California Environmental Protection Agency
AIR RESOURCES BOARD

STAFF REPORT: INITIAL STATEMENT OF REASONS FOR PROPOSED REQUIREMENTS FOR STATIONARY DIESEL IN-USE AGRICULTURAL ENGINES

Stationary Source Division
Emissions Assessment Branch

September 2006

State of California
AIR RESOURCES BOARD

STAFF REPORT: INITIAL STATEMENT OF REASONS FOR PROPOSED RULEMAKING

Public Hearing to Consider

PROPOSED REQUIREMENTS FOR STATIONARY DIESEL IN-USE AGRICULTURAL ENGINES

To be considered by the Air Resources Board on November 16-17, 2006, at:

California Public Utilities Commission
Auditorium
505 Van Ness Avenue
San Francisco, California 94102

Air Resources Board
P.O. Box 2815
Sacramento, California 95812

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State of California
AIR RESOURCES BOARD

PROPOSED REQUIREMENTS FOR STATIONARY DIESEL IN-USE AGRICULTURAL ENGINES

Staff Report

Primary Contributors

Barbara Cook
Renèe Coad
Ronald Hand
Jon Manji
Ronald Walter
Andrew Alexis

Reviewed by:

Richard A. Boyd II, Manager
Process Evaluation Section

Erik White, Manager
Technical Analysis Section

Daniel Donohoue, Chief
Emission Assessment Branch

Robert Fletcher, Chief
Stationary Source Division

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Executive Summary

I. INTRODUCTION

The Air Resources Board (ARB or Board) staff is proposing to amend the Airborne Toxic Control Measure for Stationary Compression Ignition Engines (Stationary Diesel Engine ATCM or existing ATCM). The Stationary Diesel Engine ATCM is part of ARB's ongoing effort to reduce diesel particulate matter (diesel PM) from diesel-fueled engines and vehicles. The existing ATCM was adopted in February 2004 and later amended in March 2005 and September 2005. In June 2005, the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) and the South Coast Air Quality Management District (SCAQMD) Boards approved revisions to local rules that included oxides of nitrogen (NOx) emission standards for in-use agricultural engines. Although SJVUAPCD Rule 4702 and SCAQMD Rule 1110.2 do not specifically regulate diesel PM, they are expected to result in the replacement of older in-use agricultural engines with electric motors or new, cleaner diesel or other engines.

The primary purpose of the proposed amendments is to establish in-use stationary diesel agricultural engine emission standards in order to reduce diesel PM emissions, exposure, and health risk. ARB staff anticipates that most of the in-use stationary diesel agricultural engines affected by the proposed amendments are used to pump water for the irrigation of crops. The proposed amendments do not apply to diesel-fueled agricultural wind machines. Additionally, agricultural emergency standby generator set engines and remotely-located agricultural engines in federal attainment areas for PM and ozone are exempt from in-use agricultural engine emission limits, provided they are registered with their air pollution control or air quality management district (local air district) and meet monitoring and recordkeeping requirements.

The proposed ATCM uses the ARB/United States Environmental Protection Agency (U.S. EPA) off-road engine certification standards to determine which engines need to be replaced/upgraded, by when, and what emission limit must be met. The off-road engine certification standards are phased in as Tiers 1 through 4. The standards become more stringent as each tiered standard takes effect in four to five year increments. Pre-1996 engines are generally referred to as noncertified (Tier 0) engines because they were manufactured before the ARB/U.S. EPA off-road certification standards were effective.

As a result of the proposed amendments, most in-use stationary diesel agricultural engines, greater than 50 horsepower (hp), will meet Tier 3 or Tier 4 off-road compression ignition (CI) engine certification standards by 2022. An overview of these

standards is provided in Table 1 (page ES-3) and in Appendix C of the Staff Report. The proposed amendments include provisions for agricultural engine emission standards, local air district registration programs, paying registration fees assessed by local air districts for the purposes of implementing and enforcing the ATCM, and other requirements. Additionally, the proposed amendments require owners or operators to fuel their stationary diesel agricultural engines with California Air Resources Board-approved diesel fuel (also known as CARB diesel fuel) or another ATCM-compliant fuel. Staff is also proposing several minor changes to the existing ATCM to address clarity and implementation issues.

ARB staff expects that most growers will comply with the emission limits with the installation of a new stationary diesel engine that meets the applicable emission standards. Compliance with the emission standards may also be achieved with the installation of an electric motor. There are several incentive programs which could play an important role in providing early emissions reductions by encouraging growers to voluntarily replace existing noncompliant stationary diesel agricultural engines with electric motors or new, cleaner Tier 3- or Tier 4-certified engines. For example, two incentive programs, the Pacific Gas and Electric Agricultural Internal Combustion Engine or AG-ICE Conversion Incentive Program and the Southern California Edison Time-of-Use Pumping Agricultural Internal Combustion Engine or TOU-PA-ICE Program, provide reduced electricity rates and electrical line and service extension allowances for growers who voluntarily replace stationary diesel agricultural irrigation pump engines with electric motors. Incentive programs such as these are expected to encourage compliance with the proposed amendments and may also be used to help comply with SJVUAPCD and SCAQMD rules.

The proposed amendments will directly affect California farms and ranches using stationary diesel agricultural engines; primarily those using these engines to pump water for the irrigation of crops. Indirectly affected businesses include diesel engine manufacturers, dealers, and distributors; businesses that sell pumps and associated equipment; installation, maintenance, and repair services; and providers of electrical motors. Other potentially affected businesses include electric power providers, fuel suppliers, and those businesses providing diesel exhaust after-treatment devices for these engines.

Currently, approximately 8,600 stationary engines are operating to power irrigation pumps. Diesel PM and oxides of nitrogen (NOx) emissions from operation of these engines is approximately 1.6 tons per day and 33 tons per day, respectively. These engines are located mostly in the San Joaquin and South Sacramento valleys. After full implementation of this ATCM (2022) and the previously mentioned local air district rules, diesel PM emissions will be reduced to 0.4 tons per day and NOx will be reduced to 11 tons per day.

II. SUMMARY OF THE PROPOSED AMENDMENTS

A. In-Use Agricultural Engines

1. Background

Staff is proposing that in-use stationary diesel engines meet emission limits equal to or more stringent than the ARB and United States Environmental Protection Agency (U.S. EPA) new off-road CI engine Tier 3 or Tier 4 certification standards. These emission limits could be met by replacing an existing diesel engine with a new diesel engine or electric motor, switching to an alternative fuel, retrofitting an existing engine with emission controls, or using any other equally effective emissions control technology. Staff finds that the proposed emission limits represent best available control technology for in-use agricultural diesel engines.

The proposed ATCM uses the off-road engine certification standards to determine which engines need to be replaced, by when, and what emission limit must be met. The off-road engine certification standards are phased in as Tiers 1 through 4 standards. The standards become more stringent as each tiered standard takes effect in four to five year increments. Pre-1996 engines are generally referred to as noncertified (Tier 0) engines because they were manufactured before the ARB/U.S. EPA off-road certification standards were effective.

The tiered standards differ depending on horsepower size and engine application. Table 1 shows the tiered standards for PM and NOx for 175 horsepower (hp) through 299 hp off-road engines. About one-third of in-use agricultural pump engines are in the 175-299 hp size range. There are also alternative compliance paths that allow delays in meeting one requirement in exchange for accelerated implementation of another.

Table 1. 175-299 hp Off-Road Engine Standards and Effective Dates[1]

Category	Effective Date of Standard[1]	PM Standard g/bhp-hr	NOx Standard g/bhp-hr
Tier 0 (noncertified)	Pre-1996	NA Est. 0.55	NA Est. 11.0
Tier 1	1996	0.40	6.9
Tier 2	2003	0.15	4.8
Tier 3	2006	0.15	3.0
Tier 4	2011	0.01	0.30

1. Effective date varies depending on the horsepower range. The 175-299 hp range is presented as an example. See Appendix C of the staff report for the complete summary of the standards.

The ARB emission inventory shows approximately 12,500 diesel engines are used to power agricultural irrigation pumps Statewide. Approximately 8,600 of these pump engines are greater than 50 horsepower and stationary -- the majority (approximately 5,000) are operated in the San Joaquin Valley. The South Coast Air

Basin has a small number of greater than 50 hp stationary diesel-fired agricultural pump engines (18 of the Statewide total). Statewide, the average size of the diesel-fired pump engines is approximately 200 hp. The operation of these engines varies regionally and from year to year. The Statewide average operation of diesel agricultural pump engines is estimated to be about 1,000 hours per year. Table 2 shows the distribution of engine sizes currently operating in the State. Table 3 shows the distribution of engines currently operating in the State by emission rate standards.

Table 2. 2005 Statewide Distribution of Agricultural Engines by Size Category[1,2]

Horsepower Range	Percent of Statewide Engines	Total Engines
>50 to 74	4	340
75 to 99	4	340
100 to 174	48	4,130
175 to 750	44	3,800
>750	<1	2

1. Values have been rounded.
2. Baseline year 2003 engine population forecasted to 2005.

Table 3. Statewide Distribution of Agricultural Engines by Tier Standard

Engine Emission Level	Number of Engines	Percent of Total Engine Population
Tier 0 (pre-1996)	3,600	42
Tier 1 (1996-2005)	3,500	40
Tier 2 (2001-2010)	1,500	18

2. Emission Limits

The basic proposal requires Tier 0 engines to be replaced with Tier 3 engines, or an equally effective alternative (i.e. an electric motor, alternative fuel, non-diesel engine, or retrofit control system), in the 2011-2012 time frame. Tier 1 and 2 engines would be replaced with Tier 4 engines, or an equally effective alternative, in the 2014 -2015 time frame.

Engines that were built before 1996 would be required to comply first. Most Tier 0 stationary agricultural engines would be required to meet Tier 3 emission limits by

December 31, 2010 or 2011, depending on the horsepower range. Table 4 summarizes the PM emission limits and proposed compliance dates for Tier 0 engines.

Table 4. Proposed Emission Standards and Compliance Dates for Tier 0 (pre-1996) Agricultural Engines Except Generator Engines

Horsepower Range	PM Limit (g/bhp-hr)	Tier Level of Limit	Compliance Date
>50 to 74	0.30	Tier 3 or Interim Tier 4	Dec. 31, 2011
75 to 99	0.30	Tier 3	Dec. 31, 2011
100 to 174	0.22	Tier 3	Dec. 31, 2010
175 to 750	0.15	Tier 3	Dec. 31, 2010
>750	0.075	Tier 4	Dec. 31, 2014

We are proposing PM emission limits for Tier 0 agricultural engines that are used with electric generators different from the PM limits and compliance dates for non-generator engines. We are doing this to ensure that the emission requirements for engines used with electric generators in non-agricultural and agricultural applications are identical. Table 5 summarizes the PM emission limits and proposed compliance dates for Tier 0 agricultural engines used with an electric generator.

Table 5. Proposed Emission Standards and Compliance Dates for Tier 0 (pre-1996) Agricultural Generator Engines

Horsepower Range	PM Limit (g/bhp-hr)	Tier Level of Limit	Compliance Date
>50 to 74	0.02	Tier 4	Dec. 31, 2015
75 to 99	0.01	Tier 4	Dec. 31, 2015
100 to 174	0.01	Tier 4	Dec. 31, 2015
175 to 750	0.15	Tier 3	Dec. 31, 2010
>750	0.075	Tier 4	Dec. 31, 2014

Tier 1 and Tier 2 stationary agricultural engines would be required to meet Tier 4 standards by December 31, 2014 or 2015, again depending on the horsepower range. For Tier 1 or 2 engines that were purchased after 2002 or 2003, the compliance date would be 12 years after the date the engine was manufactured. Table 6 summarizes the PM emission limits and proposed compliance dates for Tier 1 and Tier 2 engines.

Table 6. Proposed PM Emission Standards and Compliance Dates for Tier 1 and Tier 2 Agricultural Engines

Horsepower Range	PM Limit (g/bhp-hr)	Tier Level of Limit	Compliance Date[1]
>50 to 74	0.02	Tier 4	Dec. 31, 2015
75 to 99	0.01	Tier 4	Dec. 31, 2015
100 to 174	0.01	Tier 4	Dec. 31, 2015
175 to 750	0.01	Tier 4	Dec. 31, 2014
>750	0.075	Tier 4	Dec. 31, 2014

1. Compliance date is the date listed or when the engine is 12 years old, whichever is later.

In addition to PM emission limits, the cleaner Tier 3 and Tier 4 engines will emit significantly less NOx. Table 7 shows the percent reduction in diesel PM and NOx when an older engine is replaced with a new engine.

Table 7. Percent Reduction in Diesel PM and NOx in Relation to Change in Certification Standard

Certification Standard Change	Percent PM Reductions	Percent NOx Reductions
Tier 0 to Tier 3	70	75
Tier 1 to Tier 4	97	95
Tier 2 to Tier 4	94	92
Tier 3 to Tier 4	94	90

3. Registration Requirements

Historically, agricultural engines have not been subject to local air district permitting or registration programs. As a result, most local air districts have limited data on the stationary diesel engines used in agricultural operations. In order to implement the proposed ATCM, there is a minimum set of information about the engine that local air districts will need. To ensure that this information is available, the proposed ATCM contains a requirement that all new and in-use stationary diesel agricultural engines be registered with the local air district. Under the registration program, engine owner/operators would be required to submit registration information for each new and in-use engine to the district which would provide at a minimum:

- Contact information of the engine owner/operator;
- Make, model, year, and horsepower of the engine;
- The annual hours of operation and fuel usage of the engine;
- The location of the engine; and

- Proximity of the engine to homes, schools, and hospitals.

Local air districts, at their discretion, would have the authority to assess fees to assist with implementation of the registration program as well as general implementation and enforcement of the ATCM. Accordingly, the ATCM requires that owner/operators pay any fees assessed for this purpose.

4. Residual Risk Provision

The Air Toxics "Hot Spots" Information and Assessment Act (AB 2588 or “Hot Spots” Program) was enacted in September 1987. Under the “Hot Spots” program, stationary sources are required to report the types and quantities of certain substances their facilities routinely release into the air. The goals of the program are to collect emission data, identify facilities having localized impacts, ascertain health risks, and notify nearby residents of significant risks. In September 1992, the California State Legislature modified the "Hot Spots" Program to address the reduction of significant risks. The modifications require owners of significant-risk facilities to reduce their risks to nearby receptors. The local air districts implement the “Hot Spots” program.

Depending on proximity to receptors, it is possible that some owner/operators who replace their Tier 0 engines with Tier 3 engines in accordance with the proposed amendments may still pose a risk to nearby receptors. Pursuant to the goals of the AB 2588 “Hot Spots” Program to address such risk issues, the proposed amendments contain a provision allowing local air districts, on a site-specific basis, to extend compliance with ATCM emission standards provided the engine meets Tier 4 engine Off-Road CI Engine Certification Standards for PM (i.e., 0.02 g/bhp-hr for an engine greater than 50 bhp but less than 75 bhp or 0.01 g/bhp-hr for an engine greater than or equal to 75 bhp) no later than four years after the otherwise applicable ATCM compliance date. Staff does not anticipate residual risk issues from Tier 4 engines with because they have very low PM emission rates. Compliance may also be satisfied with the installation of an electric motor.

5. Fuel Use Requirements

The proposed amendments require that owners and operators of all in-use stationary diesel agricultural engines use only California Air Resources Board or "CARB" diesel or another ATCM-compliant fuel. Because these are the only fuels legally available in the State, no compliance problems are expected with this requirement.

6. Recordkeeping, Reporting, and Monitoring Requirements

For the purposes of public outreach and compliance assurance, owners and operators of in-use stationary diesel agricultural engines will be subject to recordkeeping and reporting requirements. The recordkeeping and reporting requirements are similar to those for other stationary diesel engines in the existing ATCM. These requirements

include maintaining records of annual hours of operation. Monitoring requirements include technical specifications for hour meters and diesel particulate filters.

7. Exemptions

The proposed amendments do not apply to engines 50 hp and less or to diesel-fueled agricultural wind machines. The exclusion of 50 hp and less engines is consistent with the exemption provided for stationary non-agricultural engines. Staff does not believe that this will have any measurable impact on the emission reductions from in-use agricultural engines since most engines in this horsepower range are portable engines. Additionally, staff is not proposing requirements for in-use diesel-fueled wind machines because they are operated infrequently, located remotely (e.g., in the middle of orchards), and the emissions disperse rapidly due to the action of the fan.

Staff is proposing limited exemptions for in-use stationary diesel agricultural emergency standby generator set engines and remotely-located engines. Emergency standby engines used for agriculture would be exempt from the emission limits in the ATCM but would have to meet the registration and reporting requirements. Staff has not found any information to suggest that there is a large population of these engines or that they are operated frequently. As more information becomes available, we will reevaluate the appropriateness of this exemption.

The remote-location exemption would apply to in-use agricultural engines in areas that are in attainment of the federal ozone and PM standards. The engine would have to be located at least one-half (½) mile from the nearest receptor and either be limited to 200 hours per year if the engine is a Tier 0 or Tier 1 engine or 600 hours per year if the engine is a Tier 2 or Tier 3 engine. With these restrictions, staff estimates that the potential cancer risk would be below one chance per million. The owner would have to apply for the exemption, satisfy registration requirements, install an hour meter, and keep operating records. Operating records would be required to be available to local air districts and the ARB upon request. Should the engine ever exceed the operating hour limit, the exemption would expire and the owner would have to comply with the applicable provisions of the ATCM within 18 months.

8. Health Impacts

a. Emissions and Emission Reductions

ARB staff estimates that the proposed amendments, in conjunction with local air district regulations, engine replacement incentive programs, and a negative growth factor for California's agricultural industry will reduce diesel PM emissions from stationary diesel agricultural engines by about 60 percent by 2012 and by 80 percent by 2022. These actions will result in a total reduction of diesel PM of 440 tons per year. ARB staff also estimate that NOx emissions will be reduced by about 50 percent by 2012 and 70 percent by 2022 for a potential total reduction of 8,100 tons per year of NOx.

Tables 8 and 9 summarize diesel PM and NOx emissions and reductions for in-use stationary diesel agricultural engines.

Staff anticipates that the bulk of the emission reductions will occur sooner than the compliance dates. We believe that this will occur because incentive funding is tied to actions prior to the compliance dates in the ATCM. Therefore, staff anticipates that significant emission reductions will occur in the 2008-2010 and 2011-2012 timeframes.

Table 8. Projected Statewide Diesel PM Emissions and Emission Reductions[1,2]

Year	Uncontrolled Emissions TPD (TPY)[3]	Controlled Emissions TPD (TPY)	Emission Reductions From 2005 TPD (TPY)	Percent Emission Reductions (2005-2022)
2005	1.6 (570)	1.6 (570)	0	0
2012	1.3 (460)	0.7 (240)	0.9 (330)	60
2022	0.8 (300)	0.4 (130)	1.2 (440)	80

1. For in-use stationary diesel agricultural pump engines.
2. All values have been rounded.
3. Baseline year 2003 emissions forecasted to 2005.

Table 9. Projected Statewide NOx Emissions and Emission Reductions[1,2]

Year	Uncontrolled Emissions TPD (TPY)[3]	Controlled Emissions TPD (TPY)	Emission Reductions From 2005 TPD (TPY)	Percent Emission Reductions (2005-2022)
2005	33 (12,000)	33 (12,000)	0	0
2012	27 (10,000)	17 (6,200)	16 (5,800)	50
2022	19 (6,900)	11 (3,900)	22 (8,100)	70

1. For in-use stationary diesel agricultural pump engines.
2. All values have been rounded.
3. Baseline year 2003 emissions forecasted to 2005.

b. Potential Cancer Risk

Because a diesel PM monitoring technique is not currently available, diesel PM concentrations from diesel-fueled agricultural pump engines were estimated using computer modeling techniques. To estimate exposure and the associated cancer risk due to the operation of pump engines, staff used assumptions encompassing a fairly broad range of possible operating conditions. Based upon the assumptions and conditions evaluated, the results showed that engines operating at Tier 0 (noncertified) and Tier 1 certification emission rates could potentially cause significant health risks at the point of maximum impact. Table 10 shows the reduction of potential cancer risk as engines operate at the proposed lower emission standards. Based on the engine population distribution shown in Table 3, staff expects the regulation will result in more than an 85 percent reduction in cancer risk.

Table 10. Reduction of Potential Cancer Risk at Proposed Emission Standards

Emission Standard Change	Percent Reduction (%)
Tier 0 to Tier 3	73
Tier 1 to Tier 4	98
Tier 2 to Tier 4	93

To illustrate the potential near-source cancer risk, staff performed a risk assessment analysis on an example pump engine operating at 225 bhp. At Tier 4 emission standards (0.01 g/bhp-hr) and operating at 1,000 hours annually, Table 11 shows that the potential cancer risk is less than or equal to one in a million. However, for emission rates of 0.15 g/bhp-hr (Tier 2 and Tier 3) and higher (noncertified and Tier 1), potential risks can be significant. These risk values assume a continuous exposure duration of 70 years for a nearby resident and use the methodology specified in the 2003 OEHHA health risk assessment guidelines (OEHHA, 2003) and the ARB Interim Risk Management Policy (ARB, 2003d).

Table 11. Potential Cancer Risks from In-Use Agricultural Engines[1,2]

Emission Standards	Distance from Source (meters)				
	100	400	800	1200	1600
Noncertified	67	13	6	4	3
Tier 1	49	10	5	3	2
Tier 2 and Tier 3	19	4	2	1	< 1
Tier 4	1	< 1	< 1	< 1	< 1

1. Assumes 1000 hours of operation and Fresno meteorology data.
2. Potential cancer risk in chances per million 70-year exposure duration.

As shown on Table 11, the potential cancer risk of a Tier 4 engine operating 1,000 hours per year is below one chance per million at 400 meters (approximately ¼ mile). The risk would still be less than one chance per million if the annual hours of operation were doubled (2,000 hours).

9. Environmental Impacts

No significant adverse environmental impacts are expected to occur from adoption of, and compliance with, the proposed requirements for in-use agricultural engines. Implementation of the proposed amendments would reduce directly emitted and secondarily formed PM levels, provide both near source and regional risk reduction, and contribute to the overall effort of reducing PM mortality, hospital admissions, and lost work days. Additionally, reductions in NOx and ROG from in-use stationary diesel agricultural engines as a result of the proposed amendments would contribute to

reducing exposures to ambient ozone. Emissions of NOx and ROG are precursors to the formation of ozone in the lower atmosphere and diesel engine exhaust contributes to ozone precursors. 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.

10. Economic Impacts

Both the compliance costs and emission reductions associated with the economic impacts discussed in this staff report are for all geographic areas and local air pollution control districts within California except for the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) and the South Coast Air Quality Management District (SCAQMD). The projected costs and emission reductions for these two districts are omitted from the economic impacts discussion due to the presence of existing district rules that include the same engines that are covered by the proposed amendments.

Table 12 presents estimates of the per engine cost to comply with the proposed ATCM. These costs assume that existing engines will be replaced with new diesel engines and do not account for any incentive funding.

Table 12. Estimated Cost-Per-Engine for Affected Businesses[1,5]

In-Use Engine Size (HP)	Capital Cost Range [2] ($)	Annual Cost Range [3] ($)
50 - 74	6,900 - 8,200	1,200 - 2,100
75 - 99	4,300 - 9,600	1,200 - 1,700
100 - 174	8,000 - 12,700	1,800 - 2,200
175 - 299	11,300 - 18,000	2,600 - 3,300
300 - 599	16,600 - 26,500	3,800 - 4,300
600 - 750	20,500 - 32,700	4,700 - 5,300
>750 (1725)[4]	21,700 - 172,200	21,500 - 26,900

1. Estimates include prorated loss-of-use costs for an in-use engine, one rebuild, and initial air district fees.
2. The capital cost estimate assumes a lump-sum, one-time cost.
3. This is the capital cost amortized over the remaining expected useful life of the engine, which, depending on the specific engine size category and emissions tier, varies from one to eight years. Includes a range of expected local air district fees and owner/operator time to prepare and submit registration forms and other air district paperwork. A real interest rate of five percent is used. The estimated amount represents uniform annual payments to cover the capital cost and local air district fees.
4. For the greater than 750 HP category, an engine size of 1,725 hp is used for calculation purposes. This is the largest size engine expected in this category.
5. Values have been rounded; for exact figures, please refer to the "Per-Engine Costs" worksheet in Appendix F.

Staff estimates that the total cost of the proposed amendments to affected businesses would range from $34 million to $42 million over the 22-year analysis period used (i.e., 2008-2029). No significant economic impacts are expected for school districts, local public agencies, universities, State agencies, or federal agencies because few, if any, of these agencies operate affected engines. ARB administrative costs for outreach, educational efforts, and technical assistance are estimated to be a one-time cost of approximately $62,000 and would be absorbed within existing budgets and resources.

There will be significant costs to local air districts to implement and enforce the ATCM. Staff estimates that local air districts costs to implement a registration program (initial registration) would be approximately $45 to $90 per engine for the first year. An additional annual cost of $26 to $242 per engine (after the first year) is estimated to cover an inspection and registration update at the time of final compliance with the ATCM. State law allows the local air districts to charge fees to recover these costs. These costs would not impact the SJVUAPCD and SCAQMD because these districts have already established registration or permitting programs similar to the registration program in the proposed amendments.

Staff estimated cost-effectiveness of the proposed amendments in terms of cost per pound of diesel particulate matter (PM) reduced. Diesel PM reductions from the proposed amendments have been estimated to range from 31 tons per year (tpy) to 124 tpy between 2011-2029 for all areas of the State except for the San Joaquin Valley Unified Air Pollution Control District and the South Coast Air Quality Management District. Considering only the benefits of reducing primary diesel PM emissions, the average cost-effectiveness of the proposed amendments is $11 per pound of diesel PM reduced (the cost-effectiveness range is from $1 to $22 per pound of diesel PM reduced). These values are on the lower end of cost for similar measures the Board has approved.

11. Alternatives to the Proposed Amendments

ARB staff considered two alternatives to the proposed in-use agricultural engine emission standards: not requiring emission standards or requiring that all stationary diesel agricultural engines be replaced with electric motors.

The no action alternative would not be consistent with the goals outlined in the Diesel Risk Reduction Plan and would not adequately ensure Statewide reductions in diesel PM from this source category. It would result in many older, dirtier diesel engines continuing to operate throughout the State. The elevated PM levels would contribute to incidence of lung cancer and other adverse health impacts.

From an air quality and health risk perspective, ARB staff supports electrification as a control strategy. Electrification is currently supported by the availability of voluntary incentive programs. An example of these voluntary approaches can be found in two utility incentive programs, the Pacific Gas and Electric Agricultural Internal Combustion Engine or AG-ICE Conversion Incentive Program and the Southern California Edison Time-of-Use Pumping Agricultural Internal Combustion Engine or TOU-PA-ICE Program. These incentive programs provide reduced electricity rates and electrical line and service extension allowances for growers who voluntarily replace stationary diesel agricultural irrigation pump engines with electric motors. These programs are designed to work in conjunction with ARB's Carl Moyer Program and other programs that provide funding toward the purchase of electric motors.

Switching from diesel to electric power would virtually eliminate in-use agricultural engine diesel PM and other emissions. However, staff found that operational and cost obstacles associated with switching from diesel engines to electric motors exist for some agricultural operations. Therefore, rather than an all electric option, ARB staff has proposed emission standards that may be met using a variety of compliance strategies, including: replacement with electric motors, cleaner diesel engines, or spark-ignited engines; retrofit with add-on diesel PM control devices; and use of alternative fuels.

B. Other Proposed Amendments

1. Background

As previously mentioned, the proposed amendments also include several additional changes to improve the clarity of some provisions in the ATCM and facilitate implementation and enforcement. These additional amendments are motivated by a number of issues that have been raised by the local air districts, engine manufacturers, and industry representatives regarding the implementation the ATCM. Staff concluded from discussion with the various interested parties that the ATCM should be amended to adequately resolve these issues.

The proposed additional amendments are intended to clarify the applicability of the ATCM, and to improve implementation and enforcement of the ATCM. The additional amendments do not impose any new standards, implementation timelines, or other requirements. As such, no health, environmental, or economic impacts are expected from the proposed additional amendments.

2. Proposed Amendments

Based on staff consultations with interested parties and to address implementation and compliance issues, staff is proposing to:

- Streamline the fuel reporting requirements for emergency standby engines;
- Update references to the tariff schedule established by the California Public Utilities Commission as it relates to the Rolling Blackout Reduction Program (RBRP);
- Add a new subsection to the definition of “maintenance and testing” that allows local air districts the discretion to not count additional hours of operation necessary to ensure operability of a repaired emergency generator as “maintenance and testing;”
- Harmonize the definition of CARB diesel fuel in the ATCM to be consistent with ARB fuel regulations;
- Provide for new sell-through provisions;
- Add a new compliance option to meet the 0.01 g/bhp-hr diesel PM standard for new and in-use prime and emergency standby engines;
- Clarify the definition of “emergency use” for emergency standby engines at United States Department of Defense facilities performing launch tracking, and

provide a schedule to have these engines meet the 0.01 g/bhp-hr diesel PM standard by December 31, 2009;
- Provide local air districts the discretion to exempt certain stationary CI engines used for: testing burners or CI engines; the testing of fuels, fuel additives, or emission control devices at research and development facilities; and training at educational facilities;
- Provide for the use of biodiesel, biodiesel blends, Fischer-Tropsch diesel, and emulsified diesel without verification; and
- Update references.

It should be noted that two of the proposed amendments listed above provide local air districts with discretionary authority when implementing the ATCM. Additionally, given the administrative nature of the additional amendments, there were no practical alternatives to consider.

At the hearing, staff may consider proposing additional changes to the Board regarding the use of engines enrolled in demand response programs. These changes may include allowances for the Executive Officer to approve additional hours of operation beyond those already provided for in the ATCM for utility demand response programs (DRP) engines, requirements for prioritizing the use of DRP engines during Stage 2 or Stage 3 electrical alerts, or other changes as appropriate.

III. KEY ISSUES

A. Remotely-located/Low-use Engines

During our public workshops, engine owners raised an issue about engines that are operated infrequently or are remotely located. Owners indicated that their diesel engines were operated very few hours per year except in drought years when surface water was not available. These engine owners felt that replacing these infrequently operated engines would create a financial hardship. They also expressed the concern that this hardship was compounded by the fact that due to the limited hours of operation they would not qualify for incentive funding.

In an effort to address this issue, staff is proposing a remotely located engine provision for engines in areas that are in attainment of the federal ozone and PM standards. As previously discussed, If there are no receptors within ½ mile (2,640 feet) of the engine, the engine may qualify for a remote-location exemption. Tier 0 and Tier 1 engines that operate no more than 200 hours per year and Tier 2 and Tier 3 engines that operate no more than 600 hours per year would not have to meet the emission limits in the proposed ATCM. However, the engine would need to be registered with the local air district and have a hour meter installed. Additionally, the owner or operator would be required to keep records of annual hours of operation, notify the local air district if the engine operates more than the allowed number of hours, and install a new compliant engine (within 18 months) if the allowed operating hours are exceeded.

IV. PUBLIC OUTREACH

Since the amendments to the ATCM in September 2005, ARB staff has been working collaboratively with the various stakeholders to identify the issues and develop proposed draft language. The proposed amendments have been discussed with the California Air Pollution Control Officers Association (CAPCOA) during several joint CAPCOA/ARB conference calls. Additionally, ARB staff made extensive contacts with industry representatives, local air districts, environmental/pollution prevention and public health advocates, and other interested parties through meetings, telephone calls, and electronic mail. Furthermore, staff held two public consultation meetings (specifically geared to farmers and their concerns) and four public workshops to discuss amendments to the ATCM. Finally, to further expand public outreach opportunities, staff made information available via ARB's web site (http://www.arb.ca.gov/diesel/ag/inuseag.htm).

V. ENVIRONMENTAL JUSTICE

A public process that involves all parties affected by the proposed ATCM is an important component of ARB rulemaking activities. The proposed amendments are consistent with the ARB's environmental justice policy to reduce health risks from toxic air contaminants (TAC) in all communities, including low-income and minority communities. The proposed amendments will reduce diesel PM and other emissions from in-use stationary diesel agricultural engines in all areas of the State where these engines are located. The amount of emission reduction in low-income, minority, and other communities will depend on the number and use of stationary diesel agricultural engines in the area.

VI. IMPLEMENTATION AND ENFORCEMENT

To efficiently and effectively implement the proposed ATCM, we believe that the following actions need to be taken by ARB staff:

- Immediately begin an outreach program to inform farmers and engine suppliers of the requirements of the ATCM and incentive funding options such as the Ag-ICE and Carl Moyer programs;
- Encourage the installation of electric motors for engines that are in close proximity to residential areas, schools, and hospitals;
- Develop registration guidance and risk analysis screening tools to assist local air districts and engine owner/operators;
- Support local air district actions to establish fees to implement and enforce the ATCM; and
- Provide oversight and assistance as needed.

VII. RECOMMENDATION

We recommend the Board approve the proposed amendments to the ATCM presented in Appendix A of the staff report. The addition of in-use stationary diesel agricultural engine emission standards will reduce diesel PM and other air pollutant emissions, exposure, and health risk across California, particularly in areas where agriculture is a major industry. Additionally, the other proposed amendments help to improve the clarity, implementation, and enforcement of the ATCM. The other proposed amendments are necessary additions and/or changes to clarify the intentions of the adopted ATCM. ARB staff believes the proposed amended ATCM is technologically feasible and necessary to carry out the Board's responsibilities under State law.

I. INTRODUCTION

A. Overview

This report provides the basis for the California Air Resources Board (ARB or Board) staff's proposal to amend the Airborne Toxic Control Measure for Stationary Compression Ignition Engines (ATCM) to add in-use stationary diesel agricultural engine requirements. As part of this action, staff is also proposing other clarifying modifications to the existing ATCM requirements in order to improve clarity, implementation, and enforcement.

This report discusses the existing ATCM, California's estimated in-use stationary diesel agricultural engine population and emissions, the regulatory proposal to reduce emissions from these agricultural engines, regulatory alternatives considered, potential environmental and economic impacts, and other proposed changes to the ATCM. In addition, the information in Staff Report: Initial Statement of Reasons for Proposed Rulemaking – Airborne Toxic Control Measure for Stationary Compression Ignition Engines, September 2003, and Staff Report: Initial Statement of Reasons for Proposed Revisions to the Airborne Toxic Control Measure for Stationary Compression Ignition Engines, April 2005, are hereby incorporated into this report by reference. The proposed amendments are presented in Appendix A and explained in Chapter IV of this Staff Report.

B. Existing Control Measure for Stationary Compression Ignition Engines

1. Initial Adoption

At a public hearing on February 26, 2004, the Board adopted the ATCM for Stationary Compression Ignition Engines in accordance with California's Toxic Air Contaminants Program. The ATCM is designed to reduce particulate matter (diesel PM) emissions from diesel-fueled engines by establishing best available control technology (BACT)-based PM emission performance standards for new and in-use stationary compression ignited engines.

Among other provisions, the ATCM contained a 0.15 grams per brake horsepower-hour (g/bhp-hr) PM standard for new stationary diesel agricultural engines. Just prior to the effective date of the standard (i.e., January 1, 2005), local air districts and agricultural engine distributors notified ARB of their concerns about the availability of compliant greater than 50 to less than 175 bhp diesel agricultural pump engines. During an extensive investigation, ARB staff found very limited availability of 0.15 g/bhp-hr PM-compliant new stationary diesel agricultural pump engines in the greater than 50 to 99 bhp size range and limited availability in the 100 to less than 175 bhp size range. The limited availability of compliant engines posed technical and cost issues, particularly regarding engine replacement.

2. Emergency Action

At a public hearing on March 17, 2005, the Board approved temporary emergency regulatory changes to the ATCM to maintain the public health benefits being achieved as a result of voluntary agricultural engine replacement incentive programs and to prevent disruption and economic hardship for farmers and agricultural equipment distributors and dealers. These emergency changes replaced the 0.15 g/bhp hr PM standard for small to medium new stationary diesel agricultural pump engines with ARB/federal new off-road/nonroad compression ignition engine certification standards of 0.30 g/bhp-hr PM for engines greater than 50 to 99 bhp and 0.22 g/bhp-hr PM for engines 100 to less than 175 bhp (the Board has adopted new off-road compression ignition engine certification standards identical to federal new nonroad compression ignition engine certification standards). The emergency changes allowed diesel PM emission and exposure reductions to continue by eliminating the technical and economic obstacles to the voluntarily replacement of older, dirtier, uncontrolled diesel agricultural engines with new, cleaner engines certified to ARB/federal standards (the existing ATCM provides emission performance standards for new stationary diesel agricultural engines but does not require that existing older agricultural engines be replaced).

At a public hearing on May 26, 2005, the Board approved amendments consistent with the emergency changes to the ATCM. Among other provisions, the amendments replaced the 0.15 g/bhp-hr PM standard for all greater than 50 to less than 175 bhp new stationary diesel agricultural engines (except generator sets) with new off-road engine PM certification standards. New stationary diesel agricultural generator sets remained subject to the 0.15 g/bhp-hr PM standard. ARB's regulatory advisory, Amendments to the Airborne Toxic Control Measure for Stationary Compression Ignition Engines, August 2005, contains a summary of all of the amendments adopted at the May 2005 Board hearing. A copy of the regulatory advisory is available at http://www.arb.ca.gov/diesel/dieselag/ag.htm. A copy of the ATCM, effective September 9, 2005, is available at http://www.arb.ca.gov/diesel/dieselag/ag.htm.

C. Summary of Proposed Amendments

During the February 26, 2004, public adoption hearing, the Board directed ARB staff to investigate the opportunities and challenges associated with replacing California's existing (i.e., in-use) population of stationary diesel agricultural engines with electric motors. During its investigation, ARB staff identified many variables associated with farm and ranch electrical power use in California (see Chapters III and IV of this Staff Report). Because of these variables, ARB staff concluded that any decision about the relative desirability or difficulty of converting stationary diesel agricultural engines to electric motors must be made on a site-by-site basis (ARB, 2004).

ARB staff also investigated other possible means of reducing diesel exhaust emissions, exposure, and health risk from this source, including voluntary incentive programs. An example of voluntary approaches can be found in two utility incentive programs, the

Pacific Gas and Electric Agricultural Internal Combustion Engine or AG-ICE Conversion Incentive Program and the Southern California Edison Time-of-Use Pumping Agricultural Internal Combustion Engine or TOU-PA-ICE Program. These incentive programs provide reduced electricity rates and electrical line and service extension allowances for growers who voluntarily replace stationary diesel agricultural irrigation pump engines with electric motors. These programs are designed to work in conjunction with ARB's Carl Moyer Program and other programs that provide funding toward the purchase of electric motors.

As a result of this investigation and discussions with stakeholders, ARB staff is proposing emission performance standards for in-use stationary diesel agricultural engines (except wind machines, emergency standby generator sets, and remotely-located engines) that may be met by a variety of compliance options, including electrification, replacement with new engines, retrofit, use of an alternative fuel (e.g., natural gas, propane), and use of an alternative diesel fuel use. Tables I-1 and I-2 summarize the proposed emission performance standards.

Table I-1. Proposed Emission Standards for Noncertified Greater than 50 bhp In-Use Stationary Diesel-Fueled Engines Used in Agricultural Operations

Horsepower Range	Application	Compliance On or After December 31	Diesel PM Not to Exceed (g/bhp-hr)	NOx Not to Exceed (g/bhp-hr)
Greater Than 50 But Less Than 75	Generator Sets	2015	0.02	Off-Road CI Engine Certification Standards for an off-road engine of the same model year and maximum rated power[1,2]
	All Other Applications	2011	0.30	
Greater Than or Equal to 75 But Less Than 100	Generator Sets	2015	0.01[3]	
	All Other Applications	2011	0.30	
Greater Than or Equal to 100 But Less Than 175	Generator Sets	2015	0.01[3]	
	All Other Applications	2010	0.22	
Greater Than or Equal to 175 But Less Than or Equal to 750	All Applications	2010	0.15	
Greater Than 750	All Applications	2014	0.075	

1. If no limits have been established for an off-road engine of the same model year and maximum rated power, then the in-use stationary diesel-fueled engine used in an agricultural operation shall not exceed Tier 1 standards in title 13, CCR, section 2423 for an off-road engine of the same maximum rated power irrespective of model year.
2. Standards also apply to HC, NMHC+NOx, and CO
3. The less than or equal to 0.01 g/bhp-hr diesel PM emission standard may be satisfied by combining a Level 3 Verified Diesel Emission Control Strategy with a certified Tier 3 engine (or Tier 2 engine for engines greater than 750 bhp) that meets the 0.15 g/bhp-hr PM emission standard.

Table I-2. Proposed Emission Standards for Tier 1- and Tier 2-Certified Greater than 50 bhp In-Use Stationary Diesel-Fueled Engines Used in Agricultural Operations - All Applications

Horsepower Range	Compliance On or After December 31	Diesel PM Not to Exceed (g/bhp-hr)	NOx Not to Exceed (g/bhp-hr)
Greater Than 50 But Less Than 75	2015 or 12 years after the date of initial installation, whichever is later	0.02	Off-Road CI Engine Certification Standards for an off-road engine of the same model year and maximum rated power[1,2]
Greater Than or Equal to 75 But Less Than 175	2015 or 12 years after the date of initial installation, whichever is later	0.01[3]	
Greater Than or Equal to 175 But Less Than or Equal to 750	2014 or 12 years after the date of initial installation, whichever is later	0.01[3]	
Greater Than 750	2014 or 12 years after the date of initial installation, whichever is later	0.075	

1. If no limits have been established for an off-road engine of the same model year and maximum rated power, then the in-use stationary diesel-fueled engine used in an agricultural operation shall not exceed Tier 1 standards in title 13, CCR, section 2423 for an off-road engine of the same maximum rated power irrespective of model year.
2. Standards also apply to HC, NMHC+NOx, and CO
3. The less than or equal to 0.01 g/bhp-hr diesel PM emission standard may be satisfied by combining a Level 3 Verified Diesel Emission Control Strategy with a certified Tier 3 engine (or Tier 2 engine for engines greater than 750 bhp) that meets the 0.15 g/bhp-hr PM emission standard.

The proposed amendments also include provisions for local air district agricultural engine registration programs and paying registration fees assessed by local air districts for the purposes of implementing and enforcing the ATCM. Additionally, the proposed amendments require owners or operators to fuel their stationary diesel agricultural engines with California Air Resources Board-approved diesel fuel (also known as CARB diesel fuel) or another ATCM-compliant fuel.

In June 2005, the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) and the South Coast Air Quality Management District (SCAQMD) Boards approved revisions to local rules that included oxides of nitrogen (NOx) emission standards for in-use agricultural engines. Although SJVUAPCD Rule 4702 and SCAQMD Rule 1110.2 differ from the proposed amendments in that they do not specifically regulate diesel PM, they are nonetheless expected to result in the replacement of older in-use agricultural engines with electric motors or new, cleaner diesel or other engines.

D. Need for Proposed Amendments

Diesel PM is one of a complex mixture of potentially harmful inorganic and organic compounds in diesel exhaust emitted from several sources, including agricultural

engines. These engines are used in the growing of crops or the raising of fowl or animals. In California, in-use stationary diesel agricultural engines are primarily used to pump water for irrigating crops. In contrast to many nonagricultural engines that are used near commercial and residential centers on a frequent basis, agricultural engines are typically operated in remote locations on a limited basis depending on the growing season and crop irrigation requirements. ARB staff estimates that approximately 8,600 greater than 50 horsepower (hp) stationary diesel agricultural irrigation pump engines are located in California (year 2005). Of these engines, an estimated 42 percent are pre-1996 uncontrolled (i.e., noncertified engines). See Chapter III and Appendix D of this Staff Report for more information.

Implementation of the proposed amendments would reduce directly emitted and secondarily formed PM levels, provide both near source and regional risk reduction, and contribute to the overall effort of reducing PM mortality, hospital admissions, lost work days due to exposure to PM, and adverse public health and environmental effects associated with the use of stationary diesel agricultural engines. Additionally, reductions in NOx and ROG from in-use stationary diesel agricultural engines as a result of the proposed amendments would contribute to reducing exposures to ambient ozone. No existing or proposed federal, State, or local air district control measures specifically addresses diesel PM emissions from these agricultural engines.

II. REGULATORY STATUS AND PUBLIC OUTREACH

This chapter discusses the Air Resources Board's (Board or ARB) regulatory authority and relevant federal, State, and local air quality regulations and programs. In addition, this chapter describes the outreach efforts the ARB staff made to provide industry, local air districts, other stakeholders, and the general public with opportunities to participate in the development of the proposed amendments.

A. Regulatory Authority

The California Health and Safety Code (H&SC) provides the ARB with the authority to adopt the proposed amendments to the ATCM. Health and Safety Code sections 39600 (General Powers) and 39601 (Standards, Definitions, Rules, and Measures) 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.

California's Toxic Air Contaminants 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 toxic air contaminants (TAC) in California. The Air Toxics “Hot Spots” Information and Assessment Act (Health and Safety Code 44300-44394) allows for the collection of emissions data to identify facilities having localized impacts, to ascertain risks and to notify nearby residents of significant risks. Owners of significant-risk facilities would then have to reduce their risks below the level of significance.

The identification phase of the Toxic Air Contaminants Program requires 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. 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 ARB's evaluation and SRP's review, the Board may formally identify a TAC at a public hearing. Following identification of a substance as a TAC, Health and Safety Code sections 39658 and 39665 require ARB, with the participation of the air pollution control and air quality management districts (local air 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. This assessment is known as the risk management phase.

In August 1998, the Board identified diesel particulate matter (PM) as a TAC and, in October 2000, ARB staff published the Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel Engines and Vehicles (Diesel Risk Reduction Plan) (ARB 2000). The Diesel Risk Reduction Plan was the initial product of the risk management phase and serves as the needs assessment under the AB 1807 process. In the Diesel Risk Reduction Plan, ARB staff recommended control measures to reduce

diesel PM from a variety of diesel vehicles and engines, including new and in-use stationary diesel agricultural engines.

In 1999, California's Toxic Air Contaminants 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, in October 2001, OEHHA published the Prioritization of Toxic Air Contaminants Under the Children's Environmental Health Protection Act. In this report, OEHHA designated diesel PM as one of five priority TACs that "may cause infants and children to be especially susceptible to illness" (OEHHA 2001). Additional requirements established by Senate Bill 25 (H&SC §39669.5) direct ARB to adopt control measures, as appropriate, to protect public health, particularly infants and children, from priority TACs.

During regulatory development, staff considered the Diesel Risk Reduction Plan, statutes, and additional details specific to the regulation of in-use stationary diesel agricultural engines as reflected in this Technical Support Document. ARB staff proposes these amendments to the ATCM as one of several measures to fulfill the goals of the Diesel Risk Reduction Plan authorized by, and in compliance with, the requirements of Health and Safety Code sections 39666 and 39669.5 to prevent endangerment to public health.

B. Summary of Relevant Regulations and Programs

This section briefly summarizes significant regulations and programs relevant to ARB staff's proposal to add emission standards and other requirements for in-use stationary diesel agricultural engines to the ATCM. Further information regarding the regulatory framework for stationary compression ignition engines in general is available in Chapter III of Staff Report: Initial Statement of Reasons for Proposed Rulemaking – Airborne Toxic Control Measure for Stationary Compression Ignition Engines, September 2003.

1. Federal National Emission Standards for Hazardous Air Pollutants (NESHAP) for Stationary Reciprocating Internal Combustion Engines (RICE)

The NESHAP for Stationary RICE (40 CFR Part 63, Subpart ZZZZ) only affects stationary diesel engines greater than 500 brake horsepower (bhp), installed or reconstructed on or after December 19, 2002, and located at a major source of hazardous air pollutants. Affected engines must comply by August 16, 2004, or upon start up, if initial installation occurs after August 16, 2004. Generally, the NESHAP requires either 70 percent or more reduction in carbon dioxide emissions or compliance with a 580 parts per billion by volume (ppbv) formaldehyde exhaust emission limit, initial and periodic testing, monitoring, recordkeeping, and reporting. The NESHAP does not address PM emission limits. Further details may be found in the final rulemaking for the NESHAP (Vol. 69, No. 114, June 15, 2004, FR 33474).

Because of the size, age, and location of most California in-use stationary diesel agricultural engines, very few are expected to be subject to the NESHAP for Stationary RICE requirements. In contrast, all of California's approximately 8,600 greater than 50 bhp in-use stationary diesel agricultural irrigation pump engines and a very small number of nonemergency generator set engines would be subject to the proposed amendments to the ATCM. Also, in contrast to the NESHAP, the proposed amendments to the ATCM primarily address diesel PM emissions although other toxic substances in diesel exhaust are also likely to be reduced.

2. New Source Performance Standards (NSPS) for Stationary Compression Ignition Internal Combustion Engines

The federal performance standards for new stationary compression ignition internal combustion engines (40 CFR Parts 60, 85, 94, 1039, 1065, and 1068) apply to owners or operators of engines constructed, modified, or reconstructed after July 11, 2005, and to manufacturers of 2007 and later model year engines. The NSPS affects all sizes and types of new stationary compression ignition engines, including those used in agricultural operations. In general, the stationary compression ignition engine NSPS for oxides of nitrogen (NOx), PM, carbon monoxide (CO), non-methane hydrocarbons (NMHC) or NMHC+NOx require the same levels of exhaust emissions as federal/California new nonroad/off-road mobile engine certification standards (see Section II.B.3 and Appendix C). Further detail may be found in the final rulemaking for the NSPS (Vol. 71, No. 132, July 11, 2006, FR 39154).

Although a variety of options are available for complying with the proposed ATCM, most growers are expected to meet the proposed standards through the replacement of noncertified and Tier 1- and Tier-2-certified engines with electric motors or new, cleaner engines that meet Tier 3 or Tier 4 certification standards. Since the proposed ATCM requires new engines to meet the off-road certification standards in effect at the time the engine is purchased, compliance with the ATCM would also result in compliance with the NSPS.

3. Federal Nonroad/California Off-Road New Mobile Engine Certification Standards

This brief discussion of federal and California exhaust emission standards for new nonroad/off-road mobile engines has been provided because these certification standards have been referenced in regulations affecting stationary engines, including stationary diesel agricultural engines. Examples of such regulations include the federal NSPS for stationary compression ignition engines, San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) Rule 4702, and ARB staff's proposed amendments for in-use stationary diesel agricultural engines.

For the purpose of regulation, diesel and other internal combustion engines are typically classified as either stationary or mobile. Mobile engines are further divided into on-road and nonroad (also known as "off-road") engines. On-road engines are used in vehicles

designed to travel on highways and other roads. Nonroad engines are designed for off-road use. As a practical matter, the very same engine model is commonly used for both stationary and mobile nonroad or "portable" applications. Since most of the engines manufactured in the United States are used in mobile engine applications, it makes sense for stationary compression ignition engine regulations to require the same exhaust emission levels as those already established for mobile nonroad engines.

Federal certification standards for new nonroad mobile compression ignition (CI) engines are set forth in the United States Code of Federal Regulations (CFR) Title 40, Chapter I, Part 89, Subpart B and Part 1039, Subpart B. California Off-Road CI Engine Certification Standards for the same subset of engines are set forth in title 13, section 2423 of the California Code of Regulations (CCR). Federal and California certification standards consist of exhaust limits expressed in grams per kilowatt-hour (g/kw-hr) for PM, HC, NOx, HC+NOx, or NMHC+NOx. The standards vary depending on engine size (i.e., brake horsepower), model year, and pollutant. Federal and California standards have been harmonized (i.e., essentially equivalent across engine sizes) since 1999. Over time, these certification standards become more stringent in four phases or "tiers" according to engine size and model year. For example, Tier 2 standards are currently in effect for engines less than 175 and greater than 750 bhp and Tier 3 standards are currently in effect for engines greater than or equal to 175 but less than 750 bhp. An overview of off-road CI engine certification standards is presented in Appendix C of this staff report.

Both the federal and California nonroad/offroad CI engine certification standard regulations allow engine manufacturers to participate in a Tier 4 Averaging, Banking, and Trading Program. This program provides flexibility in complying with emissions standards while achieving overall emission reduction goals by allowing some engine models to exceed Tier 4 standards if their emissions would be offset by cleaner-than-required engine models of the same manufacture.

Though compliant for the purposes of the certification standards, new "flexibility" engines would only be allowed if they meet the PM emission limit for the model year engine specified in the ATCM. "Flexibility" engines are not expected to present a problem for implementation of the proposed amendments because such engines are required to be identified by labels in California.

4. Federal and California Fuel Standards

Fuel standards for aromatic content, sulfur and other fuel components play a critical role in meeting exhaust emission limits. While federal and California fuel standards specifically apply to fuel producers and distributors, the existing ATCM additionally requires new stationary diesel-fueled agricultural engines and other diesel-fueled engines to use CARB Diesel Fuel or verified alternative diesel fuels. The proposed amendments to the ATCM would extend this requirement to in-use stationary diesel-fueled agricultural engines.

Federal commercial fuel standards are set forth in 40 CFR Part 80 and California fuel standards are set forth in title 13 California Code of Regulations, sections 2281-2285. Fuel suppliers in California must provide diesel fuel that meets both federal and California fuel standards, whichever is more stringent. Since CARB Diesel and verified alternative diesel fuels are the only diesel fuels available in California, ARB staff believe that most, if not all, owners and operators of in-use stationary diesel agricultural engines already use compliant fuel.

5. San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) Rule 4702

In June 2005, SJVUAPCD revised District Rule 4702, Internal Combustion Engines - Phase 2, to address District ozone and PM attainment strategies and Senate Bill 700 (Stats. 2003, Ch. 479). Among other provisions in Rule 4702, the District extended NOx, CO, and volatile organic compound (VOC) emission standards to greater than 50 brake horsepower (bhp) compression-ignited internal combustion engines used in agriculture. Except for engines greater than 500 bhp and operating 1,000 or more hours per year, these emission performance standards are scheduled to be phased in beginning in 2010 and are aligned with Tier 3 or Tier 4 new nonroad mobile engine certification standards. Noncertified engines greater than 500 bhp and operating 1,000 or more hours per year are required not to exceed 80 parts per million (ppm) NOx, 2,000 ppm CO, and 750 ppm VOC by January 1, 2008. However, the compliance deadline may be extended to January 1, 2010, if the owner agrees to replace such an engine with an electric motor.

The SJVUAPCD currently permits engines at agricultural operations that emit 50 percent or more of major source air pollutant thresholds. In order to implement and enforce Rule 4702 emission limits for internal combustion engines located at nonmajor agricultural operations, Rule 4702 requires that owners register these engines in the District's Permit-Exempt Equipment Registration Program to be set forth in District Rule 2250.

Although SJVUAPCD Rule 4702 does not specifically regulate diesel PM, it should result in the replacement of older in-use stationary diesel agricultural engines with electric motors or new, cleaner diesel or other engines, just as the proposed amendments to the ATCM will do. In some cases SJVUAPCD Rule 4702 provisions are more stringent with respect to standards or compliance dates. (SJVUAPCD, 2006)

6. South Coast Air Quality Management District (SCAQMD) Rule 1110.2

Effective June 2005, SCAQMD revised District Rule 1110.2, Emissions From Gaseous- and Liquid-Fueled Engines, to extend NOx, CO, and VOC emission standards to greater than 50 bhp gaseous- and liquid-fueled agricultural engines. The owner or operator of an existing stationary agricultural engine may replace the engine with an electric motor or otherwise comply with the Rule 1110.2 emission limits in Table II-1.

Table II-1. SCAQMD Rule 1110.2 Stationary Agricultural Engine Emission Limits

NOx (ppm)[1]	CO (ppm)[1]	VOC (ppm)[1,2]
36	2000	250

1. Corrected to 15 percent oxygen on a dry basis and averaged over 15 minutes.
2. Measured as carbon.

Depending on engine age and emissions at the agricultural operation, compliance with the SCAQMD Rule 1110.12 standards in Table II-1 is required in the 2008-2010 timeframe.

Similar to SJVUAPCD Rule 4702, SCAQMD Rule 1110.2 does not specifically regulate PM emissions, but should result in diesel PM and other pollutant reductions. SCAQMD Rule 1110.2 provisions are more stringent with respect to non-PM pollutant standards and compliance dates. Fewer than 20 greater than 50 bhp in-use stationary diesel agricultural irrigation pump engines are located in the SCAQMD. (SCAQMD, 2005)

7. Incentive and Other Programs for In-Use Stationary Diesel Agricultural Engine Replacement and Retrofit

Incentive programs could play an important role in providing early emissions reductions by encouraging growers to voluntarily replace existing noncertified and Tier 1- and Tier 2-certified stationary diesel agricultural engines with electric motors or new, cleaner Tier 3- or Tier 4-certified engines well before the compliance deadlines of the proposed amendments to the ATCM. Assistance programs, such as the Agricultural Assistance Program are expected to encourage compliance with the proposed amendments and may also be used to help comply with SJVUAPCD and SCAQMD rules. The most significant programs are briefly described below.

a. Utility Incentive Programs for Converting Stationary Agricultural Engines to Electric Motors

Two utility incentive programs (Pacific Gas and Electric's Agricultural Internal Combustion Engine or AG-ICE Conversion Incentive Program and Southern California Edison's Time-of-Use Pumping Agricultural Internal Combustion Engine or TOU-PA-ICE Program) provide reduced electricity rates and electrical line and service extension allowances for growers who voluntarily replace stationary diesel agricultural irrigation pump engines with electric motors. These utility incentive programs are designed to work in conjunction with ARB's Carl Moyer Program and other programs that provide funding toward the purchase of electric motors. Replaced engines must be destroyed unless there are special circumstances approved by ARB or the local air district overseeing incentive funding.

Under the utility incentive programs, eligible growers may submit applications for reduced electrical rates from August 1, 2005, through July 31, 2007, or, until electric line extension funding is no longer available, whichever is earlier. The programs provide up

to 10 years of rates significantly below standard agricultural electric rates (i.e., a 20 percent initial rate reduction for participants in the Pacific Gas and Electric service areas and a 12.5 percent initial rate reduction for participants in the Southern California Edison service area). The total average electrical rate is subject to increases of 1.5 percent each year through 2015.

Predictable agricultural electric rates are expected to promote switching from diesel- to electric-powered irrigation pumps. In addition, the incentive agricultural electric rates have been designed to encourage irrigation during off-peak hours to minimize impacts to the State's electric load (PUC, 2005). More than 1,200 AG-ICE Conversion Incentive Program applications were submitted during the first nine months of the program (Thesen, 2006). Further information about the AG-ICE Conversion Incentive Program is available at http://www.pge.com/agice. Further information about the TOU-PA-ICE Program is available at http://www.sce.com/rebatesandsavings/largebusiness/agricultural/tou-pa-ice.htm.

b. Environmental Quality Incentives Program

The Environmental Quality Incentives Program (EQIP) is a federally-funded program administered by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). Established in 1998, this voluntary program has been designed to provide technical and financial assistance to farmers and ranchers who must comply with local, state, and federal environmental regulations. Under EQIP, state NRCS offices are allocated funds to distribute for the promotion of nationally-prioritized conservation practices at local levels. A farm or ranch owner must apply to the state NRCS office in order to participate in the program. Application approval results in a contract obligating EQIP funds to the participant's project. This process enables the federal government to provide up to 50 percent of the cost of engine replacement to farmers and ranchers located in severe or extreme federal non-attainment areas for ozone. Through 2004, EQIP has provided approximately 3.4 million dollars to San Joaquin Valley farmers and ranchers for engine replacement in order to reduce NOx emissions. Further information about EQIP is available at http://www.nrcs.usda.gov/programs/farmbill/2002/ and http://www.ca.nrcs.usda.gov/programs/equip/. (NRCS, 2003; NRCS, 2005)

c. Carl Moyer Program

The Carl Moyer Memorial Air Quality Standards Attainment Program (Carl Moyer Program) provides incentive funds for voluntary projects that reduce NOx, particulate matter 10 microns or less in diameter (PM10), and reactive organic gas (ROG) emissions. Program grants fund the incremental cost of replacing older engines and equipment with electric motors or cleaner-than-required new engines and equipment at a reduced cost to the owner. Projects involving engine retrofits with add-on emission control technology are also eligible for grants.

ARB is responsible for developing and updating Carl Moyer Program guidelines and local air district fund allocation. The local air districts are responsible for ensuring matching funds, project selection, fund disbursement, monitoring, and enforcement. ARB's Carl Moyer Program Guidelines require potential participants to submit project applications to the local air districts. These applications are evaluated for eligibility on the basis of cost-effectiveness. Funds are granted solely to projects which will result in surplus emission reductions (i.e., emission reductions must occur before any applicable regulatory compliance dates have taken effect).

In its initial four years, the Carl Moyer Program has provided nearly 25 million dollars for the replacement of agricultural engines. Table II-2 shows the estimated agricultural engine replacement and PM10 and NOx emission reductions attributed to the Carl Moyer Program through fiscal year 2002-2003. Further information about the Carl Moyer Program is available at http://www.arb.ca.gov/msprog/moyer/guidelines/current.htm. (ARB, 2006a)

Table II-2. Carl Moyer Program Diesel Agricultural Engine Emission Reductions Through Fiscal Year 2002-2003

Irrigation Pump Engines		Tons Per Year PM 10 Reduced	Tons Per Year NOx Reduced
Diesel to Natural Gas	Diesel to Cleaner Diesel		
56	2,150	92	1,911

d. Agricultural Assistance Program

Among other provisions, Assembly Bill 923 (Firebaugh, 2004) established a voluntary Agricultural Assistance Program which authorizes local air districts to increase their motor vehicle fee surcharges in order to fund compliance with emission reduction requirements for previously unregulated agricultural sources of air pollution. Previously unregulated agricultural sources are sources that were unregulated as of January 2005, but subject to regulation at the time an Agricultural Assistance Program grant is made. Unlike the Carl Moyer Program, the Agricultural Assistance Program does not require the emission reductions to be surplus. This means that projects are eligible for funding if emission reductions are achieved within three years of applicable rule adoption, or by the compliance date of an applicable rule, whichever is later. Further information about the Agricultural Assistance Program is available at http://www.arb.ca.gov/msprog/moyer/guidelines/current.htm. (ARB, 2006a)

C. Public Outreach

The public became aware of the ARB's intention to promulgate control measures for diesel engines, including stationary diesel agricultural engines, through the development and publication of the Diesel Risk Reduction Program in 2000. In February 2004, during the public hearing to adopt the original ATCM for Stationary Compression Ignition Engines, the Board specifically directed ARB staff to investigate in-use stationary diesel agricultural engine emission reduction requirements. Therefore, ARB staff conducted public outreach to ensure that affected and interested parties had the opportunity to participate in the development and review of the proposed amendments to the ATCM.

From October 2004 through September 2006, ARB staff met with various groups to discuss regulatory concepts, emission inventory issues, potential health risk, economic impacts, and other aspects of the proposed amendments. Those groups included California Air Pollution Control Officers Association (CAPCOA) committees such as the Toxics and Risk Managers Committee and the Enforcement Managers Committee. Discussions were also held with the Diesel PM Agricultural Working Group and various agricultural industry representatives. ARB staff outreach efforts also included agricultural site-visits and numerous telephone calls and electronic mail with representatives from agricultural stakeholders. Additionally, ARB staff sent notices of public meetings to the agriculture commissioners of every county in California.

In February 2005, ARB staff established a website dedicated to the in-use stationary diesel agricultural engine amendments (http://www.arb.ca.gov/diesel/ag/inuseag.htm). An electronic listserve (to join the listserve, one may access the website or http://www.arb.ca.gov/listserv/listserv.php) has been used on an ongoing basis to notify interested parties about the availability of fact sheets, draft regulatory proposals, information about the regulatory process, and public meeting notices and presentations. The listserve has grown to more than 1,500 individuals and organizations representing affected industries, environmental and citizen groups, and the public. In addition, approximately 3,900 contact persons identified by local air districts received notices of ARB public meetings by regular mail. A summary of participating stakeholders is given in Table II-3. Tables II-4, II-5, and II-6 highlight public outreach events from October 2004 through September 2006.

Table II-3. Participating Stakeholders

Type of Company/Organization	Name of Company/Organization
Agricultural association/group	Agricultural Energy Consumers Organization California Citrus Growers California Cotton Growers and Ginners Association California Farm Bureau Federation Nisei Farmers League
Engine control system manufacturers	Engine Manufacturers Association Caterpillar Inc. Cummins John Deere
Engine distributors and dealers	Cummins West, Inc. Quinn Power Systems Western Power Products, Inc.
Environmental Groups	Coalition for Clean Air Earth Justice Environment California Environmental Defense Environmental Health Counsel Green Environment Natural Resources Defense Council Sierra Club
Fuel delivery and public utilities companies	Cleaire Advanced Emission Controls Pacific Gas & Electric (PG&E) Southern California Edison (SCE)
Government Agencies	California Energy Commission, California Department of Food and Agriculture California Department of General Services County Agricultural Commissioners of Weights and Measures California's Local air districts Public Utilities Commission United States Department of Agriculture United States Environmental Protection Agency
Others	University of California , Davis University of California, Fresno California Air Pollution Control Officers Association State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officials (STAPPA/ALAPCO)

Table II-4. Summary of Public Outreach Highlights - 2004

Date	Event	Affected and/or Interested Parties Participating or Contacted
February 26	Board Hearing for ATCM for Stationary Compression Ignition Engine ATCM	Industry and public entities using stationary diesel engines, districts, engine manufacturers, general public
March 4 June 17 September 8 (Modesto)	Agriculture Advisory Committee for Air Quality Meeting	Approximately 30 representatives of agricultural organizations (cattle, dairy, growers, farm bureaus), districts; USDA, U.S. EPA, CDFA, DPR
April 27 June 15	Agricultural Energy Subcommittee of the Agricultural Advisory Committee for Air Quality Teleconference	Approximately 10-15 representatives of agricultural organizations; districts; U.S. EPA
October 19, 2004, (Fresno)	Diesel PM Agricultural Working Group	Representatives from AECA, Madera and Fresno County Farm Bureaus, Merced County Agricultural Commission, California Citrus Growers, California Cotton Ginners and California Cotton Growers Association, Fresno Equipment Company, California Farm Bureau Federation, California Grape and Tree Fruit League, Nisei Farmers League, several agribusiness farms, ranches and companies, CAPCOA and several air districts

Table II-5. Summary of Public Outreach Highlights - 2005

Date	Event	Affected and/or Interested Parties Participating or Contacted
January 12 (Modesto) October 6 (Modesto)	Diesel PM Agricultural Working Group	Representatives from AECA, Madera and Fresno County Farm Bureaus, Merced County Agricultural Commission, California Citrus Growers, California Cotton Ginners and California Cotton Growers Association, Fresno Equipment Company, California Farm Bureau Federation, California Grape and Tree Fruit League, Nisei Farmers League, several agribusiness farms, ranches and companies, CAPCOA and several air districts
March 17 May 26	Board Meeting for Emergency Amendments and Board Hearing for Amendments to the ATCM for Stationary Compression Ignition Engines	Industry and public entities using stationary diesel engines, districts, engine manufacturers, general public
October 19-20 (Selma, Bakersfield, Riverdale, Firebaugh)	Agricultural site visits	Western Power Products, Quinn Power Systems, Borba Farms, Pikalok Farming, California Cotton Ginners and California Cotton Growers Association

Table II-6. Summary of Public Outreach Highlights - 2006

Date	Event	Affected and/or Interested Parties Participating or Contacted
February 14-15 (Tulare)	Agricultural Expo	Public event - describe briefly
March 29	Agricultural Day at the State Capitol	Public event - fact sheet regarding proposed ATCM handed out
April 26 (Modesto) April 27 (Sacramento) July 26 (Colusa, Durham) July 27 (Sacramento) September 20 (Sacramento)	Public Workshops/Meetings	Approximately 20 representatives from local air districts, California Farm Bureau Federation, California Cotton Ginners & Growers Association, Engine Manufacturing Association, Quinn Caterpillar, Western Power Inc., PM control device vendors, UC Davis, Contra Costa County Ag. Commissioner Office, USDA Natural Resources Conservation Service Approximately 50 area farmers attended Colusa/Durham meetings.

III. EMISSION INVENTORY, EXPOSURE, AND HEALTH RISK ASSESSMENT

This chapter provides an overview of stationary diesel agricultural engine operation in California and more detailed information regarding the State's in-use stationary diesel agricultural irrigation pump engine emission inventory, exposure, and potential health risk.

A. Emission Inventory

The Airborne Toxic Control Measure for Stationary Compression Ignition Engines (ATCM) defines engines used in agricultural operations (i.e., also referred to as "agricultural engines") as engines used to grow and harvest crops or raise fowl or other animals for the primary purpose of making a profit, providing a livelihood, or conducting agricultural research or instruction by an educational institution. Engines used after harvesting or slaughter for the distribution or processing of agricultural commodities are not considered agricultural engines. The local air districts who will be implementing and enforcing the proposed amendments to the ATCM have years of experience in distinguishing between agricultural and distribution/processing activities.

In California, stationary diesel agricultural engines are primarily used to pump water for the irrigation of crops. They are also used to power agricultural wind machines for the protection of crops during cold weather and may be used in harvesting activities or as back up for electric generation. Agricultural engines are generally operated on a seasonal basis in rural locations in contrast to most nonagricultural engines that are operated year-round in or near heavily-populated areas. The proposed amendments to the ATCM will affect greater than 50 brake horsepower (bhp) in-use stationary diesel agricultural engines with the exception of wind machines, emergency standby generator sets, and certain remotely-located engines (see Chapter IV of this Staff Report).

1. Stationary Diesel-Fueled Agricultural Irrigation Pump Engines

a. Emission Inventory Development

Based on 2002 agricultural census and 2003 survey data, the United States Department of Agriculture National Agricultural Statistics Service estimates that more than 83,000 electric- or fuel-powered agricultural irrigation pumps were operated in California in 2003. Of these pumps, approximately 82 percent were powered by electricity, 15 percent by diesel fuel, and 3 percent by natural gas, liquefied petroleum gas, propane, butane, or gasoline. (USDA, 2002b)

To develop an estimate of the emissions from stationary diesel-fueled pump engines used in agricultural applications, ARB staff developed a methodology that incorporated information from the federal government, other California government agencies, local air districts, and other studies conducted in conjunction with the affected parties. The contributing agencies and organizations are listed in Table III-I. Based on available information, staff believes the methodologies have resulted in a reasonable estimate of

stationary agricultural diesel pump engine emissions. Details and references for the methodology are presented in Appendix D.

Table III-I. List of Contributors to Methodology

Category of Contributor	Contributors Name
Government	California Department of Water Resources ARB Carl Moyer Program U.S. Department of Agriculture Farm and Ranch Irrigation Survey (FRIS) San Joaquin Valley Unified APCD Sacramento Metropolitan AQMD South Coast AQMD U.S. Geological Survey
Engine manufacturers	DDC, Caterpillar, Cummins, and Deutz
Equipment manufacturers	Stewart & Stevenson Valley Diesel
Others	Booz-Allen & Hamilton

b. General Operation of Diesel-Fueled Agricultural Pump Engines

An agricultural diesel-fueled engine is primarily used in two pumping applications. The first application is pumping water from a well directly through an irrigation system to crops or into a canal for later distribution to crops. The second "booster pump" application is pumping surface water from tail water pits or from canals, lakes, or ponds directly to crops or in association with well pump outlet in order to pressurize a sprinkler system. The degree to which each of these two pumping applications occurs depends on the type of crop being irrigated, the weather, and the availability of surface water. For this reason, hours of water pumping vary and may range from less than 100 to several thousand hours per year.

The engines driving the pumps are usually operating at a fixed output (constant load) which requires a constant horsepower from the engines. The constant horsepower of the engine is expressed as a percentage of its maximum capability (also known as the engine's load factor). Because of seasonal variations, such as a lower water table or a loss of pump operating efficiency, engines used in irrigation are often operated at higher horsepower than the pump's optimal design efficiency. Also, wear and tear on the pump may lower its efficiency and water output and require that the engine be operated at a higher load factor than originally designed. Therefore, some growers use engines that are larger than the pump requires in order to start with a lower load factor and increase the engine output (and load factor) as needed. For emission inventory purposes, staff adjusted for such operation by using an average load factor that accounted for the way the engines were being used. The adjusted load factor (65 percent) was obtained after numerous discussions with engines suppliers and studies of affected parties' operations.

c. Stationary Diesel-Fueled Agricultural Pump Engine Population

The 2003 U.S. Department of Agriculture Farm and Ranch Irrigation Survey (FRIS) estimates approximately 12,500 stationary and portable diesel-powered agricultural irrigation pump engines in California. Staff assumed that the diesel-fueled engines were used in the two pumping applications described earlier. Assuming that the distribution of these pump engines are the same as the relative percent in the general pump population, the majority of pump engines are expected to power water pumping from wells into canals or directly to crops (year 2003).

Using 2003 as the baseline year, staff forecast about 8,600 greater than 50 horsepower stationary diesel agricultural pump engines for year 2005. Table III-2 and Table III-3 show the age and size distribution of these engines. Table III-2 indicates that a large number are older more heavily polluting engines. More than half (about 5,000) of the 8,600 engines are expected to be located in the San Joaquin Valley Unified Air Pollution Control District. Table III-3 indicates that most of the engines are medium- to large-sized (i.e., 100 to 750 horsepower range).

Table III-2. 2005 Statewide Distribution of Greater than 50 bhp Stationary Diesel Agricultural Pump Engines (by Tier)[1]

Engine Emission Level	Number of Total Engines	Percent of Total Engines	PM Emissions (ton/day)	NOx Emissions (ton/day)
Tier 0 (Pre-1996)	3,600	42	0.7	14
Tier 1 (1996-2005)	3,500	40	0.6	13
Tier 2 (2001-2010)	1,500	18	0.3	6

1. All values have been rounded.

Table III-3. 2005 Statewide Distribution of Greater than 50 bhp Stationary Diesel Agricultural Pump Engines by Size Category[1,2]

Horsepower Range	Percent of Statewide Engines	Total Engines
>50 to 74	4	340
75 to 99	4	340
100 to 174	48	4,130
175 to 750	44	3,800
>750	<1	2

1. All values have been rounded.
2. Baseline year 2003 engine population forecasted to 2005.

d. Estimated PM Emissions from Stationary Diesel-Fueled Agricultural Pump Engines

Emissions are estimated by multiplying the number of engines by their horsepower rating, load factor, annual operating hours, and emission factor. The basic equation for calculating the emissions of agricultural irrigation pump engines is:

$$E_y = \Sigma\ Pop * EF * Hrs * HP * \%Load$$

where

E = *pollutant specific emissions (tons per year of NOx, HC, CO_2, and diesel PM)*
y = *inventory year*
Pop = *population of diesel agricultural irrigation pumps*
EF = *emission factor (units of g/bhp-hr)*
Hrs = *average annual use in hours*
HP = *average brake horsepower of engine*
%Load = *average engine load factor*

To estimate the total emissions, staff developed a method to group pump engines by horsepower and age. Where available, local district Carl Moyer Program data were used to define engine horsepower at wells, otherwise, the minimum horsepower required to move water for irrigation was calculated. Well locations were determined with GIS software and data from the United States Geological Service, and California Department of Water Resources. This information was used to create county-specific profiles. An emission factor based on the age of the engine was applied to each engine. An adjusted load factor of 65 percent was used to account for the way engines

were being operated at the pumps. An average annual operating time of 1,000 hours based on USDA FRIS, Pacific Gas and Electric (PG&E) agricultural electrical use, local air district and other data were also used to estimate total emissions.

Based on discussions with the public, the net loss of agricultural land Statewide over the past several years, and incentive programs, staff understands that some engines have been removed from service or converted to electric motors. This information (to the extent it could be verified and quantified) is reflected in the uncontrolled emissions forecast for years 2005, 2012, and 2022 shown in Table III-4. Chapter V discusses the controlled emissions forecasted assuming adoption of the proposed amendments to the ATCM.

Table III-4. Projected Statewide Diesel PM and NOx Emissions[1,2]

Year	Uncontrolled PM Emissions TPD (TPY)[3]	Uncontrolled NOx Emissions TPD (TPY)[3]
2005	1.6 (570)	33 (12,000)
2012	1.3 (464)	27 (10,000)
2022	0.8 (303)	19 (6,900)

1. For in-use stationary diesel agricultural engines.
2. All values have been rounded.
3. Baseline year 2003 emissions forecasted to 2005.

2. Stationary Diesel Agricultural Wind Machines

a. General Operation of Agricultural Wind Machines

An agricultural wind machine is an electric motor- or engine-powered fan used exclusively to provide protection to crops during cold weather by mixing warmer atmospheric air with the colder air surrounding a crop. Citrus crops (e.g., oranges, grapefruit, and lemons) are the primary cold-sensitive crops grown in California (Table III-5 shows the State's major citrus-growing areas). Extremely cold temperatures may also damage grapes, avocadoes, and almond trees during the blossom stage. Agricultural wind machines are not located everywhere cold-sensitive crops are grown because localized weather conditions may not require protective measures or because alternative means of averting cold weather damage are used (e.g., pressurized micro-sprinklers).

Table III-5. Major Citrus-Growing Areas In California 2002

County	2002 Citrus Acres
Tulare	110,523
Kern	54,348
Ventura	39,719
Fresno	35,407
Riverside	31,942
San Diego	16,216
Imperial	4,888
San Bernardino	4,864
Madera	4,654

Source: USDA, 2002a

According to agricultural equipment dealers and agricultural industry representatives, agricultural wind machine operation is expensive and labor-intensive. Consequently, an agricultural wind machine is typically operated only when below-freezing temperatures are predicted for two or more consecutive days. In mild winters, agricultural wind machines may not be used at all. In winters with extreme freezing temperatures, agricultural wind machines may be operated up to 80 hours per year. Typical operation is about 45 hours per year and takes place primarily in November and December.

b. Stationary Diesel-Fueled Agricultural Wind Machine Engine Population

Based on information from agricultural equipment dealers, California university agricultural programs, and agricultural industry representatives, ARB staff estimates that approximately 15,000 to 18,000 agricultural wind machines powered by engines or electric motors ranging from 110 to 180 bhp are located in California (typical size is 125 bhp). Only about 1,500 to 2,700 of these machines are expected to be powered by stationary diesel engines. For economic and other reasons, propane is the predominant fuel used by agricultural wind machines in California. In addition, California growers with older stationary diesel-fueled agricultural wind machine engines tend to replace them with spark-ignited propane-fueled engines. As a result, annual sales of new stationary diesel engines for agricultural wind machine applications have steadily declined and Statewide sales are currently estimated at about 10 per year.

c. Estimated PM Emissions from Stationary Diesel-Fueled Agricultural Wind Machine Engines

Specific information regarding the number, age, size, and operation of stationary diesel-fueled agricultural wind machine engines operating in California is not available. Based on available information and the conservative assumption that all of these engines are noncertified with emission rates of 0.55 g/bhp-hr PM, ARB staff estimate PM emissions of about 5 to 9 tons per year (or, less than one percent of the annual PM emissions estimated from diesel agricultural irrigation pump engines).
(CCM, 2005; Cook, 2005c; Phillips, 2005)

3. Other Stationary Diesel Fueled Agricultural Engines and Agricultural Generator Set Engines

a. Applications

Limited information is available regarding the number and characteristics of non-pump diesel engines involved in agricultural activities. ARB staff expects that many of these engines will not be subject to the proposed in-use stationary diesel agricultural engine emission standards because they are portable and/or less than or equal to 50 bhp.

Non-irrigation, non-wind machine agricultural engines may be used in or close to fields for harvesting purposes (e.g., crushing, screening, or wood waste grinding or chipping). Agricultural generator set engines primarily provide back-up power for agricultural irrigation pumps powered by electric motors. Agricultural generator set engines may also be used to provide back-up or primary power for temperature control and lighting for animal enclosures (e.g., poultry houses) or greenhouses. An agricultural generator set engine used solely in emergency situations would be considered an agricultural emergency standby engine.

B. Exposure and Health Risk Assessment

1. Exposure

The exposure and health risk assessment for in-use stationary diesel agricultural engines focuses on irrigation pump engines because they are the most prevalent and utilized of stationary diesel agricultural engines in California. Exposure to stationary diesel agricultural irrigation pump engine emissions in California varies with location. Although agricultural irrigation is a widespread activity in California, the number and use of stationary diesel agricultural irrigation pump engines depends on the crops, growing conditions, and other variables in different areas of the State.

A few California counties are able to rely almost exclusively on gravity-fed irrigation requiring no pumping. In many counties, a combination of gravity-fed and power-assisted irrigation is common. More electric-powered than diesel-fueled agricultural irrigation pumps tend to be used where electricity is readily accessible and economical. Portable and/or less than 50 bhp stationary diesel agricultural irrigation pump engines tend to be used more in areas with plentiful sources of surface water. The greatest potential for exposure is expected in agriculture-intensive areas, such as the San Joaquin Valley and Sacramento Valley, where well-pumping requires the greatest number and use of greater than 50 bhp stationary diesel agricultural irrigation pump engines.

Exposure is also influenced by the tendency of stationary diesel agricultural irrigation pump engines to be located in rural areas with low populations and to be operated on a seasonal (e.g., March through August), rather than year-round, basis.

Specific diesel PM exposure information for stationary diesel agricultural irrigation pump engines is not directly available. Typical ambient PM concentrations reflect both diesel and non-diesel PM emissions from a variety of mobile and stationary emission sources and there are no analytical tools to distinguish diesel PM emissions from different diesel engine applications. Thus, air dispersion modeling is the best means available to provide an assessment of the potential diesel PM exposure levels and health risk from stationary diesel agricultural irrigation pump engines.

2. Health Risk Assessment

a. Considerations and Assumptions

Health risk assessment is a complex process that requires the analysis of many variables to simulate real-world situations. The following key variables can impact the results of a diesel PM health risk assessment for a stationary diesel agricultural irrigation pump engine:

- Diesel PM emissions of engine - The amount of diesel PM emissions from the engine is a function of the engine's emission factor and total annual hours of operation;
- Meteorological conditions - Meteorological conditions affect the dispersion of diesel PM in the air and can have a large impact on resultant ambient concentrations. Higher diesel PM concentrations are found along the predominant wind direction and under calm wind conditions;
- Distance from the receptor - The proximity of the receptor to the engine also affects the diesel PM concentration at the receptor location. Generally, the diesel PM concentration decreases with increasing distance from the engine;
- Exposure duration - Generally, the longer the time of exposure to the PM emissions (duration) the higher the estimated potential health risk; and
- Inhalation rate of receptor - Generally, the higher the inhalation rate, the higher the estimated potential health risk.

b. Dispersion Modeling and Health Risk Assessment Parameters

ARB staff used the U.S. Environmental Protection Agency (U.S. EPA) Industrial Source Complex – Short Term (ISCST3), air dispersion model to predict annual average ambient diesel PM concentrations as a result of standard stationary diesel-fueled agricultural irrigation pump engine operation.

For the purposes of this modeling exercise, engines were chosen for three size categories: less than or equal to (≤) 120 bhp; greater than (>) 120 bhp and ≤ 175 bhp; and > 175 bhp. To represent engines in each of these size categories, stack and emission parameters for pump engines that operate at 86 bhp, 130 bhp, and 225 bhp were used for dispersion modeling to estimate ambient concentrations due to emissions of pump engines.

Ambient concentrations were estimated at distances between 20 and 1,600 meters (1 mile) from the source of emissions to demonstrate risks from pump engine operation. Fresno meteorological data was used to characterize conditions where agricultural pump engine operations are prevalent. Further information regarding the methodology and assumptions used in this modeling exercise are provided in Appendix E.

For the assessment of health risks, emission exposure was assumed to take place for 50 weeks a year for 70 years. The inhalation rate of 302 liter per kilogram-day (L/kg-day) was chosen according to ARB interim health risk management guidelines (ARB, 2003d) and consistent with the Office of Environmental Health Hazard Assessment (OEHHA) Air Toxics Hot Spots Guidance Manual for Preparation of Health Risk Assessments, August 2003 (OEHHA guidelines).

c. Potential Cancer Risk

The estimated potential cancer risk estimate is based on a diesel PM inhalation cancer potency factor of 1.1 kilogram-day per milligram (kg-day/mg) applied to the inhalation dose calculated using estimated annual average ambient diesel PM concentrations from operation of stationary diesel fueled agricultural irrigation pump engines. The estimated maximum potential cancer risk for a 225 bhp engine occurs 60 meters downwind from the engine and the risk decreases as the distance from the engine increases. At 60 meters (196 feet), the potential cancer risk for a 225 bhp at Tier 3 emission rate is about 30 chances in a million. At 1,600 meters (1 mile), potential cancer risk for the same engine is approximately 1 chance in a million. Table III-6 shows potential cancer risks at distances of 20 to 1,600 meters from the engine operating 1,000 hours. Table III-7 shows potential cancer risks for an engine operating 2,000 hours. Figure III-1 also demonstrates the change of potential risk with distance from the emission source operating 1,000 hours. Potential cancer risk estimates for the 86 bhp and 130 bhp sized engines are presented in Appendix E.

Table III-6. Potential Cancer Risk at Various Distances from Diesel-Fueled Pump Engines Operating 1,000 Annual Hours[1,2]

Emission Standards	Distance from Source (meters)												
	20	40	60	80	100	200	400	600	800	1000	1200	1400	1600
Tier 0 (Noncertified)	18	87	102	90	67	31	13	8	6	5	4	3	3
Tier 1	13	64	74	65	49	22	10	6	5	3	3	2	2
Tier 2 and Tier 3	5	24	28	25	19	8	4	2	2	1	1	1	< 1
Tier 4	< 1	2	2	2	1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

1. Fresno meteorological data, 225 bhp engine.
2. Potential cancer risk in chances per million, 70-year exposure duration.

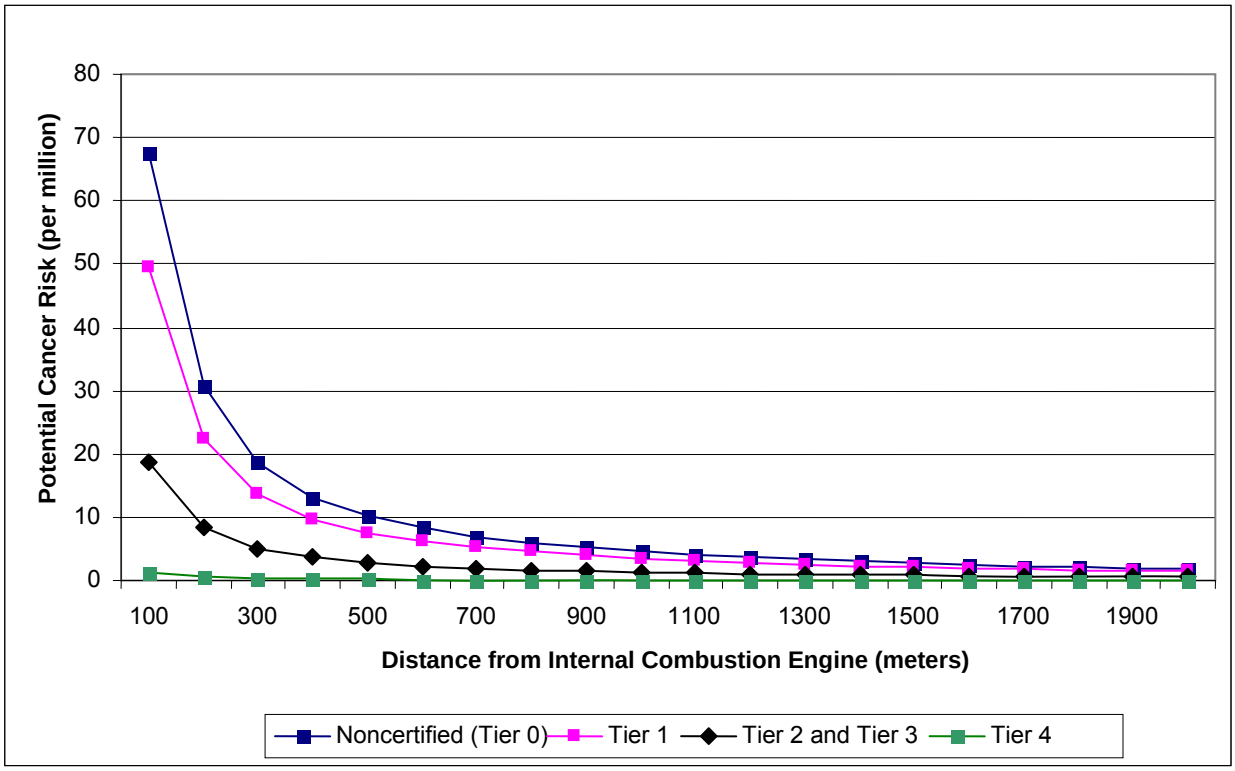
Table III-7. Potential Cancer Risk at Various Distances from Diesel-Fueled Pump Engines Operating 2,000 Annual Hours[1,2]

Emission Standards	Distance from Source (meters)												
	20	40	60	80	100	200	400	600	800	1000	1200	1400	1600
Tier 0 (Noncertified)	32	157	183	162	136	62	27	17	12	10	8	6	5
Tier 1	24	114	133	118	99	45	19	12	9	7	6	4	4
Tier 2 and Tier 3	9	43	50	44	37	17	7	5	3	3	2	2	1
Tier 4	< 1	3	3	3	2	1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

1. Fresno meteorological data, 225 bhp engine.
2. Potential cancer risk in chances per million, 70-year exposure duration.

The potential cancer risk estimates in Table III-6 and Table III-7 reflect potential risk for a possible stationary diesel-fueled agricultural irrigation pump engine. These risk estimates should not be directly applied to any particular engine. Rather, this information is intended to provide an indication of the relative potential levels of cancer risk from these engines. The potential cancer risk estimates in these analyses use conservative assumptions and cancer risks from specific engines are expected to be less than the estimates presented.

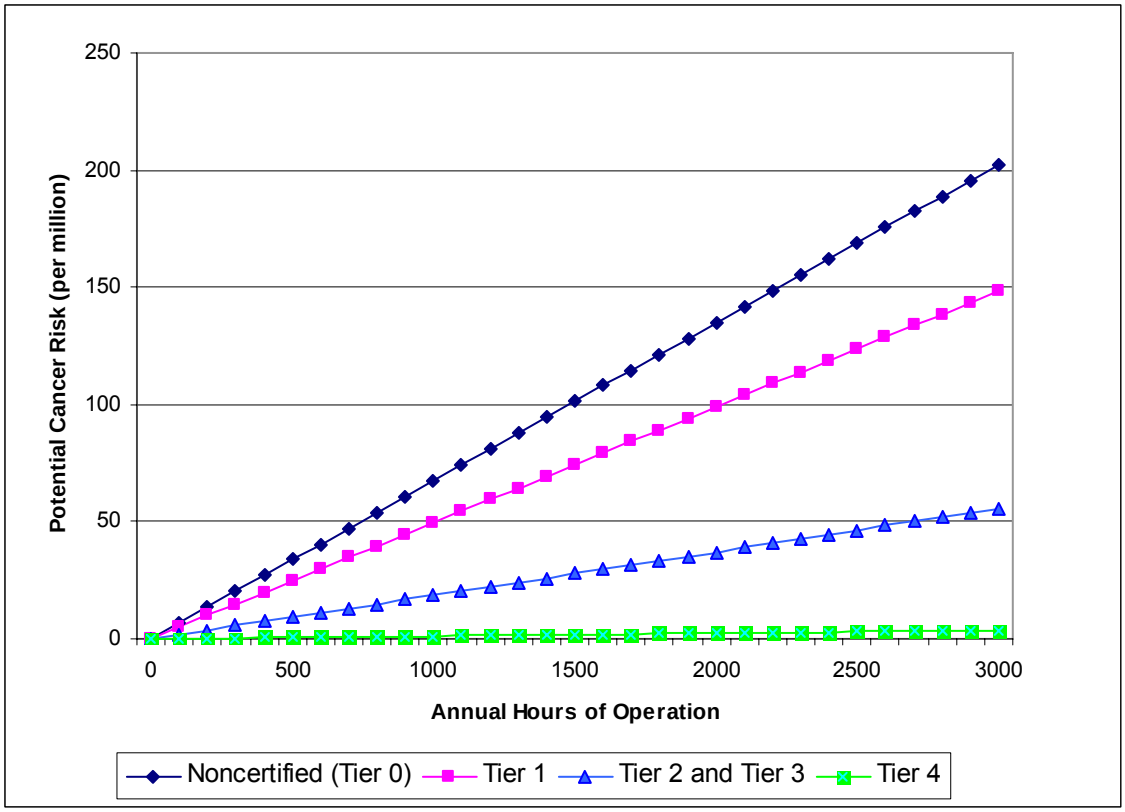
Figure III-1. Potential Cancer Risk in Relation to Distance from Source for Various Diesel PM Emission Standards



Assumptions: Fresno meteorological data, 1,000 annual hours of operation, 225 bhp engine.

In the considerations and assumptions section, we noted that risk is based on the quantity of PM emissions. These emissions and risk will increase with increased annual hours of operation. Figure III-2 demonstrates the increase in potential health risk in relation to increases in annual hours of engine operation.

Figure III-2. Potential Cancer Risk in Relation to Annual Hours of Engine Operation for Various Diesel PM Emission Rates



Assumptions: Fresno meteorological data, 225 bhp engine.

d. Health Effects from Exposure to Diesel PM

Diesel PM and other compounds in diesel exhaust are associated with adverse health effects other than cancer, including: respiratory irritation, bronchitis, aggravation of respiratory and cardiovascular disease, pulmonary inflammation, decreased lung function, and a possible role in exacerbating asthma and respiratory allergic reactions. OEHHA found that exposures to diesel PM resulted in an increase in long-term (chronic) non-cancer health effects. At this time, OEHHA has not quantified short-term (acute) non-cancer health effects. For further information on non-cancer adverse health effects, please see Chapter II of the 2003 Staff Report.

IV. PROPOSED AMENDMENTS AND ALTERNATIVES CONSIDERED

This chapter summarizes the proposed amendments to the Airborne Toxic Control Measure for Stationary Compression Ignition Engines (ATCM) presented in Appendix A of this Staff Report. This chapter also discusses alternatives considered during the development of the proposed amendments. Additional changes to clarify the ATCM are identified in Appendix B of this Staff Report.

A. Overview

1. In-use Stationary Diesel Agricultural Engine Emission Standards

The primary purpose of the proposed amendments is to establish in-use stationary diesel agricultural engine emission standards in order to reduce diesel particulate matter (diesel PM) emissions, exposure, and health risk. No other federal, State, or district regulation (existing or planned) specifically addresses diesel PM emissions from this source (note: local San Joaquin Valley Unified Air Pollution Control District and South Coast Air Quality Management District rules indirectly affect PM emissions - see Chapter II for a description of these local air district rules).

ARB staff anticipates that most of the in-use stationary diesel agricultural engines affected by the proposed amendments are likely to be used to pump water for the irrigation of crops. The proposed amendments do not apply to diesel-fueled agricultural wind machines. Additionally, agricultural emergency standby generator set engines and remotely-located agricultural engines in federal attainment areas for PM and ozone are exempt from emission limits, provided they are registered with the local air districts and meet monitoring and recordkeeping requirements.

As a result of the proposed amendments, most in-use stationary diesel agricultural engines, greater than 50 horsepower (hp), are expected to meet Tier 3 or Tier 4 off-road compression ignition (CI) engine certification standards by 2022. An overview of the off-road CI engine certification standards is provided in Appendix C of this Staff Report. The proposed amendments include provisions for local air district agricultural engine registration programs and paying registration fees assessed to implement and enforce the ATCM. Additionally, the proposed amendments require owners or operators to fuel their stationary diesel agricultural engines with California Air Resources Board-approved diesel fuel (also known as CARB diesel fuel) or another ATCM-compliant fuel. Section B discusses the emission standard compliance schedule, registration, health risk screening, and fuel requirements in detail.

2. Other Proposed Amendments

In addition to establishing emission standards and other requirements for greater than 50 bhp in-use stationary diesel agricultural engines, staff is proposing to:

- Streamline the fuel reporting requirements for emergency standby engines;

- Update references to the tariff schedule established by the California Public Utilities Commission as it relates to the Rolling Blackout Reduction Program (RBRP);
- Add a new subsection to the definition of "maintenance and testing" that allows local air districts the discretion to not count additional hours of operation necessary to ensure operability of a repaired emergency generator as "maintenance and testing;"
- Harmonize the definition of CARB diesel fuel in the ATCM to be consistent with ARB fuel regulations;
- Provide for new sell-through provisions;
- Add a new compliance option to meet the 0.01 g/bhp-hr diesel PM standard for new and in-use prime and emergency standby engines;
- Clarify the definition of "emergency use" for emergency standby engines at United States Department of Defense facilities performing launch tracking, and provide a schedule to have these engines meet the 0.01 g/bhp-hr diesel PM standard by December 31, 2009;
- Provide local air districts the discretion to exempt certain stationary CI engines used for: testing burners or CI engines; the testing of fuels, fuel additives, or emission control devices at research and development facilities; and training at educational facilities;
- Provide for the use of biodiesel, biodiesel blends, Fischer-Tropsch diesel, and emulsified diesel without verification; and
- Update references.

Appendix B of this Staff Report lists the contents and provides a brief description and rationale of the proposed amendments. In addition, Sections B and C of this chapter provide a more detailed discussion of the most significant changes to the ATCM.

B. Addition of In-Use Stationary Diesel Agricultural Engine Standards and Reporting Requirements

1. Applicability

Section 93115.2(a) Applicability - Agricultural Wind Machines; Section 93115.3(a) Exemptions - Agricultural Emergency Standby and Remotely-Located Agricultural Engines; Section 93115.10(f) Recordkeeping - Exempted Engines

The proposed amendments apply to greater than 50 bhp in-use stationary diesel agricultural engines. Exceptions include stationary diesel agricultural wind machines, emergency standby generator set engines, and remotely-located engines. These engines are not expected to pose a health hazard because of their small numbers, low operating hours, infrequent use, and/or remote locations.

The ATCM does not apply to agricultural wind machines. As described in Chapter III, the stationary diesel engines associated with these machines are not expected to

significantly contribute to diesel PM exposure because of their low annual operating hours and remote locations. In addition, agricultural wind machine emissions are dispersed rapidly due to the machine's fan. In California, most agricultural wind machines are fueled by propane and the relatively small number of diesel-fueled agricultural wind machines is decreasing.

ARB staff is proposing to exempt two types of stationary diesel agricultural engines from in-use emission limits: agricultural generator set engines used solely for emergency standby purposes (e.g., electrical power or natural gas supply failures, floods, and fires) and remotely-located agricultural engines. Due to limited information about the number and operation of these engines, their exempted status is contingent upon the engines being equipped with hour meters and being registered with the local air district. Owner/operators are also required to maintain records of annual hours of operation. Registration and annual operating information would enable future evaluation of these exemptions, if necessary.

Stationary diesel agricultural emergency standby generator set engines are not expected to significantly contribute to diesel PM emission exposure or health risk because they are typically operated on an infrequent basis and in more remote locations than nonagricultural emergency standby engines that are primarily located in densely-populated urban areas (see Chapter III).

Remotely-located agricultural engines must be located more than one-half mile from any receptor and have annual operating hour restrictions (no more than 200 hours per year for Tier 0 and Tier 1 engines; no more than 600 hours per year for Tier 2 and Tier 3 engines). ARB staff expects that engines meeting these criteria will pose a potential cancer risk of less than one chance per million. Also, to be eligible for the exemption, these engines must be located in federal attainment areas for both PM and ozone. This criterion is consistent with ARB and local air district State Implementation Plan (SIP) goals for achieving compliance with federal ambient air quality standards.

If an owner or operator replaces, fails to register, or fails to maintain annual operating hour records for an agricultural emergency standby generator set engine or a remotely-located agricultural engine, he or she must replace the engine with one that does not exceed applicable stationary diesel agricultural engine emission limits within 18 months.

2. Proposed Standards

Section 93115.8(b)

The ATCM's proposed emission performance standards for greater than 50 bhp in-use stationary diesel agricultural engines are summarized in Tables IV-1 and IV-2. These standards are based on the Off-Road CI Engine Certification Standards as described in Chapter II, Section B, of this Staff Report. An overview of the Off-Road CI Engine Certification Standards is provided in Appendix C.

Table IV-1. Proposed Emission Standards for Noncertified Greater than 50 bhp In-Use Stationary Diesel-Fueled Engines Used in Agricultural Operations

Horsepower Range	Application	Compliance On or After December 31	Diesel PM Not to Exceed (g/bhp-hr)	HC, NOx, NMHC+NOx, and CO Not to Exceed (g/bhp-hr)
Greater Than 50 But Less Than 75	Generator Sets	2015	0.02	Off-Road CI Engine Certification Standards for an off-road engine of the same model year and maximum rated power[1]
	All Other Applications	2011	0.30	
Greater Than or Equal to 75 But Less Than 100	Generator Sets	2015	0.01[2]	
	All Other Applications	2011	0.30	
Greater Than or Equal to 100 But Less Than 175	Generator Sets	2015	0.01[2]	
	All Other Applications	2010	0.22	
Greater Than or Equal to 175 But Less Than or Equal to 750	All Applications	2010	0.15	
Greater Than 750	All Applications	2014	0.075	

1. If no limits have been established for an off-road engine of the same model year and maximum rated power, then the in-use stationary diesel-fueled engine used in an agricultural operation shall not exceed Tier 1 standards in title 13, CCR, section 2423 for an off-road engine of the same maximum rated power irrespective of model year.
2. The less than or equal to 0.01 g/bhp-hr diesel PM emission standard may be satisfied by combining a Level 3 Verified Diesel Emission Control Strategy with a certified Tier 3 engine (or Tier 2 engine for engines greater than 750 bhp) that meets the 0.15 g/bhp-hr PM emission standard.

Table IV-2. Proposed Emission Standards for Tier 1- and Tier 2-Certified Greater than 50 bhp In-Use Stationary Diesel-Fueled Engines Used in Agricultural Operations - All Applications

Horsepower Range	Compliance On or After December 31	Diesel PM Not to Exceed (g/bhp-hr)	HC, NOx, NMHC+NOx, and CO Not to Exceed (g/bhp-hr)
Greater Than 50 But Less Than 75	2015 or 12 years after the date of initial installation, whichever is later	0.02	Off-Road CI Engine Certification Standards for an off-road engine of the same model year and maximum rated power[1]
Greater Than or Equal to 75 But Less Than 175	2015 or 12 years after the date of initial installation, whichever is later	0.01[2]	
Greater Than or Equal to 175 But Less Than or Equal to 750	2014 or 12 years after the date of initial installation, whichever is later	0.01[2]	
Greater Than 750	2014 or 12 years after the date of initial installation, whichever is later	0.075	

1. If no limits have been established for an off-road engine of the same model year and maximum rated power, then the in-use stationary diesel-fueled engine used in an agricultural operation shall not exceed Tier 1 standards in title 13, CCR, section 2423 for an off-road engine of the same maximum rated power irrespective of model year.
2. The less than or equal to 0.01 g/bhp-hr diesel PM emission standard may be satisfied by combining a Level 3 Verified Diesel Emission Control Strategy with a certified Tier 3 engine (or Tier 2 engine for engines greater than 750 bhp) that meets the 0.15 g/bhp-hr PM emission standard.

The proposed standards require that noncertified engines (also referred to as "Tier 0" engines) not exceed Tier 3 Off-Road CI Engine Certification Standards for PM by the 2011-2012 timeframe. The proposed standards require that noncertified generator set engines (except emergency standby generator set engines) not exceed Tier 4 Off-Road CI Engine Certification Standards for PM by the 2016 timeframe. Later compliance dates for in-use stationary diesel agricultural generator set engines are reasonable because new engines of this type are already required not to exceed a 0.15 grams per brake horsepower-hour (g/bhp-hr) PM standard that is equivalent to, or more stringent than, the Off-Road CI Engine Certification Standards in effect for the next several years.

The proposed standards also require that Tier 1- or Tier 2-certified engines not exceed Tier 4 Off-Road Certification Standards by the 2015-2016 timeframe, or 12 years after initial installation, whichever is later. Consistent with San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) Rule 4702 (Internal Combustion Engines Phase 2), the proposed amendments allow at least 12 operating years for newly purchased and installed engines certified to Tier 1 or Tier 2 emission levels.

The proposed compliance dates for in-use stationary diesel agricultural engines are generally four years after Off-Road CI Engine Certification Standards for new engines become effective. This compliance schedule allows one year to ensure the availability of compliant engine packages for agricultural applications plus the potential for three years early emission reductions as required by the Carl Moyer Program guidelines for incentive funding. Engine availability and Carl Moyer Program incentive funding are discussed in more detail in Sections B.2.b. and B.2.c.

The proposed amendments set forth emission performance standards for pollutants other than PM such as carbon monoxide (CO), hydrocarbons (HC), oxides of nitrogen (NOx), or non-methane hydrocarbons (NMHC)+NOx. These proposed standards require that an in-use stationary diesel agricultural engine not exceed the Off-Road Compression Ignition Engine Certification Standards for an off-road engine of the same model year and maximum rated brake horsepower. If no certification standards have been established for an off-road engine of the same model year and maximum rated brake horsepower, then the affected engine is required not to exceed Tier 1 standards. The proposal would allow owners and operators of Tier 1 and Tier 2 engines to explore add-on PM control technology, rather than replacement, as a compliance option, provided at least Tier 1 emission requirements for non-PM pollutants are met. Compliance options are discussed in more detail in Section B.2.a.

a. Compliance Options

Potential compliance options for meeting the proposed standards include: replacement with an electric motor, replacement with a new CI or another type of nondiesel engine, retrofit with add-on control devices, or alternative fuel use. ARB staff believe that the majority of affected owners and operators will choose to replace their noncertified, Tier 1, or Tier 2 in-use stationary diesel agricultural engines. The major reasons for selecting the engine replacement option include:

- Currently, there is no PM add-on control technology verified for noncertified or "Tier 0" stationary diesel agricultural engines. The relatively small market for California-compliant agricultural engines, coupled with owner concerns regarding engine monitoring, maintenance, and warranty issues, make it unlikely that add-on control devices will be selected as a compliance option for Tier 0 engines;
- Source testing will be needed to demonstrate compliance for retrofitted Tier 1- or Tier 2-certified engine makes and model that are not verified. Engine owners are likely to avoid this option to the cost of testing;
- The proposed amendments allow local air districts to establish more stringent emission limits, earlier compliance dates, and other requirements. Most local air districts are not expected to adopt more stringent PM emission limits, but some may adopt (or already have adopted) more stringent NOx requirements. Often, the only practical means to comply with both the proposed ATCM's PM and district NOx requirements will be engine replacement with an electric motor or new, cleaner diesel engine;
- Because engine replacement maximizes the potential for multiple pollutant emission reductions, it is a more competitive control strategy from an incentive program perspective. Multiple pollutant emission reductions affect cost-effectiveness, the basis for incentive program project evaluations (see Chapter II, Section B); and
- Stationary diesel agricultural engines located close to residential areas, schools, or hospitals may require more stringent emission limits in order to address residual risk. The owners and operators of such engines should consider replacement with electric motors, if feasible.

b. Tier 3 and Tier 4 Diesel Engine Availability

When Off-Road CI Engine Certification Standards transition to more stringent Tier 3 and Tier 4 levels, the effective date for manufacture of the new cleaner engine does not include the six to nine months necessary to develop and manufacture ancillary equipment (e.g., cooling systems, electronic control panels, mufflers) to produce an application-ready engine package. Additional time is usually needed to order, receive, and install a newly-manufactured engine. It is unreasonable to require owners and operators to replace engines before engine packages in the applications they need are widely available. After discussions with engine manufacturers, distributors, and dealers, ARB staff concluded that about one year following the transition to new standards is necessary to ensure that a sufficient number and variety of agricultural pump and other engine packages are available (Cook, 2006a).

To further ensure that compliant new engine packages for agricultural applications are available, ARB staff is proposing to allow the ARB Executive Officer to extend an in-use stationary diesel agricultural emission standard compliance date for up to one year. The Executive Officer's compliance extension must be based on verifiable information that insufficient new engine packages are available to meet the needs of the State's agricultural community.

c. Potential Incentive Funding

Once engine packages become available, current State guidelines generally require at least three years of operation prior to a mandated emission reduction in order to qualify for Carl Moyer Program incentive funding (ARB, 2006a). Allowing for the use of Carl Moyer Program funding should provide a strong incentive for owners and operators to voluntarily replace their engines with electric motors or new cleaner, engines early. This would result in early emission reductions.

Although the Agricultural Assistance Program (see Chapter II, Section B) provides compliance assistance funding without requiring three years of surplus emission reductions, the amount of funds that will be available under this program is unclear. Not all districts are expected to adopt Agricultural Assistance Programs and the amount of funds each district can expect to raise under this program depends on local motor vehicle registration. This creates a disadvantage for a rural district with a low vehicle population but significant numbers of in-use stationary diesel agricultural engines.

d. Provision for Electric Motor Installation

The proposed amendments provide districts with the option of allowing owners or operators up to two additional years to comply, provided they submit documentation that they intend to replace an engine with an electric motor. The time required for utilities to construct line electric extensions and install electric meters can cause unavoidable delays and discourage the electrification option. The additional two years to comply helps to alleviate this potential obstacle to electrification.

e. Compliance Option for Engines Meeting 0.15 b/bhp-hr PM and Equipped With A Verified Control Device

Section 93115.8(b)(6) provides a compliance option for the 0.01 g/bhp-hr PM standard consistent with that available to nonagricultural stationary diesel emergency standby and prime engines meeting 0.15 g/bhp-hr PM and equipped with Level 3 Verified Diesel Emission Control Strategies as explained in Section C.7.

3. Registration Requirements

Section 93115.8(c)

Historically, agricultural engines have not been subject to local air district permitting or registration programs. As a result, most local air districts have limited data on the stationary diesel engines used in agricultural operations. In order to implement the proposed ATCM, there is a minimum set of information about the engine that local air districts will need. To ensure that this information is available, the proposed amendments to the ATCM contain a requirement that all new and in-use greater than 50 bhp stationary diesel agricultural engines be registered with the local air district. Under the registration program, engine owner/operators would be required to submit

registration information for each new and in-use engine to the district which would provide:

- Contact information of the engine owner/operator;
- Make, model, year, and horsepower of the engine;
- The annual hours of operation and fuel usage of the engine;
- The location of the engine; and
- Proximity of the engine to residential areas, schools, and hospitals.

To assist the local air districts, the ARB staff plan to publish guidelines for the agricultural engine registration program. The registration program would provide a tool for district outreach to affected owners or operators as well as a means for compliance tracking and enforcement.

A few agricultural engines located at major operations are already permitted. Alternate programs (for example, a district permitting program) or other district alternatives may be used, provided they are equivalent to the proposed registration program.

4. Residual Risk Provision

Section 93115.8(b)(5)

The Air Toxics "Hot Spots" Information and Assessment Act (AB 2588 or “Hot Spots” Program) was enacted in September 1987. Under the “Hot Spots” program, stationary sources are required to report the types and quantities of certain substances their facilities routinely release into the air. The goals of the program are to collect emission 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" Program was amended by the California State Legislature to address the reduction of significant risks. The amendments require owners of significant-risk facilities to reduce their risks to nearby receptors. The “Hot Spots” program is implemented by the local air districts.

Depending on proximity to receptors, it is possible that some owner/operators who replace their Tier 0 engines with Tier 3 engines in accordance with the proposed amendments may still pose a risk to nearby receptors. Pursuant to the goals of the “Hot Spots” program to address such risk issues, the proposed amendments contain a provision allowing local air districts, on a site-specific basis, to extend compliance with ATCM emission standards provided the engine meets Tier 4 engine Off-Road CI Engine Certification Standards for PM (i.e., 0.02 g/bhp-hr for an engine greater than 50 bhp but less than 75 bhp or 0.01 g/bhp-hr for an engine greater than or equal to 75 bhp) no later than four years after the otherwise applicable ATCM compliance date. Staff does not anticipate residual risk issues from Tier 4 engines because they have very low PM emission rates.

5. Fee Requirements

Section 93115.8(d)

Local air districts are expected to need to assess fees in order to recover the cost of implementation and enforcement activities, including outreach, registration program development and administration, compliance assistance, compliance inspections, and enforcement actions. Adequate funding is critical in order to achieve the stationary diesel agricultural engine emission reductions projected as a result of the proposed amendments. Accordingly, the proposed amendments require that affected owner/operators pay any fees assessed by the local air districts for the purpose of ATCM implementation and enforcement.

6. Fuel-Use Requirements

Section 93115.5(c) - Fuel Use Requirement for In-Use Stationary Diesel Agricultural Engines

The original ATCM and revision to the ATCM (effective December 2004 and September 2005, respectively) exempted in-use stationary diesel agricultural engines from all requirements. The proposed amendments remove this exemption and require that in-use stationary diesel agricultural engines comply with the same fuel use requirements applicable to other stationary diesel-fueled CI engines subject to the ATCM. This means that affected owner/operators would be required to fuel their in-use stationary diesel agricultural engines with one or any combination of the following: CARB Diesel Fuel, an alternative diesel fuel meeting the requirements of the Verification Procedure, an alternative fuel, CARB Diesel Fuel used with fuel additives that meets the requirements of the Verification Procedure.

7. Exemption for Engines Equipped With Selective Catalytic Reduction Systems

Section 93115.3(m) Exemptions - In-Use Stationary Diesel-Fueled CI Engines with Selective Catalytic Reduction Systems

Consistent with the existing ATCM's exemption of in-use stationary diesel emergency standby and prime engines that have selective catalytic reduction (SCR) systems, the ATCM is being amended to extend the exemption to similarly equipped in-use stationary diesel agricultural engines. In general, these engines are exempted because of the high cost and technical issues associated with installing diesel PM control technologies on engines that already have SCR systems in place. Further discussion on the rationale for exempting in-use stationary diesel engines with SCR is provided in Chapter V, Section D, "Staff Report: Initial Statement of Reasons for Proposed Rulemaking - Airborne Toxic Control Measure for Stationary Compression Ignition Engines," September 2003.

8. Definitions

Section 93115.4 - Definitions

Several proposed definitions have been added and one has been revised to clarify the proposed requirements for in-use stationary diesel agricultural engines. Additional definitions to clarify the applicability of the proposed requirements include: agricultural wind machine, certified engine, date of initial installation, noncertified engine, remotely-located agricultural engine, and residential area.

The definition of "New CI Engine" was revised to avoid triggering new stationary diesel agricultural engine emission standards each time a given owner or operator replaces one engine for another on his or her property. Unlike nonagricultural engine applications, the variety and seasonality of crops grown in California mean that a significant number of agricultural engines are moved from one location to another though they are still considered stationary. Also, the "New CI Engine" definition was revised to clarify that new stationary diesel agricultural engines installed after January 1, 2005, are expected to meet in-use stationary diesel agricultural engine emission standards if they are used more than 12 years.

9. Recordkeeping, Reporting, and Monitoring Requirements

Section 93115.10 - Recordkeeping, Reporting, and Monitoring Requirements

For the purposes of public outreach and compliance assurance, owners and operators of in-use stationary diesel agricultural engines will be subject to recordkeeping, reporting, and monitoring requirements. The recordkeeping and reporting requirements are similar to those for other stationary diesel engines in the existing ATCM. These requirements include maintaining records of annual hours of operation, where applicable. Owners and operators of in-use stationary diesel agricultural engines will also be subject to monitoring requirements which include technical specifications for hour meters and diesel particulate filters, where applicable.

Since the majority of information required to reported is collected via the registration program, section 93115.10 has been amended to allow the local air districts to exempt an owner or operator from providing all or part of the recordkeeping and reporting requirements if the information is submitted via a District registration program. The ATCM already provides local air districts the authority to provide an exemption from all or part of the recordkeeping and reporting requirements provided there is a current record of information on the owner or operator’s permit to operate, permit application, or other District records.

10. Alternatives Considered

ARB staff considered two alternatives to the proposed in-use stationary diesel agricultural engine emission standards: requiring no standards and requiring that all stationary diesel agricultural engines be replaced with electric motors.

a. No Action

If ARB did not propose these amendments, emissions control for in-use stationary diesel agricultural engines would be left to the local air districts or the federal government. In general, local air districts have the primary responsibility for controlling air pollution from nonvehicular sources. However, Health and Safety Code 39650 through 39675 directs ARB to identify and control toxic air contaminants such as diesel PM. To date, only two districts have regulated in-use stationary diesel agricultural engines, however these regulations are for oxides of nitrogen (NOx) to achieve ozone attainment. It is likely that other districts that are in attainment or moderate non-attainment for ozone will not adopt NOx emission limits at all or will adopt measures that will not address PM emissions. Therefore, the diesel PM emission standards in the proposed amendments to the ATCM are the best means of ensuring diesel PM emissions and exposure reduction from in-use agricultural engines across the State.

b. Require Electrification

From an air quality perspective, electrification of stationary diesel agricultural engines would be highly desirable because it virtually eliminates all emissions. However, cost is a significant obstacle to electrification. Staff found that the annual operating cost of using diesel fuel was between 33 percent (large users) and 70 percent (small users) lower than using electricity based on the 2003 rate schedule. These figures do not include the capital costs for purchasing and installing an electric motor or the cost of obtaining an electric power line extension (if needed) and hook-up.

Staff also found that growers' selection of irrigation pump equipment and preferred power source depends on many variables including irrigation method and schedule, availability of surface water, well pumping depth, quantity of water needed, fuel costs, electricity costs, and electrical infrastructure proximity and adequacy. Staff's evaluation indicated that any decision about the relative desirability or difficulty of converting agricultural irrigation pump diesel engines to electric motors must be made on a site-specific basis.

Electric utility and other incentive programs (see Chapter II, Section B) have overcome some of the cost obstacles by providing a discounted agricultural electric rate schedule or funding for switching from diesel engines to electric motors. However, limited funds are available and not all agricultural operations with in-use stationary diesel engines will qualify or will be able to take advantage of these financial incentives or assistance. Also, the 0.01 g/bhp-hr Tier 4 PM standard would result in 94 percent to 98 percent PM

emission control depending on engine size. This level of emission control is consistent with that achieved by electrification when power plant emissions are considered.

ARB staff believes that the proposed amendments identifying performance standards that can be met by a variety of compliance options including electrification, replacement with new engines, retrofits, alternative technologies, and alternative fuels is the best approach. Electrification is a viable compliance option for farmers, but they need several other options as well to match their site-specific needs. (ARB 2004) However, during development of the proposed amendments, it became clear that more stringent emission limits would be necessary for stationary diesel agricultural engines located near residential areas due to potential residual risk issues. To eliminate potential residual risk, the owners or operators of these engines should consider replacing them with electric motors, if feasible.

C. Other Proposed Amendments

1. Streamline Fuel Reporting and Recordkeeping Requirements for Emergency Standby Engines

Section 93115.10 - Reporting Requirements for Emergency Standby Engines

Several entities have indicated that the fuel reporting requirements for emergency standby CI engines are difficult to meet and place an unnecessary burden on the owner or operator. This is because the refueling practices for emergency standby engines are based upon need, which is different than the refueling practices for prime engines which are typically refueled on a regular schedule. Also, refueling for emergency standby engines often occurs from a centralized location, whereby small quantities of complying fuel are delivered (often via pick-up truck or other small vehicle) from a company corporate yard or fueling station to multiple engines at different locations. Thus, fuel records are often not engine specific. However, the ATCM requires each owner or operator to maintain records that account for all of the fuel used or purchased for use in the engine. An additional concern raised by emergency standby CI engine owners and operators is that the records or logs of fuel deliveries are currently required under the ATCM to be retained on-site. However, many in-use emergency standby CI engines are in remote locations, where it is impractical to maintain fueling records on-site. For these engines, fueling records are typically maintained at a central location that may maintain records for many different engines.

To address these concerns, staff proposes to amend the fuel recordkeeping requirements. First, staff is proposing to allow emergency standby CI engine owners and operators to maintain fuel purchase records demonstrating that the only fuel purchased and supplied to their engine or engines is compliant fuel. These records would be required to be compiled in a monthly summary, and be made available to local air district staff upon request. Also, staff is proposing to allow the retention of these records to be at an off-site central location within California.

2. Amend the Definition of a Rolling Blackout Reduction Program

Section 93115.4(mmm) - Definition of Rolling Blackout Reduction Program

The San Diego Gas and Electric Company (SDG&E) offers an optional interruptible electric service (ISC) to its customers in exchange for discounted electric rates. In return, the customer agrees to reduce its power consumption from the grid during either a Stage 3 electrical alert or a transmission emergency. The Rolling Blackout Reduction Program (RBRP) is the ISC program in San Diego County. The most current rates and special conditions, which are authorized and approved by the California Public Utilities Commission (PUC), are posted on SDG&E website in its "Electric Tariff Book – Miscellaneous Rates".

Since adoption of the ATCM, the PUC has approved a new tariff schedule for the RBRP that contains a new energy reduction payment rate and special conditions. This payment rate and special conditions are not consistent with similar elements in the ATCM's definition of the RBRP. For example, the new tariff schedule for the RBRP contains a new energy reduction capacity (50 kilowatts (kW) instead of 100 kW) and new payment rate ($0.35 instead of $0.20 per kW-hr). The new tariff schedule became effective on May 29, 2005.

Since various elements of the Schedule RBRP are subject to change by the PUC, staff proposes to remove any reference to specific values, percentages, or minimum reductions in capacity in the definition of an RBRP in the ATCM, and instead reference the currently applicable tariff schedule for SDG&E, as approved by the PUC.

3. Clarify the Definition of "Maintenance and Testing"

Section 93115.4(uu) - Definition of Maintenance and Testing

Several facilities have indicated that during routine maintenance they have encountered equipment breakdown or failure of one or more of their emergency standby engines. This has necessitated additional testing after repair of the equipment to ensure its reliability in the event of emergency use. Staff found that some local air districts recognize these additional hours as maintenance and testing, while other local air districts recognize these additional hours as emergency use. Staff proposes to add a new subsection to the definition of "maintenance and testing" that allows local air districts the discretion to not count these additional hours of operation as "maintenance and testing".

4. Changes to the Definition of CARB Diesel Fuel

Section 93115.4(h) – Definition of CARB Diesel Fuel

The current definition of California (CARB) diesel fuel in the ATCM is inconsistent with the current specifications for CARB diesel fuel, as prescribed in Title 13, California Code

of Regulations (CCR), sections 2281 and 2282. Title 13, CCR, sections 2281 and 2282 establish sulfur and aromatic hydrocarbon specifications, respectively, for vehicular diesel fuel sold in California, and provide for diesel fuels that contain less than 50 percent biodiesel to be sold as CARB diesel fuel. In addition to these specifications, the California Department of Food and Agriculture, Division of Measurement Standards (DMS) also enforces minimum diesel fuel quality specifications, as specified in American Society for Testing and Materials (ASTM) D975, for CARB diesel fuel sold through retail outlets in the state. However, these same provisions are not enforced by DMS at non-retail distribution outlets (i.e., diesel fuel storage tanks at farms, government and private corporate yards, etc.). Also, ASTM D975 is not an element in the CARB diesel fuel regulations.

In order to ensure consistency between the CARB diesel fuel regulations and the ATCM, staff is proposing to harmonize the definition of CARB diesel fuel with the CARB diesel fuel regulations. This will also ensure that the ATCM does not place additional requirements on diesel fuel supplied from non-retail diesel fuel outlets to engines covered by the ATCM.

5. Changes to the Definition of Alternative Diesel Fuel

Section 93115.4(e) - Definition of Alternative Diesel Fuel

As previously discussed, the CARB diesel fuel regulations allow for a biodiesel blend less than 50 percent biodiesel (B50) to be sold as CARB diesel fuel so long as the biodiesel blend meets the specifications of Title 13, CCR, sections 2281 and 2282. However, all biodiesel blends are currently defined as “alternative diesel fuel” in the ATCM To alleviate this, staff is proposing to include biodiesel blends less than B50 in the definition of “CARB diesel fuel” Biodiesel blends greater than B50, and any other biodiesel blends which do not meet the definition of “CARB diesel fuel”, would continue to be defined as “alternative diesel fuel.”

6. Use of Certain Alternative Diesel Fuels

Section 93115.5(c) - Fuel and Additive Requirements for New and In-Use Stationary CI Engines That Have a Rated Brake Horsepower of Greater than 50

Currently, in order to use alternative diesel fuels in engines covered by the ATCM, the fuel must meet the requirements of the Verification procedures. Under the proposed amendments, staff is proposing to remove the requirement that certain alternative diesel fuels first undergo verification prior to their use. Specifically, staff is proposing to allow, without verification, the use of biodiesel, biodiesel blends not meeting the definition of CARB diesel fuel, Fischer-Tropsch fuels, and emulsions of water in diesel fuel.

Staff’s proposal is based on both a reevaluation of existing statute relative to fuel specifications, and a recognition that the use of these alternative diesel fuels can provide substantial PM benefits relative to CARB diesel fuel. While the use of some of

these fuels may result in slight increases in some pollutants, such as NOx and hydrocarbon, the new revisions to the Verification Procedures effective in 2006 disallow NOx+HC exceedances greater than 10 percent.

In providing for the use of these fuels, it is also important to note that local air districts maintain permitting authority over these engines, and as part of that authority, may specify allowable fuels which may be used. In addition, many local air districts have also adopted prohibitory rules regulating criteria pollutant emissions from these engines. As such, even with the proposed amendments, local air districts maintain the discretion to allow, limit, or prohibit the use of these fuels in stationary engines operating in their district.

7. Sell-through Provision for Stock Engines

Sections 93115.3(s) and 93115.4(vvv) - Sell-Through Provision for Stock Engines

Revisions to the ATCM made in September 2005 clarified that when new engine standards change, local air districts have some discretion to allow, in specific instances, end users to acquire and install engines which do not meet the most current new engine standards in effect, as specified in the Off-Road CI Certification Emission Standards. For example, in certain circumstances, this provision allows an end user to install a new Tier 2 engine rather than a new Tier 3 engine. Local air districts must base this decision on either the date of engine acquisition or on the date an application was submitted for a district permit.

While provisions for addressing the impacts on end users when new engine standards change was addressed in the September 2005 amendments, this issue was not addressed for new engine distributors and dealers and the owner/operator of the engines. This issue is significant in that new engine distributors and dealers can be left with an inventory of non-compliant, non-salable stock engines when new, more stringent emission standards become effective. Currently, distributors and dealers cannot legally sell these engines in California. Also, they cannot return them to the manufacturer or sell them outside their sale territories. The engines, which can't be sold, represent a potentially significant financial loss to California distributors and dealers.

To address these concerns, staff is proposing a sell-through provision for the sale of never-been-used stock engines. This provision, subject to local air district approval, would allow the limited sale and use of these stock engines in California, which do not meet the current new engine standards, as provided in the Off-Road CI Certification Emission Standards. To sell engines not meeting the current Off-Road CI Certification Emission Standards, dealers and distributors must comply with the following applicable conditions:

- The engines were delivered in California to the seller no more than 12 months immediately preceding the transition to new standards for an off-road CI engine of the same model year and maximum rated power;
- The engine was sold by the seller no later than six months after the effective date of the new standards; and
- The engine must meet the Off-Road CI Engine Certification Standards (title 13, CCR, section 2423) immediately preceding the current certification standards for an off-road CI engine of the same model year and maximum rated power.

Since carrying excessive inventory of new engines on hand is expensive for dealers and distributors, staff does not believe that significant numbers of engines not meeting the current Off-Road CI Certification Emission Standards will be available at the time that more stringent emission standards become effective.

An additional provision has been added which allows owners or operators to use these engines as long as the following conditions are met:

- The date of acquisition of the stock engine is no later than six months from the date an emission standard applicable to new engines becomes more stringent than the emission standard to which the stock engine is certified; and
- The date the District determines the application is complete for an Authority to Construct permit is no later than six months after the date of acquisition of the stock engine.

8. Compliance Demonstration for New and In-Use Emergency and Prime Diesel-Fueled Engines

Tables (1 & 2) Summary of the Emission Standards and Operating Requirements New and In-Use Emergency Standby Diesel-Fueled CI Engines Greater Than or Equal to 50 bhp; and Tables (3 & 4) Summary of the Emission Standards for Prime Diesel-Fueled CI Engines Greater Than 50 bhp

Since the amendments to the ATCM, engine manufacturers, owners, and operators have brought to our attention that source testing to demonstrate initial compliance to the 0.01 g/bhp-hr diesel PM emission standard was becoming commonplace within certain local air districts. However, the intent of the ATCM was to reduce the need for source testing through the installation of CI engines certified to the applicable Off-Road CI Certification Emission Standards, in combination (if necessary) with a Verified Diesel Emission Control Strategy. It was expected that this action would expedite the local air district permitting process and limit the costs associated with source testing.

To clarify staff's intent, we are proposing to add new language specifying that a certified Tier 3 off-road engine (or Tier 2 off-road engine for engines greater than 750 bhp) meeting a 0.15 g/bhp-hr PM emission standard, when equipped with a Level 3 Verified Diesel Emission Control Strategy, will be deemed in compliance with the 0.01 g/bhp-hr diesel PM emission standard in the ATCM, until such time that Tier 4 engine standards

become effective. Staff believes that this change will provide consistency and more certainty to end users throughout the state regarding what technology is acceptable to demonstrate compliance with the 0.01 g/bhp-hr diesel PM emission standard in the ATCM.

9. Pre-launch System Checks and Post Launch Tracking at Vandenberg Air Force Base

Section 93115.3(t) - Allowance for up to 100 Hours of Maintenance and Testing
Section 93115.4(dd) - Definition of Emergency Use

Officials from Vandenberg Air Force Base (VAFB) and the Santa Barbara County Air Pollution Control District met with staff to discuss the definition of emergency use as defined in the ATCM, and specifically how this definition is applied to emergency standby engines operated by VAFB for pre-launch system checks. VAFB staff indicated that they considered all engine operation associated with pre-launch system checks at Command Destruct (CT) sites as emergency hours of operation, no matter how long prior to the actual or anticipated launch the engine operation occurred. ARB staff's intent when developing the ATCM was to only consider the pre-launch system checks that occurred the day of the launch to be considered "emergency use" and any system checks conducted on days prior to day of launch should be considered as "maintenance and testing" hours.

Based on these discussions, ARB staff concluded it is necessary to clarify the definition of "emergency use" in the ATCM. Staff has proposed to clearly indicate that only pre-launch system checks and any post-launch flight tracking at CT sites that occurs in the time period of up to 24-hours surrounding the launch is considered "emergency use". Any other operation of these engines for pre-launch system checks outside of this window will be counted as "maintenance and testing." Because of the uncertainty regarding the status of these engines relative to meeting the appropriate compliance dates and limitations on hours of operation in the ATCM, staff has proposed adding a new limited exemption that provides VAFB until December 31, 2009, to modernize these engines. Staff is also proposing to provide additional maintenance and testing hours to these engines until December 31, 2009, to ensure there are no disruptions in the ability of these engines to perform their required duties.

10. Test Cells, Test Stands, or Stationary Engines Used at Research and Development or Educational Facilities

Section 93115.3(u) - Exemption for Requirements of the ATCM for Stationary Engine Test Cells, Test Stands, or Stationary CI Engines Used at Research and Development Facilities or Used Exclusively for Training at Educational Facilities

Stationary CI engines used at research and development facilities or educational institutions may be operating in violation of the emission standards of the ATCM. Several local air districts have voiced concerns that the purpose and nature of these

operations require that these engines emit at rates that exceed the performance standards of the ATCM. To address this, staff is proposing upon local air district approval, a new exemption from the requirements of the ATCM for engines that are used exclusively: as engine test cells and test stands used for testing burners or CI engines; for operation or performance testing of fuels, fuel additives, or emissions control devices at research and development facilities; or for maintenance, repair, or rebuild training at educational facilities.

11. Amend Reference for In-Use Emergency Fire Pumps

Section 93115.3(n) - Exemption for In-Use Emergency Fire Pumps

The National Fire Protection Association (NFPA) 25, "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems", referenced in the ATCM was revised in 2002, and is scheduled to be updated in 2006. The ATCM currently references the 1998 edition. Staff proposes to amend this section to reference the 2006 edition, and to include additional language that allows the Executive Officer to approve a more current edition as it is updated.

D. Potential Benefits of the Proposed Amendments

The proposed amendments would benefit public health by reducing diesel PM exposure and cancer risk, particularly in areas where stationary diesel agricultural engines operate. The proposed amendments are also expected to result in reductions in emissions of other air pollutants, e.g., NOx and ROG. NOx and ROG are precursors to ozone formation in the lower atmosphere and NOx is a precursor to secondary PM. Decreased ozone formation is likely to reduce illness, emergency room visits, and hospital admissions due to respiratory problems. The proposed amendments would contribute to further progress in meeting ambient air quality standards for PM10, PM 2.5, and ozone. The proposed amendments would benefit the environment by improving visibility and by reducing soiling, crop loss, and damage to ornamental and forest vegetation.

ARB staff believes that the proposed amendments will effectively reduce diesel PM and other air pollutant emissions from in-use stationary diesel agricultural engine because they:

- Complement and are consistent with existing local air district and federal regulations without duplicating them;
- Provide compliance flexibility in recognition of the diverse nature of agriculture in California (though ARB staff expect engine replacement with an electric motor or cleaner diesel or other engine to be the most practical and popular option);
- Have been designed to maximize and facilitate compliance by ensuring the availability of compliant replacement engines;
- Provide potential for early emission reductions by allowing opportunity for affected owner/operators to apply for Carl Moyer Program incentive funding; and

- Provide a means of identifying affecting parties, conducting outreach, and tracking compliance with ATCM emission limits and residual risk requirements for engines located close to residential areas, schools, and hospitals while allowing local air district flexibility to choose the most appropriate implementation and enforcement mechanism for their area.

V. ENVIRONMENTAL IMPACTS

The proposed amendments to the Airborne Toxic Control Measure for Stationary Compression Ignition Engines (Stationary Diesel ATCM) are intended to protect the health of California citizens by reducing exposure to emissions from stationary diesel engines used in agriculture. An additional consideration is the impact the proposed amendments may have on the environment. This chapter describes the potential impacts on the environment (i.e., air, land and water) and environmental justice. Based on available information, ARB staff has determined that no significant adverse environmental impacts should occur as a result of adopting the proposed amendments.

A. Legal Requirements

Compliance with the proposed amendments are expected to directly affect air quality and potentially affect other environmental media as well. The California Environmental Quality Act (CEQA) and ARB policy require an analysis to determine the potential environmental impacts of proposed regulations. Because 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 amendments to 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 (CEQA requires an agency to identify and adopt feasible mitigation measures that would minimize any significant adverse environmental impacts); and
- An analysis of reasonably foreseeable alternative means of compliance with the amendments to the ATCM.

ARB staff's analysis of these requirements is presented below. We have concluded that the proposed amendments are needed to reduce the risk from exposures to diesel exhaust particulate matter (diesel PM), as required by the Health and Safety Code (H&SC) section 39666, and to fulfill the goals of ARB's Diesel Risk Reduction Plan. (ARB, 2002) We have also concluded that implementation of the proposed amendments would have no significant adverse environmental consequences requiring mitigation and that there are no alternative means of compliance with the requirements

of Health and Safety Code section 39666 that would achieve similar diesel PM reductions at a lower cost.

B. Effects On Air Quality

In-use stationary diesel agricultural engines emit diesel particulate matter (PM), oxides of nitrogen (NOx), carbon monoxide (CO), reactive organic gases (ROG), and several other pollutants that have the potential to cause cancer and other health effects. The proposed amendments are expected to directly impact air quality and are designed to reduce exposure to diesel PM emissions from in-use stationary diesel agricultural engines by requiring, according to a specified compliance schedule, that they emit no more than off-road compression ignition (CI) engine certification standards for a new off-road engine of the same size and model year. Provided the proposed emission performance standards are met, compliance may be achieved by retrofits or the use of alternate fuels; however, ARB staff expect replacement with electric motors or cleaner diesel or other engines to be the most practical and popular compliance strategy as explained in Chapter IV of this Staff Report. ARB staff encourage replacement as the best means for achieving maximum emission reductions of diesel PM and other pollutants.

In addition to the proposed amendments, other factors affecting emission reductions include a Statewide negative growth rate for agriculture (see Appendix D), the impact of local air district rules, and electric utility and other incentive programs encouraging older diesel engine replacement (see Chapter II, Section B). Table V-1 and Table V-II show projected daily emissions of diesel PM and NOx from stationary diesel agricultural irrigation pump engines for years 2005, 2012, and 2022. The tables also show emission reduction estimates for years 2012 and 2022 based on the assumption that, from 2005 through 2022, 20 percent of noncertified, Tier 1, and Tier 2 engines will be replaced with electric motors while 80 percent will be replaced with cleaner diesel engines. Staff estimate that diesel PM would be reduced by approximately 0.9 tons per day by 2012 and 1.2 tons per day by 2022. Similarly, NOx would be reduced by approximately 16 tons per day by 2012 and 22 tons per day by 2022.

Staff estimate average Statewide emission reductions from 2005 through 2022 of 171 tons per year of diesel PM and 3,000 tons per year of NOx and cumulative emission reductions of 2,900 tons of diesel PM and 51,000 tons of NOx.

Approximately 50 percent of the projected Statewide emission reductions can be attributed to San Joaquin Valley Air Pollution Control District Rule 4702 whose compliance dates precede those of the proposed amendments to the ATCM. Although South Coast Air Quality Management District Rule 1110.2 compliance dates also precede those of the proposed amendments, it does not have a significant impact on projected Statewide emission reductions due to the relatively small number of affected engines.

Table V-1. Projected Statewide Diesel PM Emissions and Emission Reductions[1,2]

Year	Uncontrolled Emissions TPD (TPY)[3]	Controlled Emissions TPD (TPY)	Emission Reductions From 2005 TPD (TPY)	Percent Emission Reductions (2005-2022)
2005	1.6 (570)	1.6 (570)	0	0
2012	1.3 (460)	0.7 (240)	0.9 (330)	60
2022	0.8 (300)	0.4 (130)	1.2 (440)	80

1. For in-use stationary diesel agricultural pump engines.
2. All values have been rounded.
3. Baseline year 2003 emissions forecasted to 2005.

Table V-2. Projected Statewide NOx Emissions and Emission Reductions[1,2]

Year	Uncontrolled Emissions TPD (TPY)[3]	Controlled Emissions TPD (TPY)	Emission Reductions From 2005 TPD (TPY)	Percent Emission Reductions (2005-2022)
2005	33 (12,000)	33 (12,000)	0	0
2012	27 (10,000)	17 (6,200)	16 (5,800)	50
2022	19 (6,900)	11 (3,900)	22 (8,100)	70

1. For in-use stationary diesel agricultural pump engines.
2. All values have been rounded.
3. Baseline year 2003 emissions forecasted to 2005.

C. Health Benefits of Diesel PM Emission Reductions

As described in Chapter II of Staff Report: Initial Statement of Reasons for Proposed Rulemaking – Airborne Toxic Control Measure for Stationary Compression Ignition Engines, September 2003, diesel PM is one of a complex mixture of potentially harmful inorganic and organic compounds in diesel exhaust. Implementation of the proposed amendments would reduce directly emitted and secondarily formed PM levels, provide both near source and regional risk reduction, and contribute to the overall effort of reducing PM mortality, hospital admissions, and lost work days. Table V-3 identifies the diesel exhaust compounds of major interest and briefly summarizes their effects on human health and the environment.

Additionally, reductions in NOx and ROG from in-use stationary diesel agricultural engines as a result of the proposed amendments would contribute to reducing exposures to ambient ozone. Emissions of NOx and ROG are precursors to the formation of ozone in the lower atmosphere and diesel engine exhaust contributes to ozone precursors. 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.

Table V-3. Major Air Pollutants In Diesel Exhaust

Pollutant	Potential Adverse Health Effect	Potential Adverse Environmental Effect
Diesel Particulate Matter (diesel PM)	cancer, pulmonary inflammation, aggravation of respiratory and cardiovascular disease, adjuvant in allergic responses and possibly asthma	soot, soiling, impaired visibility
Other Toxic Air Contaminants [e.g., arsenic, benzene, formaldehyde, nickel, polycyclic aromatic hydrocarbons (PAHs)]	cancer (acute exposures - reproductive/developmental problems, eye irritation, respiratory irritation, immune response problems)	
Oxides of Nitrogen (NOx)		
ozone precursor in combination with reactive organic gases	respiratory inflammation and irritation, aggravate pre-existing diseases (e.g., asthma), emphysema, bronchitis	forest and ornamental plant damage, crop loss, rubber and plastic damage
PM precursor	pulmonary inflammation, aggravation of respiratory and cardiovascular disease, adjuvant in allergic responses and possibly asthma	soot, soiling, impaired visibility
Reactive Organic Gases (ROG) (also known as Volatile Organic Compounds or VOC)		
ozone precursor in combination with NOx	see oxides of nitrogen	see oxides of nitrogen

Source: ARB, 1985; ARB, 2001b; ARB, 2003b; OEHHA, 1999

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

As previously mentioned, ARB staff expect that the most practical and popular means of complying with the proposed standards for in-use stationary diesel agricultural engines will be engine replacement with electric motors or cleaner diesel or other engines. Staff have identified potential adverse environmental impacts from other compliance options such as diesel oxidation catalysts (DOCs) and diesel particulate filters (DPFs) that may be used with new engines or as add-on control devices (i.e., retrofit devices). These impacts 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.

1. Diesel Oxidation Catalyst

Two potential adverse environmental impacts from the use of DOCs 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 DOC 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 DOCs. There is a very active market for reclaimed platinum for 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, platinum-based drugs for cancer treatment, and other uses. (Kendall, 2002; Kendall, 2003).

2. Catalyzed Diesel Particulate Filters

These devices are composed of a ceramic DPF along with a platinum catalyst to accelerate 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 DPFs. 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. Filters benefit the environment by capturing these metallic particles, known as "ash," which would otherwise be released into the air. 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 concentrations, it can make the waste a hazardous waste. Title 22, California Code of Regulations (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 ash to be characterized as a hazardous waste.

Under California law, it is the generator's responsibility to determine if waste is hazardous. 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 DPF 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 consulted with personnel of DTSC regarding management of the ash from DPFs. DTSC staff 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. Specific information regarding the identification of and acceptable disposal methods for wastes is available from DTSC (http://www.dtsc.ca.gov)

High-pressure water and detergent are sometimes used to remove ash from DPFs. However, this practice would generate wastewater containing metal oxides, and possibly be considered hazardous waste, that can not be discharged to the sanitary sewer or storm drains. Technology is currently available for reclamation of 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). Some DPF cleaning techniques can cause ash to be illegally released directly into the air/or work environment potentially exposing the public and/or workers to zinc and other metal oxides.

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 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 DPFs. In addition, measurements of NOx emissions for heavy-duty diesel vehicles equipped with passive catalyzed DPFs 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 DPFs 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 DPF 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, NO_2 may also impair lung development. In addition, a higher NO_2/NOx ratio in the exhaust could potentially result in higher initial NO_2 concentrations in the atmosphere which, in turn, could result in higher ozone concentrations.

Model simulations have shown that a NO_2 to NOx 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 the ARB Verified Diesel Emission Control System procedure (Verification Procedure). Any PM filter retrofit used to comply with the proposed amendments to the ATCM must be approved through the Verification Procedure. Any PM filter inherently part of a new Tier 3 or 4 engine used to comply with the proposed amendment need not go through California's Verification Procedure because such an engine would already have been shown to comply with Tier 3 or 4 new off-road engine emission standards.

Finally, DPFs can emit carbon dioxide (CO_2), a greenhouse gas, as a result of oxidizing PM. The contribution of CO_2 emissions from stationary diesel agricultural engines using DPFs, and how much these emissions contribute to global warming, is unknown.

3. Alternative Fuels

As discussed in Chapter VI of Staff Report: Initial Statement of Reasons for Proposed Rulemaking – Airborne Toxic Control Measure for Stationary Compression Ignition Engines, September 2003, 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/Solseng, 2002).

To ensure there are no adverse impacts from the use of alternative diesel fuels, the proposed amendments require any alternative diesel-fuel or fuel additives used in a stationary diesel agricultural engine to be verified under the ARB 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).

4. Fuel Borne Catalysts

Another option for reducing diesel PM emissions is the use of fuel borne catalysts (FBCs). FBCs may be added to diesel fuel to decrease the ignition temperature of the carbonaceous exhaust in order to aid in soot removal from DPFs. When FBCs are used without a DPF, trace amounts would be emitted with the engine exhaust. Currently, a FBC should be used with a filter to capture emissions. The contribution of emissions from FBCs is unknown.

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 amendments to the ATCM. Therefore, no mitigation measures would be necessary.

F. Reasonably Foreseeable Alternative Means of Compliance

Alternatives to the proposed amendments have been discussed earlier in Chapter IV of this Staff Report. ARB staff has concluded that there are no alternative means of compliance with the requirements of Health and Safety Code sections 39666 and 39667 that will achieve similar diesel PM emission reductions at a lower cost. Therefore, the proposed amendments provide the most effective and least burdensome approach to reducing public exposure to diesel PM and other air pollutants emitted from stationary diesel agricultural engines.

G. Environmental Justice

The ARB is committed to integrating environmental justice in all of its activities. In 2001, the Board approved Policies and Actions for Environmental Justice which formally established a framework for incorporating environmental justice into the ARB's programs, consistent with the directives of State law. 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, regulation, 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. (ARB, 2001a)

The Policies and Actions for Environmental Justice are intended to promote the fair treatment of all Californians and to cover the full spectrum of ARB activities. Underlying these policies is a recognition that ARB needs to engage community members in a meaningful way as it carries out its activities. People should have the best possible information about the air they breathe and about what is being done to reduce unhealthful air pollution in their communities. 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. Chapter II, Section C, of this Staff Report generally describes the efforts made to apprise the stakeholders and the public about the development of the proposed amendments to the ATCM.

The proposed amendments are consistent with the environmental justice policy to reduce health risks from TACs in all communities, including low-income and minority communities. The proposed amendments will reduce diesel PM and other emissions from in-use stationary diesel agricultural engines in all California communities where these engines are used.

VI. ECONOMIC IMPACTS

This chapter presents the economic impacts associated with implementation of the proposed amendments. The amendments affect in-use stationary agricultural engines as well as non-agricultural applications. The amendments affecting the non-agricultural applications were proposed to clarify existing ATCM provisions, streamline fuel reporting requirements, and make other nonsubstantive changes, which are expected to be cost-neutral or produce slight cost-savings to affected businesses. Thus, this chapter discusses the economic impacts of the proposed amendments affecting in-use stationary agricultural engines, which are expected to impose costs upon affected businesses.

The discussion includes estimates of capital and recurring costs for the engine replacement scenario, which staff believes, for economic reasons, is the compliance option that nearly all of the affected businesses are most likely to use. An analysis of the proposed amendments' cost-effectiveness with regards to PM and NOx emissions is also provided.

A. Summary

Staff estimates that the total cost of the proposed amendments to affected businesses would range from $34 million to $42 million over the 22-year analysis period used (i.e., 2008-2029). No significant economic impacts to school districts, local public agencies, universities, State agencies, or federal agencies are expected because few, if any, of these agencies operate affected engines. ARB administrative costs for outreach and educational efforts to affected businesses and local air pollution control districts would be absorbed within existing budgets and resources.

Affected businesses may use several means to comply with the proposed ATCM including engine retrofit, engine replacement, and alternative technologies such as electric power or non-diesel alternative fuels. Table VI-1 summarizes the capital and annual per-engine costs of choosing the engine replacement compliance option, plus an expected range of local air district fees and owner/operator time to prepare and submit district paperwork. The annualized capital payments are based on the assumption that the capital cost is financed via a loan that is repaid over one to eight years at a five percent annual real interest rate.

Table VI-1. Estimated Cost-Per-Engine for Affected Businesses[1,5]

In-Use Engine Size (HP)	Capital Cost Range [2] ($)	Annual Cost Range [3] ($)
50 - 74	6,900 - 8,200	1,200 - 2,100
75 - 99	4,300 - 9,600	1,200 - 1,700
100 - 174	8,000 - 12,700	1,800 - 2,200
175 - 299	11,300 - 18,000	2,600 - 3,300
300 - 599	16,600 - 26,500	3,800 - 4,300
600 - 750	20,500 - 32,700	4,700 - 5,300
>750 (1725)[4]	21,700 - 172,200	21,500 - 26,900

1. Estimates include prorated loss-of-use costs for an in-use engine, one rebuild, and initial air district fees.
2. The capital cost estimate assumes a lump-sum, one-time cost.
3. This is the capital cost amortized over the remaining expected useful life of the engine, which, depending on the specific engine size category and emissions tier, varies from one to eight years. Includes a range of expected local air district fees and owner/operator time to prepare and submit registration forms and other air district paperwork. A real interest rate of five percent is used. The estimated amount represents uniform annual payments to cover the capital cost and local air district fees.
4. For the greater than 750 HP category, an engine size of 1,725 hp is used for calculation purposes. This is the largest size engine expected in this category.
5. Values have been rounded; for exact figures, please refer to the "Per-Engine Costs" worksheet in Appendix F.

For all directly-affected businesses, the compliance cost will vary depending on the number of affected engines that are owned and/or operated. Table VI-2 shows the estimated capital and annual cost for a typical and a small business with one to three engines. The annual costs include amortization of in-use engine loss-of-use and the expected range of local air district registration fees; after the loss-of-use costs are fully amortized, the annual costs drop substantially, amounting to local air district fees only.

Table VI-2. Estimated Costs for a Typical and a Small Business[4]

Engine Size (HP)	Capital Cost[1] ($)		Annual Cost[2] ($)	
	1 Engine	3 Engines	1 Engine	3 Engines
50 - 74	6,900 - 8,200	20,500 - 24,600	1,200 – 2100	3,700 - 6,400
75 - 99	4,300 - 9,600	12,900 - 28,700	1,200 - 1,700	3,600 - 5,100
100 - 174	8,000 - 12,700	23,800 - 38,000	1,800 - 2,200	`5,500 - 6,500
175 - 299	11,300 - 18,000	33,700 - 53,900	2,600 - 3,300	7,800 - 9,900
300 - 599	16,600 - 26,500	49,700 - 79,400	3,800 - 4,300	11,500 - 12,900
600 - 750	20,500 - 32,700	61,400 - 98,100	4,700 - 5,300	14,200 - 15,800
>750 (1725)[3]	21,700 - 172,200	65,000 - 516,700	21,500 - 26,900	64,600 - 80,600

1. Estimates include loss-of-use cost for in-use engine(s), one rebuild per engine(s), local air district fees, and owner/operator time to prepare and submit registration forms and other air district paperwork.
2. This is the capital cost amortized over the remaining expected useful life of the engine, which, depending on the specific category and emissions tier, varies from one to eight years. Includes a range of expected air district fees and owner/operator time to prepare and submit registration forms and other air district paperwork. A real interest rate of five percent is used. The estimated amount represents uniform annual payments to cover both the capital cost and local air district fees.
3. For the greater than 750 hp category, an engine size of 1,725 hp is used for calculation purposes. This is the largest size engine expected in this category.
4. Values have been rounded.

Staff also estimated the proposed amendments' cost-effectiveness in terms of cost per pound of diesel particulate matter (PM) reduced. Diesel PM reduction resulting from the proposed amendments has been estimated to range from 63,000 to 250,000 pounds per year over the period from 2011 to 2026. Considering only the benefits of reducing primary diesel PM emissions, the average cost-effectiveness of the proposed amendments is $11 per pound of diesel PM reduced (the cost-effectiveness range is from $1 to $22 per pound of diesel PM reduced).

Additional benefits are expected to occur due to the reduction in reactive organic gases (ROG) and oxides of nitrogen (NO_x) emissions; ROG reduction benefits are not quantified in this analysis due to insufficient data. The estimated NO_x cost-effectiveness is discussed later in this chapter. Table VI-3 compares the cost-effectiveness of the proposed amendments with those of the adopted Transport Refrigeration Unit ATCM, Stationary Compression Ignition Engines ATCM, and the On-Road Heavy-Duty Residential and Commercial Solid Waste Collection Vehicles Control Measure.

Table VI-3. Cost-Effectiveness Comparison - Stationary Diesel Engine ATCM Proposed Amendments and Three Other Diesel PM ATCMs

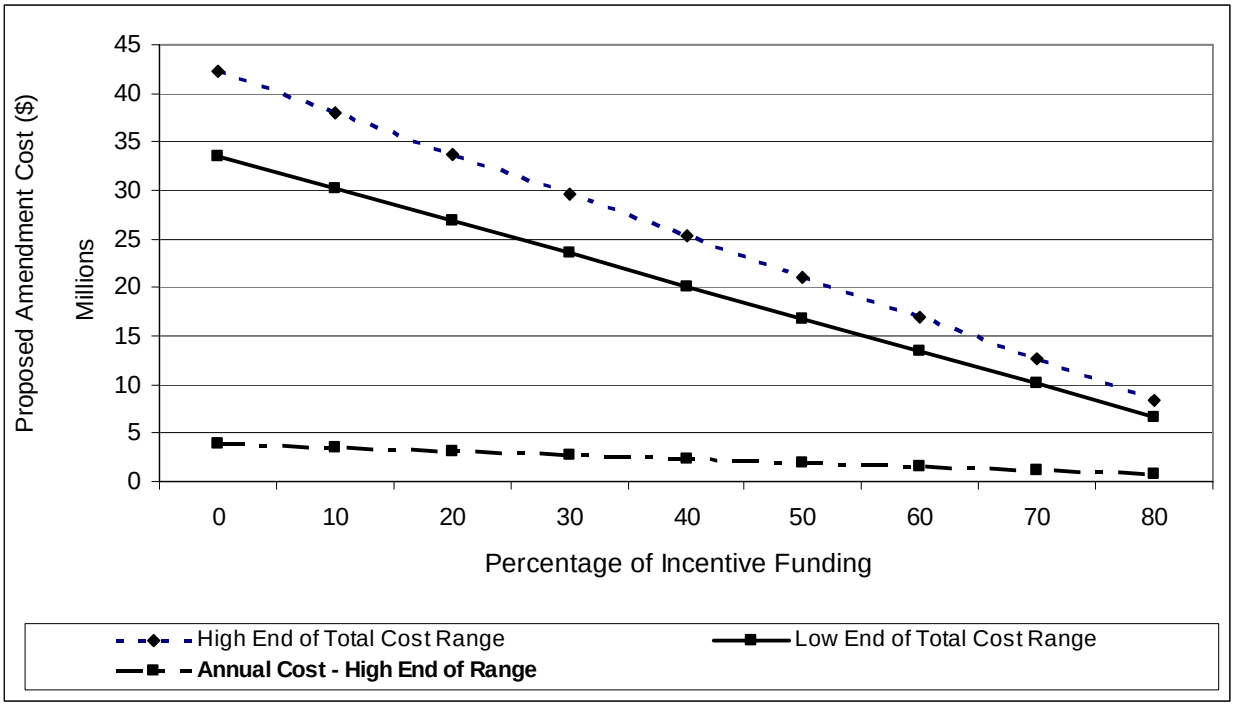
Regulation	Cost-Effectiveness
Proposed Amendments to the Stationary Diesel Engine Control Measure (Adoption Hearing scheduled for November 16 – 17, 2006)	$1 to $22 per pound of diesel PM reduced
Transport Refrigeration Unit ATCM (Adopted at an ARB Hearing on December 11, 2003)	$10 to $20 per pound of diesel PM reduced
Stationary Compression Ignition Engines ATCM (Adopted at an ARB Hearing on November 20, 2003)	$4 to $26 per pound of diesel PM reduced
On-Road Heavy-Duty Residential and Commercial Solid Waste Collection Vehicles Control Measure (Adopted September 25, 2003)	$67 per pound of diesel PM reduced

Source: ARB, 2003a; ARB, 2003b; ARB, 2003c

Based upon historical and current program activity levels, staff believes that some of the affected engines will be replaced under the incentive programs (Carl Moyer, EQIP, AG-ICE, etc.) discussed in Chapter II. Engines replaced under these programs will be replaced with either engines meeting current standards or electric motors. In addition, adoption of these proposed amendments will likely encourage affected engine owner/operators to switch to electric motors, especially in those cases where existing electric power service is close to the affected pump and the available electric service is of sufficient capacity. Staff estimates that approximately 20 percent of all affected engines will be replaced with electric motors, and the effect of these engines is taken into account in this analysis by reducing the affected engine population figures by 20 percent. Emission reductions attributable to the proposed amendments were also appropriately reduced. This adjustment reduces the cost of the proposed amendments, since a portion of the affected engines will come into compliance with funding by sources unrelated to the amendments.

Although it is not possible to determine the degree to which affected engines will be replaced under incentive programs, the potential effect of these incentive programs upon the estimated cost of the proposed amendments is illustrated in Figure VI-1.

Figure VI-1. Incentive Program Funding Effects on Proposed Amendment Cost[1]



1. The estimated proposed amendment total cost is expressed as a cost range, which assumes a compliance strategy of replacement of in-use engines with a new compliant diesel engine and payment of local air district registration fees. Since fees will vary by air district, an assumed range of air district fees was used in the total cost range estimates. Only the high end of the annual cost range is shown; annual costs (both low- and high-end) are shown at the bottom of the Reg Cost Summary worksheet in Appendix F.

Figure VI-1 is provided to illustrate the relative effect of incentive program funds upon the total cost of the proposed amendments; it is not intended to imply that local air district fees can be paid with incentive funds. Further information regarding the assumptions and methodologies used to estimate the proposed amendments' costs and economic impacts is provided in the remainder of this chapter and in Appendix F.

B. Legal Requirements Applicable to the Economic Impact Analysis

Government Code Section 11346.3 requires State agencies (including ARB) to evaluate the potential for adverse economic impacts on California businesses and individuals when proposing to adopt or amend any administrative regulation, including a regulation such as the proposed amendments. The evaluation must include the impact of the proposed regulation upon California jobs, business expansion, elimination, or creation; and businesses' ability to compete with those of other states.

Health and Safety Code Section 57005 further requires the ARB to perform an economic impact analysis of submitted alternatives to a proposed regulation before the adoption of any major regulation. A "major regulation" is defined as a regulation that would potentially cost California businesses more than 10 million dollars in any single year. Because the proposed amendments are not expected to cost California businesses more than 10 million dollars in any single year, no economic impact analysis of alternatives is necessary.

In addition, Government Code Section 11357 and guidelines adopted by the Department of Finance (DOF) require the ARB and other State agencies to estimate a proposed regulation's associated cost or savings to any local, State, or Federal agency. The agency proposing a regulation is also required to determine whether, as a result of the regulation, any cost to local agencies or school districts is reimbursable by the State. Pursuant to Government Code Section 17556, any cost to school districts, transit agencies, or other local public agencies as a result of the proposed amendments would not be reimbursable because private sector businesses would be subject to the same requirements and costs (ARB, 2002).

The proposed rulemaking does not constitute a reimbursable mandate because the proposed amendments apply to all entities that operate the affected engines in the state and does not impose unique requirements on local agencies (County of Los Angeles vs. State of California, 43Cal 3d 46 [Jan 1987]).

C. Economic Impact Analysis

1. Assumptions Used in This Analysis

This analysis is performed in the year 2006 and all costs are given in 2005 dollars (unless otherwise stated). Where future costs are mentioned, they have been adjusted to 2005 dollars using standard accepted economic analysis procedures. A real interest rate of five percent (a seven percent nominal rate minus an assumed two percent inflation rate) is used throughout this analysis, unless otherwise noted.

Initial (or capital) costs, as discussed in this chapter, are the up-front costs of a compliance strategy. The initial costs are expressed as a uniform series of payments over the remaining useful life of the engine being replaced, using a real interest rate of five percent. The interest rate for capitalization is assumed to reflect the current borrowing costs to affected businesses.

All cost and cost-effectiveness estimates are based upon an affected engine population that excludes affected engines located within the boundaries of the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) and the South Coast Air Quality Management District (SCAQMD) and includes the rest of California. In-use stationary agricultural engines that would be affected by the proposed amendments in the SJVUAPCD/SCAQMD are already either subject to or in the process of being subject to local air district rules paralleling the proposed amendments. For this reason, the

emission reductions (both PM & NO_x), as well as the compliance costs, are not included in this analysis.

An undetermined number of affected engines may qualify for the remote location exemption discussed elsewhere in this report. All of the cost and cost-effectiveness estimates presented in this report assume that none of the affected engines will take advantage of this exemption, since the number of engines that may be exempted is unknown.

Appendix F contains the affected in-use engine population data table and a discussion of its use in generating the cost and cost-effectiveness estimates in this report. Although there are no affected engines in the greater-than-750 hp category outside of the SJVUAPCD, cost information for this category is provided for completeness.

These cost estimates are based on current and known technology; staff believes that it is likely that the costs will decrease as technology improves and production and sales volumes increase. The impact of ARB Verified Diesel Emission Control Strategies (VDECS) certification costs upon in-use compliance technology costs to the end users will vary according to product sales volumes and the degree of certification testing required for a given product. Compliance technology costs used in this staff report reflect manufacturers' best-estimated retail installed product costs.

Since the costs of many items in this analysis are subject to change and vary between different vendors, cost averages or ranges are used in developing the estimated cost impacts of the proposed amendments. In addition, costs to a directly-affected business will vary according to the actual quantities, ages, and size(s) of affected engines that they may have.

Estimated costs for the proposed amendments are those within the 2008 to 2029 time period. This period was chosen to include the major portion of costs attributable to the proposed amendments. This time period (and the estimated costs) encompasses the capital cost amortization periods for all of the affected engine categories. It should be noted that local air district fees paid by the affected owner/operators are expected to be incurred until the engine is taken out of service; they are attributed to the estimated cost of the proposed amendments only until the end of the capital cost amortization period (2029.) The cost-effectiveness figures discussed in this chapter may use analysis periods that vary slightly from the estimated cost analysis period; where this occurs, the different analysis period is noted.

The affected engines are replaced or rebuilt as they wear out or fail; anecdotal information indicates that an unknown number of these engines are rebuilt repeatedly rather than replaced. In the past, due to long engine model lifespans and parts commonality among models, rebuild component availability at low prices made this rebuild practice quite feasible. As newer engines adopt electronic controls and the availability of replacement products for older decreases, the practice of repeatedly rebuilding an engine will decrease. Due to the lack of data regarding rebuilding

frequency and count, its effect is not quantified in this analysis beyond the assumption that each affected engine is rebuilt once as described below.

It is assumed that owner/operators replace or rebuild these engines on a periodic basis. Typical practice is to rebuild an engine at roughly 10,000 hours of use (assumed to be at the rate of 1,000 operating hours per year) after it has been placed in service, though this figure does vary widely according to use and care. In addition, the rebuild cost may also vary widely, as it is dependent upon an engine's exact condition, which may again vary widely. Replacement with a new engine is a more common strategy in the smaller engine sizes, as the rebuild cost is closer to the price of a new engine for the smaller engines. For the purposes of this analysis, it is assumed that an in-use engine is rebuilt once 10 years after its placement into service, and the cost of the rebuild is equal to 50 percent of the new engine purchase price.

a. Directly-Affected Businesses

The businesses directly affected by the proposed amendments are farms and ranches using compression-ignition (diesel) powered engines (producing greater than or equal to 50 horsepower) for the purposes of raising crops and/or animals. These businesses will incur the estimated compliance costs as outlined later in this chapter, which include loss-of-use for existing engines and local air district registration fees.

The United States Department of Agriculture (USDA) conducts periodic surveys of farm and ranch operators in conjunction with its Census of Agriculture. A portion of the most recent survey report, the 2003 Farm and Ranch Irrigation Survey (FRIS) contains data regarding the operational and equipment inventory characteristics of U.S. farms and ranches.

The survey shows that there are 3,895 (3,900 rounded) farms operating pumps powered by diesel-fueled engines in California. Data on a by-county basis was not available, so it was not possible to delete those affected farms in the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) and the South Coast Air Quality Management District (SCAQMD). Approximately one-half of the affected engines are located in the SJVUAPCD. However the number of engines per farm can vary widely, and for this reason the percentage of engines located in the local air districts cannot be applied to the number of statewide affected farms to delete those in the SJVUAPCD and SCAQMD. In addition, since the proposed amendments do not affect those stationary agricultural engines with less than 50 hp, and an unknown percentage of the 3,895 farms with diesel-fueled pumps may have engines with less than 50 hp and are not affected by the proposed amendments. The 3,895 figure is very conservative and the actual number of directly-affected businesses is expected to be somewhat less USDA, 2002b).

b. Indirectly-Affected Businesses

Indirectly-affected businesses include those that design, manufacture, distribute, and sell diesel engines and related accessories for this application, as well as both engine manufacturer-authorized dealers and independent service providers that install, maintain, rent, and repair these engines. Other potentially affected businesses include electric power providers, fuel suppliers, and those businesses that design, manufacture, sell, install, maintain, and repair approved diesel exhaust after-treatment devices for these engines.

Staff has identified nine engine manufacturers that design and produce engines affected by the proposed amendments; none of them are located in California. However, their authorized distributors and dealers are located in California. The total number of affected California authorized distributors/dealers is estimated at 113, based on visiting the Internet websites of the affected manufacturers and using the "dealer locator" webpage feature (Cook, 2006b). Additionally, an unknown number of independent engine service providers (IESP) outside of the engine manufacturer/distributor/dealer network may be affected. To the extent that engines are replaced rather than rebuilt as is current practice, those businesses that perform this service may see a decrease in revenues until the new replacement engines are ready to be rebuilt. Scrap metal and other businesses that deal in used engines may see an increase in revenue as a result of in-use engines being scrapped or sold to make way for new engines.

There may be a very small number of these engines owned by public agencies or universities that may be affected. Also, the local air districts will be affected, as they will have the primary implementation and enforcement authority for these proposed amendments.

The United States 2002 Economic Census was consulted to determine the number of IESPs within California; however, IESP data are combined with many other types of machinery and equipment repair and service providers. As a result, it is not possible to estimate the number of affected IESPs (U.S. Census Bureau, 2002).

c. Determination of Typical and Small Business Size

Section 11342.610 of the California Government Code defines an agricultural small business as one that does not include those independently owned and not dominant in its field of operation and "…where the annual gross receipts exceed one million dollars ($1,000,000)." Applying this definition to the FRIS data shows that 92 percent of California irrigated farms have total annual agricultural product sales of $999,999 or less. The total irrigated farm population is divided into product sales segments (by dollar range of sales; $25,000 to $49,999, for example); the lowest segment, less than $25,000 in sales, contains 49 percent of the irrigated farms. (USDA, 2002b)

Since approximately 92 percent of the affected businesses are considered small businesses, the typical business can be considered a small business and the cost

estimates developed for a small business can also be used for a “typical business” scenario, though the exact cost will depend upon the factors discussed below.

Factors such as crops raised, availability and cost of irrigation water sources, nature of irrigation water distribution, soil composition, and climate influence the number of irrigation pumps for a given business. In addition, fuel costs, electric power costs, and availability of electric service and its capacity heavily influence businesses’ decision as to the appropriate energy source for powering irrigation pumps. Due to all of these factors, it is not possible to develop an accurate and representative profile of a typical business. However, for discussion purposes, extrapolation was used to determine a range of one to three affected diesel engines for a typical business. The methodology used for this extrapolation is shown in Appendix F.

d. Business Impacts/Competitiveness Discussion

Directly-affected businesses will either absorb or pass on their compliance costs. Those California businesses that have a majority of the share of the market for their product (walnuts, for example) will be able to pass on their costs, since they are able to set the market price, to a degree. California businesses selling products that are produced in other states and for which California businesses do not have a majority of the market share (oranges, for example) will have to absorb the compliance costs.

The proposed amendments apply to existing businesses and use existing technologies. It may lead to the creation or elimination of businesses. Due to the long lead time given for compliance and a range of compliance options, staff believes that most businesses will be able to meet the compliance costs. However, it is possible that a small number of businesses (those with marginal profitability) may have difficulty in complying with these amendments. Staff believes that these amendments may lead to the alteration of job duties within existing businesses, as well as a small increase in new jobs due to the creation of business opportunities as discussed below. This may be offset by the loss of a few businesses (and attendant jobs) that are unable to comply with the proposed amendments. Staff believes that there will be little or no significant change in the total number of businesses or jobs.

Businesses that may be created include those that: furnish, install, and maintain diesel emission control systems, scrap used engines, and provide alternative (non-diesel) in-use compliance strategies. Economic productivity may be reduced as businesses devote labor and capital to comply with the proposed amendments. Individuals may be impacted to the extent that affected businesses are able to pass on the compliance costs to their customers.

e. Cost Discussion

The proposed amendments (emission standards) are intended to reduce public exposure to diesel particulate matter (diesel PM), a toxic air contaminant, from in-use stationary diesel-fueled engines that are used in agricultural applications, primarily

involving irrigation uses. The standards may be met by replacing engines with those meeting the new standards, retrofitting existing engines with approved control devices, or the use of non-diesel alternatives, such as conversion to electric power or use of alternative fuels. For economic reasons, staff believes that engine replacement will be the most popular compliance option chosen by the affected owners/operators. Thus, the cost analysis for the proposed amendments focuses on engine replacement as the primary compliance strategy.

For the retrofit option, drawbacks include: the availability of verified systems (many of these engines are relatively old, compared to other diesel engine categories), possible source test requirements imposed by local air districts, and possible in-use monitoring requirements to ensure proper system function. The sum of these costs may exceed the cost of a new engine, especially for the smaller engine sizes.

Alternative fuel use has not been considered cost-effective given past relatively inexpensive diesel fuel prices; however, the recent upswing in diesel fuel prices may make alternative fuels attractive as a compliance option. Current limited availability of many alternative fuels is a concern. Electric power is considered the most viable alternative (in most locations) at the present time; the majority (83 percent) of irrigation pumps are powered by electric motors (USDA, 2002b). Concerns about sufficient electric service availability and capacity, especially in light of the remote locations of many of these engines, preclude statewide requirements for conversion to electric power.

U.S. EPA has set forth more stringent emission requirements (commonly referred to as Tier 3 and Tier 4 engine standards) for new diesel engines; these requirements are already taking effect and are being implemented by engine horsepower category and engine model year. These requirements apply to all engines in this use category sold nationwide and are taking place independent of any rulemaking actions (such as these proposed amendments) in California. The difference in cost between a Tier 3 or Tier 4 engine and older engines is not relevant to the estimated cost of these proposed amendments. Anyone purchasing a new engine for any reason, including a normally scheduled replacement for a worn-out or damaged engine, at or before the compliance deadlines in the proposed amendments, will be purchasing a compliant engine, provided that they are not buying an engine that has been in dealer stock for an unusually long period of time.

The proposed amendments will likely encourage the replacement of in-use engines according to a specific timeline; keeping a current in-use engine in service indefinitely by rebuilding it multiple times will not be possible. Staff is unable to quantify this practice, but recognizes that it does occur and assumes the cost of one rebuild per engine. This is a conservative approach, as many owner/operators with affected engines that are near their rebuild date and the proposed amendment compliance date will choose to forego the rebuild expense and replace their engine.

The compliance costs that a directly-affected business will incur will depend upon the choice of compliance option(s) that the business elects to use, as well as the number and size of affected engines that they have. In addition, the degree to which businesses successfully take advantage of incentive programs such as AG-ICE, Carl Moyer, and EQIP will also affect their net compliance costs. This analysis and discussion assume than no portion of the compliance cost is covered by incentive programs.

Since the proposed amendments require in-use engines to be replaced according to a specified timetable, affected owners/operators will incur the cost of a new engine or a switch to a non-diesel alternative sooner than would be expected if the proposed amendments did not exist. Thus, the loss-of-use experienced by an owner/operator is the majority of the cost impact of these proposed amendments. The remainder of the incurred costs are expected to result from owner/operator local air district registration costs.

f. Loss-of-Use Costs

Loss-of-use costs are those incurred by affected owner/operators who do not receive the full expected life from their engines as a result of earlier-than-anticipated replacement required by the proposed amendments. Quantification of this amount was calculated by taking the current price of a new equivalent size (HP) engine and the cost of an average rebuild (assumed to be 50 percent of the cost of a new engine) and prorating these costs using the expected remaining life of both the engine and its last rebuild. Prorating of the costs was done to reflect the belief that it is not appropriate to assign the entire cost of engine replacement to the proposed amendments, since businesses periodically replace engines as a normal part of their day-to-day operations. This cost was then amortized over the number of years of expected remaining life of the engine; it was assumed that the median engine life is 20 years, with an annual usage of 1,000 hours. Also assumed is that these engines are rebuilt at the 10,000 operating hour (ten year) point. Table F-2 in Appendix F lists the amortization periods by engine size and U.S. EPA emission certification tier standards. A detailed discussion of the methodology used and specific cost information for each affected engine horsepower category and emission standard tier is in Appendix F.

The new engine costs used were obtained from California dealers in 2005 and reflect the cost of a “power unit,” which is the configuration that an engine for this application is normally purchased. For each engine size (horsepower) category, an average engine price was determined from quoted engine prices for sizes towards the high end of the category. The power unit price includes all accessories and controls needed to operate the engine. These prices are listed on the “Engine&Motor Costs” worksheet in Appendix F.

The estimated loss-of-use costs for the range of affected engines are given in Table VI-4. Costs vary within an engine category due to varying amounts of expected

remaining life for different engine subcategories (emission tiers) and differing proposed amendment compliance dates.

Table VI-4. Estimated Per-Engine Loss-of-Use Costs by Engine Size (hp)[2]

Engine Size (hp)	Loss of Use (Lump Sum Basis) ($)	Loss of Use (Annual Payments Basis) ($)
50 to 74	6,700 to 8,000	1,200 to 1,900
75 to 99	4,200 to 9,400	1,200 to 1,500
100 to 174	7,800 to 12,500	1,800 to 1,900
175 to 299	11,100 to 17,800	2,600 to 3,100
300 to 599	16,400 to 26,300	3,800 to 4,100
600 to 750	20,300 to 32,500	4,700 to 5,000
>750[1]	21,500 to 172,100	21,500 to 26,600

1. For estimation purposes, a size of 1,725 hp was assumed for this category.
2. Loss-of-use amounts vary due to varying amounts of expected remaining life for different engine subcategories (emission tiers) and differing proposed amendment compliance dates.

Using the per-engine loss-of-use costs and the affected engine population composition from the emissions inventory, the total loss-of-use cost for the proposed amendments are calculated on the "Reg Cost" worksheet in Appendix F.

g. Local Air District Registration Fees

For compliance purposes, affected engines will need to be identified by the local air districts. This will involve the engine owner/operator providing engine registration information to the local air district. It is assumed that the local districts will fully recover their costs by charging fees to the affected owner/operators. Two local air districts are currently in the rulemaking process to adopt registration or permitting programs and fees; the lower of the two district fee schedules was used for low end of the estimated fee range, while a modified version of ARB's Portable Equipment Registration Program (PERP) fee schedule was used for the high end. Further discussion regarding district fees is located in Appendix F.

The proposed amendments require the local air districts to collect and maintain information on the affected engines. In addition, the local air districts are primarily responsible for enforcement of these proposed amendments; previously, these engines were not tracked by either air districts or ARB, since they were under an agricultural exemption.

Where local air districts already have sufficient information on an affected engine (engines replaced with Moyer incentive funding assistance or otherwise subject to district permitting), discounted fee schedules may be used in some cases. The degree to which affected engines may qualify for discounted fees is unknown and, for the purposes of this analysis, it is assumed that none of the affected engines qualify for discounted fees.

The owners/operators of the affected engines will have to submit information about their engines to their local air districts. It is anticipated that the yet-to-be established procedures, which may differ by district, will start with a registration process, which would require the submittal of basic information including, but not limited to, the type, number, location, proximity to receptors, and operating characteristics of their engines. It is assumed that the completion of the registration form by the owner/operator will take approximately two hours, at a cost of $50 per hour, for a total of $100 per affected engine. Subsequent renewals/updates are expected to take a minimal amount of time and are not reflected in the cost estimates.

Table VI-5 summarizes the range of local air district fees used to estimate the cost of the proposed amendments. The low-end scenario assumes that an initial registration fee will be paid by the owner/operator of the affected engine as soon as the proposed amendments take effect (assumed to be in year 2008) and an annual renewal fee will be paid each subsequent year that the engine is kept in service. For the high-end scenario, the owner/operator will pay the initial registration fee in 2008, then pay a renewal fee that does not include inspection until the year that the affected engine must comply with the proposed lower emission standards, and then pay a higher inspection-included renewal fee for subsequent years that the engine is in service.

Table VI-5. Estimated Range of Per-Engine Owner/Operator Local Air District Fees

Fee Type	Low ($)	High ($)
Initial Registration (low end) - Basis: San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) Rule 3155 (inspection fee included in registration fee) ($45) - Includes $100 Cost Allowance (2 hrs. @ $50/hr.) for Affected Owner/Operator Completion/Submission of Registration Application to Local Air District	145	
Initial Registration (high end) - Basis: ARB PERP, 3-Year Fee Divided by 3 = $90 - Includes $100 Cost Allowance (2 hrs. @ $50/hr.) for Affected Owner/Operator Completion/Submission of Registration Application to Local Air District		190
Renewal (low end) - Basis: SJVUAPCD Rule 3155 - Includes Inspection Fee	26	
Renewal (high end) - Basis: ARB PERP Current Fee Schedule; Proposed PERP Fee Schedule Revisions - Renewal Fee for Years After Initial Registration But Before Engine Replacement (does not include inspection fee) - Renewal Fee for Years Including Engine Replacement Year and Thereafter ($75 renewal fee plus $167 inspection fee; assumes triennial inspection of registered engine)		75 242

Source: SJVUAPCD, 2005; ARB, 2006b

Using a range of one to three affected engines that a typical and small business is expected to have, the range of expected fees for a directly-affected business is summarized in Table VI-6.

Table VI-6. Estimated Range of Owner/Operator Local Air District Fees for a Typical and Small Business

Fee Type	1 Engine	3 Engines
Initial Registration		
Low-End	$145	$435
High-End	$190	$570
Renewal		
Low-End	$26	$78
High-End	$242	$726

Some districts may need to assess fees that are higher than the estimates given in Tables VI-5 and VI-6. These higher fees may be driven by factors including, but not

limited to, the frequency of local air district inspections of the affected engines, local air district staff resource needs, and other local air district resource needs associated with implementation and enforcement of the proposed amendments.

h. Total Cost of Proposed Amendments

The overall total cost is the sum of all costs that affected engine owners/operators would pay as a result of the adoption of the proposed amendments; these costs are the loss-of-use and local air district fees.

The overall total cost for the proposed amendments is estimated at $34 million to $42 million, over the 22-year analysis period (2008 to 2029). Overall annual costs are estimated to be within the range of $60,000 to $3.9 million per year during the same time period previously mentioned. Tables VI-1 and VI-2 summarize the per-engine as well as the typical and small business costs. The year-by-year costs, as well as the subtotals for each affected engine size category, are listed in the "Reg Cost Summary" worksheet in Appendix F.

D. Analysis of Potential Cost Impacts Upon Governmental Agencies

The scope of affected governmental agencies may include federal, State, and local agencies and municipalities, including school districts and colleges.

1. Costs to ARB

One-time expenses for local air district assistance and the development of registration and health-risk screening tools and guidelines are expected and will be absorbed within existing budgets and resources in the 2007 fiscal year. It is estimated that 0.75 person-years (PYs) of staff time will be needed to perform these tasks, at an approximate cost of $62,000.

2. Costs to Other State Agencies

An extremely small number (less than 10) of affected engines are operated by other state agencies or universities (both the California State University (CSU) and University of California (UC) systems). State prisons and universities were surveyed to determine the extent to which they might have affected engines. Four state prisons and two universities within the CSU systems were identified as possibly having engines subject to these proposed amendments (Cook, 2005a; Cook, 2005b). Based on this information, it is expected that the total number of affected engines operated by State agencies is very small; therefore, any compliance costs will have a negligible impact on other State agencies.

3. Costs to Other Governmental Agencies (Other Than State Agencies)

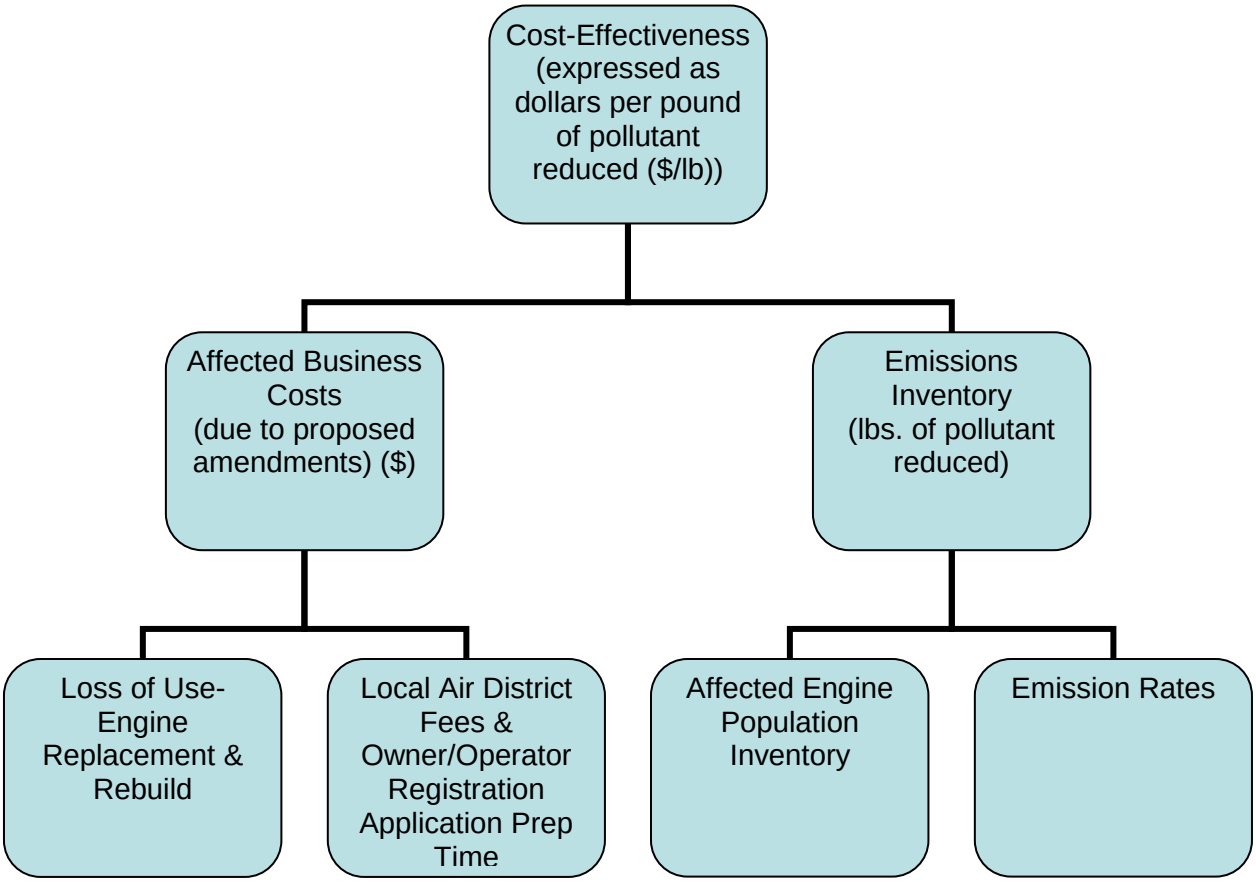
Other governmental agencies include school districts, as well as federal and local governmental agencies. Local municipalities or school districts that operate affected engines may experience compliance costs to the extent that they own and/or operate the affected engines. Staff has been unable to identify any affected engines operated by these school districts and agencies; if any exist, staff expects that they represent an insignificant portion of the total statewide population.

As previously discussed, the owners/operators of the affected engines will have to submit information about their engines to their local air districts. It is anticipated that the yet-to-be established procedures, which may differ by district, will start with a registration process, which would require the submittal of basic information including, but not limited to, the type, number, location, proximity to receptors, and operating characteristics of their engines. It is assumed that the completion of the registration form by the owner/operator will take approximately two hours, at a cost of $50 per hour, for a total of $100 per affected engine. Subsequent renewals/updates are expected to take a minimal amount of time and are not reflected in the cost estimates. It is expected that local air districts will fully recover their costs under the authority granted to them in the California Health & Safety Code, sections 40702, 40727.2(j), and 41512.5 in conjunction with the registration requirements in the proposed amendments.

E. Cost-Effectiveness Analysis of the Proposed Amendments

Health and Safety Code Sections 39658 & 39665 through 39667 require ARB to determine the need and appropriate degree of regulation for substances identified as toxic air contaminants. A portion of this determination is the estimation of the cost-effectiveness of the proposed regulation (amendments). Basically, the cost-effectiveness is the ratio of the regulation cost divided by the emissions benefits produced by the regulation; for ATCMs, the cost-effectiveness is typically expressed in dollars per pound of pollutant avoided. Figure VI-2 illustrates the components of the cost-effectiveness figure.

Figure VI-2. Cost-Effectiveness Calculation Diagram



The cost effectiveness for the proposed amendments was calculated using two different conventions, to provide equal and meaningful comparisons with other air quality measures. For both calculation conventions, both compliance costs and emission reductions estimated from implementation of the proposed amendments include all areas of California except for the San Joaquin Valley Unified Air Pollution Control District and the South Coast Air Quality Management District.

1. Overall Cost-Effectiveness for Diesel PM (DPM)

The overall cost-effectiveness figure uses the sum of all proposed amendment costs (loss-of-use and local air district fees) and the total DPM reductions attributable to the proposed amendments. Since the proposed amendments have costs (local air district fees) in years that do not have corresponding emission reductions, the years without emission reductions are omitted from the cost-effectiveness analysis period. For the overall cost-effectiveness, the analysis period is the years during which there are emission reductions, 2011 to 2029. Although the costs incurred during years without emission reductions are not used in the overall cost-effectiveness calculations, they are

accounted for and included in the total overall cost of the proposed amendments as discussed in Section C.1.h. earlier in this chapter.

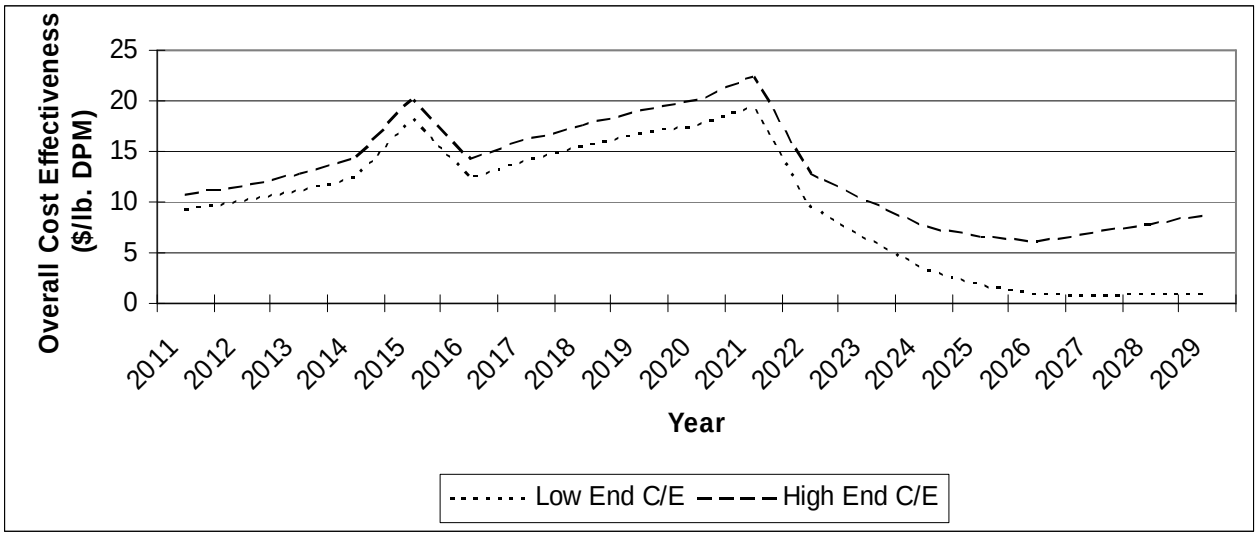
Table VI-7. Overall Cost-Effectiveness of the Proposed Amendments

Year	Overall DPM Cost-Effectiveness ($/Lb.)
2008	[a]
2009	[a]
2010	[a]
2011	9.12 – 10.54
2012	9.97 – 11.48
2013	10.98 – 12.65
2014	12.21 – 14.07
2015	18.06 – 19.96
2016	12.37 – 14.23
2017	13.92 – 15.94
2018	15.33 – 17.53
2019	16.65 – 19.03
2020	17.45 – 20.06
2021	*19.38 – 22.29*
2022	9.34 – 12.62
2023	6.26 – 9.96
2024	3.26 – 7.44
2025	1.70 – 6.41
2026	*0.76 – 6.09*
2027	0.73 – 6.78
2028	0.82 – 7.67
2029	0.93 – 8.68

a. Cost-effectiveness cannot be calculated for this year due to zero emission reduction.

For the period from 2011 to 2029, the average overall cost-effectiveness of the proposed amendments is $11 per pound of diesel PM reduced (the cost-effectiveness range is from $1 to $22 per pound of diesel PM reduced). The variation in cost effectiveness, which is due to the differing costs and emission reductions during implementation period, is illustrated in the figure on the next page.

Figure VI-3. Overall Cost-Effectiveness of the Proposed Amendments[1]



1. "C/E" means cost-effectiveness.

2. Cost-Effectiveness for Diesel PM and NO_x

Since many diesel PM control strategies also indirectly reduce NO_x emissions, another way of evaluating an emission control program is to split the control costs evenly and divide each half by the estimated diesel PM and NO_x reductions to produce cost-effectiveness figures for both diesel PM and NO_x. For this method, the loss-of-use cost and the estimated local air district fee range constitute the total cost.

The analysis period for this method is 2011 to 2029; the range of cost-effectiveness is: $0.36 to $11 per pound for diesel PM, and from $0.02 to $0.67 per pound for NO_x. A detailed table of the year-by-year cost-effectiveness values is shown on the next page.

Table VI-8. DPM and NOx Cost-Effectiveness Range Using the Split-Cost Method

Year	DPM and NO_x Cost-Effectiveness Range	
	DPM ($/lb.)	NO_x ($/lb.)
2011	4.56 – 5.27	0.27 – 0.31
2012	4.98 – 5.74	0.29 – 0.34
2013	5.49 – 6.32	0.32 – 0.37
2014	6.11 – 7.03	0.35 – 0.41
2015	9.03 – 9.98	0.51 – 0.56
2016	6.18 – 7.11	0.38 – 0.43
2017	6.96 – 7.97	0.42 – 0.48
2018	7.67 – 8.76	0.46 – 0.53
2019	8.32 – 9.51	0.50 – 0.57
2020	8.72 – 10.03	0.52 – 0.60
2021	9.69 – 11.15	0.58 – 0.67
2022	4.67 – 6.31	0.28 – 0.38
2023	3.13 – 4.98	0.19 – 0.30
2024	1.63 – 3.72	0.10 – 0.22
2025	0.85 – 3.20	0.05 – 0.19
2026	0.38 - 3.05	0.02 – 0.18
2027	0.36 - 3.39	0.02 – 0.20
2028	0.41 – 3.84	0.03 – 0.23
2029	0.47 – 4.34	0.03 – 0.26

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