and sorted into three model year groups: pre-1988, 1988 to 1995, and 1996-2003 (see Figure III-3). About 53 percent of the engines were 1988 or newer, with 37 percent being model year 1996 or newer. The average age was approximately 15 years.

Figure III-3: Prime Engine Survey - Engine Model Years



Hours of operation data was collected for 132 engines, with an average annual amount of 953 hours. Average hours were calculated for each application and are shown in Table III-6.

Table III-6: Prime Engine Average Hours of Operation by Application

Application	Average Annual Hours
air compressor	334
cogeneration	5501
crane	1024
crusher	1114
generator	1563
grinder	798
hay compressor	1482
magnetic silencer	8
mud mixer	517
pump	46
sand blaster	313
turbine starter	22
winch	<50
wood chipper	869
other	852

Many of the engines from the Prime survey had advanced emission controls, such as diesel particulate filters (DPFs), diesel oxidation catalysts (DOCs), and selective catalytic reduction (SCR). Eighteen engines utilized at least one of these technologies, and several used one in conjunction with another (i.e., DPF with SCR).

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Flach, Helen. United States Department of Agriculture, Natural Resources Conservation Service. *Telephone Conversation With Air Resources Board Staffperson*; September, 2003. (Flach, 2003)

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IV. EMISSIONS, POTENTIAL EXPOSURES, AND RISK

This chapter presents the most recent emissions inventory for stationary diesel-fueled engines in California as well as a discussion on the potential cancer health risks that may occur due to the operation of stationary diesel-fueled engines.

A. Estimated Emissions from Stationary Diesel-Fueled Engines

To develop an emissions estimate of the emissions from stationary diesel-fueled engines used in non-agricultural applications, ARB staff developed a methodology that integrated information from national engine sales data, local district permit data, and information collected in the ARB Surveys. Emission projections to 2020 were also developed using our best estimates of expected growth, engine turnover, and age distribution. For stationary diesel-fueled engines used in agricultural applications, ARB staff worked closely with the local districts and the agricultural community to create an estimate of the emissions from stationary diesel-fueled engines used in agricultural operations. Because of the limited data available for agricultural stationary engines, ARB staff was not able to project the emissions for future years with any degree of certainty. In this chapter, only emission estimates for the year 2001 are provided for stationary engines used in agricultural operations. Details of the methodologies and the supporting documentation are found in Appendix D. Based on the information available to date, we believe the methodologies have resulted in a reasonable estimate of the emissions from stationary diesel-fueled engines. However, upon implementation of the proposed ATCM, more detailed data will be available to allow for a more robust emissions estimate for non-agricultural (non-ag) applications in the July 2005 timeframe once engine operators submit the required information on engine characteristics and activity. We intend to also continue to work with agricultural representatives to refine the estimates for agricultural engines.

Current Emission Estimates for Stationary Diesel-Fueled Engines

We estimate that the operation of stationary diesel-fueled engines results in approximately 2.6 tons per day or 950 tons per year of diesel PM emissions. Of this, non-agricultural applications are responsible for approximately 40 percent (400 T/Y) of the emissions and agricultural applications about 60 percent (550 T/Y). In addition, based on an average statewide NOx to PM conversion factor of 0.1 $gNH_4NO_3/gNOx$, we estimate the secondary formation of PM_{10} nitrate from NOx emissions from diesel-fueled stationary engines to be about four tons per day.[9] Estimates for current statewide diesel PM, NOx, and NMHC emissions from all stationary diesel-fueled engines are presented in Table IV-1.

[9] The conversion factor for the transformation of NOx to NH_4NO_3 was based on a simplistic analysis of annual-average conversion factors for secondary formation of PM_{10} nitrate from NOx emissions at a number of urban sites in California. The values varied from 0.04 to 0.19 $gNH_4NO_3/gNOx$ depending on the site. To estimate the statewide secondary formation of PM_{10} from stationary engines, we assumed half the engines were in areas with a 0.19 $gNH_4NO_3/gNOx$ conversion rate and half in areas with a 0.04 conversion rate, resulting in an overall 0.1 $gNH_4NO_3/gNOx$ value.

Table IV-1: Stationary Diesel-Fueled Engines Year 2002 Emissions Estimates

Category	Number of Engines	Emission, Tons per Day			
		PM	NOx	ROG	CO
Prime	1,319	0.8	13.8	1.3	4.8
Agricultural Prime*	5,338	1.5	21.1	4.3	5.8
Emergency Standby	19,659	0.3	6.4	0.5	2.1
Total	26,321	2.6	41.3	6.1	12.7

*Emission estimates for agricultural engines are for 2001.

As shown in Table IV-1, there are approximately 26,000 stationary diesel-fueled engines in California. Of these, the majority, or 75 percent are used in emergency standby applications. However, because of the low operating hours for emergency standby engines, this category accounts for only about 10 percent of the total diesel PM emissions. A similar relationship is seen with the other pollutants as well. Prime applications (both agricultural and non-agricultural) are responsible for about 25 percent of the engines and about 90 percent of the diesel PM emissions. Agricultural engines (primarily irrigation pumps) are responsible for about 20 percent of the total number of stationary diesel-fueled engines in California.

Projected 2010 and 2020 Emission Estimates for Stationary Diesel-Fueled Engines Used in Non-Agricultural Applications

The projected uncontrolled emission estimates for the years 2010 and 2020 are presented in Table IV-2. As discussed in the methodology included in Appendix D, these estimates were developed using growth and control factors developed with input from district staff and representatives of several engine manufacturers. Those inputs include the number of diesel-fueled engines that enter the California non-ag stationary diesel-fueled engine population and the numbers of engines retired annually. These estimates include benefits from the new engine standards and turnover in the engine population but do not include the projected reductions expected from implementation of the proposed ATCM. Expected emission reductions and the impact on the emissions inventory are discussed in Chapter VIII, Environmental Impacts.

Table IV-2: Stationary Diesel-Fueled Engines Used in Non-Agricultural Applications Projected Uncontrolled Year 2010 and 2020 Emissions Estimates

Category	2010 Emissions, Tons per Day				2020 Emissions, Tons per Day			
	PM	NOx	ROG	CO	PM	NOx	ROG	CO
Prime	0.4	8.5	0.7	2.6	0.2	4.9	0.4	1.5
Emergency Standby	0.2	5.6	.4	1.7	0.1	4.6	0.2	1.4
Total	0.6	14.1	1.1	4.3	0.3	9.5	0.6	2.9

B. Potential Exposures and Risk from Diesel PM Emissions from Stationary Diesel-Fueled Engines

This section examines the potential exposures and cancer health risks associated with exposure to particulate matter emissions from stationary diesel-fueled engines. A brief qualitative discussion is provided on the potential exposures of Californians to the diesel PM emissions from stationary engines. In addition, a summary is presented of the health risk assessment conducted to determine the 70-year potential cancer risk associated with exposures to diesel PM emissions from stationary diesel-fueled engines. Additional details on the methodology used to estimate the health risks are presented in Appendix E of this report.

Potential Exposures

As discussed previously, stationary diesel-fueled engines are used in a variety of applications and contribute to ambient levels of diesel PM emissions. Because analytical tools to distinguish between ambient diesel PM emissions from stationary diesel-fueled engines from other sources of diesel PM do not exist, we cannot measure the actual exposures to persons from the emissions of stationary diesel-fueled engines. However, modeling tools can be used to estimate potential exposures to the emissions from stationary diesel-fueled engines.

Based on the most recent emissions inventory, there are over 26,000 stationary diesel-fueled engines operating in California. These engines are distributed throughout California. The majority of these engines are emergency standby engines, engines used to provide back-up power to hospitals, hotels, schools, businesses, water treatment facilities and the like. Engines used in emergency standby applications tend to be located in urban centers where the probability of a person living close to an emergency standby engine is higher. For example, based on the emissions inventory, approximately 40 percent of the total emergency standby engines statewide are located within the South Coast air basin and 80 percent are located within four air basins: San Francisco, San Diego, San Joaquin Valley, and South Coast. In September 2002, Environmental Defense published their results from a comprehensive study of the impacts of operating emergency standby engines in California. The study was based on the California Energy Commission's database of emergency standby engines and concluded, among other things, that emergency standby engines tend to be located near where people live, work, and go to school. (Ryan, 2002) Based on this information, we believe that there are substantial exposures to diesel PM emissions from the operation of stationary diesel-fueled engines in California. As presented below these exposures can result in potential cancer health risks.

Health Risk Assessment

Risk assessment is a complex process that requires the analysis of many variables to simulate real-world situations. There are three key types of variables that can impact the results of a health risk assessment for stationary diesel-fueled engines – the magnitude of diesel PM emissions, local meteorological conditions, and the length of time someone is exposed to the emissions. Diesel PM emissions are a function of the age and horsepower of the engine, the emissions rate of the engine and the annual hours of operation. Older engines tend to have higher pollutant emissions rates than newer engines, and the longer an engine operates, the greater the total pollutant emissions. Meteorological conditions can have a large impact on the resultant ambient concentration of diesel PM, with higher concentrations found along the predominant wind direction and under calm wind conditions. How close a person is to the emissions plume and how long he or she breathes the emissions (exposure duration) are key factors in determining potential risk with longer exposures times typically resulting in higher risk.

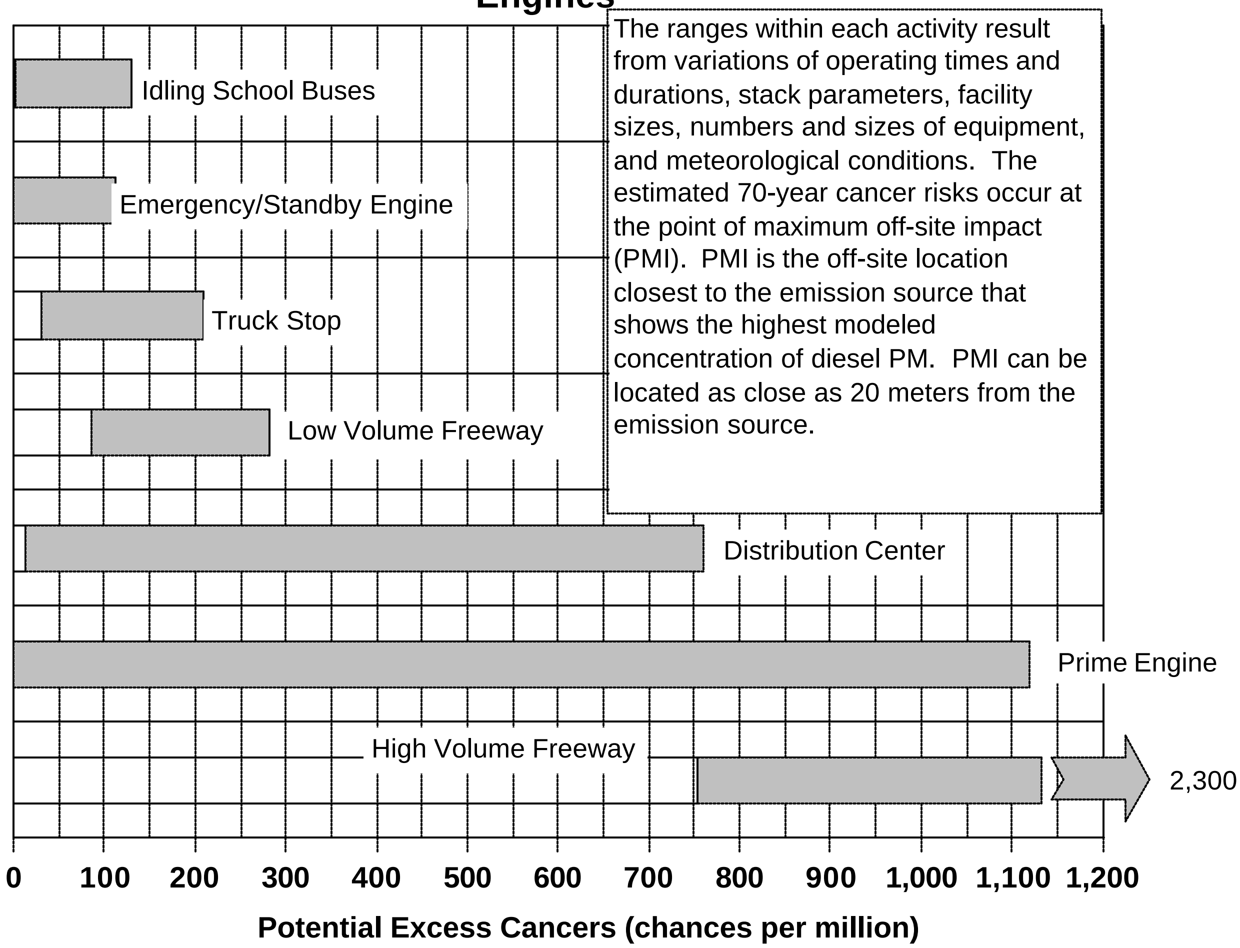
Because risk estimates for stationary diesel-fueled engines are dependent on numerous factors and because these factors vary from location to location, ARB staff developed a generic risk assessment for stationary diesel-fueled engines. We evaluated a range of emission rates and hours of operation bracketing a fairly broad range of possible operating scenarios. Meteorological data from West Los Angeles (1981) was selected to provide meteorological conditions with lower wind speeds and more persistent wind directions, which will result in less pollutant dispersion and higher estimated risk. The U.S. EPA's ISCST3 air dispersion model was used to estimate the annual average diesel PM concentration at the point of maximum impact.

The estimated annual average diesel PM concentrations were then adjusted following the current risk assessment methodology recommended by the Office of Environmental Health Hazard Assessment (OEHHA) and used by ARB in evaluating potential cancer risk from diesel PM emission sources. (OEHHA, 2002a) (OEHHA, 2002b) (OEHHA, 2000) Following the OEHHA guidelines, we assumed that the most impacted individual would be exposed to modeled diesel PM concentrations for 70 years. This exposure duration represents an "upper-bound" of the possible exposure duration. The potential cancer risk was estimated by multiplying the modeled current annual average concentrations of diesel PM, adjusted for the duration of exposure, by the unit risk factor for diesel PM (300 excess cancers per million people/microgram/cubic meter of diesel PM).

Based on our analysis under the conditions outlined above, the estimated cancer risk for persons most exposed to the emissions from emergency standby diesel-fueled engines ranged from near 0 to over 100, and for prime from near 0 to well over 1,000. The low end in each case represents a very clean engine operating only a few hours annually and the high end, an engine with a relatively high emission rate operating for many hours each year. As shown in Figure IV-1 on the next page, when compared to other activities using diesel-fueled engines, it can be concluded that stationary diesel-fueled engines, particularly those in prime applications, can pose significant near-source risks to populations living in close proximity to the engines.

The estimated risk levels presented here are based on a number of assumptions. The potential cancer risk for actual situations may be less than or greater than those presented here. For example, an increase in the emissions rate of an engine or the annual hours of operation would increase the potential risk levels. A decrease in the exposure duration or an increase in the distance from the engine would decrease potential risk levels. The estimated risk levels would also decrease over time as newer, lower-emitting stationary diesel-fueled engines replace older engines. Therefore, the results presented are not directly applicable to any particular stationary engine. Rather, this information provides an indication as to the potential relative levels of risk that may be attributed to stationary diesel-fueled engines and to act as an example when performing a site-specific risk assessment for stationary diesel-fueled engines.

Figure IV-1: Cancer Risk Range of Activities Using Diesel-Fueled Engines



(Note: The risk ranges for the non-stationary engine scenarios are taken from the DRRP. The upper bounds have been adjusted to reflect the 95th percentile breathing rate. The upper bounds for the emergency standby and prime stationary engines are for 0.55 g/bhp-hr engines operating 100 hr/yr and 2,000 hr/yr, respectively.)

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V. SUMMARY OF PROPOSED CONTROL MEASURE FOR STATIONARY COMPRESSION IGNITION ENGINES

In this chapter, we provide a plain English discussion of the key requirements of the proposed air toxic control measure (ATCM) for new and in-use stationary diesel-fueled compression ignition (CI) engines. This chapter begins with a general overview of the ATCM and the approach we took in developing the emission standards and operational limits defined by the ATCM. The remainder of the chapter is structured in accordance with the structure of the ATCM. Each major requirement of the ATCM is discussed and explained. This chapter is intended to satisfy the requirements of Government Code section 11343.2, which requires that a noncontrolling "plain English" summary of the regulation be made available to the public.

A. Overview of the ATCM

The proposed ATCM establishes requirements for new and in-use stationary CI engines. The requirements fall in three major categories: fuel-use requirements, operational requirements and emission standards, and recordkeeping and reporting requirements. In general, the fuel-use requirements and the recordkeeping and reporting requirements apply to all stationary CI engines and the operational requirements and emission standards only apply to stationary *diesel-fueled* CI engines[10].

Our approach in developing the operational requirements and emission standards for stationary diesel-fueled CI engines was to establish requirements and standards that are based on the application of the best available diesel PM control strategies for emergency standby and prime applications. Factors considered when establishing requirements included potential near-source risk, cost of controls, availability of U.S. EPA or ARB off-road certified engines that can meet the proposed stationary engine emission standards, and the availability of viable control technologies for stationary engine applications. This approach to developing requirements is reflected in the differing requirements for emergency standby and prime engines, and the establishment of specific exemptions.

The following subchapters discuss and explain the key requirements of the ATCM in more detail.

B. Purpose

The purpose of this ATCM is to reduce diesel particulate matter (PM) emissions and the associated potential cancer risks from stationary diesel-fueled engines. Diesel PM emission reductions are needed to reduce the risk to people who live in the vicinity of these engines and to reduce the contribution these engines make toward the overall

[10] There is a broad-based exception to the general fuel–use requirements. In-use stationary CI engines that are not diesel-fueled, are not subject to the fuel-use requirements. See subchapter F for further discussion.

regional exposures to diesel PM. More specifically, the purpose of the ATCM is to 1) establish a record of where stationary CI engines are located, what fuel they use, and how they are operated; 2) require new and in-use stationary CI engines to meet specified fuel requirements, operating requirements, and emission standards; and 3) require non-diesel-fueled new and in-use stationary CI engines to meet specified fuel requirements.

C. Applicability and Effective Date

The proposed ATCM establishes requirements that apply to any person who sells, offers for sale, leases, or purchases a stationary CI engine for use in California. Further, the proposed ATCM establishes emission limitations and operational requirements that apply to the owners and operators of stationary CI engines with a rated horsepower greater than 50.

The effective date of the ATCM is no later than 30 days after the approval of this subsection by the Office of Administrative Law and the adoption of the ATCM into Title 17 of the California Code of Regulations. After adoption, the requirements of the ATCM are required to be implemented and enforced by each air pollution control and air quality management district (district). Each district has the choice of either implementing and enforcing the ATCM or adopting its own rule that differs from the ATCM but is as stringent. If a district chooses to implement and enforce the requirements of this section, it must do so by no later than 120 days after the effective date. If the district chooses adopt its own rule, that rule must be implemented and enforced no later than six months after the effective date.

D. Exemptions

The proposed ATCM identifies several specific engine applications that are exempt from all or part of the fuel use, operating requirements, emission standards, or recordkeeping and reporting requirements. In general, the exemptions are provided to address specific situations where the impact of the emissions on nearby receptor locations is considered minimal and it is not practical to comply with the requirements of the proposed ATCM due to high costs or technical issues associated with controlling diesel PM emissions. Table V-1 identifies each exempted category of engine and the terms of the exemption. The exemption numbers correspond to the exemption numbers found in section (c), Exemptions, of the ATCM.

Table V-1: Summary of Exemptions

Exempted Category	Terms of the Exemption
1) Portable CI engines, on-road and off-road vehicle engines[11]	- non-stationary CI engines are exempt from all requirements
2) Marine vessel engines[2]	- non-stationary CI engines are exempt from all requirements
3) In-use stationary CI engines used in agricultural operations	- exempt from all requirements. - on-going efforts to identify how to reduce emission
4) New stationary CI engines used in agricultural operations	- Separate requirements/standards established for new agricultural engines. Exempt from operational requirements and emission standards for non-agricultural engines.
5) Single cylinder cetane test engines	- exempt from operating requirements and emission standards.
6) In-use stationary CI engines subject to requirements of *Risk Management Guidance, October 2000*	- exempt from operating requirements and emission standards if meet Risk Management Guidance requirements
7) In-use emergency standby stationary CI engines at hospitals with approved OSHPD Plans that require engine replacement	- exempt from operating requirements and emission standards
8) Stationary diesel-fueled CI engines used solely for the training of military personnel	- exempt from all the requirements except recordkeeping and reporting
9) Stationary diesel-fueled engines operating on San Clemente and San Nicolas Islands	- exempt from all requirements except recordkeeping and reporting.
10) Stationary diesel-fueled engines operating on outer continental shelf platforms	- exempt from operating requirements and emission standards
11) In-use emergency standby stationary diesel-fueled CI engines used solely for the safe shutdown and maintenance of a nuclear facility when normal power service fails or is lost	- exempt from operating requirements and emission standards.
12) In-use prime stationary diesel-fueled CI engine located beyond school boundaries that operates no more than 20 hours per year	- exempt from emission standards.
13) In-use stationary dual-fueled diesel-pilot CI Engines that use an alternative diesel fuel or an alternative fuel	- exempt from all requirements except recordkeeping and reporting
14) Stationary dual-fueled diesel-pilot CI engines that use digester gas or landfill gas	- exempt from all requirements except recordkeeping and reporting
15) In-use stationary diesel-fueled CI engines that have selective catalytic reduction (SCR) systems	- exempt from all requirements except recordkeeping and reporting
16) In-use emergency standby stationary diesel-fueled CI engines used as direct-drive fire pump engines	- exempt from emission standards and operating requirements
17) Stationary diesel-fueled CI engines owned by NASA and used solely at space shuttle landing sites	- exempt from all the requirements except recordkeeping and reporting

[11] Portable engines, on-road and off-road vehicles, and marine vessel engines will be addressed in other ATCMs.

In the following paragraphs, we discuss the rationale for establishing several of the exemptions.

Exemptions 3 and 4: Agricultural Engines

The proposed ATCM exempts in-use stationary CI engines used in agricultural operations (agricultural engines) from all requirements and establish a separate set of requirements for new agricultural engines which are presented in subchapter G.5. The reasons why in-use agricultural engines were not included in this ATCM are discussed in detail in Chapter X, Additional Considerations. In short, factors that influenced our decision to exempt in-use agricultural engines and define separate requirements for new agricultural engines included: 1) retrofit installation and availability issues unique to engines in agricultural service, and 2) implementation and enforcement constraints. Although in-use agricultural engines are currently exempt, ARB staff is continuing its efforts to determine how best to further reduce diesel PM emissions from these engines.

Exemption 6: Engines in Compliance with the *Risk Management Guidance for the Permitting of New Stationary Diesel-fueled Engines, October 2000 (Guidance)*

The proposed ATCM exempts in-use stationary diesel-fueled CI engines from the fuel requirements, emission standards, and operational requirements, if these engines are in compliance by January 1, 2005, with the requirements of the Guidance. The Guidance is a non-regulatory permitting guidance document to assist districts in making risk management decisions associated with the permitting of new stationary diesel-fueled CI engines. The requirements of the Guidance are summarized in the Table V-2.

Table V-2: Summary of Recommended Permitting Requirements for New Stationary Diesel-Fueled Engines Defined in the *Risk Management Guidance*, October 2000

				Minimum Technology Requirements			Additional Requirements	
Engine Category	**Annual Hours of Operation**	**Group**	**Performance Standard[1] (g/bhp-hr)**	**New Engine PM Emission Levels[1] (g/bhp-hr)**	**Fuel Technology Requirements**	**Add-On Control**	**HRA Required**	**SF Report**
Emergency Standby > 50 hp	≤ 100 hours[2]	1	0.15	0.15	CARB Diesel or Equivalent	No	No	No
All Other Engines > 50 hp	≤ 400 hours	1	0.02	0.15	Very low-sulfur CARB Diesel or equivalent[4]	Catalyst-based DPF or equivalent	No	No
	> 400 hours	2	0.02	0.15	Very low-sulfur CARB Diesel or equivalent[4]	Catalyst-based DPF or equivalent	Yes	If HRA shows risk > 10/million

HRA - Health Risk Assessment; SF - Specific Findings; DPF - Diesel Particulate Filter

1. ISO 8178 test procedure IAW *California Exhaust Emission Standards and Test Procedures for New 1996 and Later Off-Road Compression–Ignition Engines, May12, 1993.*
2. The annual hours of operation for emergency standby engines include the hours of operation for maintenance and testing runs only.
3. The Guidance only required very low sulfur (≤ 15 ppmw) CARB diesel or equivalent be used in areas where the district determines it is available in sufficient quantities and economically feasible to purchase. CARB diesel is required to be used in all other areas.

The performance standards and minimum technology requirements of the Guidance are consistent with the requirements of the ATCM. The requirement for a site-specific health risk assessment (HRA) is not specifically identified in the ATCM. We do not believe that a site-specific risk assessment is necessary in a most cases when a prime engine is meeting either 0.02 g/bhp-hr emission limit, or an 85 percent reduction from baseline levels. Our screening level risk analysis[12] estimates that risk from prime engines in compliance with the ATCM requirements will be below 10/million when operating 1000 hours year, which is approximately the average annual hours prime engines operate (Appendix C, Prime Stationary Diesel-Fueled Engine Survey). However, the ATCM does not preclude a district from requiring a site-specific HRA, should the anticipated hours of operation significantly exceed 1000 hours per year.

[12] The estimated cancer risks from engines meeting the requirements of the ATCM are based on the estimated diesel PM concentration at the point of maximum impact as determined using air dispersion modeling. See Appendix E, Stationary Diesel-Fueled Engines Health Risk Assessment, for a detailed discussion of how the estimated risk was determined and estimated risk values posed by engines of differing sizes and hours-of-operation.

Exemption 11: Emergency Standby Engines used solely for the safe shutdown and maintenance of a nuclear facility when normal power service fails or is lost.

Currently, there are two active nuclear power plants in California: 1) the Diablo Canyon Nuclear Power Plant, Avila Beach operated by the Pacific Gas and Electric Company (PG&E), and 2) the San Onofre Nuclear Generating Station, San Clemente, operated by the Southern California Edison Company. Both have emergency standby stationary diesel-fueled CI engines that provide power for the emergency core cooling and other vital functions for the safe shutdown of the nuclear power plant. These engines are generally large – around 3,000 horsepower. The six at Diablo Canyon are Alco Model 18-251 rated at 3,630 bhp. (PG&E, 2003) The eight at San Onofre are configured in tandem. Four pairs each consisting of a 2,879 bhp and 3,800 bhp engine. (San Diego, 2003) Based on emission test data from similar engines, the diesel PM emission rate for each engine is estimated to be in the 0.30 g-bhp-hr to 0.14 g/bhp-hr range (Fairbanks Morse, 2000). Operating records from both Nuclear Plants indicate that they have been able to operate at less than 150 hours per year for maintenance and testing purposes. The San Onofre Engines are permitted, and are limited to 200 hours of operation for maintenance and testing purposes. (SDCAPCD, 2003) The Diablo Canyon engines are currently exempt from permit requirements, however, the annual hours operated for maintenance and testing over the last three years ranged from 26 to 99 hours per engine. (PG&E, 2002) These engines are contained in hardened buildings and subject to stringent design and operational requirements.

The proposed ATCM allows each district APCO the authority to approve a Request for Exemption from the operational requirements and emission standards of the ATCM for any in-use emergency standby stationary diesel-fueled CI engine that is used solely for the safe shutdown and maintenance of a nuclear facility. The Request for Exemption may be approved for emergency standby engines that meet the following criteria:

- the engine is an emergency standby engine used solely for the safe shutdown and maintenance of nuclear facility when normal power service fails or is lost
- the engine is subject to the requirements of the Nuclear Regulatory Commission
- the engine is limited to 200 hours or less per year
- the district specifies any additional criteria that must be met. Additional criteria can include but is not limited to on-site reductions in diesel PM emissions from other diesel-fueled engines or vehicles operating at the nuclear facility, off-site reductions in diesel PM emissions from diesel-fueled engines or vehicles, and site-specific considerations that could be employed to minimize the impact of the engines diesel PM emissions.

These engines are given this exemption because they provide for the safe-shutdown of a nuclear facility and as such are subject to unique requirements (hardened buildings, Nuclear Regulatory Commission required failure mode analysis) that make retrofitting or replacing the engines extremely costly; there is an environmental benefit to there continued operation should they ever be called on in an emergency; and they are limited in the hours of operation which limits the potential diesel PM exposure resulting from there operation. (ARB, 2002) In addition, the districts have the authority to require the owners or operators to provide additional on-site or off-site reductions in diesel PM emissions should the risk from these engines exceed acceptable levels.

It should be noted that although the potential risk from one engine operating 200 hours per year is less than 10/million, the cumulative risk from all six or eight engines operating 200 hours per year at each facility may exceed district significant risk levels and be subject to additional requirements.

Exemption 12: Prime engines that operate no more than 20 hours per year

The proposed ATCM allows each district APCO the authority to approve a Request for Exemption from the emission standards of the ATCM for low-use prime engines operated outside of school boundaries. The Request for Exemption may be approved for prime engines that meet the following criteria:

- The district APCO must grant the delay in implementation in writing.
- The following conditions must be met:
  - the engine is a prime engine
  - the engine is located no more than 1000 feet from a school at all times
  - the engine operated no more than 20 hours per year cumulatively.

This exemption is being proposed in consideration of the potential risks from one engine and the significant cost to meet the requirements for prime engines. The health risk posed to receptors that are exposed to exhaust from these engines is estimated at less than 10 in a million at the point of maximum concentration given these engines operate for less than 20 hours cumulatively per year.[13] In addition, for an average size (700 horsepower) stationary diesel-fueled prime CI engine, the cost to retrofit or replace an engine to comply with the 85 percent reduction in PM emissions or the 0.01 g/bhp-hr diesel PM emission rate for compliance is estimated to range from $26,000 to $92,000.

Exemptions 13 and 14: Dual-fueled engines

The proposed ATCM exempts certain types of dual-fueled engines from the fuel requirements, operational requirements, and emission standards of the ATCM. A dual-fuel engine is any CI engine that is designed to operate on a combination of alternative fuel and conventional liquid fuel, such as gasoline or diesel. These engines have two separate fuel systems, which either inject both fuels simultaneously into the engine

[13] The estimated cancer risks from engines meeting the requirements of the ATCM are based on the estimated diesel PM concentration at the point of maximum impact as determined using air dispersion modeling. See Appendix E, Stationary Diesel-Fueled Engines Health Risk Assessment Methodology, for a detailed discussion of how the estimated risk was determined and estimated risk values posed by engines of differing sizes and hours-of-operation.

combustion chamber or fumigate the gaseous fuel with the intake air and inject the liquid fuel into the combustion chamber.

In-use dual-fueled diesel-pilot engines that use an alternative fuel or an alternative diesel fuel are exempt from the fuel requirements and emission standards of the ATCM. The term “diesel-pilot” refers to the use of a small amount of diesel fuel as an ignition source for an alternative fuel that would otherwise not combust, or combust incompletely, when used in a CI engine. The definition of “small amount” for purposes of this ATCM is 5 parts diesel fuel to 100 parts total fuel on an energy equivalent basis. The reasons why we chose to exempt them are listed below and discussed in detail in Chapter X, Additional Considerations.

- These engines represent an 85 percent reduction in diesel PM emissions from a 100 percent diesel-fueled CI engine.
- The emissions from these engines will be included in the facility-wide emission inventory/risk assessment requirements of AB 2588 (“Hot Spots” Program).
- Recordkeeping and reporting information is required. We will reevaluate the health risk posed by exposure to the exhaust of these engines at a later date.

All dual-fueled diesel-pilot engines that use digester gas or landfill gas are exempt from the fuel requirements, operational requirements, and emission standards of the ATCM. Digester gas is any gas derived from anaerobic decomposition of organic matter. Digester gas is produced at wastewater treatment plants. Landfill gas is any gas derived through any biological process from the decomposition of waste buried within a waste disposal site. The reasons why we chose to exempt dual-fueled diesel-pilot engines that use digester gas or landfill gas are listed below.

- The number of these engines is relatively small (less than 10)
- Digester gas and landfill gas is unconditioned and contains a compound called Siloxane. Siloxane, which is silicon based, clogs the catalyst beds of catalyzed emission control equipment. This reduces the availability of sites where the catalytic reaction can occur and ultimately renders the catalyst inoperable. It should be noted that installation of a pretreatment system to remove Siloxane prior to combustion in the engine is possible, and will allow a catalytic control system to operate on digester and landfill gases. However, the cost to install and maintain such a system is substantial and is the reason why these pretreatment systems are not currently operating anywhere in the country.
- There are environmental benefits to using digester or landfill gas that would otherwise be flared.
- Requiring recordkeeping and reporting information is required. We will reevaluate the health risk posed by exposure to the exhaust of these engines at a later date.

Exemption 15: In-Use Engines with SCR systems

The proposed ATCM exempts in-use stationary diesel-fueled engines that have installed selective catalytic reduction systems (SCR) from the emission limit and operating requirements. Currently, ARB staff is aware of only 12 stationary diesel-fueled CI engines with SCR systems installed. These engines are exempt because of the high costs and technical issues associated with installing diesel particulate matter control technologies on engines that already have SCR systems in place. For in-use engines with SCR systems currently installed additional cost would be associated with removing the SCR system to accommodate the installation of a DPF. The cost of installing an SCR system is significant. It can typically range from the $50 to $60/hp range, compared to about $40/hp for a DPF. (ARB, 2000) As a rule, DPFs should be installed prior to the SCR to avoid exposure to reductant slip and to facilitate the regeneration of the filter element through the exposure to high (300º C) exhaust temperatures. Although these engines are exempt from the emission standards and operating requirements of the proposed ATCM, they are still subject to local District regulations, rules, and policies. It is at that level that we believe it is most appropriate for diesel PM emission standards and operating requirements be developed for in-use engines with SCR systems.

Exemption 16: In-Use Stationary Diesel-Fueled CI Engines used as Direct-Drive Fire Pump Engines

In-use emergency fire pump assemblies that are driven directly by stationary diesel-fueled CI engines and are operated the hours necessary to comply with the testing requirements of NFPA 25, are not subject to the emission standards or operating requirements of the proposed ATCM. (NFPA25) Staff estimates this effects a very small fraction - less than one percent of the fire pump engine population. The NFPA 25 standard requires maintenance and testing operation from 29 to 34 hours per year. ARB staff is aware that this exceeds the 20 hour maximum set for uncontrolled engines, and may exceed the 30 hour maximum set for engines that meet the 0.40 g/bhp-hr standard, but this exemption is warranted because retrofitting these engines with emission control devices may compromise the Underwriters Laboratory (UL) certification of these engines, and replacement of these engines is likely to be cost prohibitive.

E. Definitions

The proposed ATCM provides definitions of all terms that are not self-explanatory. All totaled, there a 54 definitions provided in the ATCM to help clarify and enforce the regulation requirements. In this subchapter, we discuss the definitions for the key terms used throughout this chapter.

1. CARB Diesel Fuel: CARB Diesel Fuel is any diesel fuel that meets the specifications defined in Title 13, California Code of Regulations, sections 2281-2282, and section 2284. These regulations set standards on

sulfur content, aromatic content, and fuel lubricity. These regulations s also allow producers and importers of diesel fuel to comply with the regulations by qualifying through testing alternative CARB diesel fuel formulations. Alternative CARB diesel fuel formulations could include diesel fuels that are mixtures of diesel fuel and alternative diesel fuels, e.g., biodiesel.

2. New Engine: A "new" engine is an engine that was installed at a facility after January 1, 2005. The term "new" is specifically defined in the proposed ATCM. In general, a new engine is one that was installed after January 1, 2005. It doesn't matter if it were never used before (i.e., "brand-new"), or is a previously used engine. If it is new to the facility, then it is required to meet the new engine emission standards and operational limits. There are specific exceptions to this general definition of a new engine. Temporary replacement engines are not considered new engines. Engines approved for installation prior to effective date of the ATCM, but not installed until after January 1, 2005, are not considered new. An engine that is one of four or more engines owned by a single owner and relocated prior to January 1, 2008, to an offsite location owned by the same owner or operator engine is not considered new. An engine used in agricultural operations and is relocated to an offsite location owned by the same owner or operator is not considered new. Engines that fall into these exception categories are considered to be in-use engines and are subject to in-use engine requirements.

   The proposed ATCM establishes a separate set of requirements for new stationary diesel-fueled CI engines used in agricultural operations. Prior to January 1, 2008, new engines that were originally funded under a State or federal incentive funding program, e.g., California's Carl Moyer Program or the U.S. Department of Agriculture's Environmental Quality Incentives Program (EQIP), are exempt from these requirements.

3. In-Use Engines: An "in-use engine" is one that was installed at a facility prior to or on January 1, 2005. It is defined in the ATCM as an engine that is not a new engine.

4. Stationary CI Engine: "Stationary CI Engine" means a CI engine, such as an electric power generator set, grinder, rock crusher, sand screener, crane, cement blower, air compressor, and water pump, that is it is physically attached to a foundation, or remains at the same stationary source for more than 12 consecutive rolling months or 365 rolling days, whichever occurs first. This 12 month/365 day time period does not include time spent in a storage facility at the facility. There is also a special provision for "seasonal sources". A seasonal source is a CI engine that operates for at least three consecutive or nonconsecutive months per year for at least two years. Seasonal source engines are considered stationary CI engines. If a CI engine is moved from one facility to another or one location to another location in the same facility

such that, under the totality of the circumstances, the district APCO determines the movement of the engine is an attempt to circumvent the 12 consecutive rolling month requirement discussed above, that engine is considered to be a stationary CI engine. This definition is consistent with the definition of portable equipment found in the ARB's Portable Equipment Registration Program (Title 13 CCR sections 2450-2466).

5. Maintenance and Testing: "Maintenance and testing" means operating an emergency standby engine during maintenance of the engine or the supported equipment; or operating the engine to test the engine's ability to perform during an emergency, or the supported equipment's ability to perform during an emergency. "Maintenance and testing" does not include testing to show compliance with this ATCM or other district policies, rules, or regulations. Compliance testing for showing compliance with the requirements of this ATCM is not limited. Hours of operation for demonstrating compliance with other District policies, rules, or regulations are left to district discretion.

6. Emergency standby engine: Emergency standby engines are used to provide electrical power or mechanical work in the event of an emergency. What constitutes an emergency is specifically defined in the ATCM. In general, an emergency is a power outage, fire, flood, or sewage overflow. An emergency also includes the failure of a facilities internal power distribution system. An example of this would be if a ski resort looses power to its ski lift operations due to a line failure at the resort.

7. Prime engine: Prime engines are defined in the ATCM as engines that are not emergency standby engines. Prime engines are used in a wide variety of applications, including compressors, cranes, generators, pumps (including agricultural pumps), and grinding/screening units.

F. Fuel Use Requirements

The proposed ATCM specifies fuel use requirements and fuel additive requirements for all new stationary CI engines and all in-use stationary diesel-fueled CI engines. The fact that the term "diesel-fueled" is missing when defining the universe of 'new" engines affected by these requirements is not an oversight. Our policy is to hold all new stationary CI engines to the most stringent standards. This means all new CI engines, not just new diesel-fueled CI engines, must use fuels that meet the requirements identified in the ATCM. Conversely, in-use stationary CI engines that currently use non-diesel fuels are not subject to the fuel-use requirements. ARB staff considers the continued use of a non-diesel fuel to represent an appropriate fuel-use requirement for an in-use stationary CI engine.

The proposed ATCM requires all new stationary CI engines and all in-use stationary diesel-fueled engines to use either:

- CARB Diesel Fuel
- An alternative diesel fuel that meets the requirements of the Verification Procedure (which includes a multimedia impact assessment.)
- An alternative fuel (e.g., CNG, LPG)
- CARB diesel fuel used with a fuel additive that meets the requirements of the Verification Procedure
- Any combination of the above

As with all requirements, there are exemptions to the fuel and fuel additive requirements. These exemptions are identified in subchapter D and address non-stationary engines, in-use stationary CI engines used in agricultural operations, cetane test engines, specific types of military training engines, engines operating on San Clemente or San Nicolas Islands, engines operating on OCS platforms, and certain stationary dual-fueled diesel-pilot CI engines, and stationary engines owned by NASA and operating at space shuttle landing sites.

G. Operating Requirements and Emission Standards

This subchapter is comprised of six parts. Parts 1 and 2 summarize the operating requirements and emission standards for emergency standby stationary diesel-fueled CI engines with a rated horsepower greater than 50. Parts 3 and 4 summarize the operating requirements and emission standards for prime stationary diesel-fueled engines with a rated horsepower greater than 50. Part 5 summarizes the emission standards for new stationary diesel-fueled CI engines used in agricultural operations with a rated horsepower greater than 50. Part 6 summarizes the emission standards for new stationary diesel-fueled CI engines with a rated horsepower less than or equal to than 50.

This chapter does not discuss the basis for the emission standards and operating requirements. For a detailed discussion of the reasons why the emission standards and operational limits are defined in the ATCM as they are, see Appendix F, Basis for the Standards.

1. Operating Requirements and Emission Standards for New Emergency Standby Stationary Diesel-Fueled CI Engines with a Rated Horsepower Greater than 50

<u>General Operating Requirements and Emission Standards</u>

The emission standards, operational requirements, and compliance dates for new emergency standby diesel-fueled CI engines are summarized in Table V-3.

Table V-3: Diesel PM Standards and Operational Requirements for New Emergency Standby Stationary Diesel-Fueled Engines

Diesel PM Standards (g/bhp-hr)	NMHC/NOx/ CO Standards (g/bhp-hr)	Maximum Allowable Annual Hours of Operation for Engines Meeting Diesel PM Limit			Compliance Dates
		Emergency Use	Non-Emergency Use		
			Emission Testing to show compliance[2]	Maint. & Testing (hours/year)	
≤ 0.15[1]	Off-road Standard (Appropriate or Tier 1)	Not Limited by ATCM[3]	Not Limited by ATCM[3]	50	January 1, 2005
≤ 0.01[1]		Not Limited by ATCM[3]	Not Limited by ATCM[3]	District Discretion but may not exceed 100	

1. Or off-road certification standard (title 13 CCR section 2423) for an off-road engine with the same horsepower rating, whichever is more stringent
2. Emission testing limited to testing to show compliance with subsections (e)(2)(A)(ii).
3. May be subject to emission or operational restrictions as defined in current applicable district rules, regulations, or policies.

The proposed ATCM establishes requirements for both the sellers and operators of new stationary diesel-fueled engines. As shown in Table V-3, the proposed ATCM establishes diesel PM emission standards that become more stringent as the maximum allowable annual hours for maintenance and testing increase. Persons selling purchasing or leasing new emergency standby stationary diesel-fueled CI engines are required to meet the emission standards summarized in Table V-3. Engines that operate less than of equal to 50 hours per year for maintenance and testing purposes are required meet a diesel PM emission limit of 0.15 g/bhp-hr, or the off-road certification standard (title 13 CCR section 2423) for an off-road engine with the same horsepower rating, whichever is more stringent. If an owner or operator needs to operate his or her engine more than 50 hours per year for maintenance and testing purposes, the District will determine the emission standards and operating requirements for that engine on a site-specific basis with the following restrictions. In no case shall the diesel PM emission rate of the engine be greater than 0.01 g/bhp-hr and in no case shall the total number of annual hours of operation for maintenance and testing purposes exceed 100. The criteria to be considered by the District when making this decision include the NOx emission rate of the engine, the existence of additional diesel-fueled engines operating on-site, and current and planned use of surrounding land.

The proposed ATCM also requires all new stationary diesel-fueled CI engines to meet the appropriate off-road standard for HC, NOx, or NMHC+NOx, and CO, as defined in Title 13 CCR section 2423. For example, if the new stationary diesel-fueled CI engine has a rated brake horsepower (hp) of 250 hp and is a 2003 model year engine, then the appropriate off-road standards would 4.9 g/bhp-hr for NMHC+NOx, and 2.6 g/bhp-hr for CO (also referred to as Tier II standards). Similarly, if the new engine is an older model, lets say a 250 hp, model year 1997, then the appropriate off-road standard would be 1.0 g/bhp-hr for HC, 6.9 g/bhp-hr for NOx, and 8.5 g/bhp-hr for CO (also referred to as

Tier I standards). If the engine pre-dates the off-road standards, for example a 1987 model year engine, the appropriate standard would default to the Tier I standard for the horsepower rating category of the engine. For the greater than 50 hp to less than 175 hp category of engines, the Tier I standard defines emission standards for NOx only. For these engines, there would be no emission standards for HC or CO.

The proposed ATCM does not limit the number of hours of emergency use operation. As discussed in Appendix F, Basis for the Standards, the number of hours for emergency use operation for a typical emergency standby engine is relatively small when compared to the hours of operation for maintenance and testing. This, coupled with the fact that the owner or operator can directly control the number of hours of operation for maintenance and testing, led us to establishing upper limits for maintenance and testing hours only.

The ATCM does not limit the number of hours of operation for ATCM compliance testing. ATCM compliance testing is a one-time event and is only required when emission test data is not already available. See subchapter I, Emissions Data, for a discussion on the types of information that can be submitted to the district APCO to show compliance with the emission standards of the ATCM.

The proposed ATCM does not establish any ongoing testing requirements for purposes of enforcement of the requirements beyond initial compliance testing. Ongoing compliance is left to each individual District. However, to facilitate a District's ongoing compliance program, the proposed ATCM does require ongoing recordkeeping and reporting requirements as well as the monitoring equipment requirements (see subchapter H, Reporting, Notification, Recordkeeping, and Monitoring Requirements).

Interruptible Service Contract Engines

An interruptible service contract (ISC) is a voluntary arrangement between a non-residential electrical customer and an electrical service provider where the customer agrees to reduce its electrical consumption during periods of peak demand in exchange for compensation. Currently, the proposed ATCM classifies a new engine used to provide power in a "non-emergency" situation, e.g., the fulfillment of an ISC contract, as a new prime engine, not an emergency standby engine, and is subject to the new prime engine emission standards discussed in subchapters G(3) and G(4). Some stationary diesel-fueled engine owners under existing ISC contracts argued that the current approach sets emission standards that are too stringent, given that ISC contracts help prevent blackouts which could result in widespread use of diesel-fueled engines during a blackout. Others argued against easing the current approach, raising concerns about the potential for elevated near source exposures to diesel PM from ISC engines. ARB staff will continue to meet and confer on this issue and may provide a modified proposal to the Board at the November 13-14, 2003 hearing.

District's Authority to Establish More Stringent Standards and Allow Additional Hours of Operation

The ATCM clarifies that the district Air Pollution Control Officer (APCO) has the authority to establish more stringent emission standards and operating requirements, and to allow additional hours of operation for demonstrating compliance with other District rules, Verification testing, and initial start-up testing.

The authority to establish more stringent emission standards and operating requirements is consistent with the requirements of Health and Safety Code section 39666 (d), which gives the district the authority to adopt a rule that is as stringent or more stringent than the ATCM.

We also believe that it is necessary to grant districts the authority to allow emergency standby engines to operate for other specific purposes. In discussions with District representatives, we concluded that emergency standby engines may be required to operate for emission testing purposes to show compliance with existing internal combustion engine rules. It has also come to our attention that several control equipment manufacturers wish to verify their emission reduction claims by emission testing emergency standby stationary engines equipped with their control technologies. Further, newly installed emergency standby engines may be required to operate after initial installation to ensure proper performance of the engine and supported equipment. District Air Pollution Control Officers are best suited to make site specific decisions as to the number of hours an engine should be run for demonstrating compliance with other District rules, Verification testing, or initial start-up testing.

2. Operating requirements and Emission Standards for In-Use Emergency Standby Stationary Diesel-Fueled CI Engines with a rated horsepower greater than 50

General Operating Requirements and Emission Standards

The emission standards and operating requirements for in-use emergency standby diesel-fueled CI engines are summarized in Table V-4.

Table V-4: Diesel PM Standards and Operational Requirements for In-Use Emergency Standby Stationary Diesel-Fueled Engines

Diesel PM Standards (g/bhp-hr)	NMHC/NOx/CO Standards (g/bhp-hr)	Maximum Allowable Annual Hours of Operation for Engines Meeting Diesel PM Limit			Compliance Dates by Model Year of Engine	
		Emergency Use	Non-Emergency Use: Emission Testing to show compliance[1]	Non-Emergency Use: Maint. & Testing (hours/year)	Owns 3 or Fewer Engines	Owns 4 or More Engines
Not Limited by ATCM[2]	If control strategy is not Verified retrofit technology, show no increase from baseline levels	Not Limited by ATCM[2]	Not Limited by ATCM[2]	20	Pre-89 thru 89 1/1/2006 90 to 96 1/1/2007 96 thru POST- 96 1/1/2008	Pre-89 thru 89 25% 1/1/06 50% 1/1/07 75% 1/1/08 100% 1/1/09 90 to 96 30% 1/1/07 60% 1/1/08 100% 1/1/09 96 thru POST- 96 50% 1/1/08 100% 1/1/09
≤ 0.40		Not Limited by ATCM[2]	Not Limited by ATCM[2]	30		
≤ 0.15		Not Limited by ATCM[2]	Not Limited by ATCM[2]	District Discretion but may not exceed 50		
≤ 0.01		Not Limited by ATCM[2]	Not Limited by ATCM[2]	District Discretion but may not exceed 100		

1. Emission testing limited to testing to show compliance with subsections (e)(2)(A)(ii).
2. May be subject to emission or operational restrictions as defined in current applicable district rules, regulations, or policies.

As with new emergency standby stationary diesel-fueled CI engines, the ATCM establishes diesel PM emission standards that become more stringent as the maximum allowable annual hours for maintenance and testing increase. The owners or operators of in-use stationary diesel-fueled CI engines are required to comply with these emission and operational limits. Engines that operate less than or equal to 20 hours per year for maintenance and testing purposes are not required by the proposed ATCM to meet a diesel PM emission limit. Engines that operate more than 20, but less than or equal to 30 hours per year for maintenance and testing purposes are required to meet a diesel PM emission limit of 0.40 g/bhp-hr. The proposed ATCM is structured to limit maintenance and testing operation at 30 hours per year for most engines, based on staff's belief that the majority of engines do not require more hours to ensure reliability. However, if an owner or operator needs to operate his or her engine more than 30 hours per year for maintenance and testing purposes, the proposed ATCM allows the District to establish the emission standards and operating requirements for that engine on a site-specific basis with the following restrictions. If the owner or operator needs more than 30 hours per year, but less than or equal to 50 hours per year for maintenance and testing purposes, the diesel PM emission rate of that engine may not exceed 0.15 g/bhp-hr. If the owner or operator needs more than 50 hours per year, but less than or equal to 100 hours per year for maintenance and testing purposes, the diesel PM emission rate of that engine may not exceed 0.01 g/bhp-hr. The criteria to be considered by the District when making this decision include the site-specific potential cancer risk, the NOx emission rate of the engine, the existence of additional diesel-fueled engines operating on-site, and current and planned use of surrounding land.

ARB staff estimates that an engine that meets the requirements of the ATCM as summarized in Table V-4, and operates the typical number of hours for emergency use, will result in a maximum offsite cancer risk that is below district-defined significant risk levels. See Appendix F, Basis for the Standards, for a more detailed discussion on potential offsite cancer risk. For those site-specific situations where the potential risk may warrant further evaluation, such as facilities with multiple engines, the ATCM provides the District with the authority to establish more stringent standards.

The proposed ATCM establishes HC, NOx, or NMHC +NOx, and CO standards for in-use emergency standby stationary diesel-fueled CI engines that use diesel PM control technologies that are not verified through the ARB's Verification Procedure. For technologies that have been verified through ARB's Verification Procedure, these standards are unnecessary because the Verification Procedure requires limits at least as stringent as these be met. For unverified control technologies, the ATCM limits any increase in the emission rate of HC or NOx emissions to less than or equal to 10 percent from baseline levels. The 10 percent increase is allowed to take into account the uncertainty of the test methods. An option to meeting the separate HC and NOx standards is to meet a combined NMHC+NOx limit. The ATCM does not allow any increase in the sum of NMHC and NOx from baseline levels. For CO, the ATCM limits the increase in CO emissions from implementing a non-verified control strategy to less than or equal to 10 percent from baseline levels. The underlying goal of these standards is to not increase the emissions of other criteria pollutants when implementing control strategies that reduce diesel PM emissions.

In-Use Stationary Diesel-Fueled Engines: Compliance Schedule

Schedule for Engines that Meet Requirements with Hour Limitations

Each owner or operator of an in-use emergency standby stationary diesel-fueled engine that can meet the emission standards and operating requirements discussed above by solely maintaining or reducing the current annual hours of operation for maintenance and testing, shall maintain engine usage records to show compliance beginning with the January 1, 2005, to December 1, 2006, period and continuing every year thereafter.

Schedule for Engines that Meet Requirements by Reducing Emission Rates

Each owner or operator of three or less in-use emergency standby stationary diesel-fueled engine must meet the operating requirements and emission standards discussed above in accordance with the following schedule:

- All 1989 model year engines and pre-1989 model year engines must be in compliance by no later than January 1, 2006.

- All 1990 model year and post-1990 model year engines, to pre-1996 model year engines must be in compliance by no later than January 1, 2007.

- All 1996 model year engines and post-1996 model year engines must be in compliance by no later than January 1, 2008.

Each owner or operator of four or more in-use emergency standby stationary diesel-fueled engine engines is afforded more time to come into compliance with the above requirements.

1989 and Pre-1989 Model Year Engines

Percent of Engines	Compliance date
25%	January 1, 2006
50%	January 1, 2007
75%	January 1, 2008
100%	January 1, 2009

1990, Post-1990 through Pre-1996 Model Year Engines

Percent of Engines	Compliance date
30%	January 1, 2007
60%	January 1, 2008
100%	January 1, 2009

1996 and Post-1996 Model Year Engines

Percent of Engines	Compliance date
50%	January 1, 2008
100%	January 1, 2009

Prior to the earliest applicable compliance date, the owner operator must provide the District APCO with emissions data for the purposes of demonstrating compliance. The types of emissions data that are acceptable for showing compliance are discussed in more detail in section I.

Interruptible Service Contracts

As with new emergency standby stationary diesel-fueled engines, a new engine used to provide power in a "non-emergency" situation, e.g., the fulfillment of an ISC contract, is classified as a new prime engine, not an emergency standby engine, and is subject to the new prime engine emission standards discussed in subchapters G(3) and G(4). This approach is currently being reevaluated by ARB staff. Modifications to this approach may be presented at the November 13-14, 2003, Board hearing.

District's Authority to Establish More Stringent Standards and Allow Additional Hours of Operation

As with new emergency standby stationary diesel-fueled CI engines, the ATCM grant's the district Air Pollution Control Officer (APCO) the authority to establish more stringent emission standards and operating requirements, and to allow additional hours of operation for demonstrating compliance with other District rules, Verification testing, and initial start-up testing.

3. Operating Requirements and Emission Standards for New Prime Stationary Diesel-Fueled CI Engines with a Rated Horsepower Greater Than 50

General Operating Requirements and Emission Standards

The emission standards for new prime stationary diesel-fueled CI engines are summarized in Table V-5.

Table V-5: Diesel PM Standards and Operational Requirements for New Prime Stationary Diesel-Fueled Engines

DIESEL PM Standards (g/bhp-hr)	NMHC/NOx/CO Standards (g/bhp-hr)	Maximum Allowable Annual Hours of Operation for Engines Meeting Diesel PM Standard	Compliance Dates
≤ 0.01[1]	Off-road Standard (Appropriate or Tier 1)	Not Limited by ATCM [2]	January 1, 2005

1. Or off-road certification standard (title 13 CCR section 2423) for an off-road engine with the same horsepower rating, whichever is more stringent
2. May be subject to emission or operational restrictions as defined in current applicable district rules, regulations, or policies.

The proposed ATCM establishes requirements for both the sellers and owners of new prime stationary diesel-fueled CI engines. These requirements go into effect January 1, 2005. The proposed ATCM requires all new prime stationary diesel-fueled CI engines to emit diesel PM at a rate of 0.01 g/bhp-hr or less, or meet the current applicable off-road certification standard for an off-road engine of the same horsepower rating.

As with new emergency standby stationary engines, the ATCM also requires all new prime stationary diesel-fueled CI engines to meet the appropriate off-road standards for HC, NOx, or NMHC+NOx, and CO, as defined in Title 13 CCR section 2423. If the engine pre-dates the off-road standards, for example a 1987 model year engine, the appropriate standard would default to the Tier I standard for the horsepower rating category of the engine.

More Stringent Standards for New Prime Stationary Diesel-Fueled Engines that Produce Electricity Near the Place of Use (Distributed Generation) Currently Eliminate Diesel-Fueled Engines as an Option for Prime Power Generation

Senate Bill 1298 (SB 1298), which was chaptered in September 2000, required the ARB to adopt emission standards and establish a certification program for electrical generation technologies that are exempt from air pollution control or air quality management district permit requirements. SB 1298 focused on electrical generation that is near the place of use and defined these sources as "distributed generation". The ARB also developed guidance to the air districts on the permitting or certification of electrical generation technologies that are subject to district permit.

As a result, new prime stationary diesel-fueled CI engines that are "well controlled" and are used as distributed generations sources will not meet the emission standards defined in the certification regulation. However, these "well-controlled" engines may meet District permitting program requirements, which are less stringent, if those programs are based on the ARB's Guidance for the Permitting of Electrical Generation Technologies. A "well-controlled" new diesel-fueled engine would be the equivalent of a Tier 3 off-road certified engine with an 85 percent reduction in diesel PM emissions (based on the installation of a diesel particulate filter (DPF)) and a 95 percent reduction in NOx emissions (based on the installation of a selective catalyst reduction (SCR) system). The resultant diesel PM and NOx emission levels of a well-controlled diesel-fueled CI engine are estimated at ranging from 0.02 g/bhp-hr (0.06 lb/MW-hr) to 0.03 g/bhp-hr (0.09 lb./MW-hr) for diesel PM and from 0.14 g/bhp-hr (0.41 lb/MW-hr) to 0.23 g/bhp-hr (0.67 lb./MW-hr) for NOx. Although these reductions are theoretically possible, installing both control technologies on one engine may result in less than optimum reduction in diesel PM. Factors that could reduce the reduction efficiency of a DPF that is installed in back of an SCR in the exhaust stream of a diesel-fueled engine include reduced inlet temperature and reductant slip.

The following paragraphs summarize the requirements of both the certification regulation and the guidance.

DG Certification Regulation Requirements

- Distributed generation sources must be certified by the ARB before they can be sold in California *if they are exempt from district permit requirements.*
- The DG Certification emission standards for 2003 and 2007 are summarized below.

Table V-6: January 1, 2003 Emission Standards

Pollutant	DG Unit not Integrated with Combined Heat and Power	DG Unit Integrated with Combined Heat and Power
NOx	0.5 lb/MW-hr (0.17 g/bhp-hr)	0.7 lb/MW-hr (0.24 g/bhp-hr)
CO	6.0 lb/MW-hr (2.0 g/bhp-hr)	6.0 lb/MW-hr (2.0 g/bhp-hr)
VOCs	1.0 lb/MW-hr (.34 g/bhp-hr)	1.0 lb/MW-hr (0.34 g/bhp-hr)
PM	An emission limit corresponding to natural gas with fuel sulfur content no more than 1 grain/100scf	An emission limit corresponding to natural gas with fuel sulfur content no more than 1 grain/100scf

Table V-7: January 1, 2007 Emission Standards

Pollutant	All DG Units
NOx	0.07 lb/MW-hr (.02 g/bhp-hr)
CO	0.10 lb/MW-hr (.03 g/bhp-hr)
VOCs	0.02 lb/MW-hr (.007 g/bhp-hr)
PM	An emission limit corresponding to natural gas with fuel sulfur content no more than 1 grain/100scf

The above standards are not currently achievable by diesel-fueled CI engine technology.

DG Guidance Document

The ARB developed guidance for electrical generation technologies *that are subject* to district permits. These technologies included reciprocating engines. The purpose of the guidance is to assist the air districts in making permitting decisions for electrical generation technologies that are subject to district permits. The guidance includes recommended Best Available Control Technology (BACT) levels and suggested permit conditions

Table V-8 summarizes the BACT recommendations for Reciprocating Engines used in Distributed Generation Applications.

Table V-8: Summary of BACT for the Control of Emissions from Reciprocating Engines Used in Electrical Generation

Equipment Category	NOx lb/MW-hr	VOC lb/MW-hr	CO lb/MW-hr	PM lb/MW-hr
Fossil fuel fired	0.5 (0.15 g/bhp-hr or 9 ppmvd*)	0.5 (0.15 g/bhp-hr or 25 ppmvd*)	1.9 (0.6 g/bhp-hr or 56 ppmvd*)	0.06 (0.02 g/bhp-hr)

* lb/MW-hr standard is equivalent to g/bhp-hr and ppmvd expressed at 15 percent O_2. Concentration (ppmvd) values are approximate.

4. Operating Requirements and Emission Standards for In-Use Prime Stationary Diesel-Fueled CI Engines with a rated horsepower greater than 50

General Operating Requirements and Emission Standards

The emission standards for in-use prime stationary diesel-fueled CI engines are summarized in Table V-9.

Table V-9: Diesel PM Standards and Operational Requirements for In-Use Prime Stationary Diesel-Fueled Engines

<table>
<tr><th colspan="2">Diesel PM Standards
(g/bhp-hr)</th><th rowspan="2">NMHC/NOx/CO Standards
(g/bhp-hr)</th><th rowspan="2">Maximum Allowable Annual Hours of Operation for Engines Meeting Diesel PM Standard</th><th colspan="2">Compliance Dates by Model Year of Engine</th></tr>
<tr><th>Applicability</th><th>Limit</th><th>Owns 3 or Fewer Engines</th><th>Owns 4 or More Engines</th></tr>
<tr><td>All Engines</td><td>85% reduction from baseline levels
(Option 1)

or

0.01 g/bhp-hr [1]
(Option 2)</td><td rowspan="2">If control strategy is not Verified retrofit technology, show no increase from baseline levels</td><td rowspan="2">Not Limited by ATCM[2]</td><td><u>Pre-89 thru 89</u>
1/1/2006

<u>90 to 96</u>
1/1/2007

<u>96 thru POST- 96</u>
1/1/2008</td><td><u>Pre-89 thru 89</u>
25% 1/1/06
50% 1/1/07
75% 1/1/08
100% 1/1/09

<u>90 to 96</u>
30% 1/1/07
60% 1/1/08
100% 1/1/09

<u>96 thru POST- 96</u>
50% 1/1/08
100% 1/1/09</td></tr>
<tr><td>Uncertified Engines</td><td>30% from baseline and meet 0.01 g/bhp-hr by July 1, 2011
(Option 3)</td><td colspan="2">All Model Years
- 30% reduction from baseline levels by January 1, 2006
- Meet 0.01 g/ bhp-hr by July 1, 2011</td></tr>
</table>

1. Or off-road certification standard (title 13 CCR section 2423) for an off-road engine with the same horsepower rating, whichever is more stringent
2. May be subject to emission or operational restrictions as defined in current applicable district rules, regulations, or policies.

The proposed ATCM requires each in-use prime stationary diesel-fueled CI engine that is NOT certified to the Off-Road Compression Ignition Engine Standards (Title 13, CCR section 2423) to either

Option 1) reduce its diesel PM emission rate by 85 percent from baseline levels; or

Option 2) emit diesel PM at a rate of 0.01 g/bhp-hr or less, or meet the current applicable off-road certification standard for off-road engines of the same horsepower, whichever is more stringent; or

Option 3) reduce its diesel PM emission rate by at least 30 percent from baseline levels, by no later than January 1, 2006, and emit diesel PM at a rate of 0.01 g/bhp-hr or less by no later than July 1, 2011.

In-use prime stationary diesel-fueled CI engines that are certified to the Off-Road Compression Ignition Engine Standards must comply with either Option 1 or Option 2, above.

Baseline level is defined as the emission level of a diesel-fueled CI engine using CARB diesel fuel as configured upon initial installation or by January 1, 2003, whichever is later. The purpose of setting the baseline as some point in the past as opposed to the effective date of the ATCM, was to avoid providing a disincentive to an owner from reducing diesel PM emissions well prior to the compliance date for the engine. Additional guidance that owners or operators can use when defining the baseline diesel PM emission levels can be found in Appendix I, Determination of Baseline Levels.

As with new emergency standby stationary diesel-fueled CI engines, the ATCM establishes HC, NOx, or NMHC +NOx, and CO standards for in-use emergency standby stationary diesel-fueled CI engines that use diesel PM control technologies that are not verified through the ARB's Verification Procedure. For unverified control technologies, the ATCM limits any increase in the emission rate of HC or NOx emissions to less than or equal to 10 percent from baseline levels. An option to meeting the separate HC and NOx standards is to meet a combined NMHC+NOx limit. The ATCM does not allow any increase in the sum of NMHC and NOx from baseline levels. For CO, the ATCM limits the increase in CO emissions from implementing a non-verified control strategy to less than or equal to 10 percent from baseline levels. The underlying goal of these standards is to not increase the emissions of other criteria pollutants when implementing control strategies that reduce diesel PM emissions.

Schedule for Engines that Meet Requirements by Complying with Option 1 or Option 2

Each owner or operator of three or less in-use emergency standby stationary diesel-fueled engine must meet the operating requirements and emission standards discussed above in accordance with the following schedule

- All 1989 model year engines and pre-1989 model year engines must be in compliance by no later than January 1, 2006.

- All 1990 model year and post-1990 model year engines, to pre-1996 model year engines must be in compliance by no later than January 1, 2007.

- All 1996 model year engines and post-1996 model year engines must be in compliance by no later than January 1, 2008.

Each owner or operator of four or more in-use emergency standby stationary diesel-fueled engine engines is afforded more time to come into compliance with the above requirements.

1989 and Pre-1989 Model Year Engines

Percent of Engines	Compliance date
25%	January 1, 2006
50%	January 1, 2007
75%	January 1, 2008
100%	January 1, 2009

1990, Post-1990 through Pre-1996 Model Year Engines

Percent of Engines	Compliance date
30%	January 1, 2007
60%	January 1, 2008
100%	January 1, 2009

1996 and Post-1996 Model Year Engines

Percent of Engines	Compliance date
50%	January 1, 2008
100%	January 1, 2009

Prior to the earliest applicable compliance date for Option 1, 2, or 3, the owner operator must provide the District APCO with emissions data for the purposes of demonstrating compliance. The types of emissions data that are acceptable for showing compliance are discussed in more detail in subsection I.

District's Authority to Establish More Stringent Standards and Allow Additional Hours of Operation

As with new emergency standby stationary diesel-fueled CI engines, the ATCM grant's the district Air Pollution Control Officer (APCO) the authority to establish more stringent emission standards and operating requirements, and to allow additional hours of operation for demonstrating compliance with other District rules, Verification testing, and initial start-up testing.

5. Operating Requirements and Emission Standards for New Stationary Diesel-Fueled CI Engines Used in Agricultural Operations with a rated horsepower greater than 50

General Operating Requirements and Emission Standards

The emission standards and operational requirements for new stationary diesel-fueled CI engines used in agricultural operations (new agricultural engines) are summarized in Table V-10.

Table V-10: Diesel PM Standards and Operational Requirements for New Agricultural Engines

Diesel PM Standards (g/bhp-hr)	**NMHC/NOx/CO Standards** (g/bhp-hr)	**Maximum Allowable Annual Hours of Operation for Engines Meeting Diesel PM Limit**	**Compliance Dates**
≤0.15[1]	Off-road Standard	Not Limited by ATCM [2]	January 1, 2005

1. Or off-road certification standard (title 13 CCR section 2423) for an off-road engine with the same horsepower rating, whichever is more stringent
2. May be subject to emission or operational restrictions as defined in current applicable district rules, regulations, or policies.

The proposed ATCM establishes requirements for both the sellers and owners of new stationary diesel-fueled CI engines used in agricultural operations. These requirements go into effect January 1, 2005. The proposed ATCM requires all new agricultural engines to emit diesel PM at a rate of 0.15 g/bhp-hr or less, or meet the current applicable off-road certification standard for an off-road engine of the same horsepower rating. Both prime and emergency standby must meet the same emission limit. Emergency standby engines used in agricultural operations are not limited in their hours of operation.

As with new non-agricultural stationary diesel-fueled stationary CI engines, the ATCM requires new agricultural engines to meet the appropriate model year HC, NOx (or NMHC + NOx) and CO Off-Road Compression Ignition Engine Standards, as defined in Title 13 CCR section 2423. If the engine pre-dates the off-road certification standards, for example a 200hp engine manufactured in 1995, the agricultural engine would not be required to meet a HC, NOx (or NMHC+NOx) or CO emission limit.

Basis for Separate Standards

The proposed ATCM establishes separate emission standards for new agricultural engines. See section D, Exemptions, for a detailed discussion on why these separate emission standards were established.

Carl Moyer/EQIP Engines

The Carl Moyer Memorial Air Quality Standards Attainment Program provides funds on an incentive-basis for the incremental cost of cleaner than required engines and equipment. Eligible projects include cleaner on-road, off-road, marine, locomotive and stationary agricultural pump engines, as well as forklifts, airport ground support equipment, and auxiliary power units. The program's primary goal is to achieve near-term reductions in emissions of oxides of nitrogen (NOx), which are necessary for California to meet its clean air commitments under the State Implementation Plan. In addition, local air districts use these NOx emission reductions to meet commitments in their conformity plans, thus preventing the loss of federal funding for local areas throughout California. A secondary goal of the program is the reduction of particulate matter (PM) emissions. Many of the stationary agricultural pump engines that were replaced as part of the Carl Moyer Program, were replaced with engines that significantly reduced both NOx and diesel PM emissions.

The Environmental Quality Incentives Program (EQIP) was reauthorized in the Farm Security and Rural Investment Act of 2002 (Farm Bill) to provide a voluntary conservation program for farmers and ranchers that promotes agricultural production and environmental quality as compatible national goals. EQIP offers financial and technical help to assist eligible participants install or implement structural and management practices on eligible agricultural land. The program provides funds for the purchase of low-emitting diesel-fueled engines.

Prior to January 1, 2008, the ATCM allows new agricultural engines that were purchased with Carl Moyer and EQIP funds to be exempt from the emission standards discussed in this section as long as they meet Tier II Off-Road Compression Ignition Standards for the horsepower category of the engine. The Tier II standards are found in Title 13, CCR section 2423).

6. Emission Standards for New Stationary Diesel-Fueled CI Engines with a rated horsepower less than or equal to 50

General Emission Standards

The emission standards for new stationary diesel-fueled CI engines with a rated horsepower less than or equal to 50 are summarized in Table V-11.

Table V-11: Diesel PM Standards and Operational Requirements for New Stationary Diesel-Fueled Engines ≤ 50 HP

Diesel PM Standards (g/bhp-hr)	**NMHC/NOx/CO Standards** (g/bhp-hr)	**Maximum Allowable Annual Hours of Operation for Engines Meeting Diesel PM Limit**	**Compliance Dates**
Off-road Standard	Off-road Standard	Not Limited by ATCM [1]	January 1, 2005

1. May be subject to emission or operational restrictions as defined in current applicable district rules, regulations, or policies.

The proposed ATCM establishes requirements for sellers of new stationary diesel-fueled CI engines with a rated horsepower less than or equal to 50. These requirements go into effect January 1, 2005. The proposed ATCM requires all new stationary diesel-fueled CI engines with a rated horsepower less than or equal to 50 meet the current applicable off-road certification standard for an off-road engine of the same horsepower rating.

H. Reporting, Notification, Recordkeeping, and Monitoring Requirements

1. Reporting Requirements

The purpose of the reporting requirements are to establish an accurate inventory of stationary CI engines currently operating in California. The information that is required to be reported will be used by both District and ARB staff. Initially, owners or operators of stationary CI engines will be required to report information on their current inventory of engines. Those that are required to meet emission standards will be required to submit information to the district on how they plan on complying with the ATCMs requirements. Owners and operators of either engines that are less than or equal to 50 hp or agricultural engines will not be required to report any information, but those that sell these engines to end-users will be required to report to the ARB, the number of each make and model engine they sell for stationary applications. An "end-user" is defined as any person who purchases or leases a stationary diesel-fueled engine for operation in California. Persons purchasing engines for resale are not considered end-users. The following paragraphs discuss the reporting requirements in more detail.

Initial Reporting Requirements for Owners and Operators of Stationary CI Engines > 50 hp that are not used in Agricultural Operations

Table V-12 identifies the initial information that is required to be submitted to the District APCO by no later than January 1, 2005, by owners or operators of in-use stationary CI engines, and prior to the engine installation date by owners or operators of new stationary CI engines. The District APCO may exempt the owner or operator from providing all or part of the information identified in Table V-6 if the information is available in the owner or operators permit to operate. With the information provided, District staff will be able to develop a detailed inventory of engines subject to the requirements of the ATCM. The information will also be useful in updating the ARB's stationary engine inventory and emissions inventory, and for implementing the requirements AB 2588 (see Chapter X, Additional Considerations for a discussion of AB 2588 requirements). ARB staff will develop a standard spreadsheet format in Microsoft Word that will be made available to the public via our web site, http://www.arb.ca.gov. We request that submittals be made using the spreadsheet.

Table V-12: Reporting Information – Stationary CI Engines Currently Operating in California

Owner/Operator Contact Information	(EXAMPLE RESPONSES)
Company Name	ABCD, Inc.
Contact Name, Phone number, address, and e-mail address	Joe Smith 999 High Desert Bluff Road, Mojave, CA 90089 www.jsmith.com
Address of engine	Same as above
Engine Information	
Make	Acme
Model	3006 D
Serial Number	Abcd1234567
Year of manufacture (if unable to determine, approximate age)	Bought brand new in 1987
Rated Brake Horsepower	330 bhp @ 2200 rpm
Exhaust stack height from ground	10 feet
Engine Emission Factor and Supporting Data (if available)	
PM	.25 g/bhp-hr (manuf. Test data)
NOx	0.40 g/bhp-hr
HC	0.25 g/bhp-hr
NMHC+NOx	N/A
CO	0.25 g/bhp-hr
Control Equipment	
Turbo	X
Aftercooler	X
Injection Timing Retard	
Catalyst	
Diesel Particulate Filter	
Other	
Fuel Used	
CARB Diesel	
Jet Fuel	
Diesel	
Alternative Diesel Fuel	Biodiesel 50
Alternative Fuel	
Combination (dual fuel)	
Other	
Operation Information	
Describe General Use of Engine	Stationary crane for loading trucks
Typical Load (% of bhp rating)	80% load
Typical annual hours of operation	200
If seasonal, months of year operated and typical hours per month operated	N/A
Fuel Usage Rate (if available)	7 gallons/hour
Distance to nearest offsite receptor	14 miles (residence)
Is engine included in an existing AB 2588 emission inventory?	No

Control Strategy Reporting Requirements for Owners or Operators of In-Use Stationary CI Engines > 50 hp that are not used in Agricultural Operations

No later than 180 days prior to the earliest applicable compliance date (see subchapter I for information on compliance dates), each owner or operator of an in-use stationary diesel-fueled CI engine shall provide the District with information identifying the control strategy for complying with the requirements of the ATCM. Examples of compliance strategies include 1) reducing hours used for maintenance and testing, 2) reducing diesel PM emissions by 85 percent through the implementation of a diesel particulate filter, and 3) removing an engine from service and replacing it with a new diesel-fueled CI engine that meets the ATCM requirements.

Sales Reporting Requirements for New Diesel-Fueled CI Engines > 50 hp Used in Agricultural Operations

Any person who sells a stationary diesel-fueled CI engine > 50 hp to another person who will operate it in California in an agricultural operation shall provide the information identified in Table V-13 to the Executive Officer of the Air Resources Board.

The sales reports will be due on the first of the year and will cover all sales during the previous calendar year. The first report is due January 1, 2006, and will cover all sales from January 1, 2005, to December 31, 2005.

Table V-13: Reporting Information for Sellers of Stationary Agricultural Engines > 50 HP, and All Engines ≤ 50 HP

Seller Contact Information				**(Example Responses)**			
Company Name				ACME, Inc.			
Contact Name, Phone Number, Address, and E-Mail Address				Joe Smith 999 Stony Road, Truckee, CA 90089 www.jsmith.com			
Engine Sales Information							
Make	**Model**	**Model Year**	**Rated Brake Horsepower**	**Executive Order Number for Off-Road Certification**	**Engine Family Number**	**Emission Control Strategy**	**Number Sold**
CAT	1234	2005	300 bhp @ 1800 rpm	1232456	897654	DPF	14
DDC	N/A	N/A (~1994)	N/A	N/A	N/A	DPF	1

Sales Reporting Requirements for New Diesel-Fueled CI Engines < 50 hp

Any person who sells a stationary diesel-fueled CI engine ≤ 50 hp to another person who will operate it in California shall provide the information identified in Table V-12 to the Executive Officer of the Air Resources Board.

The sales reports will be due on the first of the year and will cover all sales during the previous calendar year. The first report is due January 1, 2006, and will cover all sales from January 1, 2005, to December 31, 2005.

2. Notification Requirements

Notification of Non-Compliance

Owners or operators that determine they are operating their stationary diesel-fueled CI engines in violation of the operating requirements or emission standards of the ATCM shall notify the district APCO upon detection and be subject to district enforcement action or variance provisions. Examples of non-compliance scenarios that should be detected by owners or operators include exceeding limits on annual hours for maintenance and testing operation, exceedance of emission limitation as determined through visual inspection (i.e., black smoke out of tail pipe.)

Notification of Loss of Exemption

Owners or operators of in-use stationary diesel-fueled CI engines that violate the conditions of their exemption (e.g., minimum distance to receptor requirements, annual hours of operation requirements) shall notify the district APCO of the exceedance upon detection. The engines shall then be brought into compliance with the appropriate emission standards and operating requirements of the ATCM by no later than 180 days after notification. The owners and operators of these engines shall provide the District APCO with emissions data showing compliance, as necessary. The types of emissions data that are acceptable for showing compliance are discussed in more detail in subchapter I.

Owners or operators of in-use stationary diesel-fueled CI engines exempt from the operating requirements or emission standards of the ATCM in accordance with Exemptions listed in subchapter D, shall be notified by the District APCO if the exemption no longer applies. No later than 180 days (may change to 18 months) after notification, the previously exempt engine must come into compliance with the appropriate emission standards and operating requirements and provide the District APCO with emissions data showing compliance, as necessary. The types of emissions data that are acceptable for showing compliance are discussed in more detail in subchapter I.

Monitoring Equipment and Recordkeeping Requirements

A non-resettable hour meter must be installed on all stationary diesel-fueled CI engines subject to operating requirements or emission limitations. For emergency standby engines, and those engines that have hours of operation limitations based on exemption criteria, the hour meters serve tool for District's to use when enforcing the requirements of the ATCM. However, because hour meters cannot determine between hours used for an emergency and hours used for maintenance and testing, the ATCM also requires records to be kept documenting the reason for operation of these engines. An owner or operator of an emergency standby engine or one subject to an exemption that limits hours of operation, must keep records of the number of hours the engines are operated on a monthly basis. Such records must be retained on-site for a minimum of 36 months from date of entry. Record entries must be retained on-site, either at a central location or at the engine location, and made immediately available to the District staff upon request. Record entries made 36 months from the most recent entry shall be made available to the District staff five working days from request. The monthly record log shall contain the following information:

- emergency use hours of operation
- maintenance and testing hours of operation, including ISC hours as appropriate
- hours of operation for emission testing to show compliance with the emission standards of the ATCM
- initial start-up hours
- other use hours.

A backpressure monitor must be installed on all engines that have a diesel particulate filter. The purpose of the backpressure monitor is to notify the owner or operator when the high backpressure limit of the engine is approached.

The district has the authority to require additional monitoring equipment dependant on the control strategy used to meet the emission standards of the ATCM.

I. Emissions Data

This section identifies describes the types of information that can be submitted to the district APCO to show compliance with the emission standards of the ATCM. This information includes engine manufacturer’s data, emission test data from similar engines, emission test data used in meeting the requirements of the Verification Procedure, certification data, and source test information from the engine subject to the requirements. ARB staff does not anticipate that a majority of the engines subject to the proposed ATCM will be required to be source tested. ARB staff believes that most owners of emergency standby diesel-fueled CI engines subject to the requirements of the proposed ATCM will reduce their hours of operation for maintenance and testing operations to below 20 hours per year. This is the most cost-effective method of compliance. For prime engines, and those emergency standby engines that are unable to reduce their hours of operation to below 20 hours per year, engine certification test data for post –1996 engines and manufacturers test data for post-1988 engines is available for many in-use engines.

<u>Engine Manufacturer’s Data</u>

Many engine manufacturer’s have historical emissions test data for 1988 model year engines and newer. For in-use stationary prime diesel-fueled CI engines, this data could be used to establish baseline emission levels. The owner or operator of the engine would submit the data to the District for review. The District would evaluate the engine manufacturer's data and determine how applicable it is to the baseline configuration of the engine. The type of information that should be submitted to the district when using engine manufacturer's emissions data to show compliance with the ATCM includes the following:

- Engine Make
- Engine Model Number
- Engine Serial Number
- Engine Family Number
- Year of Manufacture
- Engine Emission Rates
    - Test Method
    - Modal data
        a. PM
        b. NOx
        c. HC
        d. NMHC+NOx
        e. CO
- Weighted Average Value for Test for each pollutant

Verification Procedure

The Verification Procedure (Procedure) can be found on the ARB's web site at http://www.arb.ca.gov/regact/dieselrv/dieselrv.htm. The purpose of the procedure is to verify the emission reduction capability of technologies that can be used to reduce the emissions of diesel PM and NOx from diesel-fueled engines. The procedure requires the control technology manufacturers to identify the targeted emission control group. The term "Emission control group" means a set of diesel engines and applications determined by parameters that affect the performance of a particular control technology. Parameters can include engine cycle, engine size, operating load, fuel used, etc. The Procedure requires emission testing be performed in accordance with requirements defined in the Procedure. The emission testing results are from both baseline testing and post-control-technology-installation testing. To the extent that the emission control group includes an engine that is subject to the emission standards of this ATCM, the emissions test data that is used to support Verification can be used to support compliance with the ATCM.

Certification Data

Since 1996, diesel-fueled CI engines that are used in off road applications have been required to be certified in accordance with the ARB off-road regulations, California Code of Regulations, Title 13, section 2423. Similarly, U.S. EPA has required nonroad (which is equivalent to off-road) diesel-fueled CI engines to be certified in accordance with U.S. EPA nonroad regulations, Code of Federal Regulations, Title 40, Part 89. The goal of the California certification program was to harmonize with the federal certification program as much as possible. The test cycles identified in each of the programs are identified by different "names", but are otherwise identical. When certifying an off-road engine, the applicant identifies and tests an engine that is representative of a specific engine family. The certification results apply to all engines within that family. The emission tests are completed in accordance with the steady state cycles outlined in both certification programs. These test cycles are consistent with the test cycles that are identified in the ATCM as defined in ISO-8178 Part 4, and discussed in subchapter K, Test Methods. Upon District approval, and to the extent the certification test engine is similar in configuration to the engine seeking compliance with this ATCM, the certification test data can be used as baseline emission test data.

Source Test

To show compliance with the emission standards identified in the ATCM, the owner or operator always has the option of testing the engine. Subchapter J, Test Methods, provides information on the recommended test methods for showing compliance with the emission standards identified in the ATCM.

J. Test Methods

The proposed ATCM establishes emission standards for stationary diesel-fueled CI engines in the form of emission rate limits and percent reductions from baseline emission levels. In most cases, existing emission rate data from engine manufacturer testing, off-road engine certification, and control equipment verification can be used to show compliance with these emission standards. For those cases where no applicable emissions rate data exists, emission testing of the engine may be necessary. ARB staff has identified the following emission test methods as those that should be used to show compliance with the proposed ATCM. Alternatives to these test methods may be used upon approval of the District APCO.

Diesel PM

Diesel PM emission testing shall be done in accordance with one of the following three methods. See Appendix G, Test Method Workgroup, for a more detailed discussion of these methods:

- CARB Method 5 (front half, only, and in accordance with ISO 8178-4 cycles)
- International Standards Organization (ISO) 8178-1:1996(E); ISO 8178-2: 1996(E); and ISO 8178-4 1996(E).
- California Code of Regulations, Title 13, Section 2423, Exhaust Emission Standards and Test Procedures – Off-Road Compression Ignition Engines.

NOx, CO, and HC

Nitrogen Oxides, Carbon Monoxide, and Hydrocarbon emission testing shall be done in accordance with one of the following three methods:

- CARB Method 100 (in accordance with ISO 8178-4 cycles)
- International Standards Organization (ISO) 8178-1:1996(E); ISO 8178-2: 1996(E); and ISO 8178-4 1996(E).
- California Code of Regulations, Title 13, Section 2423, Exhaust Emission Standards and Test Procedures – Off-Road Compression Ignition Engines.

NMHC

Non-Methane Hydrocarbon emission testing shall be done in accordance with one of the following two methods:

- International Standards Organization (ISO) 8178-1:1996(E); ISO 8178-2: 1996(E); and ISO 8178-4 1996(E).
- California Code of Regulations, Title 13, Section 2423, Exhaust Emission Standards and Test Procedures – Off-Road Compression Ignition Engines

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Pacific Gas and Electric Company. *Letter responding to ARB's request for information on diesel-fueled engines at Diablo Canyon Power Plant*; August 6, 2002. (PG&E, 2002)

San Diego County Air Pollution Control Districts. *Facsimile from San Diego County APCD: Permit to Operate, Diesel-fueled Emergency Standby Engines operated by Southern California Edison at HY 101 Nuclear Gen Station, San Onofre, CA, Permit Number 960632*; June 18, 2003. (SDCAPCD, 2003)

California Air Resources Board. *Meeting with representatives from Diablo Canyon Nuclear Power Plant, San Onofre Nuclear Generating Station, San Diego County Air Pollution Control District, and San Luis Obispo County Air Pollution Control District*; September 11, 2002. (ARB, 2002)

California Air Resources Board. *Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles*; October 2000. (ARB, 2000)

VI. TECHNOLOGICAL FEASIBILITY OF THE PROPOSED ATCM

There are a variety of technologies available to reduce diesel PM emissions from stationary diesel-fueled engines. Since the 1970's, much of the diesel emission control has been achieved through emission-conscious engine design. For example, emission improvements include modifications in combustion chamber geometry, increased fuel injection pressure, and design for better fuel atomization and mixing with the air. (DieselNet, 1998) In the past 15 years, more development effort has been put into catalytic exhaust emission control devices for diesel engines, particularly in the areas of particulate matter control. Those developments make the widespread commercial use of diesel exhaust emission controls feasible. (ARB, 2003a)

In this chapter of the staff report, we provide descriptions of PM reduction emission control strategies currently available and projected to be available in the near future. We focus on those we believe will be employed to comply with the proposed ATCM. Additional information on the wide variety of emission reduction options for diesel fueled engines is provided in the Diesel Risk Reduction Plan. (ARB, 2000) We also describe actual in-use experience with diesel PM emission control systems (DECS) or clean fuels that stationary engine operators are currently using and the results from a demonstration program undertaken by the ARB to further evaluate the applicability of various DECS to stationary diesel-fueled engines.

A. New Engine Standards

Many advancements have been made in combustion technology and engine design that have significantly reduced the emissions from new diesel engines. Diesel engines today emit over 80 percent less PM and over 60 percent less NOx than they did in 1988. (Diesel, 2003) Beginning in 1996, manufacturers of diesel engines have been subject to U.S. EPA's nonroad diesel emission regulation (40 CFR Part 89). The nonroad diesel emission standards are tiered (i.e., Tier 1, 2, 3, 4), and the date upon which each tier takes effect depends on the engine size. As of January 1, 2000, all engine sizes were subject to Tier 1 standards. In 2006, all engines sizes will be subject to Tier 2, and in 2008, all engines sizes will be subject to Tier 3 standards. These standards, which become increasingly more stringent over time, will result in the development of new lower emitting diesel engines in the future years. More recently, in May 2003, U.S. EPA proposed new Tier 4 emission standards which will require most engines to meet a 0.01 g/bhp-hr emission rate in the 2011-2014 timeframe. The proposed Tier 4 standards, if adopted, will result in ultra-clean diesel engines that will be over 90 percent cleaner than 1988 vintage engines.

B. Diesel PM Exhaust Aftertreatment Emission Controls

There are various advanced exhaust aftertreatment technologies commercially available that can provide significant reductions in diesel PM particularly when combined with low sulfur diesel fuel. The principal technologies that have been successfully used to reduce diesel PM from stationary diesel-fueled engines are diesel particulate filters

(DPFs) and diesel oxidation catalysts (DOCs). Flow through filters, sometimes referred to as enhanced DOCs, are relatively new to the market but also show promise in reducing diesel PM from diesel-fueled engines. These are each briefly described below.

<u>Diesel Particulate Filters</u>

DPFs have been successfully used in many applications, including prime stationary and emergency standby engines. In general, a DPF consists of a porous substrate that permits gases in the exhaust to pass through but traps the diesel PM. Diesel PM emission reductions in excess of 85 percent are possible, depending on the associated engine's baseline emissions, fuel sulfur content, and emission test method or duty cycle. In addition, up to a 90 percent reduction in CO and a 95 percent reduction in HC can also be realized with DPFs. (Allansson, 2000) Most DPFs employ some means to periodically regenerate the filter, i.e., burn off the accumulated PM. In California, diesel-fueled school buses, emergency backup generators, solid waste collection vehicles, urban transit buses, medium-duty delivery vehicles, people movers, and fuel tankers trucks have been retrofitted with DPFs through various voluntary and regulatory mandated programs as well as demonstrations programs. Particulate filters can be either active or passive systems.

Active DPFs use a source of energy beyond the heat in the exhaust stream itself to help regeneration. Active DPF systems can be regenerated electrically, with fuel burners, with microwaves, or with the aid of additional fuel injection to increase exhaust gas temperature. Some active DPFs induce regeneration automatically onboard the vehicle or equipment when a specified back pressure is reached. Others simply indicate when to start the regeneration process. Some active systems collect and store diesel PM over the coarse of a full day or shift and are regenerated at the end of the day of shift with the vehicle or equipment shut off. A number of the smaller filters are removed and regenerated externally at a "regeneration station." Because they have control over their regeneration and are not dependent on the heat carried in the exhaust, active DPFs have a much broader range of application and a much lower probability of getting plugged than passive DPFs.

A passive DPF is one in which a catalytic material, typically a platinum group metal, is applied to the substrate. The catalyst lowers the temperature at which trapped PM will oxidize to temperatures periodically reached in diesel exhaust. No additional source of energy is required for regeneration, hence the term "passive."

Field experience has indicated that the success or failure of a passive DPF is primarily determined by the average exhaust temperature at the filter's inlet and the rate of PM generated by the engine. These two quantities, however, are determined by a host of factors pertaining to both the details of the application and the state and type of engine being employed. As a result, the technical information that is readily accessible can sometimes serve as a guide, but it may be insufficient to determine whether a passive DPF will be successful in a given application. (ARB, 2002)

With regard to estimating average exhaust temperature in actual use, commonly documented engine characteristics such as the exhaust temperature at peak power and peak torque are insufficient. The exhaust temperature at the DPF's inlet is highly application dependent in that the particular duty cycle experienced plays a prominent role, as do heat losses in the exhaust system. Very application-specific characteristics enter the heat loss equation, such as the length of piping the exhaust must travel through before it reaches the DPF. Lower average exhaust temperatures can also be the result of operations of engines oversized for the application or engines run without a load applied. (ARB, 2002)

Diesel Oxidation Catalysts

Diesel oxidation catalysts (DOCs) are the most common currently used form of diesel aftertreatment technology and have been used for compliance with the PM standards for some on-highway engines since the early 1990s. DOCs are generally referred to as "catalytic converters." DOCs are devices attached to the engine exhaust system. They have chemicals lining them which catalyze the oxidation of carbonaceous pollutants – some of the soot emissions and a significant portion of the soluble organic fraction. These carbon-containing pollutants are oxidized to CO_2 and water. The catalysts that are used are known as the platinum group metals (PGMs). These consist of platinum, iridium, osmium, palladium, rhodium, and ruthenium. Platinum is best suited as the catalyst for diesel engine control devices; therefore, it appears that it will be the main catalyst used in diesel catalytic converters. (Kendall, 2002/2003)

DOC effectiveness in reducing PM emissions is normally limited to about 30 percent of diesel PM. This is because the soluble organic fraction portion of diesel PM for modern diesel engines is typically less than 30 percent. Additionally, DOCs increase sulfate PM emissions by oxidizing the sulfur in fuel and lubricating oil, reducing the overall effectiveness of the catalyst. Limiting fuel sulfur levels to 15 ppm allows DOCs to be designed for maximum effectiveness (nearly 100 percent control of soluble organic fraction emissions). DOCs also reduce emissions of HC and CO with reported efficiencies of 76 percent and 47 percent respectively. (Khair, 1999)

DOCs are also very effective at reducing the air toxic emissions from diesel engines. Test data shows that emissions of toxics such as polycyclic aromatic hydrocarbons (PAHs) can be reduced by more than 80 percent with a DOC. (DieselNet, 2002)

Flow Through Filters

Flow through filter (FTF) technology is a relatively new technology for reducing diesel PM emissions. Unlike a DPF, in which only gasses can pass through the substrate, the FTF does not physically "trap" and accumulate PM. Instead, exhaust flows through a medium (such as wire mesh) that has a high density of torturous flow channels, thus giving rise to turbulent flow conditions. The medium is typically treated with an oxidizing catalyst that is able to reduce emissions of PM, HC, and CO, or used in conjunction with a fuel-borne catalyst. Any particles that are not oxidized with the FTF flow out with the rest of the exhaust and do not accumulate.

The filtration efficiency of an FTF is lower than that of a DPF, but the FTF is much less likely to plug under unfavorable conditions, such as high PM emissions, low exhaust temperatures and emergency circumstances. The FTF, therefore, is a candidate for use in applications that are unsuitable for DPFs.

Combinations

Combinations of more than one technology are also being explored to maximize the amount of diesel PM reduction. For example, fuel-borne catalysts can be combined with any of the three main hardware technologies discussed above: DPF, FTF, or DOC.

C. Cleaner Diesel Fuels, Alternative Diesel Fuels, and Alternative Fuels

Diesel PM emission reductions can also be realized through the use of cleaner diesel fuels, alternative diesel fuels, or alternative fuels (e.g., compressed natural gas). All stationary diesel-fueled engines would be required under the proposed ATCM to use low-sulfur diesel fuel, which will result in modest PM reductions by itself and will also enable the use of advanced exhaust aftertreatment systems for those engines that need DECS to meet the performance standards in the proposed ATCM. There are also some stationary engine operators that have explored the use of alternative diesel-fuels with some success and compressed natural gas fueled stationary engines are in use throughout California. While there are limitations to using alternative diesel-fuels and alternative fuels, particularly with emergency standby engines, we believe they may provide a satisfactory route to compliance for some engine operators. Below we describe some fuel options for stationary engines.

Low Sulfur Diesel Fuel (CARB Diesel)

Lowering the sulfur content of diesel fuel is important to the performance of aftertreatment technologies, particularly DPFs. Sulfur affects filter performance by inhibiting the performance of catalytic materials upstream of or on the filter (i.e., catalyst "poisoning"). This phenomenon not only adversely affects the ability to reduce emissions, but also adversely impacts the capability of these filters to regenerate - there is a direct trade-off between sulfur levels in the fuel and the ability to achieve regeneration. Sulfur also competes with the chemical reactions intended to reduce pollutant emissions and creates particulate matter through catalytic sulfate formation. The availability of low sulfur fuel (i.e., less than 15 ppm) will enable these filters to be designed for improved PM filter regeneration and emission control performance, as well as to reduce sulfate emissions. Indeed, diesel fuel containing less than15 ppm sulfur is required to ensure maximum emission control performance on the broadest range of diesel non-road engines possible. (MECA, 2003)

Recently, the ARB approved amendments to the California diesel fuel regulations. One of the proposed amendments reduces the sulfur content limit from 500 parts per million by volume (ppmv) to 15 ppmv for diesel fuel sold for use in California in stationary source engines, on-road and off-road motor vehicles starting in mid-2006. This reduced sulfur content will provide a small emission benefit because a portion of PM emissions is comprised of sulfates, the formation of which is a direct function of the level of sulfur in the fuel. (Diesel, 2003) The availability of 15 ppm sulfur fuel will also allow after-treatment manufacturers to use more highly active catalysts, which operate effectively at lower temperatures and have a broader range of vehicle applications. Low sulfur diesel is available today for use by centrally fueled fleets in voluntary emission reduction programs, and we believe it will be widely available by 2005 when the ATCM would become enforceable. (Diesel, 2003)

Alternative Diesel Fuels

Alternative diesel fuel is a fuel that can be used in a diesel engine without requiring engine or fuel system modifications for the engine to operate, although minor modifications (e.g., recalibration of the engine fuel control) may enhance performance. Examples of alternative diesel fuels include biodiesel, emulsified fuels, Fischer-Tropsch fuels, or a combination of these fuels with CARB Diesel fuel. A detailed discussion of these fuels is provided in the Diesel Risk Reduction Plan. (ARB, 2000) These alternatives may result in significant benefits for higher-emitting categories, such as off-road engines. Synthetic or alternative diesel fuels may also prove to be part of the preferred control strategy for diesel-fueled engines that would otherwise result in relatively high risk, or where control retrofit options are very expensive or difficult to implement. The emissions effects of these fuels can vary widely. There has not been significant penetration of these fuels into stationary engine applications. However, biodiesel is being used with some success in both prime and emergency standby engines.

Alternative Fuels

Alternative fuels, such as natural gas, propane, ethanol or methanol, are options available to reduce emission from diesel engines. There are several prime stationary engine applications that are successfully using compressed natural gas (CNG) as an alternative to diesel-fuel. These engines have significantly lower emission levels than a comparable engine operating on diesel fuel. An operating cycle for compression ignition engines involves injecting a small amount of diesel along with natural gas into the combustion chamber. The heat generated by compressing this mixture ignites the diesel fuel that in turn ignites the natural gas mixture, operating much like a conventional diesel engine. CNG is available at over 100 retail outlets in California. (CEC, 1999)

For many years, natural gas has been an efficient, clean burning power application for prime engines. Natural gas produces prime power in a wide variety of industries from heat treating to printing. Storage problems (i.e., space and leak containment) and higher operating costs associated with other fuels are eliminated using natural gas. (Peoples, 2003) Other advantages of using natural gas are the extended time between oil changes and cleaner, cooler combustion compared to diesel or propane fuel.

Natural gas can also be used in some emergency stand by applications. Natural gas is an energy source permitted by National Fire Protection Association (NFPA) Standard for Emergency and Standby Power Systems (NFPA 110). Natural gas would be an appropriate power supply where failure of an emergency power supply source is less critical to human life and safety, for example, heating and air conditioning systems, communication systems, ventilation and smoke removal systems, sewerage disposal, lighting, industrial processes. Natural gas would be inappropriate in safety situations to human life, where an on-site storage tank would be required. (NFPA, 2002)

D. Engine Design Modification or Repower

There are engine modifications that can be employed, generally at the time of an engine rebuild to reduce emissions. Two examples of engine design modifications, that reduce PM emissions are a diesel engine reengineering kit produced by Clean Cam Technology (Clean Cam) and the ECOTIP Superstack Fuel Injectors (ECOTIP) distributed by Interstate Diesel.

Clean Cam consists of specific engine retrofit components, including a proprietary camshaft. The product reduces NOx emissions by increasing the volume of exhaust gas that remains in the combustion chamber after the power stroke. Within the combustion chamber, the residual exhaust gas absorbs heat and reduces the peak combustion temperature, which results in lower NOx emissions. The injection timing can then be adjusted (i.e., advanced) to maximize the diesel PM emission reductions or it can be varied to achieve the desired balance of NOx vs. PM. The product reduced diesel PM and NOx emissions from eleven pre-1993 and four pre-2000 models of two-stroke diesel-fueled engines manufactured by Detroit Diesel Corporation (DDC).

Interstate Diesel takes a different approach with the ECOTIP Superstack Fuel Injectors to reduce emissions from existing engines. This product has been shown to reduce diesel PM emissions from engines manufactured by General Motors Electro-Motive Division (EMD) and DDC. The product consists of a fuel injector with a reduced sac volume and a more consistent fuel injection pressure, and it can be incorporated into either mechanical or electronic fuel injection systems. The product improves combustion and reduces diesel PM emissions by minimizing the amount of fuel that drips into the combustion chamber at the end of the chamber's fuel injection cycle. The manufacturer states that the overall diesel PM removal efficiency can be as high as 44 percent for EMD engines and as high as seven percent for DDC engines. The product is commercially available and has been installed on approximately 2,000 diesel-fueled engines.

Repowering (i.e., replacing the engine) can be a viable and cost-effective way to reduce emissions from older uncontrolled diesel engines. (Diesel, 2003) Heavy-duty diesel engines manufactured today are significantly cleaner than those built just a short time ago and can provide significant NOx and PM benefits when compared to an older engine. Repowering can be particularly cost-effective in situations where the engine would have been removed anyway for a rebuild. (Diesel, 2003)

Another alternative is to replace a diesel-fueled engine with a fuel cell. Fuel cells have captured worldwide attention as a clean power source and have generated interest and enthusiasm among industry, environmentalists, and consumers. In principal, a fuel cell operates like a battery. A fuel cell converts chemical energy directly into electricity by combining oxygen from the air with hydrogen gas. However, unlike a battery, a fuel cell does not run down or require recharging. It will produce electricity as long as fuel, in the form of hydrogen, is supplied. Fuel cells have been a reliable power source for many years. Installations have occurred at Kaiser Hospitals in Anaheim and Riverside, the University of California at Irvine, Las Virgenes Municipal Water District in Calabasas, the Chevron Texaco Headquarters building in San Ramon, and several military installations, to name a few. Applications include electrical power supply for space flights, as well as conventional electric power generation in buildings and power plants. Fuel cell manufacturers are looking at all markets; one specific market is for smaller applications, including premium power applications, rural and remote applications, residential power applications, backup power for telecommunications systems and cell towers, and other premium power applications. At current prices, fuel cells are most suitable for power applications where the cost of the fuel cell is not a primary issue when compared, for example, to the loss of critical equipment and data. (CSFCC, 2002)

E. Reducing Hours of Operation

Reducing the number of hours an engine is operated may be an available option to reduce diesel PM emissions for some diesel power sources, particularly for emergency standby engines. In cases where an alternative fuel, emission control device, or repowering are not practical or economically feasible, owners of emergency standby engines may consider reducing the hours of operation for maintenance and testing to reduce emissions. Non-life-critical emergency back up generators could reduce hours of operation for maintenance and testing. NFPA 110 offers suggested standards for generator maintenance and testing of 30 minutes per month. (NFPA, 2002) Depending on individual power needs, the NFPA 110 maintenance and testing standards could be followed in cases where operators are unnecessarily operating more than the recommended six hours annually for maintenance and testing, thereby reducing the diesel PM emissions.

F. Verification of Diesel Emission Control Devices

In support of the ARB’s regulatory efforts to reduce diesel PM, the *Verification Procedure, Warranty and In-Use Compliance Requirements of In-Use Strategies to Control Emissions from Diesel Engines* (Verification Procedure) was adopted by the Board in March 2002. The Verification Procedure establishes a process through which manufacturers of emission control equipment can demonstrate and verify the emission reduction capabilities of control technologies. Examples of emission control technologies that can be considered for verification include diesel particulate filters, diesel oxidation catalysts, exhaust gas re-circulation, selective catalytic reduction systems, fuel additives and alternative diesel fuel systems. The Verification Procedure is voluntary and applies to emission control technologies for on-road, off-road and stationary applications. While the proposed ATCM does not require the use of verified systems to demonstrate compliance, some operators may choose to purchase a verified system. A brief discussion on the Verification Procedure is provided in this section.

The Verification Procedure requires emission control strategy applicants to establish the emissions reduction capabilities for a emission control device, conduct a durability demonstration, conduct a field demonstration and submit results along with other information in an application to the ARB following a prescribed format. The applicant verifies the product for a specific engine manufacturer, years produced, engine family and series. If the ARB approves the application, it will issue an Executive Order to the applicant stating the verified emission reduction and any conditions that must be met for the diesel emission control strategy to function properly. The Verification Procedure also requires that the applicants provide a warranty to the end-user and conduct in-use compliance testing.

The results of the Verification Procedure testing determine the control technology classification. The multi-level verification system consists of three PM reduction levels. The Verification Procedure also has provisions for verifying strategies that reduce NOx emissions. Control device verifications for both PM and NOx are classified by level as listed in Table VI-1.

Table VI-1: Verification Classifications for Diesel Emission Control Strategies

Pollutant	Reduction	Classification
PM	<25%	Not Verified
	≥ 25%	Level 1
	≥ 50 %	Level 2
	> 85% or <0.01 g/bhp-hr	Level 3
NOx	<15%	Not Verified
	>15%	Verified in 5% increments

Once a device has been verified, the executive order and accompanying information is posted on the ARB's web site at http://www.arb.ca.gov/diesel/verifieddevices/verdev.htm.

With respect to verification for stationary applications, CleanAIR Air Systems received verification on June 6, 2003, for its PERMIT™ filter for 85 percent particulate reduction. The Table VI-2 below outlines specific operating criteria for the verified CleanAIR Systems diesel particulate filter. (ARB, 2003b)

Table VI-2: CleanAIR Systems PERMIT™

Maximum consecutive minutes at idle	240 minutes
Number of 10 minute idle sessions before regeneration is required	Regeneration recommended after 12 consecutive sessions; required after 24
Minimum temperature/load/time requirements for regeneration in 4-stroke engine	300° Celsius for 30% of operating time or 2 hours, whichever is longer. For most engines, 40% load results in temperature of at least 300°Celsius
Number of hours of operation before cleaning/disposal of filter	5000 hours under normal operating conditions
Fuel	Diesel sulfur content must not exceed 15 parts per million by weight
PM emission/certification level	Equal or less than 0.1 g/bhp-hr (as tested on an appropriate steady-state certification cycle outlined in the ARB off-road regulations - similar to ISO 8178 D2)
Cycle	Four-stroke

There are also three additional emission control technologies, one fuel additive one DPF and one DOC, currently going through the verification process that are applicable to stationary engines.

G. In-Use Experience with Diesel PM Emission Control Strategies

To verify that control technologies are commercially available and have been demonstrated, ARB staff interviewed operators of stationary engines that have actual experience with a variety of DECS, alternative diesel-fuels or alternative fuels. Questions on operating performance, reliability, and effectiveness were asked to provide a better understanding of the actual in-use performance of available DECS or alternative fuels and the technological feasibility of the proposed performance standards in the ATCM. Operators of both emergency standby and prime engines were interviewed.

Emergency Standby Engines: In-Use Experience

There are numerous emergency standby engines in California that have DPFs or DOCs installed. As shown in Table VI-3, installed DECS are reducing diesel PM emissions on engines providing emergency back-up power to a variety of industries. ARB staff interviewed representatives from eight of the facilities to determine actual in-use experience. Summaries of the interviews are provided below. The DECS were installed on model year engines ranging from 1993-2002. The most common technologies are DPFs. Of those interviewed, most stated that the DECS required little or no extra maintenance. Most companies installed the DECS to meet the local air pollution control permit requirements and others to reduce odor complaints from neighbors. Many of the engines had source test data to support the emission reductions. All of the engines were on a regular maintenance and testing schedule.

There are also emergency standby engines that are currently using alternative fuels. ARB staff interviewed engine owners currently using biodiesel or compressed natural gas. Biodiesel offered a large reduction in diesel PM emissions. There was minor extra maintenance required to prevent biodiesel (B50) from clogging fuel filters. A drawback to biodiesel is the increase in NOx emissions that occur particularly with the blends having a larger portion of biodiesel. Natural gas powered engines offer a non-diesel power source. For example, the Advanced Micro Devices (AMD) engine is used for emergency backup and participating in a peak shaving program. Feedback from owners is that natural gas engines do not require extra maintenance. A paragraph about AMD natural gas engines and Mt. Rainer National Park using biodiesel provides more details on in-use experience with alternative fuels.

Table VI-3: In-Use Emergency Standby Stationary Engines with DECS

Location	Facility Type	Engine Make and Horsepower	Emission Control System
San Joaquin Valley APCD, CA	Public Works	Caterpillar 3516B 2848 hp	CleanAIR Systems DPF
Bay Area AQMD, CA	County Service Center	Cummins KTTA 50-G2 2220 hp	CleanAIR Systems DPF
Butte County AQMD, CA	Brewery	(2) Caterpillar 3412 1100 hp each	Engelhard DPF
Bay Area AQMD, CA	Communications	(3) Caterpillar 3516 2479 hp each	Engelhard DPX
Bay Area AQMD, CA	Communications	Caterpillar 512 1005 hp	Engelhard DPX
Bay Area AQMD, CA	Communications	Caterpillar 3516B 2479 hp	Engelhard DOC
San Joaquin Valley APCD, CA	Medical Center	Caterpillar 3406 519 hp	Engelhard DPX
San Joaquin Valley APCD, CA	Hospital	Caterpillar 3516B 2680 hp	CleanAIR Systems DPX
Bay Area AQMD, CA	Communications	Caterpillar 3412C 896 hp	CleanAIR Systems
Tehama APCD, CA	Communications	Caterpillar 3406 449 hp	DCL MINE-X SOOTFILTERS®
Colusa County APCD, CA	Communications	Caterpillar 3406 449 hp	DCL MINE-X SOOTFILTERS®
Bay Area AQMD, CA	Communications	Caterpillar 1800 hp	Ceryx Quad Cat
Butte County AQMD, CA	Communications	Detroit Diesel 7243 1550 hp	CleanAIR Systems
Bay Area AQMD, CA	Communications	(6) Caterpillar 3516 2000 hp	Unknown

Table VI-3 (continued)

Location	Facility Type	Engine Make and Horsepower	Emission Control System
Bay Area AQMD, CA	Candy Company	Caterpillar 3516B 2680 hp	CleanAIR Systems
San Diego County AQMD, CA	Data	(2) Caterpillar 1072 and 536 hp	Caterpillar DPF
San Diego County AQMD, CA	Hotel	(2) Caterpillar 175 hp	Caterpillar DPF
Butte County AQMD, CA	Communications	Cummins KTA50-G9 2200 hp	Nett Technologies
San Joaquin Valley APCD, CA	Communications	Caterpillar 3406 587 hp	Englehard DPX, DPF
San Joaquin Valley APCD, CA	Unknown	John Deere 6076 300 hp	Unknown
Bay Area AQMD. CA	Communications	Caterpillar 3412C 804 hp	CleanAIR Systems
South Coast APCD, CA	Construction	Caterpillar 3512B 1876 hp	CleanAIR Systems
Bay Area AQMD, CA	Communications	Caterpillar 3516B 2680 hp	CleanAIR Systems
Bay Area AQMD, CA	Data	Caterpillar 3406C 536 hp	CleanAIR Systems
Bay Area AQMD, CA	Data	Perkins 3.8L, 80.4 hp	CleanAIR Systems
San Luis Obispo County APCD, CA	Energy	Cummins KTTA50 2142 hp	CleanAIR Systems
San Joaquin Valley APCD, CA	Hospital	Caterpillar 3516B 2680 hp	CleanAIR Systems
Bay Area AQMD, CA	Equipment Sales	Caterpillar 3508 1340 hp (2) Caterpillar 3512C 804 hp (2) Caterpillar 3506C 536 hp	CleanAIR Systems
San Joaquin Valley APCD, CA	Equipment Sales	Detroit Diesel Series 60 335 hp	CleanAIR Systems
San Diego County AQMD, CA	Municipality	Caterpillar 3512 1608 hp	CleanAIR Systems
South Coast APCD, CA	Manufacturer	Isuzu 4GB1 67 hp	CleanAIR Systems
Unknown	Power Generation	(10) Various	CleanAIR Systems
Various	Various	(7) Various	Various Systems

<u>Emergency Standby Engines: Summaries of Interviews Regarding In-Use Experience</u>

Kings County Department of Public Works: Kings County Department of Public Works, located in Hanford, California, installed a CleanAIR Systems Inc. Permit™ catalyzed diesel particulate filter on a diesel-fueled Caterpillar 3516B 2000 kilowatt (kW) generator set operating on CARB low sulfur diesel fuel (<15 ppm sulfur). The engine is model year 2000 and is used for emergency power and complies with an interruptible load contract with Southern California Edison. An interruptible contract allows Kings County to receive electricity at a reduced cost but must disconnect from the local utility when notified. According to the Kings County Public Works Director, the engine has run over 800 hours since installation in 2001 and they have not experienced any problems with the DPF. CleanAIR Systems removed the filter after 556 hours to inspect soot build up which would indicate if the DPF was regenerating properly. The inspection results revealed very clean filters, which indicate the engine was reaching and sustaining adequate temperatures to ensure regeneration. Emission testing of the engine, with and without the DPF installed, was also conducted and demonstrated that the DPF was reducing emissions by 85 percent. The emissions test also provided information to verify the PERMIT™ system with the ARB. (ARB, 2003b) (NESCAUM, 2003) (Kings, 2003)

Santa Clara County: Santa Clara County operates a standby emergency generator set, located at the Santa Clara County Government Facility located in San Jose, California. In 1997, Santa Clara County installed a CleanAIR Systems, Inc. CleanDIESEL™ soot filter DPF on a diesel-fueled Cummins Model KTTA 50-G2 operating on CARB Diesel fuel. The engine is a V-16, 2220 horsepower at 1,800 rpm, 3067 cubic inch turbo charged engine. The exhaust is configured with twin exhaust outlets, each of which is equipped with CleanDIESEL™ soot filters. The engine operates an Onan Model 1500 DFMP generator with a rated output of 1500 kW. A representative with Santa Clara County stated the DPF was installed to eliminate odor and employee complaints. The ARB completed source tests on this engine exhaust with and without the DPF in place. The engine was running at 100 percent load, and a CARB Method 5 (Determination of Particulate Matter emissions from Stationary Sources) was used to determine emission levels. Based on the results, when considering the front half as recommended in the proposed ATCM, the DPF had an efficiency of approximately 75 percent. Using the total PM (front half and back half), the efficiency was much lower due to an unusually high contribution from the back half. (NESCAUM, 2003) (Santa Clara, 2002) (Santa Clara, 2003)

Sierra Nevada Brewery: Sierra Nevada Brewery Company (SNBC) located in Chico, California installed Engelhard DPX DPFs on a pair of CARB diesel fueled Caterpillar 3412 engines each driving 750 kW generators. The engine exhaust is configured with twin exhaust outlets, each of which is equipped with DPFs. In 1997 and 1999, the engines were purchased to produce emergency electrical power. To meet air quality requirements, SNBC installed the DPFs in 1999 and 2000. The ARB has completed emissions tests on the engines. The emission controls system reduces diesel PM emissions by 85 percent from 0.164 g/bhp-hr to 0.025 g/bhp-hr. The Sierra Nevada Brewery has not had any problems with the DPFs. According to a Sierra Nevada Brewery representative, they identifed two disadvantages with the DPFs. First, the engine must run a little longer to reach temperature high enough to burn off soot buildup, and second, there was higher initial cost for the dual exhaust added to eliminate potential back-pressure problems and filter assemblies. (SNB, 2003) (NESCAUM, 2003) (Sierra, 2000)

SBC Telecommunications: SBC Telecommunications (SBC), has five emergency backup generators located in San Francisco and one engine in San Jose that have been retrofitted with diesel emission control strategies. SBC had ECS's installed on each of the emergency backup generator engines to respond to smoke and odor complaints.

SBC in San Francisco has five Caterpillar emergency backup engines powering generators with ECS's installed on the engines. In 1993 four Englehard DPFs were installed on three Caterpillar 3516 and one Caterpillar 3516B, 2479 horsepower engines. In 1999, an Englehard DPF was installed on a Caterpillar 3512, 1005 horsepower engine. All of the engines burn CARB diesel fuel. A representative of SBC stated that the emission control strategies were installed to reduce both particulate emissions and odor complaints. The engines are exercised for about an hour per month for maintenance and testing. To reduce public's exposure to exhaust emissions the engines are run early in the morning but the odor complaints continued. Subsequent inspections revealed that the encased Engelhard DPX filters cracked and repairing the cracked unit was difficult. The Englehard DPX filters remove CO, HC and PM. (SBC, 2003) (NESCAUM, 2003)

Emissions tests were completed on the Caterpillar 3516 engines. The results revealed the engines were emitting 0.239 g/bhp-hr prior to emission controls, with an ECS installed the PM emissions were reduced to 0.036 g/bhp-hr (85 percent reduction). (NESCAUM, 2003) (SBC, 2003)

In San Jose SBC installed a Englehard DOC on a Cummins KTA50-G9, turbocharged and aftercooled, 2,220 horsepower engine burning #1 or #2 diesel fuel powering an emergency generator. The engine is exercised for an hour per month for maintenance and testing. An emission test showed a 25 percent reduction of diesel PM emissions with the DOC installed. When the engine was installed in 2000, a DOC was mounted on the exhaust to control odors. Since installation odor complaints have been eliminated. (SBC, 2003) (NESCAUM, 2003)

Memorial Hospital of Los Banos: Memorial Hospital of Los Banos in Los Banos California installed an Engelhard DPX diesel particulate filter on a 1994 Caterpillar 3406, 519 horsepower engine operating an emergency backup generator. The particulate filter was installed in 2002 to satisfy San Joaquin Valley Air Pollution Control District emission permit requirements. The hospital runs the engine about 30 minutes per week for maintenance and testing. The exhaust temperature is monitored during the weekly engine test. According to an engineer with Memorial Hospital of Los Banos, the exhaust gas temperature reaches 1000 degrees F, for 30 percent of the run time, which is sufficient to regenerate trapped diesel PM and keep the filter clean. Annual turning over of the DPF units is the only maintenance the unit would need. The filter has not been turned over because the engine produces high exhaust temperatures. (Los Banos, 2003)

Fresno Regional Medical Center: Fresno Regional Medical Center in Fresno, California installed a PERMIT™ CleanAIR catalyzed diesel particulate filters on five 2002 Caterpillar 3516TA, 2680 horsepower engines that power Caterpillar SR4 B emergency backup generators. As part of the SJVAPCD permit, the medical center was required to reduce PM emissions. Emission information was provided to the project manager at the Medical Center. The data stated a Caterpillar generator will produce 0.10 g/bhp-hr PM emissions without an emission control device. The Caterpillar generator running on CARB diesel and a particulate filter has PM emissions reported at 0.01 g/bhp-hr. The PERMIT™ System being used by the Fresno Regional Medical Center has been verified by the ARB. The generator units are new and scheduled maintenance has not needed to be performed. (Fresno, 2003a) (Fresno, 2003b)

Intel Corporation: Intel Corporation located San Jose California, installed two CleanAIR Systems diesel particulate filters a Caterpillar 3412C, 896 horsepower engine which powers an emergency backup generator. The facilities manager stated that they have not had any problems with the emission control device and there is no extra maintenance. Intel has not had an emergency to use the engine for an extended period of time, the engine runs 30 minutes per month for maintenance and testing purposes. (Intel, 2003)

Sierra Pacific Power Company: Sierra Pacific Power Company (SPPC) owns and operates two diesel powered electric generators at a substation located at Kings Beach in Northern California. The two diesel engines at the substation are General Electric Model 20-645-E4, 20 cylinder, turbo-charged engines. B100 (100 percent biodiesel) was used to minimize emissions. Testing was completed on one of the engines under 90 to 100 percent load. The first test was completed on December 1990 using off-road diesel fuel a second test was completed September 2002 using B100 fuel. Table VI-4 summarizes test results performed comparing off-road diesel and biodiesel. The emission testing demonstrated over 40 percent reduction in total PM. There was also about a 30 percent increase in NOx emissions. At this time the decision as to whether or not to use biodiesel has not been made. (Tetra Tech, 2002)

Table VI-4: Biodiesel (B100) Emission Reductions vs. Off-Road Diesel

Emissions	Reductions
Filterable PM	63.5%
Total PM	42%
CO	28%
SO2	92%
NOx	+32%

Pacific Gas and Electric: Pacific Gas and Electric, Kettleman Station (PG&E) is located in Avenal, California installed a natural gas fired emergency generator in 2000. Because PG&E is a company that supplies natural gas, the decision to run the emergency engine on natural gas was straightforward. The engine is a 2000 Caterpillar 63512 EPG, 414 horsepower engine. The engine runs about four hours per week at 25 to 30 percent load. According to the engine operator, the natural gas engine requires no special maintenance. The local air quality district has not required emission tests on this engine. (PG&E, 2003)

Advanced Micro Devices: Advanced Micro Devices (AMD) located in Sunnyvale, California purchased a natural gas powered emergency backup engine in late 2001. The engine is a 16V-AT27EL Waukesha engine producing 4073 horsepower. The Waukesha engine is turbo-charged, after-cooled, and lean burning. The engine was installed to prevent rolling blackouts. When notified of a rolling blackout, AMD must reduce the load from the power grid by 15 percent in 15 minutes. This engine will remove 15 percent of the load keeping the Sunnyvale facility powered. Currently the engine is participating in a peak shaving program and has been running since May 2003, five days a week for seven hours a day. The AMD Environmental Health and Safety Department stated that natural gas combustion has not caused engine problems. (AMD, 2003)

Prime Engines: Summaries of Interviews Regarding In-Use Experience

Prime engines also utilize different strategies to reduce diesel PM emissions. Most of the prime engine owners interviewed by the ARB staff installed DECS to meet local air district permit requirements. Source tests have been completed on the engines, some comparing the before and after effects of the control device. Natural gas is a common alternate fuel. The South Coast Air Quality Management District requires new prime engines to run on an alternative fuel. An extensive database listing prime engines has not been compiled. Table VI-5 below provides examples of prime engines with emission control devices installed, followed by interviews with some of those engine owners.

Table VI-5: In-Use Prime Stationary Engines with DECS

Location	Facility Type	Application	Engine Make and Horsepower	Emission Control System
San Joaquin Valley Unified APCD, CA	Parks and Recreation Department	Water Pump	John Deere 6068TF150 155 hp	Cleaire DPF
Northern Sierra APCD, CA	Rock Crushing Facility	Rock Crusher	Caterpillar 3406 587 hp	DOC
Bay Area AQMD, CA	Port Terminal	TRU Generator	Cummins KTA19G3 685 hp	DPF
Bay Area AQMD, CA	Recycling	Wood Chipper	Caterpillar 3412 750 hp	DOC
Bay Area AQMD, CA	Recycling	Wood Chipper	Caterpillar 3412 DITTA 800 hp	DPF, DOC
San Diego County APCD, CA	Waste Water	Electric Power Generation	Caterpillar 3512B 1718 hp	Clean Diesel Technology Platinum Plus DFX
San Joaquin Valley Unified APCD, CA	Public Works	Electric Power Generation	Caterpillar 3516B 2848 hp	DPF
San Diego County APCD, CA	Ship Construction	Gantry Crane	Cummins (2) QST30-G1-NR1 (2) QSX-15-G9 QST30-G1-NR2 QST30-G1-NR3	Engelhard DPX SCR
San Diego County APCD, CA	Dam Project	Power Supply	Caterpillar (6) 3516B	Engelhard DPX SCR

Kern County Parks and Recreation: Kern County Parks and Recreation Department in Kern County California, placed a Cleaire C-DPF on 1978 John Deere 6068TF150, 155 horsepower engine in 2002, burning off-road diesel fuel. The engine is used to pump water to a local campground at Lake Ming. The catalyzed diesel particulate filter was installed to satisfy San Joaquin Valley Air Pollution Control District permit requirements. The engine runs about 4 hours per day, approximately 784 hours per year. According to representatives of the Kern County Parks and Recreation Department there have been no problems or additional maintenance with the engine associated with the diesel particulate filter. (Kern, 2003)

TransBay Container Terminal Incorporated: TransBay Container Terminal, Inc. (TransBay) is located at the Port of Oakland in Oakland California. A diesel particulate filter was installed in March 2001 on a 1995 Cummins DTA19G3, 685 horsepower engine. The engine runs a generator and burns off-road diesel fuel. The diesel particulate filter was installed to reduce emissions of diesel PM meeting requirements of the Port of Oakland and the Bay Area Air Pollution Control District. The engine is used daily and runs about 1450 hours per year at about 50 percent load. A TransBay representative stated that they have not had any problems with the diesel particulate filter. (TransBay, 2003)

City of San Diego Metropolitan Waste Water Department: The City of San Diego MWWD, in San Diego California have installed a Clean Diesel Technology Platinum Plus DFX diesel particulate filter on a 1997 Caterpillar 3512B, 1718 horsepower engine. The engine powers a generator to produce electrical power by burning diesel fuel and digester gas. The generator produces 1200 kW of power and uses 22.2 gph diesel and 15,941 scf of digester gas. Burning 100 percent diesel at 1200 kW the engine consumes 100 gpm. The lead operator of the engine stated that the filters have been clogging. They sent soot samples to a laboratory for analysis. The analysis revealed the soot is comprised primarily of inorganic silicates from the digester gas. The clogging will be resolved by cleaned the filter every 3 weeks. San Diego County Air Pollution Control District (SDCAPCD) required the engine to install a diesel particulate filter and limited the hours of use to 730 per year. (San Diego, 2003a) (San Diego, 2003b) (San Diego, 2003c) (San Diego, 2003d)

Zanker Road Resource Management, Ltd: Zanker Road Resource Management, Ltd. (Zanker Road) is recycling plant and small landfill located in Milpitas, California. They have installed a DOC unit on a 1996 Caterpillar 3412 750 horsepower engine. Zanker Road has also installed a DOC/DPF unit on a 1999 Caterpillar 3412DITTA, 800 horsepower engine. Both engines burn off-road diesel fuel and are used to power wood chippers. The engine operator with Zanker Road did not know the manufacturer of the emission control units but did know they are very large, almost as large as the engine itself. A framework has been built to hold the emission control device. The wood chipper unit vibrates during operation originally causing cracks in the framework bracing. The crack has been fixed and more bracing was added to reduce vibration effects. (Zanker, 2003)

National Steel and Shipbuilding Company (NASSCO): NASSCO is located in San Diego California has six gentry cranes with emission control devices installed. The Cummins engines are four QST-30-G1 and two QSX-15-G9, produce 1030 and 680 horsepower respectively. The engines run between 1075-3761 hours per year. The engines have Engelhard DPX catalyzed diesel particulate filters to remove particulate matter. Additionally, the engines have selective catalytic reduction system with urea injection, controlling NOx emissions. A 40 percent aqueous solution of urea is used as a reagent. Urea is injected into the exhaust at 0.34 gallons per hour with less than 10 ppm ammonia slip. Exhaust gas temperatures are maintained above 715º F with an exhaust heater to properly regenerate the DPF. The SCR requires temperatures above 570º F to remove NOx efficiently. Air pollution control equipment was installed to meet San Diego County Air Quality District requirements. (NESCAUM, 2003)

Mt. Rainer National Park: Mt. Rainer National Park is currently converting all diesel applications to biodiesel fueled engines (prime and emergency standby). A B50 biodiesel blend was selected to run the engines at the park. B50 is a blend of 50 percent diesel fuel and 50 percent biodiesel fuel. According to the maintenance manger at Rainer National Park, a 90 kW generator located in a remote area has been using B50 for fuel. This engine runs 24 hours a day 3 months of the year. When they began using B50 fuel the engine was having problems with a fuel filter clogging. The problem was resolved by changing the fuel filter during regular scheduled maintenance. The fuel filters are changed monthly on the snow removal equipment to avoid filter clogging. They are currently replacing the diesel fuel blend to an ultra low sulfur diesel fuel. (Mt. Rainer, 2003)

Fetzer Five River Ranch Winery: Fetzer Five River Ranch Winery (Fetzer) located in Paso Robles, California installed two used 1963 Waukesha F-817 engines that have been configured burn natural gas. The engines are used to power refrigeration units controlling fermentation at the winery. Combined the engines run a total of 600 hours per year mainly from August to October. The decision to run on natural gas was by the winery to do an environmentally friendly alternative to diesel. The operations manager stated the engines have not required extra maintenance because they burn natural gas. (Fetzer, 2003)

H. Diesel PM Control Technology Demonstration Program for Stationary Applications

As discussed earlier, there are a number of potentially effective emission control technologies that can be used to reduce diesel PM emissions from diesel-fueled engines. To further investigate the effectiveness of these technologies for stationary diesel-fueled engine applications, ARB under took a demonstration program. The stationary engine control device demonstration was performed in conjunction with a California Energy Commission Back-up Generator Program. (CEC, 2001) The demonstration included testing of backup generators for baseline emission levels, retrofitting selected engines with commercially available diesel PM control devices, and testing controlled emission levels. Emissions were tested for PM, total hydrocarbons (THC), methane, nonmethane hydrocarbons (NMHC), CO_2, CO, NO_x, NO_2 using ISO 8178 1992-05-25 Parts 1, 2 and 4 testing procedures. (ISO/DP 1878, 1992) A five-mode D2 test cycle was used in all emission testing. The program was designed to support the testing and data requirements for control device verification under ARB's Verification Procedure. To support verification, the test protocol included baseline and initial control efficiency testing. Durability and post-durability control efficiency are currently in progress. Emission testing was performed by University of California, Riverside, Bourns College of Engineering-Center for Environmental Research and Testing (UCR CE-CERT) under the direction of Wayne Miller, Ph.D. Additional details on the demonstration program are provided in Appendix H.

<u>Control Technologies</u>

Diesel PM control technologies were selected for demonstration based on a number of criteria: projected diesel PM control efficiencies, commercial availability, demonstrated infield use, willingness of manufacturer to complete the verification process, and product cost. Devices were selected that were projected to meet varying levels of diesel PM control. Technologies included emulsified diesel fuel, diesel oxidation catalysts, flow through filter technology, and both active and passive particulate filters. When recommended by the control technology manufacturers, fuel-borne catalysts were used to enhance or promote regeneration. The control device technologies that were tested are described in Table VI-6.

Table VI-6: Control Strategies Included in Demonstration Program

Control Device Manufacturer	Product	Product Description
Lubrizol-Engine Control Systems	Sequentially Regenerated Combifilter	Triple bank silicon carbide particulate filter with online filter regeneration by electrical heating (Active DPF).
Johnson Matthey	Continuously Regenerating Trap (CRT)	Catalyzed diesel particulate filter (Passive DPF).
Sud Chemie	SC-DOC	Diesel Oxidation Catalyst (DOC 1).
CleanAir Systems Flow-Thru-Filter System and Clean Diesel Technologies (CDT) Fuel-Borne Catalyst	Flow-Thru-Filter System combined with CDT Fuel-Borne Catalyst	Combined system includes a DOC, flow through filter used with a CDT fuel-borne catalyst. The flow through filter component was removed prior to testing due to lower than required exhaust temperatures (DOC with Fuel-Borne Catalyst or DOC/FA).
Chevron	Proformix Fuel	Water emulsified fuel (20% water emulsification) utilizes Lubrizol's PuriNOx™ technology (Emulsified Fuel).
Catalytic Exhaust Products Particulate Filter and Clean Diesel Technologies Fuel-Borne Catalyst	SXS-B/FA combined with CDT Fuel-Borne Catalyst	Uncatalyzed diesel particulate filter used with a CDT fuel-borne catalyst (Particulate Filter with Fuel-Borne Catalyst).

Results from the Demonstration Program

Active and passive diesel particulate filters, diesel oxidation catalysts, and emulsified diesel fuel technologies were tested for generator applications. Emission testing was conducted according to ISO-8178 test procedures using the D2 test cycle. The results from the testing are presented in Table VI-7. As can be seen, the D2 weighted emission factors and diesel PM control efficiencies for both active and passive DPF technologies were better than 90 percent. The technologies were capable of regenerating under the intermittent cold start maintenance cycling and loaded operation, typical for backup generators. While the passive CRT DPF did have increased levels of NO_2, overall NOx levels decreased for both active and passive DPFs. The actively regenerating system showed better than 99 percent reduction for diesel PM, with regeneration independent of exhaust temperature by design. For the active DPF system, issues involving high backpressure levels and active regeneration control design were identified and will be addressed during future system design for stationary sources. The results from the demonstration testing indicate that both active and passive technologies are effective in reducing diesel PM better than 85 percent.

The effectiveness of diesel oxidation catalysts reportedly depends on the level of soluble organic fraction in the exhaust PM relative to the elemental carbon fraction (EC/OC ratio). Comparison testing on two engines showed that for low ratios of organic diesel PM components, diesel PM control effectiveness was lower than anticipated. Where the ratio of organic components was higher, the control efficiency increased significantly. Testing of two commercially available DOC technologies on a 1985 two-stroke Detroit Diesel V92 showed control efficiencies in the range of 40 to 46 percent for diesel PM and 53 to 69 for NMHC. There were slight NOx increases, less than 10 percent, that may be attributed to differences in ambient conditions during testing. Demonstration testing indicates that DOC technologies are effective in providing better than 30 percent PM control efficiency for appropriate engine types.

Testing of emulsified fuels for two different Caterpillar engines resulted in a wide range of control efficiency for diesel PM, ranging between 18 to 73 percent. Control efficiencies for NMHC were even more varied, ranging from a decrease of 60 percent to an increase of 12 percent. For both tests, NOx reductions ranged from 3 to 14 percent. These wide variations in test results indicate that further testing is required, but for certain engine types, emulsified fuel could be a very effective technology to reduce diesel PM significantly, while also providing reductions in NOx.

In conclusion, ARB staffs believe the results of the control device demonstrations indicate that diesel PM control technologies are available to provide a wide range of reduction levels for appropriate engines and applications. Durability testing of the DPF and DOC systems for intermittent cold start and extended high load operation indicates that these technologies are effective for generator applications and may be effective for other steady-state stationary engine applications, as well. Each of the tested technologies is currently commercially available for retrofit applications.

Table VI-7: Summary of D2 Weighted Emission Factors and Control Efficiencies

		Average D2 Weighted Emission Factors (gm/bhp-hr)						
Configuration	Fuel	100% Load (HP)	THC	CH_4	NMHC	CO	NOx	PM
2000 CAT 3406C with Johnson Matthey CRT Passive DPF								
Baseline	CARB Diesel	465.9	0.087	0.015	0.074	1.041	6.608	0.142
Controlled	ULSD	467.1	0.007	0.003	0.004	0.228	6.212	0.012
Percent Reductions			92.3	82.6	94.1	78.1	6.0	91.4
2000 CAT 3406C with ECS Sequentially Regenerated Combifilter Active DPF								
Baseline	CARB Diesel	465.0	0.082	0.017	0.067	1.468	6.783	0.159
Controlled	ULSD	458.8	0.050	0.015	0.037	1.645	6.042	0.0003
Percent Reductions			39.5	16.1	44.7	-12.1	10.9	99.8
1985 2 stroke Detroit Diesel V92 with CleanAir Systems DOC and CDT Fuel-Borne Catalyst								
Baseline	CARB Diesel	389.6	0.659	0.053	0.613	1.715	10.785	0.201
Controlled	ULSD+FBC	389.6	0.200	0.014	0.188	0.100	11.545	0.121
Percent Reductions			69.6	73.0	69.3	94.1	-7.0	40.0
2000 CAT 3406C with Sud Chemie DOC								
Baseline	CARB Diesel	465.0	0.082	0.017	0.067	1.468	6.783	0.159
Controlled	CARB Diesel	467.7	0.011	0.002	0.009	0.058	7.168	0.129
Percent Reductions			86.7	90.3	85.9	96.0	-5.7	18.8
1985 2 stroke Detroit Diesel V92 with Sud Chemie DOC								
Baseline	CARB Diesel	389.6	0.659	0.053	0.613	1.715	10.785	0.201
Controlled	CARB Diesel	393.5	0.307	0.022	0.288	0.206	10.860	0.107
Percent Reductions			53.4	58.2	53.1	88.0	-0.7	46.9
1986 CAT 3406B with Emulsified Diesel								
Baseline	CARB Diesel	399.3	0.147	0.027	0.124	0.679	11.321	0.093
Controlled	Emulsified Fuel	363.1	0.161	0.026	0.139	0.496	10.914	0.076
Percent Reductions			-9.7	2.4	-12.0	27.0	3.6	17.8
Post- 96 CAT 3406C with Emulsified Diesel								
Baseline	CARB Diesel	469.0	0.163	0.031	0.270	1.234	6.512	0.150
Controlled	Emulsified Fuel	469.0	0.131	0.027	0.108	0.820	5.563	0.041
Percent Reductions			19.4	13.1	60.0	33.6	14.6	72.7

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VII. REGULATORY ALTERNATIVES

ARB staff evaluated four alternative strategies to the current proposal. Based on the analysis, none of the alternative control strategies were considered more effective than the proposed regulation. Full implementation of the proposed regulation is necessary to achieve ARB's goal, as described in the Diesel Risk Reduction Plan, to reduce by 85 percent diesel PM emissions and associated potential cancer risks by 2020. (ARB, 2000) The proposed regulation provides owners or operators of stationary diesel-fueled CI engines with flexibility in determining the most cost-effective control strategy that will meet the proposed emission standards and operational requirements for their operation.

A. Do Not Adopt This Regulation

With full implementation of the proposed regulation, the estimated reduction in diesel PM is approximately 80 percent in 2020 relative to the 2002 baseline from stationary engines used in non-agricultural applications. The recommended control options should reduce diesel PM emissions to the lowest level achievable through the application of best available control technology or a combination of one or more effective control methods. These estimated reductions in diesel PM are an important element in the Diesel Risk Reduction Plan, and along with other control measures to be adopted by the ARB will contribute to reducing cancer and noncancer health risks to the public associated with inhalation exposure to emissions of diesel PM. Short-term exposure to diesel PM emissions may cause acute or chronic noncancer respiratory effects such as irritation of the eyes, throat, and bronchial passages. It has also been concluded that inhalation of diesel PM emissions can cause neurophysiological symptoms such as lightheadedness or nausea. Additional benefits of the proposed regulation would be a reduction in acute or chronic noncancer health effects associated with inhalation exposure to diesel PM emissions.

The ARB is required by H&SC Section 39658 to establish ATCMs for TACs. Further, H&SC Section 39666 requires the ARB to adopt ATCMs to reduce emissions of TACs from nonvehicular sources. In consideration of ARB's statutory requirements and the recognized potential for adverse cancer and noncancer health impacts to the public resulting from inhalation exposure to diesel PM, this alternative is not a reasonable option.

B. Rely on New Engine Standards

Another alternative would be to rely on existing governmental programs. Beginning in 1996, manufacturers and vendors of diesel engines have been subject to U.S. EPA's nonroad diesel emission regulations (40 CFR Part 89). The standards are tiered and the date upon which each tier takes effect depends on the engine size. As of January 1, 2000, all engine sizes were subject to Tier 1 standards. (SCAQMD, 2003) Recently, the U.S. EPA proposed new engine standards (Tier 4) for nonroad diesel engines that would take effect in 2008 and would include stringent emission standards for PM, NOx, and SOx, pollutants which contribute to adverse public health impacts. In addition, U.S. EPA's proposed rule would require nonroad diesel engines to use diesel fuel with a maximum sulfur content of 500 ppm in 2007 and 15 ppm in 2010. (EPA, 2003) California has harmonized its new engine standards for off-road diesel engines with the proposed U.S. EPA nonroad standards. While technically these requirements do not extend to "stationary" engines, manufacturers have indicated they generally sell certified off-road engines for stationary use, and the benefits of the nonroad standards could be extended to new stationary CI engines.

However, the U.S. EPA's proposed Tier 4 new engine standards do not address existing in-use diesel engines, and the new standards would be implemented on a phased-in schedule based on engine size beginning in 2008 through 2014. Additionally, the proposed federal standards offer various alternatives to demonstrate (use of emission reduction credits) or delay compliance to a certain phase-in schedules. These critical implementation measures will not produce the greatest potential reductions in diesel PM emissions in the shortest timeframe. Further, the long useful life of diesel engines and the lack of stringent standards for in-use nonroad diesel engines will significantly limit the potential reduction in ambient concentrations of diesel PM and associated cancer and noncancer health risks. ARB staff does not recommend this alternative because it would result in less reduction in diesel PM emissions and greater potential cancer risk than the proposed ATCM.

C. Rely on Local Regulations

In general, local and regional authorities have the primary responsibility for control of air pollution from all sources other than emissions from motor vehicles (H&SC Section 40000). However, H&SC 93113(b) directs the ARB to regulate non-vehicle engines, which include stationary diesel-fueled engines. California air pollution control districts or air quality management districts (air districts) have established two permitting programs that control emissions from new, modified, or existing stationary sources. New or modified stationary sources are subject to federal and or local New Source Review (NSR) permitting requirements for nonattainment pollutants and their precursors. Existing stationary sources that emit nonattainment pollutants or their precursors are also subject to retrofit control requirements based on the best or reasonably available retrofit control technology. Several air districts have source-specific regulations affecting existing stationary diesel engines; however, the majority of them primarily address NOx emissions and typically exempt engines used as emergency standby engines.

Currently, at least eight air districts have adopted toxic NSR rules and many more have adopted toxic NSR permitting policies or procedures. During the development of California's Diesel Risk Reduction Plan, the ARB staff and air districts agreed that the best approach to controlling and reducing the potential adverse health risks from diesel PM is through the development of source-specific ATCMs. In this manner, each activity (e.g., on-road, off-road, marine, agricultural, etc.) would be consistently regulated throughout California, taking into account each activity's uniqueness. Because of the potential for inconsistent regulation of stationary diesel-fueled engines, reliance on local regulations is not considered a viable option.

D. Mandate 85 Percent Reductions from All Diesel-fueled CI Engines

This alternative considers requiring all diesel-fueled CI engines to achieve a minimum of 85 percent reduction from baseline emissions of diesel PM. The proposed emission reduction goal would be characterized as a performance standard in this regulation; thus, it could be met by a variety of emission control strategies. Costs of implementing this proposal would vary based on the control strategy chosen by each newly regulated source, e.g., singular emission control device, or a combination of control devices, hours of operation, and/or alternative fuels. While the emission benefits would be approximately twice as much as in this proposal, the cost for this alternative would be about four to five times greater. Therefore, this option is not considered feasible due to the high costs and fiscal impact associated with its full implementation.

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VIII. ENVIRONMENTAL IMPACTS

This chapter describes the potential environmental impacts of this proposed ATCM. This proposed ATCM is intended to protect the health of California's citizens by reducing exposure to stationary diesel engine emissions. An additional consideration is the impact that implementation of the proposed ATCM may have on the environment. Based upon available information, the ARB staff has determined that no significant adverse environmental impacts should occur as the result of adopting the proposed ATCM. This chapter describes the potential impacts that the proposed ATCM may have on wastewater treatment, hazardous wasted disposal, and air quality.

A. Legal Requirements

The California Environmental Quality Act (CEQA) and ARB policy require an analysis to determine the potential environmental impacts of proposed regulations. Because the ARB's program involving the adoption of regulations has been certified by the Secretary of Resources pursuant to Public Resources Code section 21080.5, the CEQA environmental analysis requirements may be included in the Initial Statement of Reasons (ISOR) for this rulemaking. In the ISOR, ARB must include a "functionally equivalent" document, rather than adhering to the format described in CEQA of an Initial Study, a Negative Declaration, and an Environmental Impact Report. In addition, staff will respond, in the Final Statement of Reasons for the ATCM, to all significant environmental issues raised by the public during the public review period or at the Board public hearing.

Public Resources Code section 21159 requires that the environmental impact analysis conducted by ARB include the following:

- An analysis of reasonably foreseeable environmental impacts of the methods of compliance;
- An analysis of reasonably foreseeable feasible mitigation measures; and
- An analysis of reasonably foreseeable alternative means of compliance with the ATCM.

Compliance with the proposed ATCM is expected to directly affect air quality and potentially affect other environmental media as well. Our analysis of the reasonable foreseeable environmental impacts of the methods of compliance is presented below.

Regarding mitigation measures, CEQA requires an agency to identify and adopt feasible mitigation measures that would minimize any significant adverse environmental impacts described in the environmental analysis.

The proposed ATCM is needed to reduce the risk from exposures to diesel PM as required by Health and Safety Code (H&SC) section 39666 and to fulfill the goals of the Diesel Risk Reduction Plan. Alternatives to the proposed ATCM have been discussed earlier in Chapter VII of this report. ARB staff have concluded that there are no alternative means of compliance with the requirements of H&SC section 39666 that would achieve similar diesel PM emission reductions at a lower cost.

B. Effects on Air Quality

The proposed ATCM will provide diesel PM emissions reductions throughout California, especially in urban areas and those areas non-attainment for the State and federal ambient air quality standards for PM_{10} and $PM_{2.5}$. Air quality benefits will result from the reduction of NOx, ROG, and CO emissions as well. The projected controlled emissions from stationary diesel-fueled engines are presented in Table VIII-1.

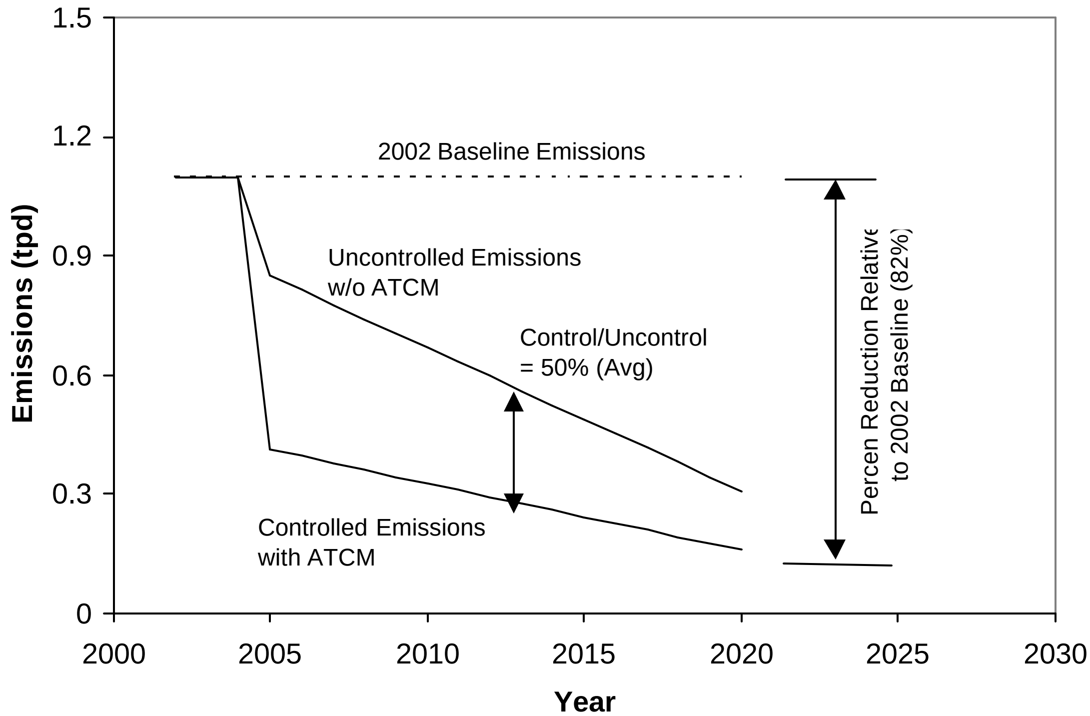
Table VIII-1: Projected Annual Emissions for Stationary Engines Used in Non-Agricultural Applications with Implementation of the Proposed ATCM*

	2002 Emissions (Tons per Day)				2010 Emissions (Tons per Day)				2020 Emissions (Tons per Day)			
Category	**PM**	**NOx**	**ROG**	**CO**	**PM**	**NOx**	**ROG**	**CO**	**PM**	**NOx**	**ROG**	**CO**
Prime	0.8	13.8	1.3	4.8	0.1	8.5	0.5	1.6	0.1	2.9	0.3	1.2
Emergency Standby	0.3	6.4	0.5	2.1	0.2	4.6	0.3	1.4	0.1	2.5	0.2	1.2
Total	1.1	20.2	1.8	6.9	0.3	13.1	0.8	3.0	0.2	5.4	0.5	2.4

* We do not have projected ATCM-impacted emission estimates for agricultural engines at this time.

ARB staff estimates that, with implementation of the proposed ACTM, diesel PM emissions from stationary diesel-fueled non-agricultural engines will be reduced by approximately 0.9 tons per day in 2020, relative to 2002 baseline levels. As shown in figure VIII-1, this is about an 80 percent reduction from the 2002 baseline. Of this, about 50 percent can be attributed to the ATCM.

Figure VIII-1: Projected Diesel PM Emissions with and without the ATCM



Between 2005 and 2020, we estimate approximately 1,710 tons of PM will be removed from California's air as a result of the ATCM. As shown in Table VIII-2, ARB staff estimates that, as older engines are replaced with new engines or retrofitted with DECS, there will also be a reduction in NOx of approximately 790 tons per year (2.2 tons per day) and 106 tons per year (0.3 tons per day) reduction in ROG in the same time frame.

Table VIII-2: Emission Benefits from Implementation of the Proposed ATCM

	PM	NOx	ROG	CO
Emissions Removed 2005 to 2020 (Tons)	1,710	12,640	1,700	6,590
Annual Average Reductions (Tons per Year)	107	790	106	410

Figure VIII-2 illustrates the emissions reductions associated with the implementation of the ATCM for diesel PM and ROG. Figure VIII-3 illustrates the emissions reductions associated with the implementation of the ATCM for NOx and CO.

Figure VIII-2: PM and ROG Emission Reductions Attributable to the ATCM for Non-Agricultural Engines

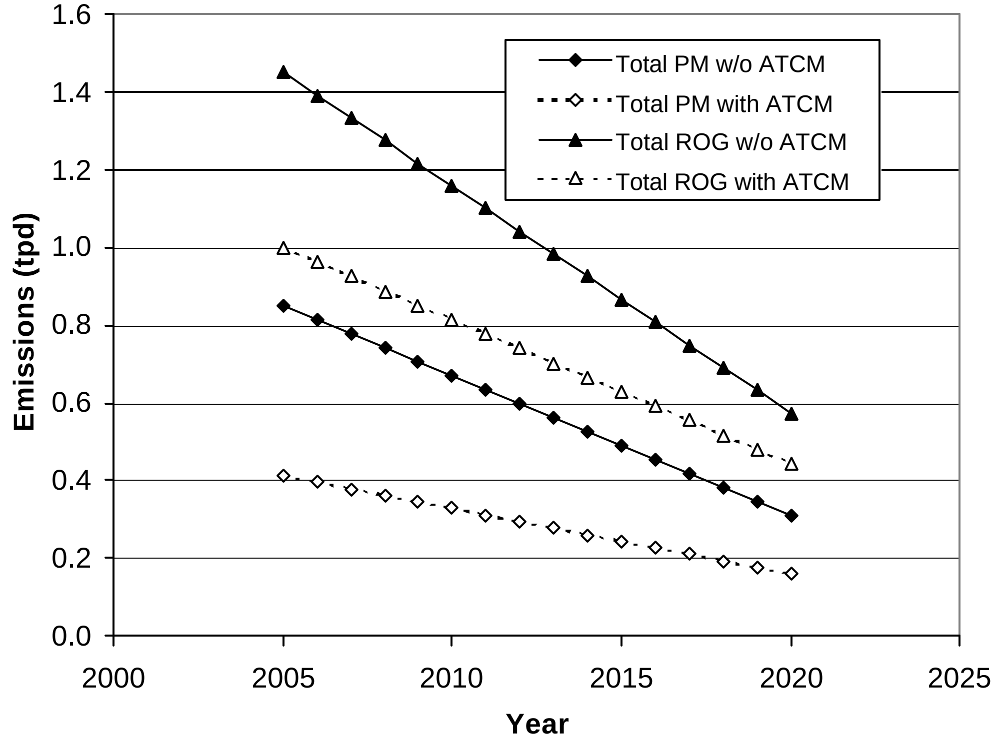
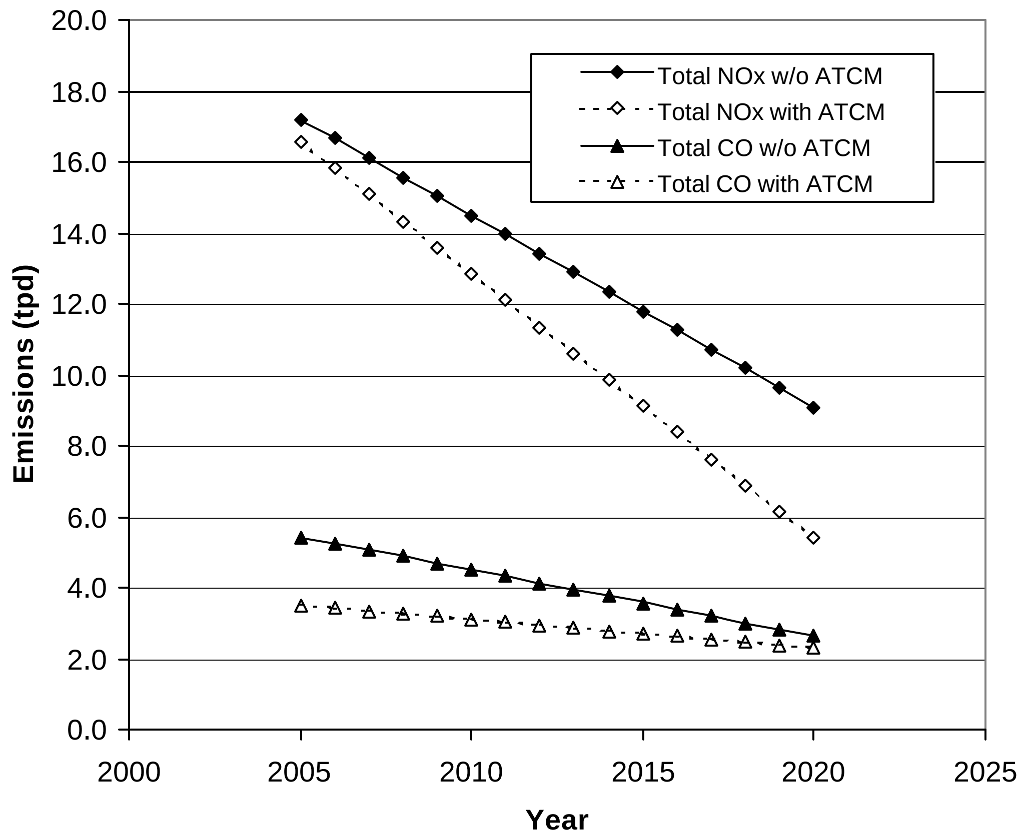


Figure VIII-3: NOx and CO Emission Reductions Attributable to the ATCM for Non-Agricultural Engines



C. Health Benefits of Reductions of Diesel PM Emissions

The emission reductions obtained from this regulation will result in lower ambient PM levels and significant reductions of exposure to primary and secondary diesel PM. Lower ambient PM levels and reduced exposure, in turn, would result in a reduction of the prevalence of the diseases attributed to PM and diesel PM including, reduced incidences of hospitalizations for cardio-respiratory disease, and prevention of premature deaths.

<u>Primary Diesel PM</u>

Lloyd and Cackette estimated that, based on the Krewski *et al.* study[14], diesel $PM_{2.5}$ exposures at level of 1.8 $\mu g/m^3$ resulted in a mean estimate of 1,985 cases of premature deaths per year in California. (Lloyd/Cackette, 2001) The diesel PM emissions corresponding to the direct diesel ambient population-weighted PM concentration of 1.8 $\mu g/m^3$ is 28,000 tons per year. (ARB, 2000) Based on this information, we estimate that reducing 14.11 tons per year of diesel PM emissions would result in one fewer premature death (28,000 tons/1,985 deaths). Comparing the $PM_{2.5}$ emission before and after this regulation, the proposed regulation is expected to reduce emissions by 1,713 tons at the end of year 2020, and therefore prevent an estimated 121 premature deaths (60-185, 95 percent confidence interval (95 CI)) by year 2020. Prior to 2020, cumulatively, it is estimated that 60 premature deaths (29-90, 95 CI) would be avoided by 2010 and 97 (48-146, 95 CI) by 2015.

If we multiply 14.11 tons of diesel PM emissions by the average present value of cost-effectiveness of $7.67 per pound PM (or $15,340 per ton; see Chapter IX) the estimated cost of control per premature death prevented is about $216,447 in 2002 dollars. The U. S. EPA has established $6.3 million (in year 2000 dollars) for a 1990 income level as the mean value of avoiding one death. (EPA, 2003) As real income increases, the value of a life may rise. U.S. EPA further adjusted the $6.3 million value to $8 million (in 2000 dollars) for a 2020 income level. Assuming that real income grew at a constant rate from 1990 and will continue at the same rate to 2020, we adjusted the value of avoiding one death for the income growth. Since the control cost is expressed in 2002 discounted value, accordingly, we discounted values of avoiding a death in the future back to the year 2002. In U.S. EPA's guidance of social discounting, it recommends using both three and seven percent discount rates. (EPA, 2000) Using these rates, and the annual avoided deaths as weights, the weighted average value of reducing a

[14] Although there are two mortality estimates in the report by Lloyd and Cackette – one based on work by Pope *et al.* and the other based on Krewski *et al.*, we selected the estimate based on the Krewski's work. For Krewski *et al.,* an independent team of scientific experts commissioned by the Health Effects Institute conducted an extensive reexamination and reanalysis of the health effect data and studies, including Pope *et al*. The reanalysis resulted in the relative risk being based on changes in mean levels of $PM_{2.5}$, as opposed to the median levels from the original Pope *et al.* study. The Krewski *et al*. reanalysis includes broader geographic areas than the original study (63 cities vs. 50 cities). Further, the U.S. EPA has been using Krewski's study for its regulatory impact analyses since 2000. (Krewski, 2000) (Pope, 1995)

future premature death discounted back to year 2002 is $4.4 million at seven percent discount rate, and $6 million at three percent. The cost per death avoided because of this proposed regulation is 20 to 28 times lower than the U.S. EPA's benchmark for value of avoided death. This rule is, therefore, a cost-effective mechanism to reduce premature deaths that would otherwise be caused by diesel PM emissions without this regulation.

The benefits of reducing diesel emissions are based on a statewide average diesel emission value, such as in the Lloyd and Cackette analysis, which contains off-road emissions from a number of categories that occur well away from population centers. Stationary diesel-fueled engines and their diesel emissions are more concentrated in urban areas, thus a greater reduction of the emissions as a result of the regulation are expected to occur in urban areas, as compared to rural areas. Emission reductions are, therefore, likely to have greater benefits than those estimated by Lloyd and Cackette. Thus, the proposed rule is likely more cost-effective than the above estimate would suggest.

Secondary Diesel PM

Lloyd and Cackette also estimated that indirect diesel $PM_{2.5}$ exposures at a level of 0.81 $\mu g/m^3$ resulted in a mean estimate of 895 additional premature deaths per year in California, above those caused by directly emitted formed diesel PM. The NOx emission levels corresponding to the indirect diesel ambient PM concentration of 0.81 $\mu g/m^3$ is 1,641 tpd (598,965 tpy). Following the same approach as above, we estimate that reducing 669 tons of NOx emissions would result in one fewer premature death (598,965 tons/895 deaths). Therefore, with the 12,645-ton reduction of NOx that is expected by the end of 2020, an estimated 19 deaths would be avoided.

If we multiply 669 tons of NOx emissions by the average present value of cost-effectiveness of $0.75 per pound NOx (or $1,500 per ton, see Chapter IX), the estimated cost of control per premature death prevented is about $1 million. The cost is again lower than the U.S. EPA's present value of an avoided death by four to six times.

Reduced Ambient Ozone Levels

Emissions of NOx and ROG are precursors to the formation of ozone in the lower atmosphere. Exhaust from diesel engines contributes a substantial fraction of ozone precursors in any metropolitan area. Therefore, reductions in NOx and ROG from diesel engines would make a considerable contribution to reducing exposures to ambient ozone. Controlling emissions of ozone precursors would reduce the prevalence of the types of respiratory problems associated with ozone exposure and would reduce hospital admissions and emergency visits for respiratory problems.

D. Reasonably Foreseeable Environmental Impacts as a Result of Potential Compliance Methods

We have identified potential adverse environmental impacts from the use of diesel oxidation catalysts (DOCs) and diesel particulate filters (DPFs). These include a potential increase in sulfate PM, a potential increase in NO_2 from some DPFs, and the potential for creating hazardous wastes. As described below, options are available to mitigate these potential adverse impacts.

Diesel Oxidation Catalyst (DOC)

Two potential adverse environmental impacts of the use of diesel oxidation catalysts have been identified. First, as is the case with most processes that incorporate catalytic oxidation, the formation of sulfates increases at higher temperatures. Depending on the exhaust temperature and sulfur content of the fuel, the increase in sulfate particles may offset the reductions in soluble organic fraction emissions. Using low sulfur diesel fuel can minimize this effect. Second, a diesel oxidation catalyst could be considered a “hazardous waste” at the end of its useful life depending on the materials used in the catalytic coating. Because catalytic converters have been used on gasoline powered on-road vehicles for many years, there is a very well-established market for these items (see, for example, http://www.pacific.recycle.net – an Internet posting of buyers and sellers of various scrap materials). In the recycling process, the converters are broken down, and the metal is added to the scrap-metal stream for recycling, while the catalysts (one or a combination of the platinum group metals) are extracted and reused.

Because of platinum’s high activity as an oxidation catalyst, it is the predominant platinum group metal used in the production of diesel oxidation catalysts. There is a very active market for reclaimed platinum for use in new catalytic converters, jewelry, fuel cells, cathode ray tube screens, catalysts used during petroleum refining operations, dental alloys, oxygen sensors, platinum electrode spark plugs, medical equipment, and platinum-based drugs for cancer treatment, to name a few. (Kendall, 2002) (Kendall, 2003)

Catalyzed Diesel Particulate Filters

These devices are composed of a ceramic diesel particulate filter along with a platinum catalyst to catalyze the oxidation of carbon-containing emissions and significantly reduce diesel PM emissions. This is an obvious positive environmental impact.

However, there are also inorganic solid particles present in diesel exhaust, which are captured by diesel particulate filters. These inorganic materials are metals derived from engine oil, diesel fuel, or engine wear and tear. While the PM filter is capable of capturing inorganic materials, these materials are not oxidized into a gaseous form and expelled.

Because these materials would otherwise be released into the air, the filters are benefiting the environment by capturing these metallic particles, known as "ash." However, the ash that is collected in the PM filter must be removed from the filter periodically to maintain the filter's effectiveness.

Ash collected from a diesel engine using a typical lubrication oil and no fuel additives has been analyzed and is primarily composed of oxides of the following elements: calcium, zinc, phosphorus, silicon, sulfur, and iron. Zinc is the element of primary concern because, if present in high enough concentration, it can make a waste a hazardous waste. Title 22, CCR, section 66261.24 establishes two limits for zinc in a waste: 250 milligrams per liter for the Soluble Threshold Limit Concentration and 5,000 milligrams per kilogram for the Total Threshold Limit Concentration. The presence of zinc at or above these levels would cause a sample of ash to be characterized as a hazardous waste.

Under California law, it is the generator's responsibility to determine whether their waste is hazardous or not. Applicable hazardous waste laws are found in the H&SC, division 20; title 22, CCR, division 4.5; and title 40 of the Code of Federal Regulations. Staff recommends owners that install a diesel particulate filter on an engine to contact both the manufacturer of the diesel emission control system and the California Department of Toxic Substances Control (DTSC) for advice on proper waste management.

ARB staff has consulted with personnel of the DTSC regarding management of the ash from diesel particulate filters. DTSC personnel have advised ARB that it has a list of facilities that accept waste from businesses that qualify as a conditionally exempt small quantity generator. Such a business can dispose of a specific quantify of hazardous waste at certain Household Hazardous Waste events, usually for a small fee. An owner who does not know whether or not he qualifies or who needs specific information regarding the identification and acceptable disposal methods for this waste should contact the California DTSC.[15]

Additionally, the technology exists to reclaim zinc from waste. For example, the Swedish company MEAB has developed processes for extracting zinc and cadmium from various effluents and industrial waste streams. Whether reclamation for reuse will be economically beneficial remains to be seen. (MEAB, 2003)

Because of the time and costs associated with filter maintenance, there are also efforts by industry to reduce the amount of ash formed. Most of the ash is formed from the inorganic materials in engine oil, particularly from zinc-containing additives necessary to control acidification of engine oil – due in part to sulfuric acid derived from sulfur in diesel fuel. As the sulfur content of diesel fuel is decreased, the need for acid neutralizing additives in engine oil should also decrease. A number of technical programs are ongoing to determine the impact of changes in oil ash content and other

[15] Information can be obtained from local duty officers and from the DTSC web site at http://www.dtsc.ca.gov.

characteristics of engine oil on exhaust emission control technologies and engine wear and performance.

It may also be possible to reduce the ash level in diesel exhaust by reducing oil consumption from diesel engines. Diesel engine manufacturers over the years have reduced engine oil consumption in order to reduce PM emissions and to reduce operating costs for engine owners. Further improvements in oil consumption may be possible in order to reduce ash accumulation rates in diesel particulate filters.

In addition, measurements of NOx emissions for heavy-duty diesel vehicles equipped with passive catalyzed filters have shown an increase in the NO_2 portion of total NOx emissions, although the total NOx emissions remain approximately the same. In some applications, passive catalyzed filters can promote the conversion of nitrogen oxide (NO) emissions to NO_2 during filter regeneration. More NO_2 is created than is actually being used in the regeneration process; and the excess is emitted. The NO_2 to NOx ratios could range from 20 to 70 percent, depending on factors such as the diesel particulate filter systems, the sulfur level in the diesel fuel, and the duty cycle. (DaMassa, 2002)

Formation of NO_2 is a concern because it irritates the lungs and lowers resistance to respiratory infections. Individuals with respiratory problems, such as asthma, are more susceptible to the effects. In young children, nitrogen dioxide may also impair lung development. In addition, a higher NO_2/NOx ratio in the exhaust could potentially result in higher initial NO2 concentrations in the atmosphere which, in turn, could result in higher ozone concentrations.

Model simulations have shown that a NO_2 to NO_X emission ratio of approximately 20 percent would nearly eliminate any impact of increased NO_2 emissions. (DaMassa, 2002). According to the model, at the NO_2 to NOx ratio of 20 percent, there will be a decrease of the 24-hour ozone exposure (greater than 90 parts per billion) by two percent while an increase of the peak 1-hour NO_2 by six percent (which is still within the NO_2 standard).

The health benefits derived from the use of PM filters are immediate and offset the possible adverse effects of increases in NO_2 emissions. For this reason, a cap of 20 percent NO_2 to NOx emission ratio was established for all diesel emission control systems through ARB's Verification Procedure. ARB staff believes most prime engine operators will choose to install verified systems on their engines. For these engines, the 20 percent NO_2 to NOx emission ratio can be met. There is the potential, however, for the use of systems that exceed the 20 percent cap. Both ARB and the district will monitor this and determine if any additional requirements need to be incorporated into the ATCM.

Alternative Fuels

As discussed in Chapter VI, a number of alternative fuels and alternative diesel fuels show great promise in their potential to reduce diesel PM emissions. These include biodiesel, Fischer-Tropsch fuels, and alternative fuels such as natural gas. No significant negative environmental impacts have been determined from the use of alternative fuels. With respect to alternative diesel fuels, there may be a slight increase in NOx emissions as a result of biodiesel use. (Hofman and Solseng, 2002)

To ensure there are no adverse impacts from the use of alternative diesel fuels, the proposed ATCM requires any alternative diesel-fuel or fuel additives used in a stationary diesel-fueled engine to be verified under the ARB's Verification Procedure. The Verification Procedure permits verification only if a multimedia evaluation of the use of the alternative diesel fuel or additive has been conducted. In addition, verification requires a determination by the California Environmental Policy Council that such use will not cause a significant adverse impact on public health or the environment pursuant to H&SC section 43830.8 (see Public Resource Code, section 71017).

E. Reasonably Foreseeable Mitigation Measures

ARB staff has concluded that no significant adverse environmental impacts should occur from adoption of and compliance with the proposed ATCM. Therefore, no mitigation measures would be necessary.

F. Reasonably Foreseeable Alternative Means of Compliance with the Proposed Airborne Toxic Control Measure

Alternatives to the proposed ATCM are discussed in Chapter VII of this report. ARB staff has concluded that the proposed ATCM provides the most effective and least burdensome approach to reducing children's and the general public's exposure to diesel PM and other air pollutants emitted from diesel-fueled stationary engines.

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IX. ECONOMIC IMPACTS

In this chapter, we present the estimated costs and economic impacts associated with implementation of the proposed ATCM for stationary engines. The expected capital and recurring costs for potential compliance options are presented, as well as an analysis of the cost effectiveness of the ATCM. The cost effectiveness is calculated two ways, as the cost in dollars per pound of diesel PM reduced and also as the cost in dollars per pound of combined ROG + NOx reduced. The costs and associated economic impacts are presented for private companies, as well as governmental agencies.

A. Summary of the Economic Impacts

ARB staff estimates the cost of the ATCM to affected businesses and government agencies to be approximately 47 million dollars for the total capital costs. This corresponds to 8.4 million dollars annually over the useful lift of the control equipment. This cost represents the capital cost of equipment, purchased in 2005 and 2011 using 2002 dollars, annualized over the useful life of the emission control equipment plus the annual recurring costs or savings. ARB does not have data to determine multiple engine ownership and associated engine ages to accurately determine the retrofit phase in schedule. These costs were not brought back to net present value, and the diesel emission control equipment was not phased in over four years. Instead, we assumed the equipment to be purchased at the beginning of the ATCM implementation. This method results in a conservative cost estimate and was used to estimate near term (i.e., 1-3 years) fiscal impacts.

The useful life of the control equipment depends on the number of hours the engine is expected to operate annually. For prime engines, the useful life ranges from 4 to 25 years with a 10-year average. For emergency standby engines, the expected useful life is 25 years.

As shown in Table IX-1, the majority of the costs will be borne by prime engine owners, while in many cases, owners of emergency standby engines will have no cost or net savings due to the reduced operating hours. We estimate that only a small number of emergency standby engines will need to install diesel emission controls (DECS).

Table IX-1: Summary of Annual Costs for the Proposed ATCM

Engine Application	Category	Total Capital Cost	Annualized Capital Cost	Annual Recurring Costs ($)	Total Annualized Cost ($)
Emergency Standby	Private	$2,296,000	$163,000	-$123,000	$40,000
	State	$199,000	$14,000	-$111,000	-$97,000
	City	$370,000	$26,000	-$13,000	$14,000
	County	$192,000	$14,000	-$20,000	-$7,000
	Other Local	$397,000	$28,000	-$71,000	-$43,000
	Federal	$502,000	$36,000	-$22,000	$14,000
Prime	Private	$34,183,000	$5,979,000	$737,000	$6,716,000
	State	$556,000	$98,000	$11,000	$109,000
	City	$2,624,000	$464,000	$53,000	$516,000
	County	$1,330,000	$235,000	$27,000	$262,000
	Other Local	$1,441,000	$255,000	$29,000	$284,000
	Federal	$3,143,000	$556,000	$63,000	$619,000
Total		$47,233,000	$7,868,000	$560,000	$8,427,000

For businesses with a prime engine, the capital cost is expected to be within $14,000 to $173,000. The low end of the range reflects a smaller horsepower engine (e.g.,120 hp) equipped with a diesel particulate filter (DPF). At the upper end, we used a larger engine (e.g.,1500 hp) equipped with a diesel oxidation catalyst (DOC) initially, which is later replaced with a new Tier 4 engine in 2011. The estimated annual ongoing costs are comprised of two parts: (1) a reporting cost of about $100, and (2) a cost ranging from $12 to $2,900 (depending on size and hours of use) for annual maintenance of any DPFs that are used. For example, the costs for a typical prime engine (rated at 590 hp operated 1040 hours per year) with a DPF are about $22,400 for equipment and installation, $100 for reporting, and $550 per year for ash cleaning. The costs for the same engine with a DOC that is later replaced with a Tier 4 engine are about $60,850 ($6,150 in 2005 and $54,700 in 2011), with an annual reporting cost of $100.

For businesses with emergency standby engines, we expect most operators to reduce their annual hours of operation to avoid installation of DECS, which should result in cost savings due to a reduction in the annual diesel fuel usage. For example, an operator with one engine (520 hp) could reduce maintenance and testing usage from 35 to 20 hours, thereby saving about $760 annually. While most operators will likely reduce their hours of operation to meet the ATCM requirements, we estimate that about one percent of operators will need to install a DOC.

Overall, most affected businesses will be able to absorb the costs of the proposed regulation with no significant adverse impacts on their profitability. This finding is based on the staff's analysis of the estimated change in "return on owner's equity" (ROE). The analysis found that the overall change in ROE ranges from negligible to a decline of about six percent. Generally, a decline of more than ten percent in ROE suggests a significant impact on profitability. Because the proposed ATCM would not alter significantly the profitability of most businesses, we do not expect a noticeable change in employment, business creation, elimination, or expansion, and business competitiveness in California. We also found no significant adverse economic impacts on any local or State agencies.

We estimate the overall cost effectiveness of the proposed ATCM to be about $15 per pound of diesel PM reduced, considering only the benefits of reducing diesel PM. Because the proposed ATCM will also reduce reactive organic gases (ROG) and NOx emissions, we allocated half of the costs of compliance against these benefits, resulting in cost effectiveness values of $8/lb of diesel PM and $1/lb of ROG plus NOx reduced.

With regard to mortality benefits, we estimate the cost of avoiding one premature death to be about $216,000 based on attributing half of the cost of controls to reduce diesel PM. Compared to the U.S. EPA's present assignment of $4.4 million as the value of an avoided death, this proposed ATCM is a very cost-effective mechanism for preventing premature deaths caused by diesel PM.

B. Legal Requirements

In this section, we explain the legal requirements that must be satisfied in analyzing the economic impacts of the ATCM.

Section 11346.3 of the Government Code requires State agencies to assess the potential for adverse economic impacts on California business enterprises and individuals when proposing to adopt or amend any administrative regulation. The assessment shall include a consideration of the impact of the proposed regulation on California jobs, business expansion, elimination or creation, and the ability of California business to compete with businesses in other states.

Also, State agencies are required to estimate the cost or savings to any State or local agency and school district in accordance with instructions adopted by the Department of Finance (DOF). The estimate shall include any non-discretionary cost or savings to local agencies and the cost or savings in federal funding to the State.

Moreover, Health and Safety Code section 43013(c) prohibits regulatory actions affecting nonvehicle engines (e.g., stationary diesel engines) used in agricultural operations unless the ARB determines that the standards and other requirements in the ATCM are necessary, cost-effective, and technologically feasible for such engines.

Finally, Health and Safety Code section 57005 requires the Air Resources Board to perform an economic impact analysis of submitted alternatives to a proposed regulation before adopting any major regulation. A major regulation is defined as a regulation that will have a potential cost to California business enterprises in an amount exceeding ten million dollars in any single year. Because the estimated cost of the ATCM does not exceed 10 million dollars in a single year, the proposed ATCM is not a major regulation.

The following is a description of the methodology used to estimate costs as well as ARB staff's analysis of the economic impacts on California businesses and State and local agencies.

C. Methodology for Estimating Costs Associated with Implementation

In this section, we describe how we estimated the number and types of engines and the costs of bringing these engines into compliance with the proposed ATCM. We separately analyzed the costs on new prime engines, new emergency standby engines, existing (in-use) prime engines, and existing (in-use) emergency standby engines. The basic methodology in this section is used in subsequent sections of the report to analyze the costs to private companies and governmental agencies.

Businesses and federal, State, and local public agencies with stationary diesel-fueled engines in California will incur compliance costs as discussed below, to the extent that they have engines that must meet the performance standards in the regulation. Examples of these businesses and public agencies include hospitals, schools and universities, telecommunications providers, oil refineries, power generation facilities, banks, hotels/motels, retail stores, correctional facilities, military installations, waste and recycling facilities. The compliance costs will vary depending on the number and operating parameters of the stationary engines operated and the approach taken to comply with the proposed ATCM.

Surveys of Engine Population

To assist in evaluating the cost impacts from the proposed ATCM, ARB staff conducted two surveys (ARB Survey) of businesses and public agencies that operate stationary engines. As described in Chapter III, the ARB Survey collected data on the number, type, application, and ownership for emergency standby and prime stationary engines operated in California. The engine population and operating characteristics reported in the ARB Survey was assumed to be representative of the total engine population subject to the ATCM. The cost analysis was performed on the population of engines reported in the ARB Survey and scaled to the total number of engines in the emissions inventory to determine the total costs of the proposed ATCM. The level of control needed to demonstrate compliance with the ATCM was based on the horsepower, age, emission rate, and hours of operation for each engine reported in the ARB Survey.

Based on the survey results, the ARB staff estimates approximately 4,280 private companies having an estimated 9,900 emergency standby engines and 1,040 prime engines will be subject to this regulation. Approximately 6.5 percent (280) of the estimated total number of businesses could be considered small businesses based on annual gross receipts of $10,000,0000 or less (per California Government Code Section 14837(d)(1)). Federal, State, and local public agencies will also be affected by the ATCM. Based on the ARB Survey, ARB staff estimates there are approximately 280 prime engines and 9,900 emergency standby engines operated by public agencies.

Capital and Recurring Costs

The cost evaluation considers both capital and on-going or recurring operating costs. Capital costs include equipment purchase, installation (i.e., piping, insulation, electrical, foundations and supports, engineering design, start-up), emissions testing and permit modification costs. The capital investment costs for purchase and installation of DECS were determined from actual costs of installing DECS on stationary diesel-fueled engines in California over the last 2-4 years (see Appendix I). A simple linear regression was used to project the costs to other engines based on their horsepower size. Based on this analysis, we estimate the cost to install a diesel particulate filter at $38 per horsepower, a diesel oxidation catalyst at $10.40 per horsepower, and a new engine at $92.65 per horsepower.

Other capital costs associated with compliance with the ATCM are emissions testing ($5,000 to $17,000 per source test), installation of hour meters ($25 per meter), and for modifications to existing permits ($1,000 when control equipment is installed and $124 when only the operating hours are adjusted). With respect to emissions testing, ARB staff believes that many engine owners will have access to data on expected engine emission rates for engines with model years 1988 and newer from the engine manufacturer. To be conservative, ARB staff assumed 50 percent of the prime engine population may need additional source testing to establish either baseline or after control PM emission rates.

Most diesel engines have an hour meter as standard equipment; however, there may be some engines that will need to install an hour meter to comply with the ATCM. If an hour meter is needed, the cost of purchase and installation of an hour meter is fairly minor. A quartz hour meter can be purchased for $25.00. The hour meter may also be useful to properly maintain the engine and thus save the owner/operator money. ARB staff assumed about 5 percent of the engines would need to install a hour meter.

Operating or recurring costs include expenditures for recordkeeping and reporting, periodic maintenance of DECS, and incremental fuel costs. We assumed annual costs of $100 per emergency standby stationary engine for owners to assemble the data and report to the district when required. ARB staff believes this is a conservative assumption since many companies already keep these records or have set schedules that allow readily-calculated annual maintenance and testing hours. In most all cases, prime stationary engines are already required by permit to maintain records on hours of operation. Therefore, we attributed no additional costs for recordkeeping for prime engines.

Maintenance costs include the removal of ash from DPFs; removal of ash is not an issue with DOCs. Based on discussions with manufacturers of DPFs, ARB staff estimated the cost for DPF maintenance (ash removal and disposal) to be about $1.33 per horsepower for every 1,500 hours of operation.

Fuel costs may be lower under the ATCM in cases where operators of emergency standby engines choose to reduce annual operation to avoid the need to install a DECS. In these cases, the proposed ATCM will likely result in cost savings. Another factor that was considered is the slightly higher fuel cost for engines with diesel particulate filters or oxidation catalysts that require the use of low sulfur diesel fuel (less than 15 ppm sulfur) prior to July 1, 2006. After July 1, 2006, this added cost should disappear, because the recently amended California diesel fuel regulations mandate the use of low sulfur fuel for all on-and off-road diesel vehicles and stationary engines, resulting in widespread availability of the fuel.

ARB staff performed the cost analysis relative to the year 2002 (current value of the control costs), and unless otherwise stated, all costs are given in 2002 dollars. Using an annual discount rate of seven percent with an inflation rate of two percent, ARB staff determined annual costs over the life of the DECS (25 years assumed for emergency backup engines, 10 years for prime engines). Where future costs are mentioned in the cost effectiveness and mortality sections, they have been adjusted to 2002 dollars using well-established economic principles.

All cost estimates are based on currently available technology as described below; staff believes it is likely that the costs will decrease as technology improves and production and sales volumes increase. Additional details on the cost analysis can be found in Appendix I.

D. Potential Compliance Options and Related Capital and Recurring Costs

The costs associated with compliance will vary depending on whether: (1) the engine must meet the requirements for a new engine or an in-use engine and (2) if the engine is a prime engine or an emergency stand-by engine. Briefly summarized below is a discussion of the potential compliance options for typical prime and emergency standby engines, the estimated capital and recurring costs associated with each compliance, and the assumptions used in the cost analysis. Tables IX-2 and IX-3 provide a summary of the major assumptions used in these analyses.

New Prime Engines

For new prime engines, the ATCM requires the engine to meet a PM emissions rate of 0.01g/bhp-hr. Because 0.01 g/bhp-hr engines are not expected to be available “off the shelf” until 2011, new engine purchasers would need to buy engines that are certified to 0.15 g/bhp-hr or less and install a diesel particulate filter (DPF) on the engine to lower the emissions to 0.01 g/bhp-hr. Beginning in 2011, U.S. EPA is expected to require new engines to meet the 0.01 g/bhp-hr emissions level. (see U.S. EPA's proposed rulemaking on the "*Control of Emissions of Air Pollution from Nonroad Diesel Engines and Fuel*," as published in the Federal Register (68 FR 28328, May 23, 2003)).

We assumed the capital costs attributable to the ATCM are the costs of purchase and installation of the DPF on new engines put into service prior to 2011. Additional costs include emissions testing for half the engines, incremental fuel costs associated with the purchase of low sulfur fuel in 2005, and reporting and recordkeeping as discussed below. No permit costs were assumed because a new engine would require a permit regardless of whether the ATCM were in place or not. We assumed no additional cost due to the ATCM beginning in 2011, since U.S. EPA is expected to require manufacturers to produce engines to meet the standards in the ATCM.

New Emergency Standby Engines and New Agricultural Engines

The ATCM requires new emergency standby engines and any new agricultural engine to meet PM emissions standards of 0.15 g/bhp-hr in 2005. As discussed in Appendix F, Basis for the Diesel PM Standards, there are engines in all horsepower ranges greater than 50 hp that can be purchased off the shelf at this emission limit. Therefore, we assumed there will be no capital costs attributable to the ATCM for this category of engines.

However, we did account for the costs of annual recordkeeping and reporting of hours of operation required for owners of non-agricultural emergency standby engines. For agricultural engines, the ATCM requires sellers of stationary agricultural engines to report annual sales. In the cost analysis, ARB staff assumed annual costs of $100 per distributor to assemble the data and report to the district when required. It was assumed there were 20 distributors.

In-Use Prime Engines

Certified existing prime engines (generally engines manufactured in 1996 or later) are required to either reduce diesel PM emissions by at least 85 percent or meet an emissions standard of 0.01g/bhp-hr in the 2005-2009 timeframe. In most cases, we expect that engine operators will choose to retrofit their engine with emission control technology to reduce diesel PM emissions by 85 percent. Based on the current availability of emission control technologies for diesel engines, we expect most operators to install a diesel particulate filter, for which the associated capital costs are summarized in Table IX-2.

For non-certified engines, where it is not possible to install a DPF due to technical issues, the proposed ATCM allows for installation of a DOC in 2005, followed by replacement of the engine with a new Tier 4 engine in the 2011-2013 timeframe. The capital costs in this case include the cost for the DOC and the purchase of a new engine in 2011. We assumed approximately 10% of the engines would have been at the end of their useful life in 2011 and did not attribute any new engine costs for these engines to the ATCM. Additional costs include annual maintenance costs associated with DECS.

We estimate that retrofitted DECS will last for 8400 hours of use (twice the typical warranty period required by the Verification Procedure). This is based on our assumption that prime engines run an average of 1040 hours a year, with a range of 70 to 2200 hours per year (Diesel Risk Reduction Plan, October 2000). DECS installed on these engines could last from 4 to 25 years. To be conservative, staff assigned 10 years as the average useful life of DECS installed on prime engines based on the population weighted useful life.

In-Use Emergency Standby Engines

There are a wide variety of compliance options available for in-use emergency standby engines, depending on the hours of operation needed for maintenance and testing and the emission rate of the engine. Because the ATCM proposes increasingly more stringent performance standards with increasing hours of operation for maintenance and testing, we expect that many operators will comply with the requirements by adjusting their hours for maintenance and testing to a level where additional controls are unnecessary. This compliance option will potentially result in net savings to the operator due to reduced annual fuel consumption.

ARB staff believes that the majority of owners of emergency standby engines will be able to limit the hours for maintenance and testing and avoid installing DECS. However, in some cases, an engine with a lower emissions rate will require the installation of an oxidation catalyst to allow routine maintenance and testing. In other situations, particularly for engines emitting more than 0.15 g/bhp-hr that require over 30 hours a year for maintenance and testing, the owner may need to install a diesel particulate filter or some other highly effective emission control device.

We estimate that DECS will last for 8,400 hours of use (twice the typical warranty period). Because emergency standby stationary engines run on average 30 hours a year (ARB Survey), DECS installed on these engines could last much more than 25 years. To be conservative, staff limited the DECS useful life to 25 years.

Stationary Engines = 50 hp

For new stationary engines rated at or below 50 horsepower, the ATCM requires compliance with the current model Off-Road Compression-Ignition Engine Standards (title 13, CCR, section 2423). Because these engines are widely available and required for use in off-road mobile or portable applications, we assumed no capital costs attributable to the ATCM.

Table IX-2 summarizes the estimated capital, operation and maintenance, reporting, and recordkeeping costs associated with the compliance options. In Table IX-3, the key cost assumptions used in the cost analysis are provided.

Table IX-2: Estimated Capital, Operation, and Maintenance Costs for Compliance with the Proposed ATCM

Compliance Option	DPF	DOC	New Engine	Reduce Hours or No Additional Controls Necessary
Capital Costs				
Equipment & Installation	$38/hp	$10.40/hp	$92.65/hp	0
Hour Meter	$25	$25	0	0
On-Going Costs / Operation and Maintenance				
Cleaning	$1.33 per hp for every 1,500 hours of operation	0	0	0
Current Diesel Fuel Cost	$1.74/gal	$1.74/gal	$1.74/gal	$1.74/gal
Incremental Fuel Cost (2005)[1]	$0.15/gal	$0.15/gal	$0.15/gal	0
Reporting/ Record-keeping/Compliance				
Reporting and Record-keeping of Hours	$100/year-engine	$100/year-engine	$100/year-engine	$100/year-engine
District Permits[2] Emergency	$1,000	$1,000	$1,000	$124
District Permits[2] Prime	$1,000	$1,000	$1,000	N/A
Emissions Testing[3]	$5,000 -$17,000	$5,000 - $17,000	0	0

1. After July 1, 2006, California diesel fuel regulations mandate the use of low sulfur fuel (15 ppm sulfur) for on and off-road motor vehicles and stationary engines. We assumed this fuel would be available for stationary use as of the same date.
2. Local district permit costs vary widely depending on the district, the size of the engine, and the permit modification. Costs ranged from less than $100 to over $2,000. We assumed an average of $1,000 per permit modification for the cost analysis. For emergency standby engines that only adjust the hours of annual operation to comply with the ATCM, we assumed a lower permit fee of $124 to reflect the expected minimal engineering analysis that would need to be conducted to change the permit conditions.
3. We estimated the costs for emission testing to range from $5,000 to $17,000. The low end represents a single mode test in triplicate and the upper end a 3-mode test done in triplicate. To be conservative, for our cost estimate we assumed the higher costs. We believe, however, that in many cases, there will be alternative data available that can be used in lieu of emission testing (e.g., manufacturers' certification data).

Table IX-3 outlines the cost assumptions used in the cost analysis for the various engine categories affected by this ATCM.

Table IX-3: Key Cost Assumptions Used in the Cost Analysis

Category	Assumptions
New Prime	• New engines must install DPF between 2005-2011 • DPFs effective for twice the 4200 warranty hours (8400) or 25 years, which ever comes first • Off-the-shelf engines available in 2011 and no capital costs attributed to the ATCM after that date • 5 new prime engines/year • Additional cost for low sulfur fuel in 2005 only
New Emergency Standby/New Agricultural Engines	• Off-the-shelf engines that meet the emissions limit available concurrent with ATCM implementation • Approximately 200 new engines each year (½ ag and ½ non-ag) • No capital cost attributed to the ATCM
In-Use Prime	• 80 percent of engines install DPF • 20 percent of engines initially install a DOC and later replaced with new Tier 4 engine in 2011 – Costs assume that 10% would need a new engine anyway • DPFs and DOCs effective for twice the 4200 warranty hours (8400) or 25 years, which ever comes first • Expected life of the DECS averages 10 years (range from 4 to 25) • Discount Rate: 7%, Inflation Rate: 2% • 5% of engines of engines installing a DPF may need to install hour meters because of the ATCM requirement
In-Use Emergency Standby	• 90% of older engines operating over 20 hours per year will reduce hours of operation to below 20 hours per year and avoid controls • Engines capped at 30 hours per year. • Additional cost for low sulfur fuel in 2005 only for those engines with DPFs • 5% of engines need to install hour meters because of the ATCM requirement • DPFs and DOCs effective for twice the 4200 warranty hours or 25 years, which ever comes first • Expected life of the DECS averages 25 years • Discount Rate: 7%, Inflation Rate: 2%
All Engines	• Total capital costs are annualized over the lifetime of the DECS using an annual 7% discount rate and 2% inflation rate • The annual costs are the sum of the annualized capital costs and the annual maintenance and operation costs. • The ARB Survey data is representative of the current California stationary engine population

E. Estimated Costs to Businesses

Here, we estimate the costs and economic impacts on businesses. The analysis estimates the overall total statewide cost to businesses and the total costs to different sectors of the industry. We also estimate the overall impact on business competitiveness, employment, and other business impacts as required by state law.

We estimate the statewide total costs to businesses to be approximately $36.5 million dollars, which equates to annualized costs of about $6.8 million per year. The total statewide cost to businesses is derived from the combined capital and installation costs, using 2002 capital cost values, and equipment lifetime operating and maintenance costs associated with compliance with the regulation. We evaluated the costs for both in-use and new, and prime and emergency standby, stationary diesel-fueled CI engines.

Using the available information from the ARB Survey on the engine population and current in-use and expected PM emission rates, staff determined the percent of engines that would potentially incur capital costs (either from installing a DECS or purchasing a new engine) when complying with the proposed regulation. As shown in Table IX-4, for California businesses, approximately 1,200 engines may require some type of DECS emission control system to meet the performance standards proposed in the regulation.

Table IX-4: Estimated Number of Privately Owned Stationary Diesel-Fueled CI Engines in California Potentially Requiring Installation of Diesel Emission Control Systems

Engine Application		**Emission Control Systems**			
Emergency Standby	**Model Year**	**Diesel Particulate Filter**	**Diesel Oxidation Catalyst**	**New Tier 4 Engine in 2011**	**None Needed**
	1988 – 2002	0	0		6,420
	Pre 1988	0	167		3,330
Prime	All	835	209	209	0

The total statewide costs to businesses were then estimated by adding the 2002 value of the capital costs and operating and maintenance costs for the life of the equipment. For both emergency and non-agricultural prime engines, the total capital cost was estimated to be $36.5 million with an annualized cost of $6.8 million. A summary of the expected costs is presented in Table IX-5.

Table IX-5: Estimated Statewide Costs for Businesses

Equipment		Total Capital Cost ($)	Annualized Capital Cost ($)	Annual Recurring Costs / Savings ($)	Total Annualized Cost ($)
In-use	**Prime**	$ 33,653,000	$ 5,966,000	$ 674,000	$ 6,640,000
	E/S	$ 2,296,000	$ 163,000	$ -130,000	$ 32,800
New	**Prime**	$ 530,000	$ 75,000	$ 400	$ 75,800
	E/S	0	0	$ 7,400	$ 7,400
Total		$ 36,479,000	$ 6,204,000	$ 551,800	$ 6,755,000

Costs to a Typical Business

Most business in California do not own any diesel-fueled stationary engines. For those businesses that do have engines, the cost will vary depending on the number of engines operated and the engine activity and operating parameters. To provide some perspective on the costs that may be incurred by a business, ARB staff estimated the costs to comply with the ATCM for a typical business with one engine. For prime engines, we used the average horsepower for prime engines reported in the emissions inventory (590 hp), and for emergency standby engines we used the average horsepower of the engines reported in the ARB Survey (700 hp). As shown in Table IX-6, most businesses that own an emergency standby diesel-fueled engine will not need to install DECS, and for those that do, the majority can use the less expensive diesel oxidation catalyst. If a business owns a prime diesel-fueled engine, then retrofit with a DPF or DOC is necessary.

Table IX-6: Estimated Costs per Engine for a Typical Business

Category	Activity	% of all Private Engines	Typical Engine Size (hp)	Capital Cost per Engine	Annualized Capital Costs	Recurring Costs	Total Annual Costs ($)
Emergency Standby	Reduce Hours	88.8%	700	$100	$0	$100	$100
	DOC	1.5%	700	$7,280	$517	$100	$617
Prime	DPF	7.7%	590	$22,420	$2,903	$550	$3,453
	DOC and	1.9%	590	$6,136	$1,417	$0	$1,417
	Replace in 2011			$54,664	$3,879	$0	$3,879

The estimated capital cost to a business with a typical size emergency standby engine could range from $100 to $7,280 per engine. The low end of the cost range reflects reporting costs for businesses that will not have to install a DECS (no equipment cost). The upper end reflects businesses that will retrofit emergency standby engines with DOCs at an average capital cost of $7,280 each. The estimated capital cost to a typical business with a prime engine is $22,400 for the installation of a DPF. For those businesses with prime engines needing to install a DOC and then later replacing that engine with a new Tier IV engine in 2011, the estimated capital cost is $60,800 ($6,136 for DOC + $54,664 for new engine). For engines with a DPF, there will be an additional annual cost of approximately $550 for maintenance.

Based on the ARB Survey, for those businesses that do have either emergency standby or prime stationary diesel-fueled engines, the average business owns 2.5 emergency standby engines of 700 horsepower, and three prime engines of 590 horsepower.[16] The typical small business that owns an emergency standby engine has 1.5 emergency standby engines. The typical small business owning prime engines has 1.75 prime engines. The costs for typical businesses and typical small businesses can be estimated by multiplying the cost per engine values, present in Table IX-6 above, by the typical number of engine per business. Additional information on the impacts to businesses can be found in Appendix I.

Costs and Impacts to Various Industry Sectors

ARB staff categorized the emergency standby stationary diesel-fueled engines owned by businesses and reported in the ARB Survey into nine categories. These categories are hospitals, power generation, telecommunications, broadcasting, hotels, petroleum refiners, food processing, and private other. The category ‘private other' is made up of a wide variety of businesses or agencies that do not fit within the other categories. Some examples of ‘private other' engines include malls, mail-order retailers, retirement homes, condominiums, corporate headquarters, parcel delivery hubs, freight, research facilities, ports, airports, manfacturing, mining, financial, mills, pharmaceutical companies, ski resorts, aquariums, and museums. Because prime engines were reported by a very diverse range of businesees, we did not try to subcategorize these engines.

The methodology used to estimate the costs in Table IX-7 is the same as that used to estimate the total statewide costs of the ATCM in Section D, except that the individual industry sectors were analyzed separately. The industry sectors are derived from the businesses responding to our survey. Based on the information in the ARB survey and applying the assumptions outlined in Table IX-3, there were actual cost savings to the telecommunication industry due to the reduction in the annual hours of operation for maintenance and testing of emergency standby engines.

[16] We believe this may be an overestimate of the number of engines owned by a typical business. Some of the telecommunication businesses own hundreds of engines, which may have biased the average.

Table IX-7: Distribution of Total Costs by Businesses Category

Business Category	Estimated Total Capital Costs	Annualized Capital Cost	Annual Recurring Costs ($)	Total Annualized Cost ($)
Emergency Standby Applications				
Hospitals	$ 200,916	$ 14,255	$ 4,628	$ 18,884
Power Generation	$ 74,810	$ 5,942	$ - 2,769	$ 4,957
Telecommunications	$ 155,710	$ 11,555	$ - 12,418	$ 2,607
Broadcasting	$ 95,850	$ 7,296	$ - 4,625	$ 2,671
Hotels	$ 101,830	$ 8,239	$ - 50	$ 10,662
Petroleum Refiners	$ 97,160	$ 7,845	$ - 3,025	$ 4,820
Food Processing	$ 62,200	$ 5,174	$ - 1,570	$ 3,604
Other[2]	$ 741,850	$ 57,138	$ - 44,970	$ 12,168
Prime Applications				
Prime [3]	$ 36,797,505	$ 6,040,991	$ 674,483	$ 6,715,474
Total	$ 38,327,831	$ 6,158,436	$ 609,684	$ 6,775,846

1. We are assuming that all hospitals and health care facilities will reduce maintenance and testing to less than 20 hours a year pending legislative approval of AB 390. The 458,887 is the estimated reporting and recordkeeping costs for a 25 year period.
2. Examples " other" business types using emergency standby engines include but are not limited to the following: retail, office buildings/property management, airports, ski resorts, and factories.
3. The use of prime engines was not easily categorized by business type. A wide variety of business types use prime engines including: private waste and sanitation facilities, power generation, food processing, petroleum refiners, construction, sand and gravel facilities, shipyard, mountain resorts, recycling, landfill, and composting facilities.

Potential Business Impacts

In this section, we analyze the potential impacts of the estimated costs of the proposed ATCM on business enterprises in. Section 11346.3 of the Government Code requires that, in proposing to adopt or amend any administrative regulation, state agencies shall assess the potential for adverse economic impact on California business enterprises and individuals. The assessment shall include a consideration of the impact of the proposed or amended regulation on the ability of California businesses to compete with businesses in other states, the impact on California jobs, and the impact on California business expansion, elimination, or creation.

This analysis is based on a comparison of the annual return on owner's equity (ROE) for affected businesses before and after the inclusion of the equipment costs, associated recurring costs, and fees. The analysis also uses publicly available information to assess the impacts on competitiveness, jobs, and business expansion, elimination, or creation.

ARB staff does not have access to financial records for most of the privately-owned companies that responded to the ARB Survey. However, the small business status of the survey respondents was determined by including a query on the ARB Survey for the respondent to indicate if their business was a small business (annual gross receipts of $10,000,000 or less per Government Code section 14837 (d)(1)). Based on the ARB Survey responses, staff identified approximately 6.5 percent of the businesses (~280 statewide) as small businesses. These small businesses account for 3.7 percent of the emergency standby engines owned by California businesses (~354 engines statewide). The ARB Survey responses also indicate 38 percent of the businesses that own prime engines are would qualify as small businesses, representing 26 percent of the prime engines.

The types of businesses that may be impacted include private schools and universities, private water treatment facilities, hospitals, office buildings, power generation, communications, broadcasting, building owners, banks, hotel/motels, refiners, resorts, recycling centers, quarries, wineries, dairies, food producing and packaging, manufacturing, landfills, and retail stores. Based on the ARB Survey, staff estimates approximately 4,280 companies, having an estimated 9,900 emergency standby stationary engines and 1,040 prime engines, will be affected by this regulation. The vast majority of the engines requiring a retrofit or replacement are prime engines. The affected businesses fall into different industry classifications, as shown in Table IX-8.

Table IX-8: List of Industries with Affected Businesses

SIC Code	Industry
0723	Agricultural Services
1311	Crude Petroleum And Natural Gas
1389	Oil and Gas Field Services
1429	Crushed and Broken Stone
1442	Construction Sand And Gravel
1542	General Contractors-Nonresidential Buildings, Other Than Industrial
2048	Prepared Feeds and Feed Ingredients for Animals and Fowls
2421	Sawmills and Planing Mills, General
2951	Asphalt Paving Mixtures and Blocks
3272	Concrete Products, Except Block and Brick
3273	Ready-Mixed Concrete
3479	Coating, Engraving, and Allied Services
3711	Motor Vehicles and Passenger Car Bodies
3731	Ship Building and Repairing
4491	Marine Cargo Handling
4581	Airports, Flying Fields, and Airport Terminal Services
4911	Electric Services
4931	Electric & Other Services Comb
4953	Refuse Systems
5093	Scrap and Waste Materials
5932	Used Merchandise Stores
6531	Real Estate Agents and Managers
7353	Heavy Construction Equipment Rental and Leasing
7699	Repair Shops and Related Services, Not Elsewhere Classified

The approach used in evaluating the potential economic impact of the proposed ATCM on California businesses is as follows:

(1) All affected businesses are identified from responses to the ARB surveys. Standard Industrial Classification (SIC) codes identified by these businesses are listed in Table IX-8 above.

(2) Annual costs for the ATCM are estimated for each of these businesses based on the assumptions previously discussed.

(3) The total annual cost for each business is adjusted for both federal and states taxes.

(4) These adjusted costs are subtracted from net profit data and the results used to calculate the Return on Owners' Equity (ROE). The resulting ROE is then compared with the ROE before the subtraction of the adjusted costs to determine the impact on

the profitability of the businesses. A reduction of more than 10 percent in profitability is considered to indicate a potential for significant adverse economic impacts. This threshold is consistent with the thresholds used by the U.S. EPA and others.

Using Dun and Bradstreet financial data from 1999 to 2001, staff calculated the ROEs, both before and after the subtraction of the adjusted annual costs, for the typical businesses from each industry category. These calculations were based on the following assumptions.

- All affected businesses are subject to federal and state tax rates of 35 percent and 9.3 percent, respectively.

- Affected businesses neither increases the prices of their products nor lowers their costs of doing business through cost-cutting measures because of the ATCM.

These assumptions, though reasonable, might not be applicable to all affected businesses.

California businesses are affected by the proposed annual cost of the ATCM to the extent that the implementation of the proposed ATCM reduces their profitability. Using ROE to measure profitability, we found that the ROE range for typical businesses from all industry categories would have declined by about 0.01 to 6 percent in 2006. This represents a small decline in the average profitability of the affected businesses. Overall, most affected businesses will be able to absorb the costs of the proposed ATCM with no significant impacts on their profitability.

Potential Impact on Business Competitiveness

The proposed ATCM may affect the ability of some California businesses that sell their products nationally to compete with businesses outside the State due to the slight increase in stationary diesel-fueled engine costs. However, most businesses affected by this proposed regulation compete in local markets and are not subject to competition from businesses located outside the State.

Emergency standby diesel-fueled engines are located in a wide variety of businesses. However, ARB staff estimates that only one percent of the emergency engines will require modifications that will result in costs to the engine owners. For owners of prime engines, we expect approximately 80 percent to install a DPF and 20 percent to install a DOC with the intent to replace with a new engine in 2011. Most of the affected businesses are large and are expected to be able to absorb the increased costs associated with the proposed ATCM with no significant impact on their ability to compete with non-California businesses (see analysis in Appendix I).

Potential Impact on Employment, Business Creation, Elimination or Expansion

The proposed ATCM is expected to have no noticeable impacts on employment and business' status. Businesses that manufacture, sell, install, repair, or clean diesel particulate emission control systems may experience an increase in demand for their products or services, resulting in an expansion of those businesses or the creation of new businesses. Staff believes used engine dealers would not be eliminated; instead, we believe the dealers would adapt to incorporate additional refurbishment and upgrading of the engines for resale.

ARB staff believes jobs will not be eliminated as a result of the ATCM, but it may lead to the augmentation or alteration of job duties, leading to no net result change in the number of jobs. For example, a mechanic who previously worked on muffler installation would now be installing a DECS. Staff believes additional training and emissions testing may be required for these additional duties, if not provided by the DECS manufacturers. To the extent that DECS are manufactured in California, some jobs may also be created. Some jobs will be created to install, repair, or clean DECS.

F. Potential Costs to Local, State, and Federal Agencies

In this section, we estimate the total costs to governmental agencies. The analysis also estimates the total costs to local, state, and federal agencies individually. As shown in Table IX-9, ARB staff estimates the total costs to public agencies to be approximately 8.1 million dollars, with annualized costs of approximately $1.7 million.

Table IX-9: Summary of Total Lifetime and Annualized Costs for Public Agency Compliance with the ATCM

Engine Application	Category	Total Capital Cost ($)	Annualized Capital Cost ($)	Annual Recurring Costs ($)	Total Annualized Cost ($)
Emergency Standby	State	$198,870	$14,110	-$110,820	-$96,710
	City	$370,000	$26,235	-$12,625	$13,610
	County	$191,850	$13,610	-$20,450	-$6,840
	Other Local	$396,590	$28,142	-$71,302	-$43,160
	Federal	$502,060	$35,624	-$22,084	$13,540
Prime	State	$555,892	$98,266	$11,135	$109,400
	City	$2,624,238	$463,897	$52,563	$516,460
	County	$1,330,292	$235,164	$26,646	$261,810
	Other Local	$1,441,043	$254,736	$28,864	$283,600
	Federal	$3,142,928	$555,587	$62,953	$618,540
Total		$10,753,762	$1,725,371	-$55,121	$1,670,250

Local Public Agencies

The majority of local governments provide services requiring the use of emergency engines to insure public safety or maintain essential services during emergencies. Examples include police departments, jails, fire departments, government data storage facilities, and sewage and water treatment facilities. In the event of power outages, floods or other emergencies, the emergency standby engines prevent disruptions in critical operations.

Based on the ARB Survey and the most current stationary engine emissions inventory, we estimate there are approximately 5,400 emergency standby engines and 170 prime engines owned and operated by local government agencies. As shown in Table IX-10, approximately 45 diesel backup engines and 167 diesel prime engines will incur capital costs associated with installation of a DECS. The remaining engines will incur minimal costs for reporting and record-keeping requirements proposed in the regulation.

Table IX-10: Estimated Number of Local Publicly Owned Stationary Diesel-Fueled CI Engines in California Potentially Requiring Installation of Diesel Emission Control Systems

Engine Application			**Emission Control Systems**			
	Category	**Total Engine Population**	**Diesel Particulate Filter**	**Diesel Oxidation Catalyst**	**New Tier 4 Engine**	**None Needed**
Emergency Standby	City	2,465		12		2,453
	County	923		8		915
	Other Local	2,044		25		2,019
	Total Local Standby	5,432		45		5,387
Prime	City	81	65	16	16	
	County	41	33	8	8	
	Other Local	45	36	9	9	
	Total Local Prime	167	134	33	33	

To estimate the expected costs of the proposed ATCM to local public agencies, we used the cost estimates and assumptions outlined in Tables IX-2 and IX-3 and the basic cost methodology discussed previously. Using these assumptions, the estimated average cost to retrofit or modify a emergency standby stationary diesel-fueled engine is about $5,600 for a city owned engine (average 450 hp) and $8,100 for a county owned engine (average 680 hp). The estimated total equipment and installation costs on local governments to modify prime and emergency standby stationary diesel-fueled engines will be approximately $6,354,000. The estimated discounted capital cost plus the annual additional operation and maintenance cost on local governments is approximately $1,021,000 annually. A brief summary of the estimated costs for local public agencies is presented in Table IX-11.

Table IX-11: Estimated Statewide Costs for Local Publicly Owned Stationary Diesel-Fueled CI Engines in California

Engine Application	Category	Total Capital Cost ($)	Annualized Capital Cost ($)	Annual Recurring Costs ($)	Total Annual Cost ($)
Emergency Standby	City	$370,000	$26,200	-$12,630	$13,600
	County	$191,900	$13,600	-$20,450	-$6,800
	Other	$396,600	$28,100	-$71,300	-$43,200
Prime	City	$2,624,200	$463,900	$52,600	$516,500
	County	$1,330,300	$235,200	$26,600	$261,800
	Other	$1,441,000	$254,700	$28,900	$283,600
Total		$6,354,000	$1,021,000	$3,700	$1,025,500

To estimate the fiscal impacts for fiscal year (FY) 2005-2006, we assumed that 25 percent of the total engines needing a retrofit would incur costs for that current year. As currently proposed, the regulation requires 1989 model year and pre-1989 model year engines to be in compliance by January 1, 2006; 1990 model year to 1995 model year engines to be in compliance by January 1, 2007; and 1996 and newer model year engines to be in compliance by January 1, 2008. In addition, owners of four or more engines have until January 1, 2009, to have all the engines in compliance with the performance standards specified in the regulation. Because we lacked detailed information on the age distribution of engines owned by local public agencies, we concluded a 25 percent compliance rate per year was reasonable. Using this assumption, we estimate the total cost for the 2005-2006 fiscal year is about 25 percent of the total annual cost, or $256,380.

There may also be other potential cost impacts. For example, for public agencies that contract with private companies, an increase in the contract cost may occur under the terms of the contract or at the renewal of the contract. Staff did not consider this a direct cost, and, therefore, did not include it in the cost to local government agencies.

The local air districts are responsible for enforcing this regulation. The enforcement of the engines affected by this regulation would probably take the form of a typical inspection. The typical inspection takes about one hour annually for a prime engine and about a half-hour every four years for an emergency engine. Based on the number of engines in the ARB Survey, the additional local costs on the air districts statewide will be approximately $362,000 per year for district enforcement.

Fiscal Effect on State Government

Several State agencies provide services requiring emergency backup diesel equipment for public safety. Examples of these operations include prisons, government data storage facilities, emergency flood control, and college campuses. Some agencies may also have prime engines such as wood chippers used for composting forest waste. Examples of the State agencies that potentially may be impacted by the ATCM include the Department of Corrections, General Services, the University of California and the California State University systems, the Department of Water Resources, the Franchise Tax Board, and the Department of Fish and Game. Based on the ARB Survey, and as shown in Table IX-12, we estimate about 882 standby and 17 prime diesel engines operated by State agencies will be impacted by this regulation.

Table IX-12: Percentage of State Owned Stationary Diesel-Fueled CI Engines in California Potentially Requiring Installation of Diesel Emission Control Systems

Engine Application			Emission Control Systems			
Category		Total Engine Population	Diesel Particulate Filter	Diesel Oxidation Catalyst	New Tier 4 Engine	None Needed
Emergency Standby	State	882		9		873
Prime	State	17	14	3	3	

To estimate the expected costs associated with State agencies compliance with the regulation, we used the cost estimates and assumptions outlined in Tables IX-2 and IX-3 and the basic cost methodology discussed previously. As shown in Table IX-13, the proposed ATCM is expected to result in $754,500 initial capital cost to the State agencies. The fuel savings and retrofit costs of emergency standby engines are calculated over 25 years and the retrofit costs for prime engines are calculated over 10 years. The result is a low annual cost of $12,690.

A brief summary of the estimated costs for State agencies is presented in Table IX-13. Similar to the cost estimate for local public agencies, the expected costs for the FY 2005-2006 were estimated by assuming 25 percent of the engines would need to comply with the regulation in that year at a cost for equipment and installation of $189,000.

Table IX-13: Estimated Statewide Costs for State Owned Stationary Diesel-Fueled CI Engines in California

Engine Application	Total Capital Cost ($)	Annualized Capital Costs ($)	Annual Recurring Cost ($)	Total Annual Cost ($)
Emergency Standby	$198,900	$14,100	-$110,820	-$96,710
Prime	$555,900	$98,300	$11,140	$109,400
Total	$754,800	$112,400	-$99,680	$12,690

Fiscal Impact on Federal Agencies

Several federal agencies provide services requiring emergency backup diesel equipment for public safety. Examples of operations requiring emergency standby engines are prisons, government data storage facilities, and military bases. Examples of the federal agencies that potentially may be impacted by the ATCM include, the National Aeronautics and Space Administration (NASA), military bases, U.S. Park Service facilities, Federal Bureau of Prisons, and the Federal Aviation Administration. As shown in Table IX-14, we estimate approximately 3,594 emergency standby and 98 prime diesel engines operated by the federal government will be impacted by this regulation.

Table IX-14: Percentage of Federally Owned Stationary Diesel-Fueled CI Engines in California Potentially Requiring Installation of Diesel Emission Control Systems

Engine Application			Emission Control Systems				
Category		Total Engine Population	Diesel Particulate Filter	Diesel Oxidation Catalyst	New Engine + DPF	New Tier 4 Engine	None Needed
Emergency Standby	Federal	3,594		12			3,582
Prime	Federal	98	78	20		20	

Source: ARB Survey

To estimate the expected costs associated with federal agencies compliance with the regulation, we used the cost estimates and assumptions outlined in Tables IX-2 and IX-3 and the basic cost methodology discussed previously. As shown in Table IX-15, the estimated total capital costs of Federal agencies to comply with the regulation is $3,645,000, with annualized capital costs plus the annual operation and maintenance costs of about $632,000. The fuel savings and retrofit costs of emergency standby engines are calculated over 25 years, and the retrofit costs for prime engines are calculated over 10 years. Similar to the cost estimate for local public agencies, the expected costs for the FY 2005-2006 were estimated by assuming 25 percent of the engines would need to comply with the regulation in that year at a cost for equipment and installation of $911,250.

Table IX-15: Estimated Statewide Costs for Federally Owned Stationary Diesel-Fueled CI Engines in California

Engine Application	Total Capital Cost ($)	Annualized Capital Cost ($)	Annual Recurring Cost ($)	Total Annualized Cost ($)
Emergency Standby	$502,100	$35,600	-$22,100	$13,500
Prime	$3,142,900	555,600	$63,000	$618,500
Total	$3,645,000	$591,200	$40,900	$632,100

G. Summary of Total and Annual Costs for Compliance with the Proposed ATCM

In this section, the results shown in Tables IX-5 and IX-9 are summarized in Table IX-16 (i.e., the total cost of the ATCM to both private companies and governmental agencies). Based on these results, we estimate the total statewide capital costs for all affected entities in the State are $47 million, with an annualized cost of $8.4 million.

Table IX-16: Summary of Total Lifetime and Annualized Costs for Compliance with the Proposed ATCM

Engine Application	Category	Total Capital Cost	Annualized Capital Cost	Annual Recurring Costs ($)	Total Annualized Cost ($)
Emergency Standby	Private	$2,296,000	$163,000	-$123,000	$40,000
	State	$199,000	$14,000	-$111,000	-$97,000
	City	$370,000	$26,000	-$13,000	$14,000
	County	$192,000	$14,000	-$20,000	-$7,000
	Other Local	$397,000	$28,000	-$71,000	-$43,000
	Federal	$502,000	$36,000	-$22,000	$14,000
Prime	Private	$34,183,000	$5,979,000	$737,000	$6,716,000
	State	$556,000	$98,000	$11,000	$109,000
	City	$2,624,000	$464,000	$53,000	$516,000
	County	$1,330,000	$235,000	$27,000	$262,000
	Other Local	$1,441,000	$255,000	$29,000	$284,000
	Federal	$3,143,000	$556,000	$63,000	$619,000
Total		$47,233,000	$7,868,000	$560,000	$8,427,000

H. Cost Effectiveness

In this section, the cost-effectiveness of the ATCM is estimated. Cost effectiveness is expressed in terms of control costs (dollars) per unit of air emissions reduced (pounds). As described below, for example, the cost effectiveness for the proposed ATCM is determined by dividing the annualized capital costs plus the annual operation and maintenance costs by the annual pounds of diesel PM reduced. For the mortality cost-effectiveness, we presented the annualized capital costs and annual operation and maintenance costs in 2002 equivalent expenditure dollars.

The annualized capital costs and annual operation and maintenance have been represented differently for the cost effectiveness and mortality sections. ARB does not have data to determine multiple engine ownership and associated engine ages to accurately determine the retrofit phase in schedule. Therefore, the capital costs at the beginning of the ATCM implementation are phased in over four years to accommodate potential issues regarding the engine age and multiple engine ownership. Also, all costs are brought back to 2002 net present value to compare with other regulations. This method better represents when emission reductions will occur and more accurately represents costs further in the future.

Expected Emission Reductions

We estimated the projected annual emission reductions under the ATCM as described in Appendix D. The following provides a summary of the annual statewide reductions that will result from the proposed ATCM.

The baseline and ATCM-controlled diesel PM emissions are calculated based on the statewide inventory. These results are shown in Table IX-17.

Table IX-17: Estimated Statewide Diesel PM Annual Emissions and Reductions

Year	Uncontrolled Emissions (tons/day)	Controlled Emissions* (tons/day)	Reduction Emissions* (tons/day)	Reduction Emissions (tons/yr)
2005	0.8680	0.4067	0.4613	168.4
2006	0.8134	0.3957	0.4177	152.5
2007	0.7786	0.3816	0.3970	144.9
2008	0.7414	0.3619	0.3795	138.5
2009	0.7054	0.3450	0.3604	131.5
2010	0.6452	0.3482	0.2970	108.4
2011	0.6334	0.3112	0.3222	117.6
2012	0.5974	0.2943	0.3031	110.6
2013	0.5614	0.2774	0.2840	103.7
2014	0.5254	0.2605	0.2649	96.7
2015	0.4791	0.2137	0.2654	96.9
2016	0.4534	0.2267	0.2267	82.7
2017	0.4174	0.2098	0.2076	75.8
2018	0.3814	0.1929	0.1885	68.8
2019	0.3454	0.1760	0.1694	61.8
2020	0.3246	0.1720	0.1526	55.7

*Expected emissions and emission reductions due to implementation of ATCM

Cost Effectiveness

To determine the cost-effectiveness of the proposed regulation, we divided the annualized costs and annual ongoing costs by the diesel PM emission reductions attributable to the ATCM. The resulting cost effectiveness in each year of implementation up to 2020 is listed in Table IX-18. The estimated overall annual cost effectiveness, weighted by annual PM reduced, is $15.4 per pound of diesel PM reduced, if all the costs of compliance are allocated to diesel PM reduction. The range if from $4 to $26 per pound of diesel PM reduction. This cost effectiveness is near the lower end of anticipated cost effectiveness for diesel PM controls.

Table IX-18: Summary of Annual Cost Effectiveness for the Proposed ATCM

Year	Sum Annual Costs ($)	Inventory Based PM Reduced	Cost Effectiveness	
		(tons/yr)	($/ton)	($/lb)
2005	$ 1,354,316	145	$ 8,043	$ 4.02
2006	$ 3,108,844	125	$ 20,391	$ 10.20
2007	$ 4,693,204	114	$ 32,388	$ 16.19
2008	$ 6,119,622	103	$ 44,179	$ 22.09
2009	$ 5,842,752	93	$ 44,416	$ 22.21
2010	$ 5,578,374	73	$ 51,459	$ 25.73
2011	$ 5,409,320	76	$ 45,996	$ 23.00
2012	$ 5,159,407	68	$ 46,636	$ 23.32
2013	$ 4,135,495	61	$ 39,895	$ 19.95
2014	$ 3,197,399	54	$ 33,069	$ 16.53
2015	$ 2,358,752	51	$ 24,349	$ 12.17
2016	$ 1,592,726	42	$ 19,248	$ 9.62
2017	$ 1,336,349	36	$ 17,636	$ 8.82
2018	$ 1,100,777	32	$ 15,999	$ 8.00
2019	$ 900,639	27	$ 14,566	$ 7.28
2020	$ 717,067	23	$ 12,874	$ 6.44
Weighted Average =			$ 30,821	$ 15.41

Since the ATCM will also result in reductions in reactive organic gases (ROG) and oxides of nitrogen (NOx) emissions, staff conducted a second cost effectiveness analysis in which half of the cost of compliance was allocated to PM benefits and half the cost was allocated to ROG plus NOx benefits. This results in cost effectiveness values of $7.70/lb diesel PM, weighted by annual PM reduced, and $0.92/lb of ROG plus NOx, weighted by annual ROG plus NOx reduced. The resulting ROG plus NOx cost effectiveness for the combined standby and prime engines in the State are listed in Table IX-19. Based on their relative weights, the ROG and NOx cost effectiveness can be further expressed as $0.17 per pound ROG and $0.75 per pound NOx based on the respective weights. This cost effectiveness is near the lower end of anticipated cost effectiveness for diesel PM controls.

Table IX-19: Summary of Annual ROG Plus NOx Cost Effectiveness for the Proposed ATCM

Year	Sum of Annual[1] Costs ($)	Inventory Reduced			ROG+NOx Cost Effectiveness	
		ROG (tons/yr)	NOx (tons/yr)	ROG + NOx (tons/yr)	($/ton)	($/lb)
2005	$ 677,158	165	418	583	$ 1,162	$ 0.58
2006	$ 1,554,422	157	306	463	$ 3,358	$ 1.68
2007	$ 2,346,602	149	389	538	$ 4,360	$ 2.18
2008	$ 3,059,811	141	455	596	$ 5,131	$ 2.57
2009	$ 2,921,376	133	530	663	$ 4,407	$ 2.20
2010	$ 2,789,187	126	352	478	$ 5,839	$ 2.92
2011	$ 2,704,660	118	679	796	$ 3,396	$ 1.70
2012	$ 2,579,704	110	753	863	$ 2,989	$ 1.49
2013	$ 2,067,748	102	828	930	$ 2,224	$ 1.11
2014	$ 1,598,699	94	902	997	$ 1,604	$ 0.80
2015	$ 1,179,376	87	897	983	$ 1,199	$ 0.60
2016	$ 796,363	79	1,051	1,130	$ 705	$ 0.35
2017	$ 668,174	71	1,126	1,197	$ 558	$ 0.28
2018	$ 550,388	63	1,200	1,263	$ 436	$ 0.22
2019	$ 450,320	55	1,275	1,330	$ 339	$ 0.17
2020	$ 358,533	48	1,485	1,532	$ 234	$ 0.12
				Weighted Average =	$ 1,834	$ 0.92

[1] Annual costs is the sum of annualized capital costs and annual ongoing costs
Source: ARB Emissions Inventory, Off-Road Model

Cost-Effectiveness of the ATCM as Applied to Agricultural Operations

For several reasons, the ARB staff believes the ATCM is cost-effective for agricultural operations. First, the ATCM applies only to new diesel engines used in agricultural operations. Therefore, agricultural operations will not need to buy new compliant engines until they need such new engines. In that case, the agricultural operations would have replaced their existing engines with new engines irrespective of the ATCM. Second, the ATCM requires these new engines to meet a 0.15 g/bhp-hr diesel PM limit and the current off-road certification standards. As noted earlier in this chapter, such engines are readily available “off-the-shelf” and have been shown to be cost-effective. Third, the ATCM does not require retrofits on existing, in-use engines. Therefore, when agricultural operations decide to purchase new engines, they would be required to buy new engines that are already available “off-the-shelf” and cost-effective, which they would have done anyway irrespective of the ATCM. This is the basis for our finding that the cost attributable to the ATCM for agricultural operations is essentially zero for purchasing a new engine. And for these reasons, the ARB staff believes the ATCM is cost-effective for agricultural operations.

X. ADDITIONAL CONSIDERATIONS

In this chapter ARB staff provide additional supporting documentation for the proposed ATCM and discussion on issues raised during the development of the ATCM.

A. Direct-Drive Diesel Fire Pump Engines

The proposed ATCM establishes emission standards for emergency standby engines based on the hours of operation needed for maintenance and testing. The greater the number of hours operated for maintenance and testing, the more stringent the emission performance standard. During the development of the ATCM, concerns were raised regarding the application of the performance standard to emergency standby fire pump engines. Specifically, most fire pump engines are tested according to the National Fire Protection Association's (NFPA) "Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems" (NFPA 25), which requires approximately 26 hours of testing in a one year period with an additional two to four hours needed once every five years. Because these pump engines are used for fire protection, concerns were raised regarding the ability of the pump engines to perform with a diesel emission control strategy installed and whether the pump engines with emission controls would still be certified by the Underwriters Laboratory (UL) or FM Global (FM). The following explains fire pump engines, fire pump engine regulations and the requirements included in the ATCM that were proposed to address these concerns.

Fire Pump Engine Power Configurations

Fire pumps are used to supply water to building fire sprinkler systems. Fire pumps are needed at sites where water pressure is insufficient for fire protection. (Gray, 2001) There are thee main types of fire pump power configurations:

- Electric motor-driven fire pumps (electric pumps) are the most common method of powering fire pumps. Electric fire pumps are reliable power sources and offer no emissions.
- Electric motor-driven fire pumps with diesel generator backup engines are also commonly used. In this configuration, in the event of power interruption, the generator would provide electrical power to the fire pump.
- Direct-drive diesel engine fire pumps (direct-drive pumps) are fire pumps directly powered by a diesel-fueled engine. Generally, direct drive diesel engine fire pumps are used to power fire pumps in areas with unreliable electrical power and in remote areas. (Sweat, 2003)

Direct-drive pump engines are designed slightly different than other diesel-power sources; reliability and running until failure are priorities. According to a representative from Cummins Engine Company, Inc., there are two main differences in the engines. First, the cooling system is designed like that of a marine engine. The radiator is removed and water flow enters the engines from the water supply, exiting the engine flowing to the fire pump. This ensures that a constant supply of cool water flows into the engine. Second, the electronic protection system is turned off. On non-direct-drive pumps, this system would normally protect the engine by preventing operation outside of normal specifications. By contrast, the system is turned off for direct-drive pumps so that the pumps operate to failure despite warnings for high water temperature, low oil pressure, or other condition outside of normal specifications. (Cummins, 2003a) (Cummins, 2003b)

Fire Pump Engine Maintenance and Testing Requirements

There are requirements in State law that specifies how fire pump engines should be maintained and tested. As discussed below, these requirements refer back to NFPA guidelines.

California regulations have requirements for the testing and maintenance of fire pump engines that are linked to NFPA guidelines. The current 2001 California Building Code, Chapter 35 "Uniform Building Code (UBC) Standard," page 1-308 refers to NFPA 13 "Standard for the Installation of Sprinkler Systems" which in turn refers to NFPA 25. Currently, the Office of the State Fire Marshal (SFM) office is adopting NFPA 25 in the update of title 19 of the California Code of Regulations as the standard for the inspection, testing, and maintenance of water-based fire protection systems. When NFPA 25 is incorporated into title 19, it will become an explicit standard in the California Building Code. (SFM, 2003)

There are two main NFPA standards concerning diesel fire pump engines and pumps. The first is NFPA 20 "Standard for the Installation of Stationary Pumps for Fire Protection." The second is NFPA 25 "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems." These two volumes cover what is needed to install, operate and maintain diesel fire pump engines/pumps. In addition, a separate standard, NFPA 110 "Standard for Emergency and Standby Power Systems," recommends guidelines for the maintenance and testing of emergency standby generators that are used for providing backup power to electrical systems, including electrically driven fire pumps. A summary of the suggested annual hours necessary for the recommended maintenance and testing requirements for these NFPA standards is provided in Table X-1. (NFPA, 1998) (NFPA, 2003)

Table X-1: Existing NFPA Maintenance and Testing Guidelines

	Fire Pump Power Configuration		
	Direct Drive	**Electric**	**Electric with Generator Backup**
Suggested Maintenance and Testing Hours Per Year	29-34 hours (30 minutes each week plus additional annual testing)	9 hours (10 minutes each week)	6 hours (30 minutes each month)
Reference Guidelines	NFPA 25 2001 UBC Chapter 35	NFPA 25	NFPA 110

Fire Pump Engine Inventory

Because concerns regarding fire pumps were raised late in the rulemaking process, the ARB Surveys did not collect information that would allow an estimate of the number of fire pump engines in California or the number of engines in each power configuration. However, based on the Sacramento Metropolitan Air Quality Management District (SMAQMD) permit data and conversations with fire pump distributors, ARB staff believes that the direct-drive diesel fire pumps are the least prevalent. The SMAQMD permit data showed 67 permitted fire pumps with 60 fire pumps being electric with generator backup and seven that we assumed were direct-drive fire pump engines. In addition, John Sweat (of The John Sweat Company), who installs and completes initial testing on fire pumps, and James Feld, a fire protection engineer, indicated that the majority of fire pumps are electric motors connected to the grid, followed by electric powered fire pumps with generator backup. The diesel direct-drives are generally used in remote areas or areas with unreliable power. (Sweat, 2003) (Feld, 2003)

ATCM Proposal for Fire Pump Engines

Based on the reasons discussed above, ARB staff incorporated a provision in the ATCM to allow in-use direct drive diesel fire pumps to continue to operate the annual hours necessary for compliance with NFPA 25 without meeting the performance standards for other emergency standby engines. ARB staff believes it is appropriate to allow these engines to exceed the 30-hour annual cap and not obtain district approval as required for other engines because of NFPA 25 requirements. NFPA 20 requires that diesel fire pump engines be specifically tested and listed for fire pump service by a testing laboratory. Installing an emission control system to modifying the exhaust system may void the UL or FM lab certification. Given the public safety concerns, ARB staff believes that the exemptions for the engines are appropriate.

B. In-Use Stationary Diesel-Fueled Engines Used in Agricultural Operations

The proposed Stationary Diesel Engine ATCM establishes performance standards (representing best available control technology) for new agricultural engines similar to the requirements for new emergency standby engines but without operating hour restrictions. New agricultural engines would be required to meet a 0.15 g/bhp-hr PM standard and the NMHC+NOx and CO standards in the U.S. EPA and ARB Non-Road Engine Emission Standards for the specific model year and horsepower category of the engine. New engines meeting the 0.15 g/bhp-hr PM requirement are currently available “off-the-shelf” for all engine horsepower categories greater than 50 hp, even though the certification standards for the engines in the 50 to 175 hp range are higher the 0.15 g/bhp-hr PM standard.

At this time, ARB staff is not proposing any performance standards or operating hour restrictions for in-use agricultural engines as part of the ATCM. For in-use agriculture engines, staff is working with the agricultural community and other parties to identify how best to reduce PM and NOx emission from stationary diesel engines used in agricultural activities. As part of this effort, staff will be following the development of retrofit controls that could be reliably installed and maintained on engines in agricultural uses. If we determine that technically feasible and cost-effective retrofit controls become available for in-use agricultural engines we will propose amendments to the ATCM. Below is a discussion of the rationale for the ARB staff's proposal.

Staff's proposal requires new agricultural engines to be the cleanest currently produced by engine manufacturers. The proposal does not require the installation of retrofit controls for new or in-use agricultural engines, as required for non-agricultural prime engines. At this time, ARB staff believes that it is infeasible to require retrofit controls on new or in-use agricultural engines because of retrofit installation and availability issues unique to engines in agricultural service and the lack of implementation and enforcement mechanisms because these engines are not subject to district permit.

A major factor in staff's decision not to require retrofit controls for new or in-use agricultural engines is retrofit installation and availability issues. Engine manufacturers currently are not producing engines with add-on PM controls for off-road applications and retrofit manufacturers have not offered retrofit controls that can be readily installed on in-use engines in-field locations. The purchaser of a new agricultural engine would have to arrange to have retrofit controls installed after purchase. It would be very difficult for the individual farmer or the local engine dealer to arrange for installation of retrofit controls since it is currently not an option offered by the engine manufacturer or adapted by the retrofit manufacturer. Staff believes that to successfully implement retrofits requirements for engines in agricultural service, bolt-on retrofit kits will be needed. When this occurs, staff is committed to coming back to the Board to amend the ATCM.

In addition to the retrofit installation and availability issue, there are implementation and enforcement issues affecting control of new and in-use agricultural engines. H&SC section 42310 exempts any equipment used in agricultural operations from having to obtain a permit.[17] The ATCM relies on an effective permit system to ensure that controls are properly designed, installed, and operated. Staff believes that it would be extremely difficult and resource intensive to implement retrofit control requirements without a permitting system. Requiring a permit provides a mechanism for obtaining critical data on engine location, make/model, model year, horsepower, and operating hours. More importantly, it provides an enforceable mechanism for the district to obtain the information necessary to determine if the selected equipment is capable of meeting the requirements of the ATCM. Because of the permitting restriction, staff believes that the best approach is to require new agricultural engines to meet the lowest achievable off-road engine standards and to not require retrofits on in-use agricultural engines.

Finally, staff also believes that any effort that would require retrofit controls for new and existing engines needs to be closely coordinated with on-going programs to reduce emissions of both PM and NOx from these engines. This effort is continuing and should

[17] SB 700 was signed into law by Governor Davis on September 22, 2003, and eliminates the exemption from permits in State law for any equipment used in agricultural operations.

be fully integrated with any ATCM requirements for existing engines. Currently a large number of older agricultural engines have been replaced with newer engines meeting the 0.15 g/bhp-hr PM standard and with lower NOx emissions under the Carl Moyer program. Due to increased costs, we believe that requiring retrofit controls on in-use engines may make it less likely that these engines will be removed from service and replaced with electric power. We believe that replacing diesel engines with electric power may be the best long-term approach for reducing PM and NOx emissions from stationary agricultural engines. Because of the factors discussed above, more time and effort is needed to determine how best to further reduce PM emissions from engines in agricultural operations. We plan to report back to the Board by June 2004 with an analysis of the feasibility of converting agricultural diesel engines to electrical power.

C. Cumulative Risk

The proposed ATCM addresses the emissions from single sources and does not take into consideration the cumulative impacts of multiple sources in close proximity. Concerns have been raised that individual sources may not exceed acceptable regulatory standards, but pose a significant health hazard when the emissions from multiple sources overlap or when there is a high concentration of polluting sources. The ARB is currently developing sophisticated tools to provide information to use in cumulative impact analyses and for use by other agencies such as local air districts and land use planners in addressing cumulative air impacts. These tools include regional risk maps, enhanced air dispersion models, and improved emissions inventories. These tools are data intensive and are still under development.

While the proposed ATCM does not initially address cumulative impacts, it establishes a process to receive information from owners of stationary diesel engines that can be used in future analyses when the tools are fully developed. The reporting requirements of the proposed ATCM will provide information, such as the location of engines, size, emissions, fuel and control equipment. This information may be used in a variety of programs to determine the potential for significant health risks in a cumulative impact analysis. Some of the programs where this type of information may be used to address potential cumulative impacts include local air district permitting, “Hot Spots” Program, or possible development of more stringent regulatory standards at either the State or local level.

D. Interruptible Service Contracts

Since the mid-1980s, investor-owned utilities are authorized to offer optional “interruptible or curtailable” electric service to customers at discounted rates in exchange for the customer reducing power consumption from the grid during periods when available grid power is insufficient to meet all demand while maintaining an adequate reserve margin. If demand exceeds supply after voluntary interruptions, utilities implement rotating outages based on the Public Utilities Commission authorized curtailment priorities. In exchange for agreeing to have service interrupted, customers receive discounts on their electricity service under interruptible service contracts (ISCs).

In some cases, customers with ISCs operate emergency standby engines as a way to reduce their consumption of power from the grid and, in effect, become self-generators of electricity. These interruptible programs serve as a type of insurance policy against uncertainty and function to provide statewide grid reliability and reduce the probability of experiencing rotating outages or catastrophic system collapse. (PUC, 2002)

Participation in interruptible service programs has decreased over the past several years. In previous years, various programs provided up to 2,800 MW of interruptible load capacity. The same programs provided only 1,600 MW capacity in 2001, and 1,400 MW capacity in 2002. The duration of all interruptible programs were extended through the date of the final decision in the rate design phase of each utility's next general rate case application, i.e., either by the end of 2003 or early 2004. Assembly Bill 425, proposed in the 2003-2004 California State legislative session, proposes to extend the availability of these types of programs or curtailable service to qualified customers until January 1, 2009.

ARB staff could not determine with any certainty the number of facilities operating diesel-fueled engines under ISCs that are associated with the three major investor-owned utilities in California. The Pacific Gas and Electric Company estimates about one third of the 335 MW currently in ISC contracts would be produced by stationary diesel-fueled engines. Southern California Edison could not give an estimate of the number of emergency standby engines in their interruptible load programs. San Diego Gas and Electric has a special type of interruptible program and estimated that they have approximately 60 diesel-fueled stationary engines in their Rolling Blackout Reduction Program.[18] Based on the ARB Survey, approximately 230 of the 3,200 engines for which data was reported in the survey, reported hours of operation in response to an ISC agreement. Of these engines, the average number of hours the engines were used during a low grid power period were about 26 hours per engine per year.

During the development of the ATCM, staff considered how the ATCM should address the continued use of emergency standby engines in interruptible programs. Some entities with existing contracts claimed that operating diesel-fueled emergency standby engines was justified because ISC contracts help prevent blackouts, which could result in the widespread use of diesel-fueled emergency standby engines during rolling blackouts. Others argued against their use, raising concerns about public exposures to diesel PM and continued reliance on a power source that is orders of magnitude dirtier than a gas-fired plant in terms of pollution produced per megawatt of electricity generator.

While possible approaches were explored during the ATCM development, it was not possible to reach agreement on how this issue should be treated prior to the beginning

[18] A special type of ISC is the Rolling Blackout Reduction Program in San Diego County. Under this program, certain engines that have signed up to participate are asked to voluntarily reduce power when grid power reached critically low levels. In exchange for reducing power from the grid, the company is paid 20 cents a kilowatt for the power demand reduced.

of the 45-day public comment period. ARB staff will continue to meet and confer on this issue and may provide a proposal to the Board at the November 13-14, 2003, hearing that would allow the continued use of some of these engine under the proposed ATCM.

E. Harmonization of the Proposed ATCM and the AB 2588 “Hot Spots” Requirements

The Air Toxics "Hot Spots" Information and Assessment Act (Assembly Bill (AB) 2588) was enacted in September 1987 (Health and Safety Code 44300-44394). The goals of the Air Toxics "Hot Spots" Act are to collect emissions data, to identify facilities having localized impacts, to ascertain health risks, and to notify nearby residents of significant risks. In September 1992, the "Hot Spots" Act was amended by Senate Bill (SB) 1731 to address the reduction of significant risks. The bill requires owners of significant-risk facilities to reduce their risks below the level of significance.

Guidance documents are currently available for conducting emission inventories, facility prioritizations, risk assessments, and public notifications. ARB developed the Emission Inventory Criteria And Guidelines for conducting emission inventories, while CAPCOA developed the Facility Prioritization Guidelines, Risk Assessment Guidelines, and the Public Notification Guidelines. Under these guidelines, diesel fueled engines or facilities with diesel-fueled engines must meet AB 2588 requirements if they use 3,000 or more gallons per year of diesel fuel. Many diesel engine operators, particularly those with emergency standby engines have not been subject to the “Hot Spots” requirements because of this usage requirement. In August 1998, the ARB approved the listing of diesel PM as a TAC and the SRP conclusion that a value of 3×10^{-4} $(ug/m^3)^{-1}$ is a reasonable estimate of unit risk from diesel-fueled engines. Now that a unit risk factor has been approved, districts are required to reevaluate the classification of facilities subject to the "Hot Spots" program, specified in H&SC section 44320, that are operating stationary diesel-fueled engines.

To assist the districts in this effort, ARB staff is currently developing amendments to the AB 2588 Air Toxics “Hot Spots” Emission Inventory Criteria and Guidelines Regulation to address diesel engines. These amendments are being developed to align with the ATCM requirements, avoid duplicative requirements, and ensure that potential risks from all engines are evaluated and mitigated where necessary.

The ARB staff believes that the initial reporting requirement in the ATCM will also fulfill the emission inventory requirement of the “Hot Spots” program. In some cases, compliance with the ATCM will fulfill all requirements under the “Hot Spots” program. For example, for owners of a single emergency standby diesel engine at a facility currently not in the “Hot Spots” program, compliance with the ATCM will also reduce the potential risk from that engine to below 10 in a million. For these engines, compliance with the ATCM will also fulfill the “Hot Spots” requirements, provided the district has a 10 in a million significance level.

For owners of prime engines, multiple prime or emergency standby engines, or engines that are in "Hot Spots" facilities, additional site specific evaluations will likely be needed to determine if the resulting risk is too high and needs to be reduced. It will be important for these facilities to consider the "Hot Spots" requirements concurrent with their obligation under the ATCM, because additional controls above and beyond what are required in the ATCM may be necessary in some cases.

The proposed amendments to the "Hot Spots" Emission Inventory Criteria and Guidelines Regulation are tentatively scheduled to be considered by the Board at the December 2003 hearing. ARB staff expects to conduct additional workshops this fall to further define the necessary modifications to the regulation.

F. Potential Federal Requirements That May Apply to Stationary Diesel-Fueled Engines

On December 19, 2002, U.S. EPA proposed *The National Emission Standard for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines* (RICE NESHAP or NESHAP) in the Federal Register (40 CFR Part 63). (EPA, 2002) As currently proposed, the RICE NESHAP would establish requirements for stationary internal combustion engines rated above 500 horsepower (hp) that are located at major sources of hazardous air pollutants (HAPs). The comment period for this NESHAP ended on February 18, 2003. The U.S. EPA is in the process of reviewing the comments received. Based on their current schedule, the NESHAP will be promulgated in February 2004. The rule would be effective immediately giving new sources 180 days to comply, and existing sources up to three years to comply.

As proposed, the RICE NESHAP would affect facilities in California that are also subject to the proposed ATCM. The NESHAP requires installation of a diesel oxidation catalyst (DOC) to reduce HAPs (aldehydes) and carbon monoxide. It also includes recordkeeping, monitoring, and testing requirements. Because the NESHAP does not recognize particulate matter (PM) as a public health concern, it is not designed to reduce PM emissions, and it does not allow for the installation of a DPF in lieu of a DOC. As a result, facilities complying with the ATCM may be required to install additional controls and to conduct continuous monitoring with little or no additional environmental benefit. ARB staff raised several concerns regarding the RICE NESHAP proposal including: (1) that the State and Local agencies have authority to regulate PM to reduce diesel exhaust risk, which is also a goal in the Urban Air Toxic Strategy; (2) that the EPA should recognize that DPFs are more effective in reducing diesel engine emissions; and (3) the current definition of "reconstruction" may affect facilities in California using retrofit technologies and may exceed the reconstruction cost threshold. A copy of ARB's comment letter to the U.S. EPA is included in Appendix J.

The U.S. EPA is also in the process of writing a New Source Performance Standard (NSPS) for diesel engines. The NSPS will include controlling emissions, including PM, from existing engines and small diesel engines (as low as 50 hp). With work beginning on the NSPS, the EPA may consider a delay in implementing the diesel engine part of the NESHAP until the NSPS is complete.

The ARB staff will continue to work with the EPA to coordinate both the NESHAP and NSPS requirements with the ARB stationary ATCM.

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