TITLE 17. CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC HEARING TO CONSIDER THE ADOPTION OF A PROPOSED AIRBORNE TOXIC CONTROL MEASURE FOR PORTABLE DIESEL-FUELED ENGINES

The Air Resources Board (ARB or Board) will conduct a public hearing at the time and place noted below to consider adopting an airborne toxic control measure (ATCM) to reduce public exposure to diesel particulate matter (PM) emitted from portable diesel-fueled engines (proposed ATCM).

DATE: February 26, 2004

TIME: 9:00 a.m.

PLACE: California Environmental Protection Agency
Air Resources Board
Central Valley Auditorium, Second Floor
1001 I Street
Sacramento, California 95814

This item will be considered at a two-day meeting of the ARB, which will commence at 9:00 a.m., on February 26, 2004, and may continue at 8:30 a.m., on February 27, 2004. This item may not be considered until February 27, 2004. Please consult the agenda for the meeting, which will be available at least 10 days before February 26, 2004, to determine the day on which this item will be considered.

If you have special accommodation or language needs, please contact the ARB's Clerk of the Board at (916) 322-5594 or sdorais@arb.ca.gov as soon as possible. TTY/TDD/Speech-to-Speech users may dial 7-1-1 for the California Relay Service.

INFORMATIVE DIGEST OF PROPOSED ACTION AND POLICY STATEMENT OVERVIEW

Sections Affected: Proposed adoption of sections 93116, 93116.1, 93116.2, 93116.3, 93116.4, and 93116.5, title 17, California Code of Regulations (CCR).

Background: In 1998 the Board identified diesel PM emissions from diesel-fueled engines as a toxic air contaminant (TAC). In September 2000, the Board approved the Diesel Risk Reduction Plan, which outlined steps that would be taken to reduce diesel emissions from both new and existing diesel-fueled engines and vehicles, including portable engines. The ultimate goal of the Diesel Risk Reduction Plan is to reduce California's diesel PM emissions and associated cancer risks by 85 percent by 2020.

Unlike stationary engines, portable engines may be moved readily from one location to another. The engines are used to power a variety of equipment, including pumps

(e.g., agricultural irrigation pumps and other water pumps), ground support equipment at airports, cranes, oil-well drilling and workover rigs, power generators, dredging equipment, rock crushing and screening equipment, welding equipment, woodchippers, and compressors. Portable diesel engines emit approximately 1,500 tons per year of diesel PM. These engines are distributed throughout California, and many are located in urban centers where the population is exposed to diesel PM emissions.

The proposed ATCM is designed to minimize the public's exposure to diesel PM emitted from diesel-fueled portable engines. Health and Safety Code (H&SC) sections 39666 and 39667 require the ARB to adopt regulations to achieve the maximum possible reduction in public exposure to TACs through the application of best available control technology (BACT), or a more effective control method, in consideration of cost, risk, environmental impacts, and other specified factors.

Furthermore, the Children's Environmental Health Protection Act (Stats. 1999, Ch. 731) requires the California Environmental Protection Agency to specifically consider children in setting Ambient Air Quality Standards and in developing criteria for TACs. The Office of Environmental Health Hazard Assessment (OEHHA) identified diesel PM and several other TACs associated with motor vehicle exhaust among the top priority pollutants affecting children's health.

The ARB staff has prepared an Initial Statement of Reasons (ISOR) for the proposed ATCM that, together with the needs assessment (Diesel Risk Reduction Plan), serves as the report on the need and appropriate degree of regulation for diesel-fueled portable engines.

EXISTING FEDERAL AND STATE REGULATIONS

There are no federal regulations that are comparable to the proposed ATCM. However, since January 1, 1996, new portable engines sold in California have been subject to ARB's Off-Road Compression Ignition emission standards (title 13, CCR, sections 2320 et seq.), which are equivalent to the United States Environmental Protection Agency (U.S. EPA) emission standards for newly manufactured nonroad engines (40 CFR, Part 89). There are currently three tiers of standards; Tier 1, 2, and 3. The U.S. EPA proposed Tier 4 emission standards in April 2003, which will, if adopted, require most engines to meet more stringent emission limits in the 2011-2014 timeframe.

The ARB currently administers a Statewide Portable Equipment Registration Program (PERP; title 13, CCR, sections 2450-2466) that allows portable-engine owners to voluntarily register their engines with the State in lieu of obtaining operating permits from the local air pollution control and air quality management districts (districts). By January 1, 2010, only engines certified to U.S. EPA/ ARB off-road engine emission standards (Tier 1, 2, or 3) can be registered under PERP.

Description of the Proposed Regulatory Action

Applicability and Requirements

The proposed ATCM would affect all diesel-fueled portable engines that are larger than 50 horsepower (hp). The proposed ATCM would require all portable engines to be certified to Tier 1, 2, or 3 U.S. EPA/ARB off-road engine standards by 2010, as is currently required for engines registered in the PERP. After 2010, it would require all fleets of portable engines to meet diesel PM emission averages that become more stringent in 2013, 2017, and 2020. The owners/operators of these fleets will have flexibility in determining how the fleet emission standards are to be satisfied. Options that are available to satisfy this standard include replacing engines, using add-on control devices, switching to alternative fuels or alternative diesel fuels, and receiving credit for electrification. By 2020, the proposed ATCM would require diesel-fueled portable engines to either:

1) be certified to Tier 4 emission standards for newly manufactured off-road engines; or
2) be equipped with a diesel PM control technology that has been verified by the ARB under it's Verification Procedure for diesel PM control technologies (title 13, CCR sections 2700-2710) to reduce diesel PM emissions by 85 percent (Level-3 Verification), or equipped with a combination of verified control technologies that cumulatively achieve 85 percent diesel PM reduction.

Fleet Requirements

In addition to the requirements outlined above, portable engines will be subject to the following fleet weighted standards starting in 2013 and becoming progressively more stringent in 2017 and 2020. Fleet weighted diesel PM standards are proposed for engines less than 175 horsepower (hp), engines between 175 hp and 749 hp, and engines greater than or equal to 750 hp.

Fleet Standard Compliance Date	Diesel PM Standard (g/bhp-hr) for Engines <175 hp	Diesel PM Standard (g/bhp-hr) for Engines 175 hp to 749 hp	Diesel PM Standard (g/bhp-hr) for Engines ≥ 750 hp
1/1/13	0.3	0.15	0.25
1/1/17	0.18	0.08	0.08
1/1/20	0.04	0.02	0.02

Owners of portable engine fleets will determine compliance with the proposed fleet standard by comparing the fleet's actual weighted diesel PM emission rate with the fleet emission standard.

Engines that are used exclusively in emergency applications or meet the requirements for low-use engines must be certified to U.S. EPA/ARB off-road engine standards by

2010 but are not subject to the fleet emission standards in 2013 or 2017. These engines would be required by January 1, 2020, to be certified to Tier 4 engines standards, or be equipped with a Level-3 diesel PM control technology, or a combination of verified control technologies to achieve a 85 percent diesel PM reduction.

Incentives

The proposed ATCM provides several incentives to encourage repowering or replacement of older engines with new, lower-emitting engines as part of the fleet reduction approach. Credits are being proposed for satisfying a fleet standard for adding alternative-fueled engines to the fleet, replacing diesel-fueled engines with electrification, and early replacement of older engines with Tier 4 engines.

Recordkeeping and Reporting Requirements

Specific recordkeeping requirements address only those engines in a fleet whose use is based on hourly limitations, fleets taking advantage of the electrification incentive, and engines equipped with Selective Catalytic Reduction (SCR). All fleet owners will have to submit a status report to the ARB by March 1, 2011, that includes the fleet's average diesel PM emission rate for the 2010 calendar year, information identifying each engine in the fleet, and each engine's emission rate. In addition, fleet owners must submit signed statements of compliance and corroborating data indicating that they are meeting the fleet standards by March 1 of each applicable year (i.e., 2013, 2017, 2020).

Exemptions

Engines that would be exempt from the proposed ATCM include: engines less than or equal to 50 hp, engines used to propel mobile equipment or motor vehicle; portable equipment that is owned by the United States Department of Defense and used in combat, combat support, tactical or relief operations, or training for such operations (military tactical support equipment); and portable engines used at San Clemente or San Nicolas Island.

AVAILABILITY OF DOCUMENTS AND AGENCY CONTACT PERSONS

The Board staff has prepared an ISOR for the proposed regulatory action, which includes a summary of the potential environmental and economic impacts of the proposal, if any. The ISOR is entitled, "Staff Report: Initial Statement of Reasons for the Proposed Airborne Toxic Control Measure for Diesel Particulate Matter from Portable Engines Greater Than 50 Horsepower."

Copies of the ISOR and the full text of the proposed regulatory language may be obtained from the Public Information Office, Air Resources Board, 1001 I Street, Visitors and Environmental Services Center, 1st Floor, Sacramento, CA 95814, (916) 322-2990, at least 45 days prior to the scheduled hearing, which will begin on February 26, 2004.

Upon its completion, the Final Statement of Reasons (FSOR) will be available and copies may be requested from the agency contact persons in this notice, or may be accessed on the ARB's web site listed below.

Inquiries concerning the substance of the proposed regulations may be directed to the designated agency contact persons, Mike Waugh, Manager of the Program Assistance Section, at (916) 445-6018, or by email at mwaugh@arb.ca.gov, or Grant Chin, Staff Air Pollution Specialist, at (916) 327-5602, or by email at gchin@arb.ca.gov.

Further, the agency representative and designated back-up contact persons to whom nonsubstantive inquiries concerning the proposed administrative action may be directed are Artavia Edwards, Manager, Board Administration & Regulatory Coordination Unit, (916) 322-6070, and Alexa Malik, Regulations Coordinator, (916) 322-4011. The Board has compiled a record for this rulemaking action, which includes all the information upon which the proposal is based. This material is available for inspection upon request to the contact persons.

If you are a person with a disability and desire to obtain this document in an alternative format, please contact the ARB's Clerk of the Board at (916) 322-5594 or sdorais@arb.ca.gov as soon as possible. TTY/TDD/Speech-to-Speech users may dial 7-1-1 for the California Relay Service

This notice, the ISOR and all subsequent regulatory documents, including the FSOR, when completed are available on the ARB Internet site for this rulemaking at http://www.arb.ca.gov/regact/porteng/porteng.htm

COSTS TO PUBLIC AGENCIES AND TO BUSINESSES AND PERSONS AFFECTED

The determinations of the Board's Executive Officer concerning the costs or savings necessarily incurred by public agencies and private persons and businesses in reasonable compliance with the proposed regulations are presented below.

Pursuant to Government Code section 11346.5(a)(5), the Executive Officer has determined that the proposed regulations will possibly impose a mandate on local agencies. The Executive Officer has further determined pursuant to Government Code section 11346.5(a)(6) that the proposed regulations will result in some additional costs to the Air Resources Board and other state agencies. In addition, the Executive Officer has also determined pursuant to Government Code section 11346.5(a)(6) that the proposed regulatory action will possibly create a cost to local agencies that are required to be reimbursed under Part 7 (commencing with section 17500) of division 4 of the Government Code or other nondiscretionary costs or savings imposed on local agencies. The Executive Officer further determines that the proposed regulations will result in some additional cost to federal agencies in the state.

The Executive Officer has made an initial determination that the proposed regulatory action will not have a significant statewide adverse economic impact directly affecting businesses, including the ability of California businesses to compete with businesses in other states, or on representative private persons.

The Executive Officer has determined that the total lifetime cost of the proposed ATCM to affected businesses will vary between $290 and $340 million, in 2002 expenditure equivalent dollars. This value represents the total cost of the regulation if all money required to comply with the proposed ATCM were spent today. On an annual basis, the cost will vary between $2 to $29 million per year, averaging $12 million per year. The total cost to a typical business (a fleet of fifteen engines), including capital and ongoing costs, is estimated to be between $226,000 and $238,000, in 2002 expenditure equivalent dollars. Annual costs would vary between $1,500 and $17,000 per year, with an average cost of $8,200 per year.

The Executive Officer has determined, pursuant to title 1, CCR, section 4, that the proposed regulatory action will have some impact on small businesses. The ARB staff believes that approximately 10 percent of portable engines are owned by small businesses. The ARB staff estimates that the total cost, including capital and ongoing costs, to a typical small business (a fleet of five or less engines) to be between $30,000 and $38,000, in 2002 expenditure equivalent dollars. Annual costs would vary between $400 and $5,200 per year, with an average cost of $2,000 per year.

In developing this regulatory proposal, the ARB staff evaluated the potential economic impacts on representative private persons or businesses. The ARB is not aware of any cost impacts that a representative private person or business would necessarily incur in reasonable compliance with the proposed action.

In accordance with Government Code sections 11346.3 and 11346.5(a)(10), the Executive Officer has determined that the proposed regulatory action may lead to creation or elimination of some businesses, the creation of new businesses or elimination of existing businesses within the State of California, or the expansion of businesses currently doing business within the State of California. Due to the long lead-time for compliance, we believe that most businesses will be able to absorb the compliance costs. However, it is possible that a small number of businesses (those with marginal profitability) may experience financial difficulty in complying with the regulation. Businesses that may be created in the short term include those that package engines and install engines. In the long term, engine manufacturers and businesses that sell and maintain diesel emission control systems are likely to see an increase in business due to early engine replacement and other options available to meet the proposed diesel PM standard requirements. In addition, the cost of complying with the proposed ATCM may encourage some fleet owners to replace engines with rented engines, which could lead to an increase of engine rental businesses.

The Executive Officer has determined the total capital outlay for complying with the proposed ATCM for local agencies will be between $102 million and $147 million, in

2002 expenditure equivalent dollars. Annual outlay will vary between $2 million and $13 million. The initial outlay will not be necessary until fiscal year 2008-2009. These costs are not reimbursable state mandated costs pursuant to part 7 (commencing with section 17500), division 4, title 2 of the Government Code because most, if not all, of these agencies are authorized to collect fees to recoup their costs under section 17500 et seq. of the Government Code, and the ATCM applies to all entities that own or operate portable engines and, therefore does not impose unique requirements on local government agencies.

The Executive Officer has also determined that the total cost for complying with the proposed ATCM for State agencies will be between $7 million and $11 million, in 2002 expenditure equivalent dollars. Annual outlay will vary between $0.1 million and $1 million. Initial outlay will not be necessary until fiscal year 2008-2009. Given the current fiscal and economic conditions, the Executive Officer cannot determine with certainty whether State agencies will be able to absorb these additional costs within current or future budgets, but it is anticipated that the agencies will be able to absorb annualized costs of this magnitude, given the extended period allowed for compliance.

The Executive Officer has also determined that the total cost for complying with the proposed ATCM for federal agencies will be between $2.0 million and $2.9 million, in 2002 expenditure equivalent dollars. Annual outlay will vary between $30,000 and $250,000. Initial outlay will not be necessary until fiscal year 2008-2009.

The Executive Officer has determined that individual local air districts may incur some permitting and enforcement costs as a result of implementing the proposed ATCM. However, the costs incurred by the air districts should be recovered through permit fees or fees imposed under the Statewide Portable Equipment Registration Program.

In accordance with Government Code sections 11346.3(c) and 11346.5(a)(11), the Executive Officer has found that the reporting requirements of the regulation that apply to businesses are necessary for the health, safety, and welfare of the people of the State of California.

In accordance with H&SC section 43013(c), the Executive Officer has determined that the standards and other requirements in the proposed ATCM are necessary, cost-effective, and technologically feasible for agricultural operations (i.e., farm equipment).

A detailed assessment of the economic impacts of the proposed regulatory action can be found in the ISOR.

Consideration of Alternatives

Before taking final action on the proposed regulatory action, the Board must determine that no reasonable alternative considered by the agency or that has otherwise been identified and brought to the attention of the agency would be more effective in carrying

out the purpose for which the action is proposed or would be as effective and less burdensome to affected private persons than the proposed action.

SUBMITTAL OF COMMENTS

The public may present comments relating to this matter orally or in writing at the hearing, and in writing or by e-mail before the hearing. To be considered by the Board, written submissions not physically submitted at the hearing must be received **no later than 12:00 noon, February 25, 2004**, and addressed to the following:

Postal mail is to be sent to:

Clerk of the Board
Air Resources Board
1001 I Street, 23rd Floor
Sacramento, California 95814

Electronic mail is to be sent to: porteng@listserv.arb.ca.gov, and received at the ARB **no later than 12:00 noon, February 25, 2004**.

Facsimile submissions are to be transmitted to the Clerk of the Board at (916) 322-3928 and received at the ARB **no later than 12:00 noon, February 25, 2004**.

The Board requests but does not require 30 copies of any written submission. Also the ARB requests that written, facsimile, and e-mail statements be filed at least 10 days prior to the hearing so that ARB staff and Board Members have time to fully consider each comment. The ARB encourages members of the public to bring to the attention of staff in advance of the hearing any suggestions for modification of the proposed regulatory action.

STATUTORY AUTHORITY AND REFERENCES

This regulatory action is proposed under the authority granted to the ARB in Health and Safety Code sections 39600, 39601, 39650, 39658, 39659, 39665, 39666, 41511, 41752, 43013, and 43018. This action is proposed to implement, interpret, or make specific Health and Safety Code sections 39002, 39650, 39658, 39659, 39665, 39666, 40000, 41511, 41752, 43013, and 43018.

HEARING PROCEDURES

The public hearing will be conducted in accordance with the California Administrative Procedure Act, title 2, division 3, part 1, chapter 3.5 (commencing with section 11340) of the Government Code.

Following the public hearing, the ARB may adopt the regulatory language as originally proposed or with non-substantial or grammatical modifications. The Board may also adopt the proposed regulatory language with other modifications if the text as modified is sufficiently related to the originally proposed text that the public was adequately placed on notice that the regulatory language as modified could result from the proposed regulatory action. In the event that such modifications are made, the full regulatory text, with the modifications clearly indicated, will be made available to the public for written comment at least 15 days before it is adopted.

The public may request a copy of the modified regulatory text from the ARB's Public Information Office, Air Resources Board, 1001 I Street, Visitors and Environmental Services Center, 1st Floor, Sacramento, California 95814, (916) 322-2990.

CALIFORNIA AIR RESOURCES BOARD

Michael P. Schaub

for Catherine Witherspoon
Executive Officer

Date: 12/30/2003

"The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our Web-site at www.arb.ca.gov."

State of California
AIR RESOURCES BOARD

STAFF REPORT: INITIAL STATEMENT OF REASONS FOR PROPOSED RULEMAKING

Public Hearing to Consider

ADOPTION OF THE PROPOSED AIRBORNE TOXIC CONTROL MEASURE FOR DIESEL PARTICULATE MATTER FROM PORTABLE ENGINES GREATER THAN 50 HORSEPOWER

To be considered by the Air Resources Board on February 26, 2004 at:

California Environmental Protection Agency
Headquarters Building
1001 "I" Street
Central Valley Auditorium
Sacramento, California

This report has been prepared by the staff of the California Air Resources Board. Publication does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

State of California
AIR RESOURCES BOARD

PROPOSED AIRBORNE TOXIC CONTROL MEASURE FOR DIESEL PARTICULATE MATTER FROM PORTABLE ENGINES GREATER THAN 50 HORSEPOWER

Contributing Authors

Grant Chin
Marcelle Surovik
Ray Asregadoo
Heidi Green
Ada Komorniczak
Al Ghaffari
Reza Mondavi
Pingkuan Di
Art Diamond

STATIONARY SOURCE DIVISION

Peter D. Venturini, Chief
Robert Barham, Assistant Chief
Michael Tollstrup, Chief, Project Assessment Branch
Mike Waugh, Manager, Program Assistance Section

January 2004

TABLE OF CONTENTS

Section Page

Executive Summary.....i

Technical Document

I. Introduction.....1

II. Need for Reduction of Diesel Particulate Matter Emissions.....5

III. Diesel-Fueled Portable Engine Use and Existing Regulations 11

IV. Emissions, Exposure, and Potential Risk from Diesel-Fueled Portable Engines.....19

V. Summary of Proposed Control Measure.....22

VI. Regulatory Alternatives.....39

VII. Environmental Impacts of Proposed ATCM.....42

VIII. Economic Impacts of Proposed ATCM.....54

IX. References.....72

Appendices

Appendix A: Proposed Regulation Order: Airborne Toxic Control Measure for Diesel Particulate Matter from Portable Engines Greater Than 50 Horsepower

Appendix B: Public Agency Survey

Appendix C: Off-Road Compression-Ignition Engine Standards

Appendix D: Summary of District Rules that Apply to Portable Engines

Appendix E: Portable Diesel Engine Emission Control Technologies

Appendix F: Exhaust Temperature Data Analysis for Portable Diesel-Fueled Engines

TABLE OF CONTENTS (cont.)

Appendices (cont.)

Appendix G: Economic Impact Analysis Methodology

Appendix H: Cost Analysis Example for Typical Small Business

Appendix I: List of Acronyms and Abbreviations

Tables

Table I-1: Public Workgroup and Workshop Meetings.....3

Table II-1: State and National PM Standards.....9

Table II-2: State and National Ozone Standards.....10

Table III-1: Emission Standards That Will Be in Effect When Off-Road Standards (Tier 3) Are Fully Implemented.....15

Table III-2: Proposed U.S. EPA Tier 4 Emission Standards for Engines Greater than 50 hp.....16

Table IV-1: Emission Estimates of Diesel-Fueled Portable Engines (without ATCM Implementation).....20

Table VII-1: Projected Annual Emissions for 2010 and 2020 with Implementation of the Proposed ATCM.....43

Table VIII-1: Cost and Key Assumptions Used in the Cost Analysis.....58

Table VIII-2: Distribution of Total Costs for Private Businesses.....64

Table VII-3: List of Industries with Affected Businesses.....65

Table VIII-4: Summary of Annualized Costs for Public Agency Compliance with the Proposed ATCM.....67

Table VIII-5: Summary of Total and Annualized Costs for Compliance with the Proposed ATCM.....70

TABLE OF CONTENTS (cont.)

Figures

Figure V-1: Projected Diesel PM Emissions for Status Quo and the Implementation of the Proposed ATCM.....34

Figure VII-1: Projection of NOx Emissions with and without ATCM Implementation.....43

Executive Summary

A. INTRODUCTION

The Air Resources Board (ARB or Board) staff is proposing an air toxic control measure (proposed ATCM) to reduce the emissions of diesel particulate matter (PM) from diesel-fueled portable engines. This proposed ATCM is one element in the implementation of ARB's "Risk Reduction Plan to Reduce PM Emissions from Diesel-Fueled Engines and Vehicles" (Diesel Risk Reduction Plan).

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

In August 1998, following a 10-year scientific assessment process, the ARB identified diesel PM as a Toxic Air Contaminant (TAC). Diesel PM is the number one contributor to total ambient air toxic risk in California due to the large number of diesel-fueled engines and the associated risk from these emissions. Diesel PM emissions are estimated to be responsible for about 70 percent of the total ambient air toxics risk in California. In September 2000, the Board approved the Diesel Risk Reduction Plan, which outlined steps that would be taken to reduce diesel emissions from both new and existing diesel-fueled engines and vehicles, including portable engines. The ultimate goal of the Diesel Risk Reduction Plan is to reduce California's diesel PM emissions and associated cancer risks by 85 percent by 2020.

Portable engines are engines that may be moved easily from location to location. The engines are used to power a variety of equipment, including: pumps, ground support equipment at airports, cranes, oil-well drilling and workover rigs, power generators, dredging equipment, rock crushing and screening equipment, welding equipment, woodchippers, and compressors.

The proposed ATCM will satisfy the requirements in the Diesel Risk Reduction Plan to reduce diesel PM emissions and associated risk from the use of diesel-fueled portable engines in California. The staff estimates that the proposed ATCM, when fully implemented in 2020, will reduce diesel PM emissions from portable engines by 95 percent from year 2000 emission levels. The proposed ATCM is one of several ATCMs considered by the Board in 2003 and 2004 to fulfill the goals of the Diesel Risk Reduction Plan. The other ATCMs

include measures to reduce diesel PM emissions from residential and commercial solid waste collection vehicles, stationary engines, and transport refrigeration units.

B. PORTABLE ENGINE USE AND CURRENT REGULATIONS

1. What types of businesses and public agencies use portable engines?

Both private businesses and public agencies operate portable engines in California and would be impacted by the proposed ATCM. Examples of businesses that would be affected include motion picture studios, amusement parks, air couriers, airlines, utilities, construction services, crushing, screening, and recycling services, industrial cleaning services, marine construction and dredging services, oil and gas companies, refineries, and rental services. A variety of public agencies would also be affected, including public schools and universities, local governments, county landfills, municipal utilities, wastewater treatment facilities, prisons, the California Department of Transportation, and other state agencies.

2. What regulations currently impact portable engines in California?

a. ARB/United States Environmental Protection Agency (U.S. EPA) off-road engine emission standards

Since January 1, 1996, new portable engines sold in California have been subject to ARB's Off-Road Compression Ignition emission standards, which are equivalent to the U.S. EPA emission standards for newly manufactured nonroad engines. The standards are tiered (i.e., Tier 1, 2, 3), with each set of standards more stringent than the previous set and, based on the power rating of the engine, phased in over several years. In 2006, new portable engines of all sizes will be subject to Tier 2 standards, and in 2008, new engines of all sizes will be subject to Tier 3 standards. Tier 4 emission standards were proposed by U.S. EPA in April 2003, and will, if adopted, require most engines to meet more stringent particulate matter (PM) and oxides of nitrogen (NOx) limits in the 2011-2014 timeframe.

b. Statewide Portable Equipment Registration Program

Several of the 35 air districts in California have rules that specifically pertain to portable engines. A portable-engine owner would have to obtain a permit from each of these individual districts prior to operating the engines in these districts. Instead of obtaining multiple permits from individual districts, a portable-engine owner can register the engine with ARB's Statewide Portable Equipment Registration Program (PERP). Portable engine owners have registered over 14,500 engines under PERP, which represents nearly half of the estimated

statewide inventory of portable engines. Most of the engines in PERP are diesel-fueled.

The PERP regulations were designed to promote the use of clean portable engines in California. By January 1, 2010, only engines certified to ARB/U.S. EPA off-road engine emission standards (Tier 1, 2, or 3) can be registered under PERP, meaning any engines currently in the program that do not meet at least Tier 1 standards must be replaced with certified engines by that date. By 2010, full implementation of the existing PERP requirements will result in reductions of diesel PM emissions from currently registered portable engines in the State by an estimated 30 percent. The proposed ATCM builds upon the success of the existing PERP to achieve additional diesel PM reductions. For example, one of the short-term goals of the proposed ATCM is to ensure that all portable engines in California are certified engines by 2010, the same requirement engines registered with the PERP program must satisfy.

c. Local air district permit programs

Several thousand portable engines that are not part of the PERP program are subject to local air district permitting requirements. The ARB staff estimates that there are approximately 3,000 portable engines in California that are permitted by the districts. District permit requirements vary, depending on the severity of the air quality in the district. Some districts may require engines to meet emission limits that are equivalent to Best Available Control Technology (BACT) emission limits. For some districts, BACT for portable engines means that the engine is certified to ARB/U.S. EPA off-road engine emission standards. Districts may also restrict the operating hours of portable engines to reduce the potential excess cancer risks caused by diesel PM emissions.

d. Engines not currently under permit

In addition to the 3,000 portable diesel engines currently permitted by the local air districts, ARB staff estimates that there are several thousand engines subject to permitting requirements that are neither permitted nor registered in PERP. The ARB will work with the local air districts to identify these engines and bring them into the regulatory process.

Additionally, there are portable engines that are currently exempt from local air district permitting requirements—due to size or application—that will be subject to the proposed ATCM and will therefore need to apply for permits or State registration. These engines will be identified and incorporated into the regulatory process.

3. What regulations currently impact diesel PM control technologies in California?

In March 2002, the Board adopted the "*Verification Procedure for In-Use Strategies to Control Emissions from Diesel Engines*" (Verification Procedure) to support the ARB's regulatory efforts to reduce diesel PM. The Verification Procedure establishes a process through which manufacturers of emission control equipment can demonstrate and verify the emission reduction capabilities of control technologies. Examples of emission control technologies that can be considered for verification include: diesel particulate filters, diesel oxidation catalysts, exhaust gas re-circulation, selective catalytic reduction systems, fuel additives and alternative diesel fuel systems. The Verification Procedure is voluntary and applies to emission control technologies for on-road, off-road and stationary applications. The multi-level verification system consists of three PM reduction levels that are illustrated in the following table.

Verification Classifications for Diesel Emission Control Strategies for PM

Pollutant	Reduction	Classification
PM	< 25 percent	Not Verified
	≥ 25 percent	Level 1
	≥ 50 percent	Level 2
	≥ 85 percent or 0.01 g/bhp-hr	Level 3

C. EMISSIONS AND HEALTH IMPACTS FROM DIESEL-FUELED PORTABLE ENGINES

1. What are the estimated emissions of diesel particulate matter from portable engines?

The ARB staff estimated the diesel PM emissions from portable engines by using the 2000 portable engine inventory and associated diesel PM emissions that were presented in the Diesel Risk Reduction Plan. Based on this inventory, staff estimates that there are 33,000 portable engines in California that emit a total of 4.2 tons per day or 1,533 tons per year of diesel PM, 67.1 tons per day of NOx and 6.7 tons per day of reactive organic gases (ROG).

2. What is the risk posed from diesel-fueled portable engines?

Exposure to diesel PM emissions results in increased cancer risk and health risks from other non-cancer health impacts, such as irritation to the eyes and lungs, allergic reactions in the lungs, asthma exacerbation, blood toxicity, immune system dysfunction, and developmental disorders. Because of the variability in the use of portable diesel-fueled equipment and the mobile nature of portable equipment, it is difficult to quantify the potential health risk resulting from the operation of a portable diesel-fueled engine on any specific receptor.

However, qualitative conclusions can be drawn regarding potential exposures to the emissions from diesel-fueled portable engines. Many Californians are impacted by diesel PM emissions from the operation of diesel-fueled engines. The emissions from these engines contribute toward the ambient concentration of diesel PM. Based upon the emissions inventory for diesel PM, portable diesel-fueled engines account for five percent of the ambient concentration. In addition, many of the engines are used in urban locations where the probability of a person living close to an engine is high.

The overall excess cancer risk can be significantly reduced by replacing older portable diesel-fueled engines with new, cleaner diesel-fueled engines. For example, if an older engine is replaced with a Tier 3 engine, the diesel PM emissions and associated risk would be reduced by 55 to 70 percent. Reductions of over 95 percent can be achieved if the older engine is replaced with a Tier 4 engine, which is proposed to be available in the 2011-2014 timeframe.

D. PUBLIC OUTREACH

1. What action did staff take to consult with interested parties during the development of the proposed ATCM?

The ARB staff developed the proposed ATCM and this report through extensive consultations with industry, government agency representatives, environmental organizations, and members of the public. In 2002, the ARB staff formed a Portable Diesel Engine workgroup to assist with the development of the proposed ATCM. The workgroup is comprised of over 60 representatives of affected industry and associations, air pollution control and air quality management districts' (district) staff, and other interested members of the public. The ARB staff held six public meetings with workgroup members between January and September 2003. In addition, the ARB staff held numerous individual meetings and conference calls with affected industry, associations, engine manufacturers, and environmental groups during the development of the proposed ATCM. Finally, the ARB staff held three public workshops in October, November, and December 2003 to solicit ideas and comments from the public on the proposed ATCM requirements.

An e-mail list server was created to notify potentially affected industry and other interested parties of the progress of the proposed ATCM. Approximately 500 individuals from government, environmental groups, industry, and associations subscribe to the list server. The ARB staff created and has maintained a website to facilitate the dissemination of up-to-date information on the progress of the proposed ATCM at *http://www.arb.ca.gov/diesel/ portdiesel.htm.*

The ARB staff attended several California Air Pollution Control Officers Association (CAPCOA) Engineering and Enforcement Managers Meetings to brief district staff on the developments of the proposed ATCM requirements and to solicit districts' input. The staff also held several conference calls with district staff during the development of the proposed ATCM to discuss the districts' specific concerns with the proposed requirements. In addition, ARB staff surveyed a cross-section of air districts to better understand the specific requirements placed on portable diesel engines by the districts. The ARB staff also surveyed city, county, and state facilities to solicit information on the types and numbers of portable engines used by government agencies.

E. SUMMARY OF THE PROPOSED ATCM

1. What does the proposed ATCM require?

The proposed ATCM would affect all diesel-fueled portable engines that are larger than 50 horsepower (hp). Included are engines that are registered under ARB's Portable Equipment Registration Program (PERP), engines that are permitted by the districts, and engines that have historically been exempt from district permits. The proposed ATCM would require all portable engines to be certified to Tier 1, 2, or 3 U.S. EPA /ARB off-road engine standards by 2010. After 2010, it would require all fleets of portable engines to meet diesel PM emission averages that become more stringent in 2013, 2017, and 2020. The owners/operators of these fleets will have flexibility in determining how the fleet emission standards are to be satisfied. Options that are available to satisfy this standard include: operating cleaner engines, replacing engines, using add-on control devices, switching to alternative fuels or alternative diesel fuels, and receiving credit for electrification.

By 2020, the proposed ATCM would require portable diesel-fueled engines to be certified to proposed Tier 4 emission standards for U.S. EPA/ARB newly manufactured off-road engines or be equipped with a Level-3 PM control technology or a combination of verified control technologies to achieve 85 percent reduction.

2. Are there exemptions to the proposed ATCM?

Engines that would be exempt from the proposed ATCM include: engines less than or equal to 50 hp; engines used to propel mobile equipment; portable equipment that is owned by the United States Department of Defense and used in combat, combat support, tactical or relief operations, or training for such operations (military tactical support equipment); and portable engines used at San Clemente or San Nicolas Island.

3. What is the requirement for 2010?

The proposed regulation requires all diesel-fueled portable engines in California to be certified engines by 2010, as is currently required for engines registered under PERP. This provision would expand the certified engine requirement in the PERP to engines permitted by districts and engines exempt from district permit requirements.

4. What are the fleet requirements?

After 2010, owners of fleets of portable engines must satisfy progressively more stringent diesel PM emission standards by 2013, 2017, and 2020. The purpose of the diesel PM emission standards is to create additional diesel PM emission reductions beyond those that would be achieved from normal engine turnover after 2010.

A fleet includes portable engines registered with PERP, portable engines permitted with local districts, and portable engines exempt from district permit requirements. The fleet shall exclude portable engines that operate exclusively outside of California, engines operated only within the Outer Continental Shelf (OCS), engines used exclusively in emergency applications, and engines qualifying as low-use (engines operating 80 hours or less per year). Portable engines can also be exempt from the fleet requirements if equipped, as of January 1, 2004, with a properly operating selective catalytic reduction (SCR) system. Existing engines with SCR systems are excluded due to the current technical challenge of installing both SCR and a diesel particulate filter (DPF) to one engine. After January 1, 2004, SCR-equipped engines will be considered on a case-by-case basis regarding installations of DPFs.

Standards are proposed for engines less than 175 horsepower, engines between 175 horsepower and 749 horsepower, and engines greater than or equal to 750 horsepower. The diesel PM standards (grams per brake horsepower-hour (g/bhp-hr)) are illustrated below:

Fleet Standard Compliance Date	Engines <175 hp (g/bhp-hr)	Engines ≥175 to 749 hp (g/bhp-hr)	Engines ≥ 750 hp (g/bhp-hr)
1/1/13	0.3	0.15	0.25
1/1/17	0.18	0.08	0.08
1/1/20	0.04	0.02	0.02

Owners of portable engine fleets will determine compliance with the proposed fleet standard by comparing the fleet's actual weighted diesel PM emission rate with the fleet emission standard.

To encourage the use of cleaner technologies and to encourage repowering or replacement of older engines with new, lower-emitting engines, the proposed ATCM provides several incentives to promote these options as part of the fleet reduction approach.

One incentive allows credit toward satisfying a fleet standard by adding alternative fueled engines to the fleet. To obtain the credit, the engine must operate at least 100 hours annually. The proposed ATCM also allows credit for applications where grid power is used in lieu of using a diesel fuel. The credit is granted where more than 200 hours of grid power is used for a given project and the necessary recordkeeping and reporting requirements are satisfied. Finally, a credit is included to encourage the purchase of proposed Tier 4 engines. (The Tier 4 engines are proposed to be available in the 2011 to 2014 timeframe.) The credit can be used when fleet owners purchase Tier 4 engines prior to January 1, 2015. In these cases, the owner can count the Tier 4 engine twice in the calculations for the fleet-weighted diesel PM emission rates for compliance with the 2013 and 2017 diesel PM standards.

5. <u>What are the fleet requirements in 2013 and 2017 for emergency use and low-use engines?</u>

Engines that are used exclusively in emergency applications or are deemed low-use engines are not subject to the fleet emission standards. Instead these engines would be required by January 1, 2020, to be certified to proposed Tier 4 engines standards, or be equipped with a Level-3 PM control technology, or a combination of verified control technologies to achieve a 85 percent diesel PM reduction.

6. <u>What are the requirements for school zones?</u>

The ARB staff is continuing to work with the California Air Pollution Control Officer's Association (CAPCOA) and other stakeholders to determine if it is feasible to develop provisions to address the operation of portable diesel-fueled engines near schools during periods when children are present.

7. What are the recordkeeping and reporting requirements?

For many fleets, the recordkeeping would only consist of keeping track of all the engines in the fleet and their associated emission factors. Specific recordkeeping requirements address only those engines in a fleet whose use is based on minimum or maximum hourly limitations, fleets taking advantage of the electrification incentive, and engines equipped with SCR.

All fleet owners will have to submit a status report to the ARB by March 1, 2011, that includes the fleet's average diesel PM emission rate for the 2010 calendar year, information identifying each engine in the fleet, and each engine's emission rate. In addition, fleet owners must submit signed statements of compliance and corroborating data indicating that they are meeting the fleet standards by March 1 of each applicable year (i.e., 2013, 2017, 2020).

8. What are the enforcement requirements?

Health and Safety Code 39666 (d) requires the districts to implement and enforce an ATCM that has been approved by the Board. Therefore, both the ARB and the districts have the authority to review or seek enforcement action for violation of the proposed regulation.

F. ENVIRONMENTAL AND ECONOMIC IMPACTS OF THE PROPOSED ATCM

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

The proposed ATCM is consistent with the ARB's Environmental Justice policy to reduce health risks from TACs in all communities, including low-income and minority communities. Portable engines are used in both urban and rural communities. Because they are used for a number of activities throughout the State, the risk posed by these engines may potentially impact all communities in California. Limiting diesel PM emissions from diesel-fueled portable engines in California will provide air quality benefits to all communities, including minority and low-income communities in the State.

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

The proposed ATCM will reduce diesel PM emissions and associated exposures from portable engines throughout California. The table below provides ARB staff estimates of diesel PM emissions reductions from portable engines resulting from implementation of the proposed ATCM in addition to benefits from the PERP. The estimates are based upon reductions from the year 2000 base year. California's air quality will also experience benefits from reduced criteria pollutant emissions (e.g. NOx, ROG). The table also provides ARB staff estimates for

NOx and ROG reductions. By 2010, diesel PM emissions will be reduced by 2.2 TPD, or about 803 TPY, and NOx emissions will be reduced by 34 TPD, or about 12,400 TPY.

Year	Diesel PM Emissions (TPD)	Percent Reduction	NOx Emissions (TPD)	Percent Reduction	ROG Emissions (TPD)	Percent Reduction
2000	4.2	--	67	--	6.7	--
2010	2.0	52%	33	51%	4.6	30%
2015	1.3	69%	26	61%	2.9	57%
2020	0.2	95%	23	66%	1.2	78%

The ARB staff anticipates significant health cost savings due to reduced mortality, incidences of cancer, PM-related cardiovascular effects, chronic bronchitis, asthma, and hospital admissions from pneumonia and asthma-related conditions. The diesel PM reductions are expected to reduce the number of premature deaths in California. Although the implementation date for the final diesel PM emission standards in the proposed regulation is 2020, the ARB staff believes that the full benefits of the diesel PM standard requirements will extend to 2037. (The ARB staff assumes that through a normal engine turnover rate, all portable diesel-fueled engines would have been replaced by engines that are certified to the proposed Tier 4 standards by approximately 2037. Therefore, the costs and benefits of the proposed ATCM extend to 2037, despite the full implementation by 2020.) The ARB staff estimates that by 2037, 768 premature deaths will be avoided. Prior to 2037, cumulatively, it is estimated that 50 premature deaths would be avoided by 2010 and 339 by 2020. Additional health benefits are expected from the reduction of NOx emissions, which give rise to secondary PM from the conversion of NOx to $PM_{2.5}$ nitrate. The ARB staff has concluded that no significant adverse environmental impacts should occur from adoption of, and compliance with, the proposed ATCM.

3. <u>What are the economic impacts of the proposed ATCM?</u>

The ARB staff estimates the total cost of the proposed ATCM to affected businesses and government agencies to be between $350 and $420 million discounted back to year 2002 or between $2 and $34 million per year, averaging $15 million per year. The economic impact is distributed over a 30-year period to 2037.

The ARB staff estimates that the total cost, including capital and ongoing cost, to a typical small business (a fleet of five or less engines) to be between $30,000 and $38,000 discounted back to year 2002, or about $2,000 per year. The total cost to a typical business (a fleet of fifteen engines), including capital and ongoing cost is estimated to be between $226,000 and $238,000, discounted

back to year 2002, or about $8,200 per year. The cost for complying with the proposed ATCM is affected by the number of engines in the fleet, the age of the engine, and the horsepower size of the engines in the fleet.

The costs are attributable to early replacement of existing engines, the installation of diesel PM reduction technologies, and registration fees for engines previously not required to operate with a permit. The ARB staff assumed that an existing engine would eventually be replaced at the end of its useful life and took into account the remaining value of the existing engine at the time the proposed ATCM requires the engine to be replaced with a new, cleaner engine. For example, a typical rental fleet has a more frequent engine turnover rate—about five to seven years—than other types of businesses. Consequently, the proposed ATCM will not affect these types of businesses as much as other industries that tend to keep their engines for longer periods of time. The estimated annual ongoing costs to comply with the proposed ATCM include annual costs for recordkeeping of $300 - $600, and $300 per engine for annual maintenance of emission control devices (diesel particulate filters). In addition, staff estimates that the typical company will spend a total of $125 - $1,000 to prepare the status report for compliance with the 2010 requirement and the three compliance reports for the 2013, 2017, and 2020 fleet standards.

Overall, most affected businesses will be able to absorb the costs of the proposed regulation with no significant adverse impacts on their profitability. This finding is based upon staff's estimated change in "return on owner's equity" (ROE) analysis. The analysis found that the overall change in ROE ranges from negligible to a decline of about 7 percent. Because the proposed ATCM would not alter significantly the profitability of most businesses, we do not expect a noticeable change in employment, business creation, elimination, or expansion, and business competitiveness in California. We also found no significant adverse economic impacts on any local or State agencies.

The overall estimated cost effectiveness of the proposed ATCM, considering only the benefits of reducing diesel PM is between $16 and $19 per pound of diesel PM reduced. Since the proposed ATCM will also result in reductions of ROG and NOx emissions, ARB staff allocated half of the costs of compliance against these benefits, resulting in cost effectiveness values of $8-$10 per pound of diesel PM reduced and less than $2 per pound of ROG and NOx reduced.

The estimated cost of control per premature death prevented by the proposed ATCM is $ 275,000 in 2002 dollars. Using U.S. EPA's established value for avoiding a premature death, $2.44 million (using 2037 as the end year of analysis) at seven-percent discount rate, and $4.78 million at three percent, both values discounted back to year 2002, the cost range per death avoided because of this proposed regulation is 9 to 17 times lower than the U.S. EPA's benchmark for value of avoided death. This rule is, therefore, a cost-effective mechanism to

reduce premature deaths that would otherwise be caused by diesel PM emissions without this proposed regulation.

G. NEXT STEPS

After the proposed ATCM is approved by the Board, the staff will continue its outreach efforts by distributing information on the ATCM requirements—via ARB's portable-engine website and briefing papers—to the districts, trade associates and organizations, engine manufacturers, engine repair services, and control technology companies. The staff will also, with the districts, educate owners of portable engines that are permitted with the districts of the ATCM requirements. In addition, staff will educate owners of portable engines that are registered with PERP. The ARB staff will work with the districts on identifying portable engine owners that have not obtained permits or have registered with PERP. These unregulated engines will need to be identified and brought into the regulatory process so that all owners of portable engines in California are ultimately complying with the proposed ATCM requirements. Finally, staff will monitor the development of retrofit technologies and the availability of proposed Tier 4 engines, and will conduct an assessment of this ATCM in the 2008 timeframe.

H. RECOMMENDATION

The staff recommends the Board approve the proposed ATCM presented in this report (Appendix A). The ATCM will reduce diesel PM emissions from portable engines by requiring the use of only the cleanest new engines and the most stringent retrofit of existing portable engines. The proposed ATCM will provide air quality benefits for all communities depending upon the number and duration of portable use in those communities. The ARB staff believes that the proposed ATCM is technologically feasible and necessary to carry out the Board's responsibilities under State law.

I. INTRODUCTION

In this chapter, the Air Resources Board (ARB or Board) staff provides an overview of the Staff Report, discusses the purpose of the proposed air toxic control measure for diesel-fueled portable engines (proposed ATCM), the regulatory authority of the ARB to adopt the proposed ATCM, and the outreach efforts by ARB staff while developing the proposed ATCM requirements.

A. Overview

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

- the health effects associated with exposure to diesel PM emissions (Chapter II)
- the requirements of current regulations that are designed to reduce emissions from diesel-fueled portable engines (Chapter III)
- the diesel PM emission inventory and the risk posed by diesel-fueled portable engines (Chapter IV)
- the regulatory alternatives to the proposed ATCM and why they were not chosen (chapter VI)
- the environmental impacts of implementing the proposed ATCM (Chapter VII)
- the economic impacts of the proposed ATCM (Chapter VIII)

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

B. Purpose

The primary purpose of the proposed ATCM is to reduce the general public's exposure to diesel PM from diesel-fueled portable engines. Chapter V of this Staff Report contains a plain English discussion of the key requirements of the proposed ATCM, and Appendix A contains the full text of the proposed ATCM.

C. Regulatory Authority

Several sections of the California Health and Safety Code (HSC) provide the ARB with authority to adopt the proposed ATCM. HSC 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.

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

In August 1998, the Board identified diesel PM as a TAC, and in September 2000, the ARB adopted the "Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-fueled Engines and Vehicles" (Diesel Risk Reduction Plan). The Diesel Risk Reduction Plan was the first formal product of the risk management phase and serves as the needs assessment under the AB 1807 process. In the Diesel Risk Reduction Plan, the ARB identified the available options to reduce diesel PM and the recommended control measures to achieve reductions, including a measure to reduce diesel PM from diesel-fueled portable engines.

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

This ATCM is being proposed to fulfill the goals of the Diesel Risk Reduction Plan and to comply with the requirements of H&S Code section 39666 and 39669.5 to prevent an endangerment to public health.

D. Public Outreach

An open public process is an essential part of the adoption of any air quality regulation, including this proposed ATCM. The ARB staff made extensive efforts to ensure that the public was aware of, and had an opportunity to participate in, the rulemaking process for this proposed control measure.

Outreach Efforts

In 2002, ARB staff formed a Portable Diesel Engine workgroup to assist with the development of the proposed ATCM. The workgroup is comprised of over 60 representatives of affected industry and associations, staff from the air pollution control and air quality management districts (districts), and other interested members of the public. All businesses with engines registered with ARB's Portable Equipment Registration Program (PERP) were notified of the formation of the workgroup to solicit their participation in the development of the proposed ATCM. These businesses would be directly impacted by the proposed ATCM. The PERP is discussed in Chapter III. The ARB staff held six public meetings with workgroup members between January and September 2003, with the option to participate via conference call to further meet the convenience of others. The ARB staff also held three public workshops in October, November, and December of 2003 to solicit ideas and comments from the general public on the proposed ATCM requirements. A summary of staff's outreach meetings is included in Table I-A below.

Table I-1: Public Workgroup and Workshop Meetings

Portable Diesel-Fueled Engines ATCM Public Workshops	October 3, 2003 (Sacramento)
	November 18, 2003 (Sacramento)
	December 4, 2003 (El Monte)
Portable Diesel-Fueled Engines ATCM Workgroup Meetings	January 31, 2003
	March 6, 2003
	May 9, 2003
	June 5, 2003
	July 30, 2003
	September 12, 2003

The ARB staff created an e-mail list server to notify potentially affected industries and other interested parties of the workgroup meetings and the public workshop, and to provide list server subscribers the opportunity to review draft versions of the regulation. Approximately 500 individuals from government, environmental groups, industries, and associations subscribe to the list server.

In addition to the public meetings, ARB staff held several individual meetings and conference calls with affected industry, associations, engine manufacturers, and environmental groups during the development of the proposed ATCM to address their specific concerns regarding the proposed requirements.

Furthermore, as a way of generating public participation and to enhance the information flow between ARB and interested persons, ARB staff has created and maintained a website to facilitate the dissemination of up-to-date information on the development of this proposed diesel PM control measure. The website is located at http://www.arb.ca.gov/diesel/portdiesel.htm.

The ARB staff attended several California Air Pollution Control Officers Association (CAPCOA) Engineering and Enforcement Manager Meetings to brief district staff on the developments of the control measure requirements and to solicit districts' input. The staff also held several conference calls with district staff during the development of the proposed ATCM to discuss the districts' specific concerns with the proposed requirements. Furthermore, ARB staff surveyed a cross-section of air districts through telephone calls and e-mails to better understand the specific requirements placed on portable diesel-fueled engines by the districts.

The staff also sent over 1,000 surveys to California cities, counties, colleges, and state-owned facilities in 2002 to inform these agencies of the development of the proposed ATCM and to solicit information on the types and numbers of portable engines that are used in state and local government. A summary of the survey results along with a copy of the survey that was sent to the agencies is included in Appendix B.

II. NEED FOR REDUCTION OF DIESEL PARTICULATE MATTER EMISSIONS

The primary goal of the Diesel Risk Reduction Plan is to reduce diesel PM emissions and the associated cancer risk by 85 percent in 2020. This proposed ATCM to reduce diesel PM emissions from diesel-fueled portable engines is one of a large group of regulations being developed to achieve the Plan's emission- and risk-reduction goals. The proposed ATCM will also reduce emissions of reactive organic gases (ROG) and oxides of nitrogen (NOx), precursors to the formation of ozone.

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

A. Physical and Chemical Characteristics of Diesel PM

Diesel engines emit a complex mixture of inorganic and organic compounds that exist in gaseous, liquid, and solid phases. The composition of this mixture will vary depending on engine type, operating conditions, fuel, lubricating oil, and whether or not an emission control system is present. The primary gas or vapor phase components include typical combustion gases and vapors such as carbon monoxide (CO), carbon dioxide (CO_2), sulfur dioxide (SO_2), NOx, ROG, water vapor, and excess air (nitrogen and oxygen).

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

Diesel PM is either directly emitted from diesel-powered engines (primary particulate matter) or is formed from the gaseous compounds emitted by a diesel engine (secondary particulate matter). Diesel PM consists of both solid and

liquid material and can be divided into three primary constituents: the elemental carbon fraction, the soluble organic fraction, and the sulfate fraction.

Many of the diesel particles exist in the atmosphere as a carbon core with a coating of organic carbon compounds, or as sulfuric acid and ash, sulfuric acid aerosols, or sulfate particles associated with organic carbon. The organic fraction of the diesel particle contains compounds such as aldehydes, alkanes and alkenes, and high-molecular weight PAH and PAH-derivatives. Many of these PAHs and PAH-derivatives, especially nitro-PAHs, have been found to be potent mutagens and carcinogens. Nitro-PAH compounds can also be formed during transport through the atmosphere by reactions of adsorbed PAH with nitric acid and by gas-phase radical-initiated reactions in the presence of oxides of nitrogen. Fine particles may also be formed secondarily from gaseous precursors such as SO_2, NOx, or organic compounds. Fine particles can remain in the atmosphere for days or weeks and travel through the atmosphere for hundreds or thousands of kilometers, while coarse particles deposit to the earth within minutes or hours and within tens of kilometers from the emission source.

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

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

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

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

Diesel Particulate Matter

Diesel PM is of specific concern because it poses a lung cancer hazard for humans as well as a hazard from noncancer respiratory effects such as pulmonary inflammation. Because of their small size, the particles are readily respirable and can effectively reach the lowest airways of the lung along with the

adsorbed compounds, many of which are known or suspected mutagens and carcinogens. More than 30 human epidemiological studies have investigated the potential carcinogenicity of diesel PM. On average, these studies found that long-term occupational exposures to diesel exhaust were associated with a 40 percent increase in the relative risk of lung cancer (OEHHA, 1998). However, there is limited specific information that addresses the variable susceptibilities to the carcinogenicity of diesel exhaust within the general human population and vulnerable subgroups, such as infants and children and people with preexisting health conditions. Also, the genotoxicity of diesel exhaust and some of its chemical constituents have been reported in a number of studies.

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

Another significant health effect of diesel exhaust exposure is its apparent ability to act as an adjuvant in allergic responses and possibly asthma (Diaz-Sanchez et al. 1996, Takano et al. 1998, Diaz-Sanchez et al. 1999). However, additional research is needed at diesel exhaust concentrations that more closely approximate current ambient levels before the role of diesel PM exposure in the increasing allergy and asthma rates is established.

Ambient Particulate Matter

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

The health impacts from exposure to the fine particulate matter ($PM_{2.5}$) component of diesel exhaust have been calculated for California, using concentration-response equations from several epidemiological studies. Both mortality and morbidity effects are associated with exposure to both direct diesel $PM_{2.5}$ and indirect $PM_{2.5}$, the latter of which arises from the conversion of diesel NO_x emissions to $PM_{2.5}$ nitrates. It was estimated that 2000 and 900 premature deaths resulted from long-term exposure to both 1.8 $\mu g/m^3$ of direct $PM_{2.5}$ and

0.81 $\mu g/m^3$ of indirect $PM_{2.5}$, respectively, for the year 2000. The mortality estimates are likely to exclude cancer cases, but may include some premature deaths due to cancer, because the epidemiological studies did not identify the cause of death. Exposure to fine particulate matter, including diesel $PM_{2.5}$, can also be linked to a number of heart and lung diseases.

Ozone

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

Studies have shown that there are impacts on public health and welfare from ozone at moderate levels that do not exceed the national 1-hour ozone standard. Short-term exposure to high ambient ozone concentrations has been linked to increased hospital admissions and emergency visits for respiratory problems (U.S. EPA, 2000b). Repeated exposure to ozone can make people more susceptible to respiratory infection and lung inflammation and can aggravate preexisting respiratory diseases, such as asthma. Prolonged (6 to 8 hours), repeated exposure to ozone can cause inflammation of the lung, impairment of lung defense mechanisms, and possibly irreversible changes in lung structure, which over time could lead to premature aging of the lungs and/or chronic respiratory illnesses such as emphysema and chronic bronchitis.

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

C. Health and Environmental Benefits from Implementation of the Proposed Regulation

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

Reduced Diesel PM Emissions

The estimated reductions in diesel PM emissions and the associated health benefits from reduced exposures and risk are discussed in detail in Chapter VII.

Reduced Ambient Particulate Matter Levels

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

Table II-1: State and National PM Standards

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

Particulate matter levels in most areas of California exceed one or more of current state PM standards. The majority of California is designated as non-attainment for the state PM_{10} standard (CARB, 2002a). Diesel PM emission reductions from diesel-fueled engines will help protect public health and assist in

furthering progress in meeting the ambient air quality standards for both PM_{10} and $PM_{2.5}$.

The emission reductions obtained from the implementation of this proposed ATCM will result in lower ambient particulate matter levels and significant reductions of exposure to primary and secondary diesel PM. Lower ambient particulate matter levels and reduced exposure mean reduction of the prevalence of the diseases attributed to diesel PM, reduced incidences of hospitalizations, and prevention of premature deaths.

Reduced Ambient Ozone Levels

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

Table II-2: State and National Ozone Standards

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

Improved Visibility

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

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

III. DIESEL-FUELED PORTABLE ENGINE USE AND EXISTING REGULATIONS

This chapter describes the types of businesses that use portable engines and associated equipment and describes existing regulations that currently impact portable engines used in California.

A. Summary of Portable Engine Use and Activities

Portable engines are internal combustion engines that are designed and capable of being carried or moved from one location to another. Unlike stationary engines, portable engines may be moved to various locations on the same facility, to other facilities within the same district, or throughout the State. The engines are used to power a variety of equipment, including: pumps (e.g., agricultural irrigation pumps and other water pumps), ground support equipment at airports, cranes, oil-well drilling and workover rigs, power generators, dredging equipment, rock crushing and screening equipment, welding equipment, woodchippers, and compressors.

Both private businesses and public agencies operate portable engines and associated equipment in California. Examples of businesses that use portable engines in their activities include motion picture studios, amusement parks, agriculture, air couriers, airlines, utilities, construction services, crushing, screening, and recycling services, industrial cleaning services, marine construction and dredging services, oil and gas well service companies, refineries, and rental services. Examples of public agencies that use portable engines include public schools and universities, local governments, county landfills, municipal utilities, wastewater treatment facilities, prisons, military installations, the California Department of Transportation, and other state agencies.

Portable engines and associated equipment can be categorized according to business type. A description of the businesses and public agencies and the type of equipment that is used in each category are provided below.

Rental

The businesses that are under the rental category specialize in the rental of power generation for construction activities, maintenance and repair at industrial sites, and emergency standby power. The portable equipment used by these companies includes generators, compressors, and pumps.

Oil and Gas Well Service

Businesses in this category specialize in drilling and maintaining oil and gas wells. Portable equipment used by these companies includes drilling and workover rigs, compressors, pumps, and generators.

Construction

Businesses in this category build roads, bridges, and structures, and are also involved in the demolition of such structures. Portable equipment used by these companies includes compressors, generators, booster pumps, cranes, rock crushers, rock drills, pile drivers, and welders.

Government

The government category includes governmental agencies, such as the California Department of Transportation, municipal governments, wastewater treatment plants, and water districts. Air compressors, auxiliary engines for street sweepers, brush chippers, drill rigs, emergency power generators, hydraulic pumps, power shovels, road maintenance equipment, and water pumps are some types of portable equipment that may be used by these agencies.

Industrial

This category includes businesses specializing in water-well drilling and pumping services, and industrial cleaning services. Portable equipment used by these companies includes compressors, sand blasters, drill rigs, pumps, and emergency standby engines.

Electric Utilities

The electric utility category is made up of companies that provide natural gas and electricity. The portable equipment used by utilities includes compressors, wood chippers, and emergency standby equipment.

Telecommunication

Telecommunication companies primarily use generators to provide emergency power at cell towers.

Wood Waste Recycling

Businesses in this category trim and remove trees and recycle tree parts. The portable equipment used by these companies includes wood chippers and tub grinders.

Entertainment

Businesses in this category primarily use generators to produce power for lighting, air conditioning, and other essential services at locations outside of the movie studios.

Marine Construction and Dredging

Businesses in this category maintain waterways and harbors using barges equipped with generators, large pumps, or cranes.

Ground Support

Businesses in this category use portable equipment to support the operation of airports and aircraft. The equipment used includes air compressors, start carts, and air-conditioning units.

Aggregate

Businesses in this category specialize in the crushing and sizing of gravel. Generators, rock crushers and screeners are the primary portable equipment used by these businesses.

Military

The military category includes military bases and military facilities that utilize portable equipment. Generators and compressors are the primary portable equipment used by the military.

Agriculture

Agriculture operations consist of the growing of crops or the raising of fowl or animals. Irrigation pumps are the primary portable equipment used by these businesses.

The above listing demonstrates the many diverse uses of portable diesel-fueled engines. There is significant variation in the size of the engines and the way these engines are used. The size of engines can range from about 50 hp to 3,000 hp. Due to the mobile nature of portable engines, the emissions typically would not occur in one location, but would be spread out over many locations over the course of a year. In addition, the actual operation of a specific engine can vary significantly from the average. For example, engines used only for emergency applications may operate less than 20 hours per year. Conversely, some portable activities can operate more than 2,000 hours per year. The average annual operating hours for portable diesel-fueled engines is about 450 hours per year. Finally, the engine's load varies depending upon the application.

Similar to the variability in the hours of operation, an engine's load can very significantly from application to application, from 25 percent to 80 percent of maximum load. The average load is typically 50 percent of maximum load.

In summary, the engines affected by this proposed ATCM represent a broad array of diverse applications. As discussed throughout this report, the diversity in the sizes and uses of portable diesel-fueled engines makes it a challenge to develop an effective and enforceable regulatory proposal.

B. Existing Regulations

This section describes the federal preemption that limits the ARB's and local districts' authority to regulate portable engines. It also describes specific federal, state, and local programs that currently impact portable engines used in California. These programs include the ARB/U.S. EPA emission standards for newly manufactured off-road engines, the ARB's Statewide Portable Equipment Registration Program, and the local air pollution control and air quality management district (district) permitting programs. All of these programs play a role in the ARB's and districts' efforts to attain the State and federal ambient air quality standards, particularly the ozone standards. Consequently, the focus of the programs has been to reduce emissions of NOx and ROG, and to a lesser extent reduce emissions of carbon monoxide (CO) and PM.

Federal Preemption

The Clean Air Act Amendments of 1990 generally preempted states from adopting emission standards for new nonroad engines or vehicles. Under section 209(e) of the Clean Air Act, all states are precluded from adopting emissions standards and other requirements for new nonroad engines smaller than 175 hp and used in construction or agricultural equipment or vehicles. As for other new nonroad engines, California, in recognition of the longstanding mobile source program already in place and the challenging air quality problems it faces, was allowed to adopt and enforce emission standards after receiving an authorization to do so from the U.S. EPA. California refers to engines called nonroad by the U.S. EPA as offroad engines. Accordingly this report will use the California terminology to describe such engines hereafter.

ARB/U.S. EPA New Engine Emission Standards

As mentioned above, the Clean Air Act Amendments provided for an authorization for California to adopt and enforce emissions standards for offroad engines (other than engines under 175 hp and used in construction or agricultural equipment or vehicles). Since January 1, 1996, new portable engines sold in California have been subject to ARB's Off-Road Compression Ignition emission standards (Title 13, California Code of Regulations, sections 2420 - 2427), which are equivalent to the U.S. EPA emission standards for newly

manufactured nonroad engines (40 Code of Federal Regulations, Part 89). These engines will be referred to as "certified engines" throughout the remainder of this report. The standards are tiered (i.e., Tier 1, 2, 3), with each set of standards phased in over several years based on the power rating of the engine. The Tier 1, 2, and 3 engine standards are presented in Appendix C. In 2006, newly manufactured portable engines of all sizes will be subject to Tier 2 standards, and in 2008, newly manufactured engines of all sizes will be subject to Tier 3 standards. Table III-1 illustrates the emission standards that will be in place for portable engines greater than 50 horsepower when Tier 3 standards are fully phased in.

Table III-1: Emission Standards (g/bhp-hr) That Will Be In Effect When Off-Road Standards (Tier 3) Are Fully Implemented

Rated Power (hp)	PM	CO	When Standards Apply	NMHC + NOx	When Standards Apply
Greater than or equal to 50 but less than 100	0.30	3.7	2004	3.5	2008
Greater than or equal to 100 but less than 175	0.22	3.7	currently	3.0	2007
Greater than or equal to 175 but less than 750	0.15	2.6	currently	3.0	2006
Greater than 750	0.15	2.6	2006	4.8	2006

Tier 4 emission standards were proposed by U.S. EPA in April 2003, and will, if adopted, require most engines to meet more stringent PM and NOx limits. These standards would be phased in during the 2011-2014 timeframe. As soon as the U.S. EPA Tier 4 standards are adopted, the ARB plans to adopt new engine standards that harmonize with the new federal standards. The proposed Tier 4 emission standards are presented in Table III-2 below:

Table III-2: Proposed U.S. EPA Tier 4 Emission Standards (g/hp-hr) for Engines Greater than 50 hp

Rated Power	First year that Standards Apply	PM	NOx
Greater than or equal to 25 but less than 75	2008 2013	0.22[1] 0.02	3.5[2] 0.3
Greater than or equal to 75 but less than 175	2012-2014	0.01	0.30
Greater than or equal to 175 but less than 750	2011-2013	0.01	0.30
Greater than 750	2011-2014	0.01	0.30

[1] The manufacturer has the option of skipping the 2008 standards for all 50-75 hp engines; the 0.02 g/bhp-hr PM standard would then take effect one year earlier for these engines (2012).

[2] The 3.5 g/hp-hr standard includes both NOx and nonmethane hydrocarbons.

These proposed Tier 4 standards would achieve diesel PM reductions of over 90 percent when compared to uncertified engine emission levels (i.e., engines not meeting an ARB/ U.S. EPA off-road engine emission standard). Similarly, replacing an uncertified engine with a proposed Tier 4 engine would result in reductions of NOx of over 90 percent.

Statewide Portable Equipment Registration Program

All of California's 35 air districts operate permit programs. In most cases, portable engines are subject to permit requirements established by the local air districts. Many portable engines—especially rental engines, dredging equipment, and oil-well drilling and servicing rigs—operate in multiple districts. Instead of obtaining multiple permits from individual districts, a portable engine owner can register the engine with ARB's Statewide Portable Equipment Registration Program (PERP), which was established in 1997 (Title 13, California Code of Regulations, sections 2450-2466; Health and Safety Code Section 41750-41755). Portable-engine owners have registered over 14,500 engines under PERP, which represents nearly half of the estimated statewide inventory of portable engines. Most of the engines in PERP are diesel-fueled.

The PERP regulations were designed to promote the use of clean portable engines in California. By January 1, 2010, all engines registered under PERP must be certified to ARB/U.S. EPA off-road engine emission standards (Tier 1, 2, or 3). Consequently, engines currently in the program that do not meet at least Tier 1 standards (generally those manufactured before 1996) must be replaced with certified engines—Tier 2 or Tier 3, depending on the year the engine is

purchased—by that date. By 2010, full implementation of the PERP requirements will result in reductions of diesel PM emissions from portable engines currently registered in the State by an estimated 30 percent or about 250 tons per year (0.7 tons per day) of diesel PM. The proposed portable diesel-fueled engine ATCM expands the PERP to achieve additional diesel PM reductions. For example, one of the short-term goals of the proposed ATCM is to ensure that all portable engines in California, whether registered with PERP or governed by district rules, are certified engines by 2010, the same requirement engines registered with the PERP program must satisfy.

Local District Permit Programs

Portable engines are generally subject to local air district permitting requirements, although some districts specifically exempt them. Owners of portable engines and associated equipment, where exempt, are not required to obtain construction or operating permits. Nor do they have to register their equipment with PERP, as PERP registration is a voluntary program in lieu of acquiring local air district permits.

The ARB staff estimates that there are approximately 3,000 portable engines in California that are permitted by the districts. District permit requirements vary, depending on the severity of the air quality in the district. The districts regulate pollutants and their precursors for which there are ambient air quality standards (NOx, PM, VOCs) as well as specific toxic air contaminants (e.g., benzene, hexavalent chromium, and lead).

In addition to the portable diesel engines currently permitted by the local air districts, ARB staff estimates that there are several thousand engines subject to permitting requirements that are neither permitted nor registered in PERP. By definition, portable engines may move continually from location to location, which can make them difficult to identify as nonpermitted. The local air districts and the ARB need to enhance outreach opportunities to engine owners, informing them of their permitting requirements. Additionally, there are portable engines that are currently exempt from local air district permitting requirement—due to size or application—that will be subject to the proposed ATCM and will therefore need to apply for permits or State registration.

Local air district permits for portable engines may contain a variety of operating requirements and restrictions. The ARB staff reviewed district rules and surveyed a cross-section of air districts to better understand the specific requirements placed on portable engines by the districts. A summary of district rules that apply to portable engines is included in Appendix D. One of the most common requirements for new engines is the installation of Best Available Control Technology (BACT). BACT is typically expressed as an emission level (e.g., grams per brake-horsepower hour), and the requirement is typically satisfied by the applicant either selecting existing equipment or a technology that satisfies the

emission level or by installing add-on air pollution control equipment. For portable diesel engines, however, the federal Clean Air Act amendments preempt the districts from requiring add-on control equipment on new engines, so many districts require new portable engines to meet ARB/U.S. EPA newly manufactured off-road engine standards at the time a permit to construct is issued.

Several districts also have source-specific regulations. For example, Ventura County Air Pollution Control District regulates oilfield drilling operations by requiring, if certain criteria are met, the use of electrified drilling equipment. Several other districts require portable engines to satisfy the applicable requirements of their internal combustion engine rules.

Currently, eight districts have adopted Toxics New Source Review rules and many more districts have adopted policies regulating the potential toxic emissions from a new project. These rules and policies require the application of toxics BACT and require denial of the project if the project has the potential to exceed specified thresholds for risk. Risk is typically evaluated based upon the potential increases in cases of cancer. Based upon risk, some districts also limit the hours of operation of a portable engine. The hours are limited so that the risk posed by the engine does not exceed the potential risk level where a permit is typically denied, usually at levels greater than 10 in a million potential cancer cases.

Five districts—Antelope Valley, Northern Sierra, San Diego, San Joaquin Valley Unified, and Yolo-Solano— have implemented registration programs specifically for portable engines and associated equipment. Owners of portable engines in these districts can register their engines with the district instead of obtaining an individual permit by demonstrating their engines meet specific emission rates.

IV. EMISSIONS, EXPOSURE, AND POTENTIAL RISK FROM DIESEL-FUELED PORTABLE ENGINES

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

A. Estimated Emissions

In January 2000, the Board approved an emission inventory for large off-road compression ignition engines using the Off-Road Emissions Model (Off-Road Model), which establishes emission estimates for engines 25 horsepower and larger used in off-road applications. The model was used to estimate the 2000, 2010, and 2020 portable engine inventory and associated diesel PM emissions presented in the Diesel Risk Reduction Plan.

The ARB staff used the Off-Road Model to estimate the number of portable engines greater than 50 horsepower in California and the associated diesel PM emissions. The staff updated the inventory for diesel-fueled agricultural irrigation pumps by using more recent engine estimates from agriculture representatives and the local air districts.

Based on this inventory, staff estimates that there are 33,000 portable engines in California with an estimated 4.2 tons per day or 1,500 tons per year of diesel PM emissions. Estimates for current statewide diesel PM, NOx, and ROG emissions from all diesel-fueled portable engines are included in Table IV-1.

Projected 2010 and 2020 Emission Estimates for Diesel-Fueled Portable Engines

The projected emission estimates for 2010 and 2020 are also included in Table IV-1. These estimates include benefits from the PERP, new engine standards, and turnover in the engine population, but do not include the projected additional reductions expected from implementation of the proposed ATCM. Expected emission reductions from the implementation of the proposed ATCM are discussed in Chapter V. As shown in Table IV-1, ARB staff predicts significant decreases in diesel PM, NOx, and ROG emissions from diesel-fueled portable engines between 2000 and 2020 due largely to PERP and engine turnover.

Table IV-1: Emission Estimates of Diesel-Fueled Portable Engines (without ATCM Implementation), Tons per Day

Emissions, Tons per Day			
Year	Diesel PM	NOx	ROG
2000	4.2	67.1	6.7
2010	2.8	45.3	4.6
2020	1.8	34.1	3.1

B. Potential Exposure and Risk

This section examines the potential exposures and cancer health risks associated with diesel PM emissions from diesel-fueled portable engines.

Diesel-fueled portable engines are used in a variety of applications. The majority of applications using portable diesel-fueled engines are completed in a short period of time. Examples of short-duration projects include the chipping of tree trimmings or maintenance of sewage drains and utility electrical equipment. These types of activities may use one or two portable diesel-fueled engines for a few hours over one or two days. Conversely, a major maintenance activity to update or replace existing infrastructure, such as electrical power lines or the construction of a large office complex, can utilize several portable engines for six months to several years. Because of the variability in the use of portable diesel-fueled equipment and the mobile nature of portable equipment, it is difficult to quantify the potential health risk resulting from the operation of a portable diesel-fueled engine on any specific receptor

The current risk assessment methodology recommended by the Office of Environmental Health Hazard Assessment (OEHHA) and used by ARB staff in evaluating potential cancer risk is based upon exposure to the emissions of a source for 70 years. We recognize that if this methodology is used to evaluate portable applications, the resulting potential cancer risk is overly conservative in that portable applications are short-term activities that are not likely to operate at the same location year-after-year for 70 years.

However, qualitative conclusions can be drawn regarding potential exposures to the emissions from diesel-fueled portable engines. Many Californians are impacted by diesel PM emissions from the operation of over 33,000 portable diesel-fueled engines in the State. The emissions from these engines contribute toward the ambient concentration of diesel PM. For the year 2000, exposure to ambient concentrations of diesel PM (1.8 $\mu g/m^3$) represented a health risk of 540 potential cancer cases per million people exposed over a 70-year lifetime. Based upon the emissions inventory for diesel PM, portable diesel-fueled engines

account for five percent of the ambient concentration. In addition, many of the engines are used in urban locations where the probability of a person living close to an engine is high.

The overall excess cancer risk can be significantly reduced by replacing older portable diesel-fueled engines with new cleaner diesel-fueled engines. For example, if an older engine is replaced with a Tier 3 engine, the diesel PM emissions and associated risk would be reduced by 55 to 70 percent. Reductions of over 95 percent can be achieved if the older engine is replaced with a Tier 4 engine, which is proposed to be available in the 2011-2014 timeframe.

V. SUMMARY OF PROPOSED CONTROL MEASURE FOR PORTABLE ENGINES

In this chapter, the ARB staff provides a discussion in plain English of the key requirements of the proposed air toxic control measure (ATCM) for diesel-fueled portable engines. After a general overview of the ATCM, the remainder of the chapter is structured in accordance with the structure of the ATCM. This chapter is intended to satisfy the requirements of Government Code section 11343.2, which requires that a "plain English" summary of the regulation be made available to the public.

A. Summary of Requirements

The proposed ATCM would affect all diesel-fueled portable engines that are larger than 50 horsepower (hp). This includes engines that are registered under the Portable Equipment Registration Program (PERP), engines that are subject to district permits, and engines that have been exempt to date from district permitting requirements. The proposed ATCM would reduce emissions of diesel PM by first requiring all portable engines to be certified to Tier 1, 2, or 3 U.S. EPA /ARB off-road engine standards by 2010, as is currently required for engines registered under PERP. After 2010, it would require all fleets of portable engines to meet diesel PM emission averages that become more stringent in 2013, 2017, and 2020. Owners/operators of these fleets will have flexibility in determining how the fleet emission standards are to be satisfied. Options that are available to satisfy this standard include: operating cleaner engines, replacing engines, using add-on control devices, switching to alternative diesel fuels or alternative fuels, and receiving credit for electrification.

To meet the proposed diesel PM standard for 2020, all engines in a fleet would either: a) be certified to the proposed Tier 4 newly manufactured off-road engine emission standards; or b) be equipped with a Level-3 PM control technology; or c) be a certified engine equipped with a combination of verified control technologies which achieve an emission of 0.04 g/bhp-hr for engines that are less than 175 horsepower or 0.02 g/bhp-hr for engines that are 175 horsepower and larger. As discussed previously, proposed Tier 4 off-road engine standards refer to emission standards expected to be finalized by the U.S. EPA in 2004 that would require the use of efficient PM reduction technologies, such as particulate filters, to be an integral part of the manufactured engine. Level-3 PM control technology refers to a control technology that has been verified to achieve PM reductions of at least 85 percent under ARB's *Verification Procedure, Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emission from Diesel Engines* [1] (Verification Program). The ARB Verification Program for diesel PM control technologies is explained in more detail in Appendix E.

[1] Approved by the Board in May 2002. Title 13, California code of Regulations, sections 2700-2710.

1. Applicability of the Proposed ATCM

The proposed ATCM would affect diesel-fueled portable engines greater than 50 hp. For the engine to be portable, the engine must not reside at any one location for more than 12 consecutive months. A location is any place of operation or single site at a building, structure, facility, installation, or well site. An engine that remains at one location for more than 12 consecutive months would be considered a stationary engine.

Staff is proposing not to include smaller engines at this time because these engines represent a small fraction of total emissions from portable engines in California. Furthermore, since these engines are currently exempt from district permit requirements—making identification, location, and compilation of operating data for these engines difficult and resource-intensive—a separate rulemaking effort may be necessary at a later date. While the proposed ATCM would not regulate these smaller portable engines, both the ARB and U.S. EPA have promulgated emission standards for new engines manufactured after 1995 for engines less than 25 hp and standards for engines manufactured after 1999 for engines 25 to 50 hp. Therefore, as natural attrition occurs—newer engines replacing older ones—the emissions from this category of smaller portable engines will diminish over time.

The proposed ATCM would also affect portable agricultural irrigation pumps that were previously exempt from regulations under Health and Safety Code section 42310. Senate Bill 700 which was chapter on September 22, 2003, and becomes effective on January 1, 2004, removes the exemption for equipment used in the raising of fowl or animals or the growing of crops. Consequently, agricultural irrigation pumps, whether in stationary location or used as portable equipment, that were previously exempt from district permits will now fall under district jurisdiction.

2. Exemptions to the Proposed ATCM

There are certain types of diesel-fueled engines that would be exempt from the proposed ATCM. The exemptions are as follows:

Engines Used In Mobile Applications

Engines used to propel mobile equipment and motor vehicles would not be regulated by this proposed ATCM. The ARB expects to regulate these engines through mobile-source regulations being developed for public and private on-road and off-road fleets. These engines include dual-use engines that both propel the equipment and operate the attached equipment. Examples of a dual-use engines would include cranes and cherry pickers. Power Take-Off (PTO) applications would also not be subject to the proposed ATCM. PTO refers to a

piece of equipment attached to a motor vehicle that is powered by the same engine that is used to propel the vehicle. An example would be a welder on a utility truck that is powered by the truck's engine.

Dual-Fuel Diesel Pilot Engines

Duel-fuel diesel pilot engines using an alternative fuel or an alternative diesel fuel would not be subject to this proposed ATCM. These engines use a small amount of diesel fuel, typically less than 5% of the total fuel used by the engine, and therefore the emissions of diesel PM would be a small portion of the engine's total emissions.

Military TSE

Military tactical support equipment (TSE) would not be regulated by this proposed ATCM. TSE refers to portable equipment that is owned by the United States Department of Defense and its allies and used in combat, combat support, tactical or relief operations, or training for such operations. Section 41754 of the Health and Safety Code specifically exempts TSE from control technology requirements and in-use operational controls. Portable diesel-fueled engines that are not considered TSE at military installations in California would be subject to this proposed ATCM.

Ground Support Equipment

Ground support equipment (GSE) refers to mobile and portable equipment used to support the operation of an airport. Portable equipment typically represents a small fraction (10 - 15 percent) of the total ground support equipment at an airport. This equipment includes ground power units, air conditioners, and start-carts.

To address emissions from GSE in the South Coast Air Quality Management District (SCAQMD), the ARB, the air district, and the major air carriers at the five major airports within the SCAQMD recently signed a Memorandum of Understanding (MOU), which requires the air carriers to reduce the emissions of diesel PM and ozone precursors from their GSE fleets over a specific timetable. In recognition of the commitments made under the MOU, ARB staff is proposing a mechanism that, upon a finding that equivalent or greater overall PM reductions is achieved under the MOU, would exempt the portable diesel-fueled equipment subject to this MOU from the proposed ATCM. Should similar MOUs be executed at other major airports across the State, the portable equipment portion of the affected GSE could also qualify for exemption from this proposed ATCM.

Other Categories

Portable engines that use an alternative fuel—such as natural gas, propane, butane, and gasoline— are not subject to the proposed ATCM as it only applies to portable engines that are fueled with diesel. Portable engines used at San Clemente or San Nicolas Island are also not subject to the requirements of the proposed ATCM. This exemption is consistent with the SCAQMD and Ventura County Air Pollution Control District internal combustion engine regulations, which exempt engines on these islands from the requirements of the regulation.

3. Fuel Requirements for Diesel-Fueled Portable Engines

The proposed ATCM requires portable engines to use ARB diesel fuel. The regulations for ARB diesel fuel were recently revised to limit the sulfur content of diesel fuel to 15 parts per million (ppm)[2]. The revised ARB diesel fuel regulations, which require the widespread availability of low-sulfur diesel fuel by mid-summer 2006, will help promote the use of the most efficient diesel PM control devices: diesel particulate filters.

The revised fuel regulations also allow mixtures of up to 50 percent biodiesel or 100 percent Fischer-Tropsch fuels to qualify as CARB diesel fuel as long as specific requirements are satisfied. While the use of biodiesel or Fischer-Tropsch fuels have been shown to reduce diesel PM, neither these fuels themselves or mixtures of these types of fuels have been verified under ARB's Verification Program for PM control technologies. The proposed ATCM allows only technologies or techniques, such as alternative diesel fuels or fuel additives, whose emission reductions have been verified by the ARB to be used for diesel PM reductions.

The requirements for verification differ depending on whether the diesel PM reduction strategy is considered an alternative diesel fuel or a control technology. A fuel additive can be treated in the verification process as an alternative diesel fuel or as a specific additive, which would be considered a control technology. If the additive is supplied to the engine fuel by an on-board dosing mechanism, is directly mixed into the fuel, or is added to the fuel at the time of refueling, then the additive is considered a control technology, not an alternative diesel fuel.

4. Requirements for 2010

The proposed regulation requires all portable diesel-fueled engines greater than 50 hp in California to be certified engines (engines certified to ARB/U.S. EPA newly manufactured off-road engine emission standards) by 2010, as is currently required for engines registered with the PERP. The 2010 requirement would

[2] Approved by the Board in July 2003. Revisions to section 2281, Title 13, California Code of Regulations.

expand the certified engine requirement in the PERP to engines permitted by districts and engines previously exempt from district permit requirements.

After 2006, the proposed ATCM requires all portable diesel-fueled engines greater than 50 hp initially registering or applying for permits from the local air districts to be certified engines. By 2010, all portable diesel-fueled engines greater than 50 hp—registered, permitted, or neither—must be certified engines (that is, the engine is certified to either a Tier 1,2 or 3 off-road emission standard) to operate legally in California. About 20,000 engines would need to be replaced, including about 6,000 registered with the PERP.

Recognizing that some portable engines are operated on a limited basis annually, an exception to the 2010 requirement is included in the proposed ATCM for engines used strictly for emergency purposes and low-use engines (engines operated 80 hours or less in a calendar year, including time for maintenance and testing). These engines are exempt from the 2010 requirements if a fleet owner commits to replacing the engines with engines certified to the proposed Tier 4 standards within two years from when Tier 4 engines become available. If the fleet owner does not commit to early replacement of these engines with Tier 4 engines, then the engines must be certified engines by 2010.

By requiring engine replacement by 2010, the proposed ATCM uses technology available either today or in the next few years to reduce diesel PM in the short-term. Verified add-on technologies are not yet available for off-road diesel engines, and the availability of Tier 4 engines will not occur until after 2011, if the U.S. EPA's 2003 proposal is approved in 2004. Setting an engine replacement schedule that would take effect significantly sooner than 2010 would be less effective in the long run, as many of the cleaner Tier 3 engines will not yet be commercially available. These engines will be available in the 2006-2008 timeframe. Staff believes that requiring the engines to be replaced by 2010 allows sufficient time for the engine manufacturers to satisfy the demand caused by the ATCM's proposed 2010 requirement.

5. Requirements for 2013, 2017, and 2020

After 2010, owners of fleets of portable engines must satisfy progressively more stringent diesel PM emission standards by 2013, 2017, and 2020. The purpose of the diesel PM emission standards is to create additional diesel PM emission reductions beyond those that would be achieved from normal engine turnover after 2010.

Definition of Fleet

A fleet includes portable engines registered with PERP, those permitted with local districts, and those that have been previously exempt from district permit

requirements. The fleet shall exclude portable engines that operate exclusively outside of California, engines operated only within the Outer Continental Shelf (OCS), engines used exclusively in emergency applications, and engines qualifying as low-use. Portable engines can also be exempt from the fleet requirements if equipped, as of January 1, 2004, with a properly operating selective catalytic reduction (SCR) system.

A fleet is defined in the proposed ATCM as an engine or group of engines either under the same ownership or owned by entities under the control of a Responsible Official. The Responsible Official refers to an individual who has the authority to certify that portable engines under his/her jurisdiction comply with the applicable requirements of the proposed ATCM, has authority to manage the use of the portable equipment, and may be involved in the purchase of the equipment.

A company or public agency can have more than one fleet if each fleet is under the control of different Responsible Officials. For example, companies owned by the same holding company could be considered to have separate fleets if each fleet's operation and composition are controlled by separate Responsible Officials. In the case of military installations, each installation is considered a separate fleet instead of one fleet under the control of the Department of Defense. Conversely, if several companies were under the common control of one Responsible Official, then all the portable engines in each of the companies would be considered one fleet.

As discussed later in this chapter, companies and public agencies are required to submit status reports to the Executive Officer prior to the implementation of the fleet emission standards. Based upon the information submitted, ARB staff will work with the Responsible Official to resolve any issues in determining the composition of each fleet prior to the first fleet emission standard becoming effective.

Fleet Diesel PM Standards

The ARB staff is proposing diesel PM standards for three ranges of engine sizes: engines less than 175 horsepower, engines between 175 horsepower and 749 horsepower, and engines greater than or equal to 750 horsepower. The diesel PM standards (grams per brake horsepower-hour (g/bhp-hr)) are illustrated below:

Fleet Standard Compliance Date	Engines <175 hp (g/bhp-hr)	Engines ≥175 to 749 hp (g/bhp-hr)	Engines ≥ 750 hp (g/bhp-hr)
1/1/13	0.3	0.15	0.25
1/1/17	0.18	0.08	0.08
1/1/20	0.04	0.02	0.02

Three sets of diesel PM standards are proposed to address the difference between off-road engine emission standards for engines less than 175 hp and emission standards for larger off-road engines. Emission standards for certified off-road engines less than 175 hp are less stringent than the standards for the larger class of engines; thus, the proposed diesel PM standards are less than for engines greater or equal to 175 hp. In addition, a third set of fleet standards is being proposed for engines greater than or equal to 750 hp. Staff is proposing this set of standards because these large engines are expensive to replace and have a much longer useful life than smaller engines. Owners of these larger engines are given more time for engine replacement; therefore, their 2013 standard is less stringent than the standard for 175-749 hp engines.

The proposed fleet emission standards take into account the potential commercial availability of Tier 4 engines, which should become available in the 2011 - 2014 timeframe. They also take into account the availability of verified Level-3 PM control technologies. The proposed 2013 standards are intended to force replacement of Tier 1 engines <750 hp with either Tier 3 or proposed Tier 4 engines. The PM standard for Tier 3 and Tier 4 off-road engines are significantly lower than the Tier 1 engine PM standard. At this time, most Tier 1 engines being replaced would have operated 10 to 17 years. Owners who had replaced uncertified engines with Tier 2 or Tier 3 engines prior to 2010 would probably not be subject to additional requirements until 2017.

The proposed 2017 standards are likely to result in half of the engines in a fleet being replaced with engines certified to the proposed Tier 4 standard or equipped with Level-3 control technology or a combination of verified control technologies to achieve 85% reduction. At this time, the affected engines would have operated 6 to 17 years. The proposed 2020 standards are likely to result in all engines in the fleet being certified to the proposed Tier 4 standard or equipped with Level-3 verified technology or a combination of verified control technologies to achieve 85% reduction.

Weighted Fleet Average

Owners of portable engine fleets will determine compliance with the proposed fleet standard by comparing the fleet's actual weighted diesel PM emission rate with the fleet emission standard. The fleet's actual weighted emission rate shall be determined by using the following formula:

$$\frac{\sum \text{Summation for each engine in the fleet (bhp x emission factor)}}{\sum \text{Summation for each engine in the fleet (bhp)}}$$

Where: bhp = horsepower at maximum rated capacity
Emission factor = diesel PM emission rate

For example: A fleet owner has five certified engines with the following horsepower and PM emission factors:

75 hp	emission rate of 0.30 g/bhp-hr
75 hp	emission rate of 0.30 g/bhp-hr
100 hp	emission rate of 0.22 g/bhp-hr
150 hp	emission rate of 0.22 g/bhp-hr
150 hp	emission rate of 0.22 g/bhp-hr

$$\frac{(75 \times 0.30) + (75 \times 0.30) + (100 \times 0.22) + (150 \times 0.22) + (150 \times 0.22)}{75 + 75 + 100 + 150 + 150}$$

Fleet's weighted diesel PM emission rate = 0.24 g/bhp-hr

Emission factors can be used that are derived from results of emission tests used to certify the engine to U.S. EPA /ARB off-road engine standards. This information can be accessed from the U.S. EPA's Engine Certification Information Center (www.epa.gov/otaq/certdata.htm) or from the ARB's California Certification Data Website (www.arb.ca.gov/msprog/mvcert/mvcert.htm). These emission factors can be modified using the emissions reductions for the control technologies that have been verified through the ARB Verification Procedure. For example, if an engine owner installs a diesel particulate filter that has been verified to an 85 percent control effectiveness, the engine's emission factor would be the certified value multiplied by 0.15.

Emergency and Low-Use Engines

As discussed above, engines that are used exclusively in emergency applications or are deemed low-use engines are not subject to the fleet emission standards of the proposed ATCM. These engines would be required, by January 1, 2020, to: 1) be certified to the proposed Tier 4 newly manufactured off-road engine emission standards, or 2) be equipped with a Level-3 PM control technology, or 3) be a certified engine equipped with a combination of verified control technologies to achieve an emission of 0.04 g/bhp-hr for engines < 175 hp or 0.02 g/bhp-hr for engines that are ≥175 hp. Compliance for these engines was delayed until January 1, 2020, because these engines emit less than one percent of the total diesel PM emissions from portable engines and requiring these engines to meet the interim fleet averages would not be cost-effective.

Engines Equipped with SCR

As was mentioned earlier, portable engines may be exempt from the fleet requirements if equipped, as of January 1, 2004, with a properly operating SCR system. This provision was included for a number of reasons. Source test results have shown that an SCR system, typically used to reduce NOx, also significantly reduces diesel PM emissions. In addition, the pressure drop requirements for engines makes it technically challenging today to add additional control technologies, such as a diesel particulate filter, to an engine already equipped with SCR. The proposed ATCM provisions also allow engines equipped with SCR systems after the January 1, 2004, date to be exempted from fleets on a case-by-case basis. To qualify for the exemption, engine owners must submit specific information to the Executive Officer indicating that the SCR system is operating properly.

Owners of portable engines equipped with SCR may chose to include these engines in the fleet weighted diesel PM standard. Engine-specific source tests from these engines must be used to determine diesel PM emission rates. PM measurements can be performed using ARB Test Method 5 front-half (filter and probe wash) or equivalent district methods. Requiring only the front-half of ARB Test Method 5 is consistent with the recommendations of the Test Method Working Group that was created during the development of the Stationary Compression Ignition Engines ATCM and consistent with test methods used to certify engines to off-road engine standards. The Test Method Working Group was formed to evaluating different test methods for measuring PM from diesel-fueled engines and to recommend the most appropriate measuring technique for diesel PM.

6. Incentives

To encourage the use of cleaner technologies and to encourage repowering or replacement of older engines with new, lower-emitting engines, the proposed ATCM provides for several incentives to promote these options as part of the fleet reduction approach.

One incentive allows credit toward satisfying a fleet standard by allowing, under certain circumstances, alternative-fueled engines into the fleet. To obtain the credit, the engine must operate at least 100 hours annually. The proposed ATCM also allows credit for applications where grid power is used in lieu of using a portable diesel-fueled engine. The credit is granted where more than 200 hours of grid power is used for a given project and the necessary recordkeeping and reporting requirements are satisfied. Finally, a credit is included to encourage the purchase of engines certified to the proposed Tier 4 standard. The credit can be used when fleet owners purchase Tier 4 engines prior to January 1, 2015. In these cases, the owner can count the Tier 4 engine twice in the calculations for the fleet weighted diesel PM emission rates. To use the

credit for the 2013 standard, the engine must be in the fleet prior to January 1, 2013. Double counting the Tier 4 engines will result in lower fleet weighted diesel PM rates for compliance with the 2013 and 2017 diesel PM standards. The double counting of Tier 4 engines is not allowed for compliance with the diesel PM standards for 2020 because all engines must be certified to the proposed Tier 4 standards or retrofitted with verified control devices to achieve 85 percent reduction by that date.

7. Requirements Near Schools

The ARB staff is continuing to work with the California Air Pollution Control Officer's Association (CAPCOA) and other stakeholders to determine if it is feasible to develop provisions to restrict the operation of portable diesel-fueled engines near schools during periods when children are present. At the February Board meeting, staff will present a proposal to limit the emissions of diesel PM near schools.

8. Recordkeeping and Reporting Requirements

As discussed below, the proposed ATCM specifies recordkeeping and reporting requirements to enhance the enforceability of the proposed ATCM. These recordkeeping and reporting requirements may be in addition to requirements that are specified in applicable registration or permit requirements for a portable engine.

In developing the proposed ATCM, staff intended that the recordkeeping and reporting requirements be the minimum necessary to ensure that the proposed regulation is enforceable. To this end, recordkeeping and reporting requirements are not specified in the proposed ATCM for determining a company's or agency's compliance with the 2010 requirement. Staff believes that compliance with the 2010 requirement can be enforced through the existing PERP and district permit programs.

Recordkeeping

For many fleets, the recordkeeping would only consist of keeping track of all the engines in the fleet and their associated emission factors. If the fleet's diesel PM emission rate average satisfies the 2020 fleet standards, then all the engines in the fleet are not subject to the recordkeeping or reporting requirements of the proposed ATCM. To satisfy the 2020 fleet standards, all the portable diesel-fueled engines in the fleet must either be certified to the proposed Tier 4 off-road engine emission standards or be equipped with a Level-3 PM control technology or a combination of verified control technologies that achieve 85 percent reduction.

The recordkeeping requirements address only those engines in a fleet whose use is based on minimum or maximum hourly limitations, fleets taking advantage of the electrification incentive, engines equipped with SCR, and engines operating near schools. Engines with hourly limitations would include alternative-fueled portable engines that are run for at least 100 hours per year, engines operating 80 hours or less per year (low-use engines), and engines used exclusively in emergency applications where yearly use would be limited. These engines must be equipped with a non-resettable hour meter and the operator must maintain records on the engines' annual hours of operation. The proposed ATCM requires the company to maintain the records at a central place for five years. In addition, a company is required to forward copies of records within three business days, if requested by either the ARB or local district staff.

Recordkeeping requirements are also required if electrification is used to satisfy a fleet requirement and for all engines equipped with SCR. If electrification is used to determine the fleet average, the ARB must be notified in advance of projects that will rely on electrification instead of using diesel engines. The notification shall identify each engine that will be affected by the electrification project and shall include information on the electrification activity. For engines equipped with SCR, records must be maintained to demonstrate that the SCR system is operating properly. The records must be retained for five years. In addition, a company is required to forward copies of these records within three business days, if requested by either the ARB or local district staff.

Status Report

The proposed ATCM requires the responsible official of the fleet to submit a status report by March 1, 2011, and subsequent compliance statements by March 1 of each applicable year when a fleet emission standard becomes effective.

The purpose of the status report is to provide the ARB and local air districts specific information on the composition of the fleet. The 2011 status report will include the fleet's average diesel PM emission rate for the 2010 calendar year, as well as a summary of each engine's emission rate, in g/bhp-hr. The status report should indicate the number of fleet(s) in each company or agency and the Responsible Official in charge of each fleet. The status report must identify whether each engine in each fleet within a company or agency is registered with ARB's PERP program or permitted with local districts. Alternative fueled engines must be identified by fuel type. Sufficient information should be provided for each engine to be able to identify the engine, including the make, model, serial number, year of manufacture, and district permit or state registration number. Additionally, the status report must identify each engine that the owner commits to replacing with an engine certified to the proposed Tier 4 standards, engines used exclusively in emergency applications, engines satisfying the low-use

engine requirements, and must include documentation for engines equipped with SCR demonstrating that the SCR system is operating properly.

Compliance Statements

The Responsible Official of the company must provide a signed statement of compliance indicating the applicable fleet emission standard is being achieved and identifying each engine in the fleet and the associated emission rate. The statement of compliance is due March 1 of the year the fleet emission standard becomes effective (i.e. 2013, 2017, 2020). Compliance is based upon the composition of the fleet as of January 1 of that year. Sufficient information should be provided for each engine in the fleet to be able to identify the engine, including the make, model, serial number and year of manufacture. The compliance report shall identify engines used exclusively in emergency application, low-use engines and engines excluded from the fleet because the engine operated exclusively outside of California or operated only within the OCS. If electrification was used for the calculating the fleet average, documentation must be included in the report supporting the credit claimed for electrification. As part of the compliance report, the responsible official shall certify the following:

- All alternative-fueled engines included in the fleet average operated at least 100 hours in the previous calendar year;
- engines designated as emergency were only used for emergency applications;
- engines designated as low-use were operated no more than 50 hours in the previous calendar year; and
- engines equipped with SCR comply with applicable district or PERP requirements.

The proposed ATCM allows the ARB and the district staff to require additional information from a fleet owner, beyond the submittal of compliance reports, that demonstrates the fleets are in compliance with the applicable fleet standards. The fleet owner must provide the information requested within 30 days.

9. Enforcement Requirements

Health and Safety Code 39666 (d) requires the districts to implement and enforce an ATCM that has been approved by the Board. Therefore, both the ARB and the districts have the authority to review or seek enforcement action for violation of the fleet emission standards. Despite this overlapping jurisdiction, it is not the intent of the ATCM to place engine owners in "double jeopardy." Appropriate enforcement action will be taken by either the ARB or the local air districts, as necessary.

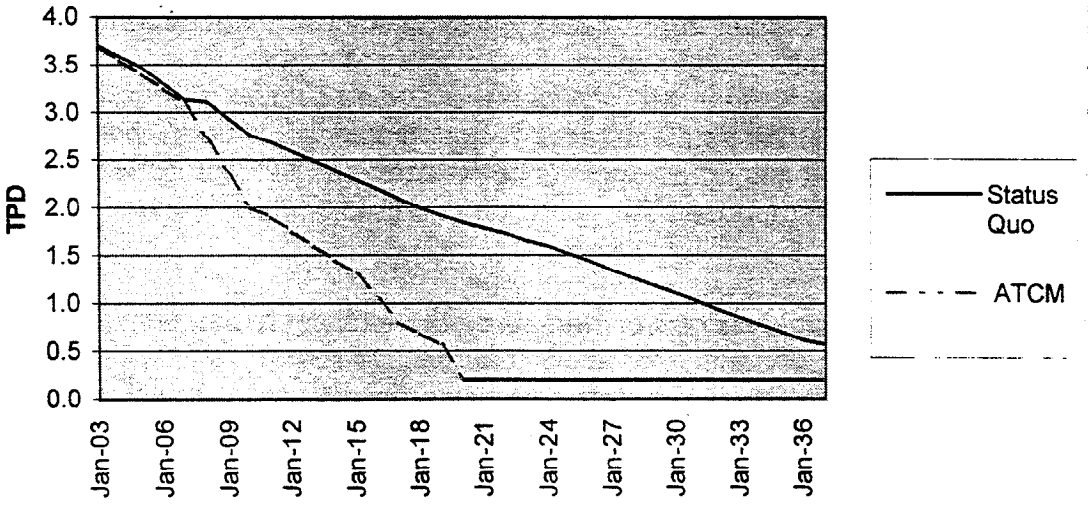
B. Evaluation of Proposed ATCM

The purpose of the proposed ATCM is to achieve the goal of the Diesel Risk Reduction Plan, which is an 85 percent reduction in diesel PM by 2020. The ARB staff estimates that the proposed ATCM will go beyond that goal by reducing diesel PM emissions by approximately 95 percent, as compared to the 2000 base year.

The proposed ATCM reduces diesel PM emissions in two ways: requiring older, dirtier engines to be replaced by newer, cleaner engines before the end of the useful life of the older engines, and requiring the installation of add-on control technologies. Without the proposed ATCM, emissions reductions would occur as seen in the "status quo" line in Figure V-1, below. The "status quo" reductions are achieved through PERP (to 2010), then a routine replacement of engines over a period of time (i.e., natural attrition). The expedited emissions reductions of the proposed ATCM are also illustrated in Figure V-1; the benefits of the ATCM are quantified by the area between the two curves.

The reductions peak by 2020, at 1.6 tons per day or 584 tons per year, when the proposed ATCM is fully implemented and then decreases until 2037. Overall, the proposed ATCM will result in cumulative diesel PM reductions of 4,700 tons by 2020 and 10,800 tons by 2037. At this time, the emissions from the status quo case are nearly equivalent to the emissions generated by the proposed ATCM. This is not unexpected, as natural attrition would have eventually (by ~2040) resulted in a replacement of all existing engines with engines certified to the proposed Tier 4 standard.

Figure V-1: Projected Diesel PM Emissions for Status Quo and the Implementation of the Proposed ATCM



The reductions resulting from the PERP program are an important portion of the reductions that occur prior to January 1, 2010. As discussed previously, by January 1, 2010, engines registered with PERP must be certified to an emission standard for off-road engines. The PERP program has about 30 percent of the portable diesel-fueled engines operating in California, and by January 1, 2010, the program is expected to reduce diesel PM emissions by 250 tons per year or about 0.7 tons per day. The current PERP reductions are significant in that it represents about 75 percent of the reduction for the status quo case by 2010 and about 30 percent of the reductions from the 2000 base year.

C. Complying with Federal Preemption For New Farm and Construction Off-Road Engines

As discussed in Chapter III, the Clean Air Act preempts all states from adopting emissions standards for new offroad engines smaller than 175 hp and used in farm and construction equipment and vehicles. The U.S. EPA has determined by regulation that such preemption applies to engines used "primarily" (51%) in farm and construction equipment. The proposed ATCM has been designed to conform with this preemption.

The proposed ATCM does not impose emission standards. The ATCM is largely predicated on the standards imposed by U.S EPA for newly manufactured off-road engines. The proposed ATCM can be satisfied by replacing older engines with newer, cleaner engines. These engines would not need to be modified, such as adding air pollution control equipment to reduce emissions. The proposed ATCM reduces diesel PM emissions by requiring all engines, by January 1, 2010, to be certified to U.S. EPA emission standards for newly manufactured off-road engines. Fleet owners would satisfy this requirement by replacing older engines with new engines manufactured to meet off-road emission standards. Subsequent diesel PM reductions are achieved with the use of fleet emission standards. For the fleet emission standard that becomes effective January 1, 2013, staff expects fleet owners to replace Tier 1 engines, the oldest engines in the fleet, with the cleanest engine available. Similarly, to satisfy the proposed 2017 and 2020 fleet emission standards, fleet owners will need to replace about half of the engines not yet certified to the proposed Tier 4 standard in 2017 with proposed Tier 4 engines and replace the remaining engines in 2020.

The proposed ATCM also allows owners of portable-diesel fueled engines to comply by retrofitting portable engines with air pollution control systems that reduce diesel PM. As discussed previously, these control systems will need to be verified through the ARB Verification program. For example, to meet the 2017 fleet standard, owners of these engines would either replace the engine with a engine certified to the proposed Tier 4 standards or consider adding verified

control technologies. At this time, these Tier 2/3 engines will be seven to sixteen years old.

D. Technical Feasibility of The Proposed ATCM

The proposed ATCM requires all diesel-fueled portable engines to be certified engines (Tier 1, 2, or 3) by 2010. It also requires a fleet to meet progressively more stringent fleet weighted diesel PM standards by 2013, 2017, and 2020. The standards rely on the availability of cleaner off-road engines and verified Level-3 PM control technologies. Currently no Level-3 PM control technology has been approved by ARB for off-road applications nor have U.S. EPA Tier 4 off-road engine standards been approved.

Since the commercial availability of verified Level-3 PM control technologies and Tier 4 engines is uncertain, staff developed the proposed ATCM to obtain the initial diesel PM reductions by relying on proven technologies: replacing older, higher-emitting engines with newer engines that emit considerably less diesel PM. Although PM standards for off-road diesel engines become fully effective for all sizes of engines by January 1, 2006, greater NOx benefits can be realized if the proposed ATCM takes advantage of Tier 3 engines, which are fully implemented by January 1, 2008. To take advantage of this NOx benefit, and because of the time necessary to replace nearly 20,000 engines, the ARB staff is proposing that the initial requirements of the regulation take effect January 1, 2010. This schedule also harmonizes with the current PERP requirements.

Retrofit technologies can be used to satisfy the fleet standards in 2013, 2017, and 2020. Consequently, emission-control technology manufacturers will have many years to develop the desired retrofit technologies. In addition, prior to 2010, the ARB staff plans to review the status of verified retrofit technologies and other applicable activities that affect portable diesel-fueled engines, and to propose changes, as necessary, for the Board's approval.

While there are several technologies available to reduce diesel PM emissions, only one of these technologies have been verified for use on off-road engines. The proposed ATCM requires all control technologies to be verified through the ARB verification program. The available technologies include particulate filters, diesel oxidation catalysts (DOCs), fuel additives, and alternative diesel fuels. A brief description of these technologies and ARB's Verification Program for these technologies is given in Appendix E. ARB verification is based on whether a control technology can be applied to off-road or on-road diesel engines and on the level of PM control that can be achieved by the technology. Presently, only DOCs have been verified for off-road application. The DOC was verified to a Level-1, which means the technology achieves up to a 25 percent reduction in diesel PM.

Many of these technologies discussed above have been used primarily on on-road engines. DOC and passive particulate filters have been verified for on-road application. The other technologies listed, such as alternative diesel fuels, have been tested primarily on on-road fleets. Of these technologies, the one with the most promise to help ARB achieve the 85% reduction in 2020 is the diesel particulate filter. For example, several passive diesel particulate filters (DPFs) have been verified as Level-3 technologies—achieving at least 85% reduction of diesel PM—for on-road engines. The passive DPF is an attractive retrofit technology. The emission reductions are high, and since it regenerates itself during use, it is a relatively hands-off type of technology. Unfortunately, the currently verified passive DPFs are only applicable to cleaner engines that maintain exhaust temperatures sufficient for regeneration (greater than 225-300 degrees Celsius, depending on the DPF manufacturer).

To gain a better understanding of the applicability of particulate filters on portable engines a stack-temperature-profile test was conducted during 2002-2003. The University of California at Riverside's Center for Environmental Research and Technology (CE-CERT) conducted the test in coordination with ARB staff. Eighty engines and associated equipment ranging from 77 hp to 2150 hp were tested. The equipment included generators, compressors, wood chippers, pumps, and grinders that are used by a variety of industries. A temperature sensor was inserted into the exhaust stream of each engine and the temperature was recorded for 20 hours of engine use. The test data illustrated a wide variation of results. The ability of an engine to sustain the minimum temperature required for a DPF to function effectively depends on the engine's duty cycle. That is, if the engine idles for most of it's operating time, runs primarily at partial load, or generally runs constantly at full load when operated. A DPF will not operate well if there is significant idle time or the engine is run primarily at a low partial load—characteristics that describe the operating pattern of many portable engines. Consequently, the test results demonstrate DPF would not be effective for many portable engines. A detailed discussion of the stack-temperature-profile test and results is included in Appendix F.

In contrast to on-road applications, developing control techniques for portable equipment is likely to prove more challenging due to: 1) the large number of different applications for portable engines; 2) the number of different engine manufacturers and models; and 3) the varying duty cycles of each application. Consequently, for the reasons stated above, staff has not relied on the availability of retrofits to assist in complying with the ATCM provision in 2010. As discussed above, the proposed regulation has been crafted to rely on early engine replacement and has allowed a longer timeframe for the development of retrofit technologies for off-road applications. For example, many control technologies will be required for on-road engines by 2007, and some of these technologies may be adapted to portable equipment at a later date.

In summary, the proposed ATCM relies initially on existing off-road engine standards to generate the initial diesel PM reductions. To achieve the goal of 85% reduction by 2020, the proposed ATCM anticipates the development of Level-3 verified technologies for the off-road category and the availability of Tier 4 off-road engines beginning in 2013. Affected owners of portable diesel-fueled engines have expressed concern regarding the availability of Level-3 verified technologies for the off-road category as well as the widespread availability of Tier 4 off-road engines within the 2011-2014 timeframe. The ARB staff believes that the proposed ATCM has provided for sufficient time for the development of the Level-3 verified technologies. Staff will monitor the development of these technologies, and if necessary, propose revisions to the ATCM.

VI. REGULATORY ALTERNATIVES

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

A. Do Not Adopt This Regulation

With full implementation of the proposed regulation, diesel PM emissions will be reduced from portable diesel-fueled engines in California by 95 percent in 2020, relative to the 2000 baseline. If the regulation is not adopted and implemented, PM reductions—achieved through PERP, local air district permitting requirements, and natural engine attrition—would only be 57 percent by 2020. Because of the number and size of the engines currently in PERP and the requirement for PERP participants to have only certified engines by 2010, PERP alone would achieve a 50 percent diesel PM reduction by 2020. The proposed ATCM is designed to build upon the success of PERP. Currently, because of the Clean Air Act preemption for non-road engines, which was discussed in Chapter III, local air districts have limited authority to regulate portable engines. Therefore, if the proposed regulation is not fully implemented, substantial emission reductions will be forgone.

These estimated reductions in diesel PM from portable engines are an important element in the Diesel Risk Reduction Plan. This proposed ATCM, along with other diesel PM control measures to be adopted by the ARB, will result in reducing cancer and noncancer health risks to the public from inhalation exposure to diesel PM emissions. Short-term exposure to diesel PM emissions may cause acute or chronic noncancer respiratory effects such as irritation of the eyes, throat, and bronchial passages. Furthermore, inhalation of diesel PM emissions can cause neurophysiological symptoms, such as lightheadedness or nausea.

The ARB is required by H&SC Section 39658 to establish ATCMs for toxic air contaminants. Further, H&SC Section 39666 requires the ARB to adopt ATCMs to reduce emissions of TACs from nonvehicular sources. Considering the recognized detrimental public health impacts from exposure to diesel PM, and ARB's statutory requirements to protect public health, this alternative is not a reasonable option.

B. Risk Assessment Approach

One of the approaches ARB staff discussed with stakeholders was a concept to limit the hours of operation at a specific location, thereby capping the potential health risk at that location to less-than-significant risk levels. The operating-hour limits were based upon the potential risk posed by an engine using standard risk assessment procedures, which includes a 70-year exposure duration. All engines used on a specific project would have to share the available operating hours. The intent of this approach was to promote engine turnover, as cleaner engines received higher allowable operating hours per project.

This approach was abandoned because the operating restrictions were too restrictive for many projects, particularly projects using larger diesel-fueled portable engines; the recordkeeping requirements would have been substantial and onerous; and field enforcement would have been difficult and resource-intensive.

C. BACT Approach

Another approach considered in other ARB diesel-risk-reduction regulations was requiring the implementation of best available control technology (BACT). Fleet operators would be required to equip all diesel-fueled portable engines with BACT by a certain date. There would also be interim dates requiring a certain percentage of the fleet to meet the BACT requirement. For example, in the recently adopted ATCM for on-road heavy-duty residential and commercial solid waste collection vehicles, BACT was defined as: 1) an engine certified to an emission rate of 0.01 g/bhp-hr; 2) an alternative-fuel engine, and 3) a control system that has been approved by the Executive Officer via the verification procedure for in-use strategies to control emissions from diesel engines.

While this approach is workable for on-road applications, staff did not pursue the approach for portable engines, primarily due to the lack of available emission-reduction options for the off-road categories. For the on-road category, the control technologies are readily available. There are verified Level-3 control technologies commercially available, and new engines equipped with particulate filters at time of manufacture will be available in the near term. As discussed in the previous chapter, only one control technology has been verified for the off-road category—a diesel oxidation catalyst (DOC)—that achieves between 20-30 percent diesel PM reductions. New engines equipped with particulate filters at the time of manufacture will not be available until 2011 or later. Due to the wide range of portable diesel-fueled engine applications—from small compressors or pumps to large dredging or oil field workover engines—DOCs may not be applicable in many cases. Consequently, to achieve the 85 percent reduction goal identified in the Diesel Risk Reduction Plan, the BACT approach would force engine owners to initially retrofit some engines by a specific date with technologies that achieve only 20-30 percent reduction and then, by 2020,

require these retrofit engines to either be replaced with an engine certified to the applicable proposed Tier 4 off-road emission standard or be retrofitted again with a Level-3 control device or technique. This was not considered to be a cost-effective alternative to the proposed ATCM.

VII. ENVIRONMENTAL IMPACTS OF PROPOSED ATCM

This chapter describes the potential impacts that the proposed ATCM may have on air quality, wastewater treatment, and hazardous waste disposal. Based upon available information, the ARB staff has determined that no significant adverse environmental impacts should occur as a result of adopting the proposed ATCM.

A. Legal Requirements Applicable to the Environmental Impact Analysis

The California Environmental Quality Act (CEQA) and ARB policy require an analysis to determine the potential environmental impacts of proposed regulations. ARB's program for adopting regulations has been certified by the Secretary of Resources, pursuant to Public Resources Code section 21080.5. Consequently, the CEQA environmental analysis requirements may be included in the Initial Statement of Reasons (ISOR) for this rulemaking. In the ISOR, the 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 proposed ATCM, to all significant environmental issues raised by the public during the public review period or at the Board public hearing.

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

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

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

B. Effects on Air Quality from Implementing the ATCM Requirements

The proposed ATCM will provide diesel PM emission reductions throughout California, including urban areas and those areas that are non-attainment for the State and federal ambient air quality standards for PM_{10} and $PM_{2.5}$. Air quality benefits will result from the reduction of NOx and ROG emissions as well. The projected emission reductions from the implementation of this ATCM are

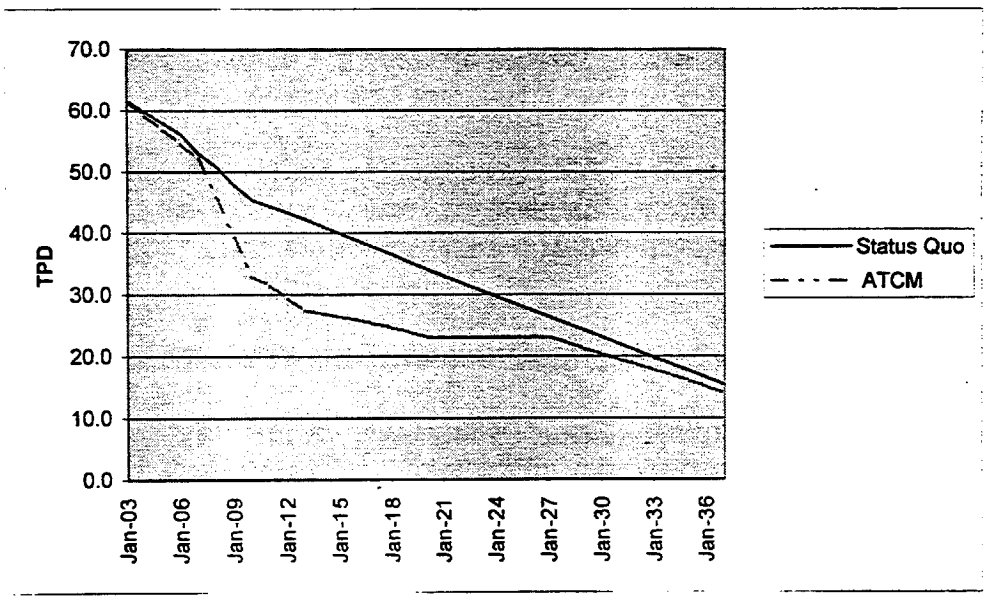
presented in Table VII-1. The percent reductions presented in Table VII-1 are the percent reductions from the 2000 base year. For example, the 2010 estimate for NOX emissions as a result of implementing the proposed ATCM is 33 TPD, which is a 51 percent reduction from the 2000 base year NOx emissions of 67 TPD.

Table VII-1: Projected Annual Emissions for 2010 and 2020 with Implementation of the Proposed ATCM

Year	Diesel PM Emissions (TPD)	Percent Reduction	NOx Emissions (TPD)	Percent Reduction	ROG Emissions (TPD)	Percent Reduction
2000	4.2	–	67	–	6.7	–
2010	2.0	52%	33	51%	4.6	30%
2015	1.3	69%	26	61%	2.9	57%
2020	0.2	95%	23	66%	1.2	78%
2037	0.2	95%	14	79%	1.2	78%

Figure VII-1 illustrates the projected emission reductions to year 2037 for NOx that are associated with the implementation of the ATCM. A similar figure for diesel PM reductions is given in Chapter V. The projected emission reductions is the difference between the NOx emissions from the status quo case (i.e., considering only the benefits of full PERP implementation and engine turnover) and the NOx emissions from implementing the proposed ATCM. As discussed previously, the NOx reductions realized are based upon the early replacement of engines with cleaner engines. Early engine replacement is expected to be the

Figure VII-1: Projection of NOx Emissions with and without ATCM Implementation



primary method to comply with the 2010 and 2013 requirements. Consequently, the peak reductions for NOx will occur between 2010 and 2020, with the greatest reduction in any one year occurring during 2013. Overall, the proposed ATCM will result in cumulative NOx reductions of 56,200 tons by 2020 and 81,000 tons by 2037. These reductions are in addition to the reductions achieved through PERP and natural attrition of older engines.

The proposed ATCM's NOx reductions are largely based upon replacing uncertified engines with Tier 2 and Tier 3 engines. Staff expects that these engines would subsequently be retrofitted with diesel PM emission reduction technologies that will not result in further NOx reductions. Greater reductions in NOx can be realized if fleet owners take advantage of the Tier 4 incentives in the proposed ATCM.

C. Health Benefits of Reductions of Diesel PM Emissions

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

Primary Diesel PM

Lloyd and Cackette (2001)[3] estimated that ambient diesel $PM_{2.5}$ exposures at a level of 1.8 $\mu g/m^3$ resulted in a mean estimate of 1,985 (974-2,991 as 95 percent confidence interval (95% CI)) cases of premature deaths per year in California. This result is based on calculations using Appendix D of U.S. EPA's report to the U.S. Congress on the benefits and costs of air pollution regulations (U.S. EPA, 1999) and on the relative risk value for mortality from $PM_{2.5}$ exposure reported by Krewski *et al.*(Krewski, 2000). In Table 31 of Part II of Krewski's publication, a relative risk of 1.12 (all causes of death) for $PM_{2.5}$ exposure is reported. This risk is associated with a mean change of 24.5 $\mu g/m^3$ in PM concentration, as stated on page 97 of the report. These values were used in equation (5) of Appendix D of the U.S. EPA document, which states the relationship between the coefficient beta, relative risk, and change in PM concentration. For these calculations, the

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

health risks from diesel PM exposure are assumed to be the same as the health risks from ambient $PM_{2.5}$. This assumption is supported by the fact that almost all diesel PM is 2.5 μg or smaller in size, and by the many studies in numerous cities that show a strong association between mortality and exposure to a wide range of combustion-related $PM_{2.5}$, including those considered markers of pollution from diesel exhaust (CARB, 2002b). The diesel PM emissions corresponding to the direct diesel ambient population-weighted PM concentration of 1.8 $\mu g/m^3$ is 28,000 tons per year (CARB, 2000b). Based on this information, we estimate that reducing 14 tons per year of diesel PM emissions would result in one fewer premature death.

Although the implementation date for the final diesel PM emission standards in the proposed regulation is 2020, the ARB staff believes that the full benefits of the diesel PM standard requirements will extend to 2037. Comparing the diesel $PM_{2.5}$ emissions before and after full implementation of this regulation, the proposed regulation is expected to reduce emissions, cumulatively, by 10,800 tons by the end of year 2037, and therefore prevent an estimated 770 premature deaths (377-1,158,95% CI) by year 2037. Prior to 2037, cumulatively, it is estimated that 50 premature deaths (25-76, 95% CI) would be avoided by 2010 and 339 (166-511, 95% CI) by 2020. Additional health benefits are expected from the reduction of NOx emissions, which give rise to secondary PM from the conversion of NOx to $PM_{2.5}$ nitrate.

To estimate the cost of control per premature death prevented, we multiply the estimated tons of diesel PM that would result in one fewer premature deaths (14 tons per year) by the average present value of cost-effectiveness ($9.76 per pound diesel PM or $19,500 per ton). The resulting estimated cost of control per premature death prevented is about $275,000 in 2002 dollars. The U.S. EPA has established $6.3 million (in year 2000 dollars) for a 1990 income level as the mean value of avoiding one death (U.S. EPA, 2003a). As real income increases, the value of a life may rise. U.S. EPA further adjusted the $6.3 million value to $8 million (in 2000 dollars) for a 2020 income level. Assuming that real income grew at a constant rate from 1990 and will continue at the same rate to 2037, we adjusted the value of avoiding one death for the income growth. Since the control cost is expressed in 2002 discounted value, accordingly, we discounted values of avoiding a premature death in the future back to the year 2002. In U.S. EPA's guidance of social discounting, it recommends using both three and seven percent discount rates (U.S. EPA, 2000a). Using these rates, and the annual avoided deaths as weights, the weighted average value of reducing a future premature death discounted back to year 2002 is $2.44 million (using 2037 as the end year of analysis) at seven percent discount rate, and $4.78 million at three percent. The cost range per death avoided because of this proposed regulation (i.e., $275,000) is 9 to 17 times lower than the U.S. EPA's benchmark for value of avoided death. Based on this analysis, the proposed rule is a cost-effective mechanism to reduce premature deaths that would otherwise be caused by diesel PM emissions.

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

Secondary PM

Lloyd and Cackette also estimated that $PM_{2.5}$ exposures due to diesel NOx emissions at a level of 0.81 $\mu g/m^3$ resulted in a mean estimate of 895 additional premature deaths per year in California, above those caused by directly emitted diesel PM. The NOx emission levels corresponding to the indirect diesel ambient PM concentration of 0.81 $\mu g/m^3$ is 1,640 tpd (599,000 tpy). Following the same approach as described above, we estimate that reducing 670 tons of NOx emissions would result in one fewer premature death (890 deaths* 670 tons/599,000 tons). Therefore, with the 82,600-ton reduction of NOx that is expected by the end of 2037, an estimated 124 (61-186, 95% CI) deaths would be avoided.

If we multiply 670 tons of NOx emissions by the average present value of cost-effectiveness of $1.30 per pound NOx (or $2,600 per ton), the estimated cost of control per premature death prevented is about $1.74 million. The cost is again lower than the U.S. EPA's present value of an avoided death by 1.4 to 2.7 times.

Reduced Ambient Ozone Levels

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

D. Analysis of Reasonably Foreseeable Environmental Impacts of the Methods of Compliance

The proposed ATCM sets diesel PM emission rates that are based on a fleet-weighted emissions average. The proposed requirements provide the fleet

owner flexibility with choosing options to reduce diesel PM emissions from an individual fleet to meet the required standards. An owner may choose to retrofit existing engines using a number of control technologies. These technologies include diesel oxidation catalysts (DOC), diesel particulate filters (DPF), and alternative diesel fuel. The ARB staff evaluated the potential impacts that these control technologies may have on wastewater treatment and hazardous waste disposal. As described below, options are available to mitigate these potential adverse impacts.

Diesel Oxidation Catalyst (DOC)

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

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

Catalyzed Diesel Particulate Filters

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

However, there are also inorganic solid particles present in diesel exhaust, which are captured by diesel particulate filters. These inorganic materials are metals derived from engine oil, diesel fuel, or engine wear and tear. While the PM filter

is capable of capturing inorganic materials, these materials are not oxidized into a gaseous form and expelled.

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

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

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

ARB staff has consulted with personnel of the DTSC regarding management of the ash from diesel particulate filters. DTSC personnel have advised ARB that it has a list of facilities that accept waste from businesses that qualify as a conditionally exempt small quantity generator. Such a business can dispose of a specific quantify of hazardous waste at certain Household Hazardous Waste events, usually for a small fee. An owner who does not know whether or not he qualifies or who needs specific information regarding the identification and acceptable disposal methods for this waste should contact the California DTSC.[4]

High-pressure water and detergent is sometimes used to remove ash from DPFs. However, this practice would generate wastewater containing metal oxides, possibly being hazardous waste, that could not be discharged to the sanitary sewer or storm drains. Technology exists to reclaim zinc from waste. For example, the Swedish company MEAB has developed processes for extracting zinc and cadmium from various effluents and industrial waste streams (MEAB, 2003). Whether reclamation for reuse will be economically beneficial remains to be seen. Some DPF cleaning techniques can cause ash to be illegally released

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

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 diesel particulate filters.

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

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

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

The health benefits derived from the use of PM filters are immediate and offset the possible adverse effects of increases in NO_2 emissions. For this reason, a cap of 20 percent NO_2 to NOx emission ratio was established for all diesel emission control systems through ARB's Verification Procedure. The proposed ATCM allows only verified PM control technology to be used on portable engines in order to meet the diesel PM emission standards.

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

Alternative Fuels

Alternative fuels and alternative diesel fuels can also be used to reduce diesel PM emissions. Alternative fuels can include natural gas, propane, methanol, or ethanol. Alternative diesel fuels include biodiesel and Fischer-Tropsch fuels. No significant negative environmental impacts have been determined from the use of alternative fuels; however, the use of biodiesel can result in a slight increase in NOx emissions (Hofman/Solseng, 2002).

To ensure there are no adverse impacts from the use of alternative diesel fuels, the proposed ATCM requires any alternative diesel-fuel or fuel additives used in a diesel-fueled portable engine to be verified under the ARB's Verification Procedure, which is discussed in Appendix E. The Verification Procedure permits a control technology to be verified 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 that such use will not cause a significant adverse impact on public health or the environment pursuant to Health and Safety Code section 43830.8 (see Public Resource Code, section 71017).

Potential Impacts from Proposed Incentives

The proposed ATCM provides several incentives to encourage repowering or replacement of higher-emitting engines as part of the fleet reduction approach. The ARB staff evaluated the potential environmental impacts that these incentives may create.

One proposed incentive provides a credit toward satisfying a fleet-weighted standard by allowing, under certain circumstances, alternative-fueled engines to be included in the fleet-weighted diesel PM emissions calculations. Alternative fuels could include methane, butane and gasoline. The ARB staff expects limited use of this credit because these engines, which are mostly spark ignited, are generally more expensive, have a shorter useful life than diesel-fueled (compression ignition) engines, and are more difficult to refuel in field operations.

In the limited cases where alternative-fueled engines are added to the fleet, staff would expect a reduction in diesel PM emissions and would expect minimal change to NOx emissions. The NOx emission standards for large spark ignition engines are comparable to Tier 3 off-road engine standards but are slightly higher than the proposed Tier 4 off-road engine standards.

Another incentive allows credit for applications where grid power is used in lieu of operating a portable diesel-fueled engine. The emission rate for those engines replaced with electrification can be reduced in the fleet-weighted diesel PM emissions calculations based on the amount of hours per year grid power is used as compared to the hours per year the diesel-fueled engine is operated.

Staff does not expect to see wide-use of this credit because electrification is likely to be used in only limited applications such as in dredging activities, ground support activities at airports, and cement and aggregate operations. When electrification is used, it would increase demand on the grid, which in turn would increase emissions from power plants, primarily NOx emissions. However, NOx emissions from power plants are much cleaner than NOx emissions from diesel-fueled engine. Thus, staff would expect a reduction in diesel PM emissions and a slight reduction in NOx emissions when electrification is used to comply with the fleet-weighted diesel PM emissions calculations.

E. Reasonably Foreseeable Mitigation Measures

CEQA requires an agency to identify and adopt feasible mitigation measures that would minimize any significant adverse environmental impacts described in the environmental analysis. The ARB staff has concluded that no significant adverse environmental impacts should occur from adoption of and compliance with the proposed ATCM. Therefore, no mitigation measures would be necessary.

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

Alternatives to the Proposed ATCM are discussed in Chapter V of this Staff Report. The ARB staff has concluded that the proposed ATCM provides the most effective and least burdensome approach to reducing the public's exposure to diesel PM and other air pollutants emitted from diesel-fueled portable engines.

G. Environmental Justice

The ARB is committed to integrating environmental justice in all of its activities. On December 13, 2001, the Board approved "Policies and Actions for Environmental Justice," which formally established a framework for incorporating Environmental Justice into the ARB's programs, consistent with the directive of California state law. Environmental Justice is defined as the fair treatment of people of all races, cultures, and incomes with respect to the development,

adoption, implementation, and enforcement of environmental laws, regulations, and policies. These policies apply to all communities in California, but recognize that environmental justice issues have been raised more in the context of low-income and minority communities.

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

During the ATCM development process, the ARB staff proactively identified and contacted representatives from engine and diesel emission control associations, portable fleet owners and associations, environmental organizations, and other parties interested in portable engines. These individuals participated by providing data, reviewing draft regulations, and attending public forum meetings, in which staff directly addressed their concerns.

The proposed ATCM is consistent with the environmental justice policy to reduce health risks from TACs in all communities, including those with low-income and minority populations, regardless of location. Portable engines are used in urban and rural communities. Because they are used for a number of activities throughout the State, the risk posed by these engines may potentially impact all communities in California. Limiting diesel PM emissions from diesel-fueled portable engines in California will provide air quality benefits to all communities in the State, including low-income and minority communities.

H. Use of CEQA to Further Mitigate Diesel PM Emissions from Portable Diesel-Fueled Engines

Implementation of the proposed ATCM will result in significant reduction of diesel PM throughout the State, and therefore will reduce the public's exposure to diesel PM. Nevertheless, for situations where numerous diesel-fueled portable engines or very large engines are used for a long-term project, additional mitigation should be considered. For example, large construction projects would likely use numerous pieces of portable equipment, such as welders, compressors, and generators on-site for several weeks or months. Although the proposed ATCM will reduce diesel PM for all portable diesel-fueled engines larger than 50 horsepower in California, local air districts can further address the impacts of these large projects through the CEQA (California Environmental Quality Act) process.

CEQA provides a public process where a project's potential environmental impacts are discussed and, as necessary, potential mitigation measures are identified and implemented for the project. A major benefit provided by the CEQA process is that the impacts and the necessary mitigation measures are identified prior to beginning the project. This is where the local air districts can comment on the air-quality impacts of portable diesel-fueled engines and recommend specific mitigation measures.

Although many times the emissions from portable engines comprise a small percentage of the total diesel PM emissions from a construction project, additional mitigation measures for these engines can include: requiring only newer, cleaner diesel engines to be used on the project; expediting the electrical hookup to the grid as soon as practicable to minimize the need for diesel-fueled portable equipment; and requiring the use of alternative-fueled portable engines, such as propane.

Since each large construction project may have its unique circumstances, and the regulatory management of 33,000 engines statewide must necessarily be broad, the CEQA process is appropriate for addressing specific air-quality issues related to large projects that employ numerous and/or large portable diesel-fueled engines.

The ARB staff will continue to work with the local air districts on identifying air-quality impacts of large projects and recommending possible mitigation measures through the CEQA process.

VIII. ECONOMIC IMPACTS OF PROPOSED ATCM

In this chapter ARB staff presents an analysis of the estimated costs and impacts associated with implementation of the proposed ATCM. The expected capital and recurring costs for the potential compliance options are presented, as well as an analysis of the cost effectiveness of the proposed ATCM. The costs and associated impacts are presented for private companies and governmental agencies.

A. Summary of the Economic Impacts

ARB staff estimates the total cost of the proposed ATCM to affected businesses and government agencies to vary between $2 to $34 million per year, averaging $15 million per year. The economic impact is distributed over a 30-year period to 2037.

Overall, most affected businesses will be able to absorb the costs of the proposed regulation with no significant adverse impacts on their profitability. This finding is based upon staff's estimated change in "return on owner's equity" (ROE) analysis. The analysis found that the overall change in ROE ranges from negligible to a decline of about 7 percent. Because the proposed ATCM would not alter significantly the profitability of most businesses, we do not expect a noticeable change in employment, business creation, elimination, or expansion, and business competitiveness in California. We also found no significant adverse economic impacts on local or State agencies.

The overall estimated cost effectiveness of the proposed ATCM, considering only the benefits of reducing diesel PM is between $16/lb and $19/lb. Since the proposed ATCM will also result in reductions of ROG and NOx emissions, ARB staff allocated half of the costs of compliance against these benefits, resulting in cost effectiveness values of between $8/lb and $10/lb for diesel PM and less than $2/lb of ROG and NOx reduced.

The estimated cost of control per premature death prevented by the proposed ATCM is $ 275,000 in 2020 dollars. Using U.S. EPA's established value for avoiding a premature death, $2.44 million (using 2037 as the end year of analysis) at seven-percent discount rate, and $4.78 million at three percent, both values discounted back to year 2002, the cost range per death avoided because of this proposed regulation is 9 to 17 times lower than the U.S. EPA's benchmark for value of avoided death. Based on this analysis, the proposed rule is a cost-effective mechanism to reduce premature deaths that would otherwise be caused by diesel PM emissions.

B. Legal Requirements

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

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

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

Finally, Health and Safety Code section 57005 requires the ARB to perform an economic impact analysis of submitted alternatives to a proposed regulation before adopting any major regulation. A major regulation is defined as a regulation that will have a potential cost to California business enterprises in an amount exceeding $10 million in any single year. Because the estimated cost of the ATCM exceeds $10 million in a single year, the proposed ATCM is a major regulation. Following is a description of the methodology used to estimate costs and ARB staff's analysis of the economic impacts on California businesses and State and local agencies.

C. Methodology for Estimating Costs Associated with Implementation

This section provides the general methodology and assumptions used to estimate the costs associated with the ATCM. In this section, we describe how we estimated the number and types of engines, and the costs of bringing these engines into compliance with the proposed ATCM.

Overview

As discussed in Chapter V, compliance with the proposed ATCM would be phased in over a period beginning 2008-2009 with full compliance by January 1, 2020. However, both the emissions reductions and the costs associated with satisfying the proposed ATCM requirements occur over a longer period of time. The reductions associated with complying with the proposed ATCM begin before 2010 and continue through 2037. These reductions result from the early replacement of the existing portable engine fleet with cleaner engines and the subsequent retrofitting of additional engines. Anticipated costs associated with

the proposed ATCM will begin in 2005, with fees associated with the permitting/registration of engines previously exempted from district permit requirements. The costs associated with the proposed ATCM continue beyond January 1, 2020, when the regulation is fully implemented, and do not end until 2037, when the costs and benefits associated with the proposed ATCM have been fully achieved.

The initial economic impact of the proposed ATCM is associated with the lost economic value from replacing engines prior to the end of their useful life (for compliance with the 2010 and 2013 requirements). Subsequent costs to satisfy the fleet emission goals of 2017 and 2020 are associated with add-on retrofit systems.

A more detailed discussion of the methodology used to determine the economic impact of the proposed ATCM is given below. Table VIII-1 summarizes the major assumptions used in this cost analysis.

Treatment of Costs Associated with Proposed ATCM

The major factors affecting the economic impact of the proposed ATCM are: 1) the number and characteristics (i.e., horsepower rating, emission rate, age of the affected engines) of engines affected; 2) changes in the overall portable diesel-fueled engine population due to implementation of the proposed ATCM; 3) the cost and timing of early replacement of engines before the end of their useful lives; and 4) the cost and timing associated with the addition of diesel PM control technologies.

The number of affected engines is based upon the engine populations used to estimate the emissions for 2000 for large off-road compression-ignition engines. Information for engines registered with ARB's Portable Equipment Registration Program (PERP) was used to characterize the affected engines. Additional details on the affected engines are given in Appendix G.

As discussed previously, the proposed regulation will require the early replacement of existing portable diesel-fueled engines with newer, cleaner engines. The cost attributed to engine replacement or repower would be the economic value to the owner for each year the engine has been prematurely replaced. Information for expected engine life used for the emissions inventory suggests that the useful life of a diesel-fueled portable engine is about 25 years—which is also supported by the age of engines that are registered with the PERP. The lost useful life would be the difference between 25 years and the average age of the affected engines at the time a standard becomes effective that forces the replacement of the engines. The average age of each affected group of engines was based upon the age of engines for similar types of engines registered with the PERP. For example, to comply with the 2010 requirement, the average age of the affected portable engines being replaced will be 20

years—the affected engines will then be replaced about five years before the end of their useful life. Conversely, for the purposes of this analysis, engines that are more than 25 years old have reached the end of their useful life, and no cost was include in the economic impact of the proposed ATCM for the replacement of this group of engines.

To estimate the economic impact caused by early replacement of portable engines, staff estimates the annual value for each year of lost useful life as the cost of the engine annualized over a 25-year period. The cost to replace or repower a portable engine is expected to range between $135-$220/horsepower. In the case of a 100 horsepower engine, the capital cost at the high end of the range would be $22,000 and the annualized cost for a 25-year period would be $1,600. The cost would apply initially in the year the emission standard became effect and for successive years for each year of lost useful life. Since the example engine was replaced to satisfy the proposed 2010 requirement, the economic impact would occur from 2010 through 2014 and the total cost is about $5,000, in 2002 dollars.

As discussed previously, all engines registered with PERP must be certified to off-road engine emission standards by January 1, 2010. Consequently, the costs and benefits for the ATCM do not include replacement requirements for engines registered with the PERP.

The use of verified Level-3 control technologies will provide an option to satisfy the proposed fleet standards that become effective by January 1, 2017. For the purposes of evaluating the economic impact associated with these standards, the cost is based upon retrofitting the engines with diesel PM particulate filters. The cost of a filter is estimated at $40/horsepower and this cost would be annualized over a 10-year period. Based upon current manufacturer's guarantees of 8,000 hours of use for a particulate trap and the average operation of a portable diesel-fueled engine, the particulate trap could have a useful life of up to 16 years. In some cases, an additional particulate trap was included in the cost analysis.

The cost analysis was calculated using 2002 dollars. Where future costs are mentioned, they have been discounted back to 2002 dollars using standard accepted economic procedures. An annual real interest rate of five percent is used. This is consistent with California Department of Finance recommendations for this type of analysis. Additional details on the cost analysis can be found in Appendix G.

D. Potential Compliance Options and Related Capital and Recurring Costs

The compliance costs for the proposed ATCM will vary depending upon the method used to satisfy each proposed fleet emission standard. A brief

Table VIII-1: Cost and Key Assumptions Used in the Cost Analysis

Category	Assumptions
All	▪ An annual 5% real interest rate is basis of all economic impacts, assuming 7% nominal interest rate and 2% inflation rate ▪ Total capital costs for control equipment are amortized over 10 years and useful life control equipment is 15 years ▪ Useful life for an engine is 25 years; cost due to early replacement of engine is based upon: 1) number of years displaced due to early replacement and 2) economic value for each year is based the annual payments for the case where the capital cost of engine is amortized over 25 years ▪ Engines older than 25 years at time of forced replacement is assumed to be at the end of its useful life ▪ Cost of replacing or repowering equipment is $135-220/horsepower ▪ Cost of diesel particulate trap is $40/horsepower; useful life is 16 years
Agriculture	▪ Cost is based upon value lost due to early replacement of engine. ▪ Engine hp is 100 and at time of replacement, five years of useful life left
Government	▪ Engines in this group is evaluated based upon both value lost due to early replacement of engine and the fiscal impact from purchasing equipment ▪ Both information from engines registered with PERP and results of a survey to public agencies were used to characterize the affected engines ▪ Over 60% of equipment would be considered emergency or low-use engines ▪ For the fiscal impact, the annual costs are the sum of the amortized capital cost and the annual maintenance and operation costs. ▪ For engines registered with PERP, the cost for compliance with the 2010 requirement is not included in the economic impact of the proposed ATCM
Private Business	▪ Cost is based upon value lost due to early replacement of engine. ▪ For engines not registered with PERP, assume statistical information from PERP (excluding engines used in dredging, oil well servicing, and rental) is representative (engine size and age of engine). ▪ For engines registered with PERP, the cost for compliance with the 2010 requirement is not included in the economic impact of the proposed ATCM

discussion of the proposed compliance options that may be used to comply with each of the proposed fleet emission standards, the estimated capital and recurring costs, and the assumptions used in the cost analysis follows.

Proposed 2010 Requirement

The proposed ATCM requires all portable diesel-fueled engines to be certified to an off-road engine emission standard by January 1, 2010. Engines that are registered with PERP are already subject to this requirement. The proposed ATCM would require all portable diesel-fueled engines to meet the same requirement.

Staff estimates that about 11,500 engines will be affected by this requirement. By the beginning of 2010, these engines will have operated for an average of 20 years. Staff anticipates most portable engine fleet owners will replace these engines predominately with Tier 3 engines for engines that are less than 750 horsepower and Tier 2 engines for engines that are 750 horsepower and larger.

For engines less than 750 horsepower, Tier 2 engines have been available since 2003. Tier 3 engines—available by 2008 in all size categories less than 750 horsepower—will have the same PM standard as the Tier 2 engines; however, Tier 3 engines are expected to emit about 30 percent less NOx, which is a significant consideration for reducing ozone concentrations.

For the engines that are 750 horsepower and larger, manufacturers are not required to satisfy more stringent PM standards until 2006. Requiring all engines to be certified by 2010 allows this group of engines sufficient time such that all uncertified engines can be replaced with the Tier 2 engine instead of a Tier 1 engine. The Tier 2 engines are 60 percent cleaner than a Tier 1 engine on a PM basis and 35 percent cleaner on a NOx basis.

Proposed 2013 Fleet Standard

The initial fleet standard becomes effective January 1, 2013. While the fleet standard provides flexibility to owners of portable diesel-fueled engines to use a range of options to satisfy the fleet standards, this analysis is based on the use of engine replacements or repowers. The standards are set such that most Tier 1 engines less than 750 horsepower will need to be replaced, which would affect about 6,000 engines. By the beginning of 2013, these engines will have operated 9-17 years, or would have a remaining useful life of 8-16 years.

For engines that are less than 175 horsepower, the Tier 1 engines would be replaced mainly with Tier 3 engines. For engines rated from 175 horsepower to 749 horsepower, staff expects the Tier 1 engines would be replaced with engines certified to the proposed Tier 4 standards. Based upon the U.S. EPA proposal, Tier 4 engines would be available in this classification beginning in 2011.

For engines rated at 750 horsepower or larger, the proposed 2013 fleet standards are not expected to cause most owners to replace or retrofit engines of this size.

Proposed 2017 and 2020 Fleet Standards

The 2017 and 2020 fleet standards represent a significant reduction in emissions from the 2010 fleet standard—a reduction in diesel PM of 50 percent or more. About 30,000 engines will be affected by these standards. This analysis is based on fleet owners relying on retrofits with Level-3 verified technologies to satisfy these standards.

Maintenance

Maintenance costs in the economic impact analysis for the proposed ATCM include the cost associated with maintaining the diesel particulate filters. On average, this cost was estimated to be $300 per engine on an annual basis, based on a qualified mechanic taking 2-3 hours to perform the maintenance. Staff did not take any credit for the assumed decrease in maintenance resulting from the older engines being replaced with new engines.

Recordkeeping and Reporting Requirements

Costs associated with recordkeeping will depend upon the number of engines, if any, in the fleet that are subject to individual recordkeeping requirements. Staff believes that most portable diesel-fueled engines will not be subject to individual recordkeeping requirements. In addition, the recordkeeping and reporting requirements of the proposed ATCM will not begin until January 1, 2010.

For fleets that do not have any engines subject to recordkeeping, the recordkeeping consists of tracking the composition of the fleet and the emission factors associated with the engines in the fleet. Staff estimates that companies and public agencies would use between one to two hours a month to maintain the information for the fleet. For larger fleets, initial development of the system to track the necessary information may take up to 10 hours. Based on these assumptions, the annual cost for recordkeeping would be between $300 to $600 per year with initial set up costing no more than $250.

Recordkeeping will be required for: alternative-fueled engines used to comply with fleet standards, engines affected by electrification if electrification is used to comply with the fleet standards, and engines designated as either emergency application only or low-use. For these engines, the owner/operator will be required to maintain the hours of operation for the engine on an annual basis. For this level of recordkeeping, staff believes one to two hours per year would be adequate to maintain this level of recordkeeping for a small- to moderate-sized

fleet (3 to 15 engines) at a cost of $50 a year. In a few cases, daily recordkeeping may be necessary. Four to twenty hours per year may be expended for each engine to adequately maintain daily records, at a cost of $100 to $500 per year.

Fleet owners/operators will be required to submit a status report to the Executive Officer of the ARB in 2011 and a compliance report for each year a new fleet emission standard becomes effective. The reports will require the submittal of information on the fleet to demonstrate compliance with any applicable emission standard, and requires the Responsible Official to certify that certain requirements are satisfied. Staff estimates that the typical company or agency (with fleets of 15 engines) will expend five hours preparing the reports, and up to 40 hours for larger fleets to prepare the information, resulting in costs of $125 to $1,000.

E. Potential Costs and Impacts to Private Companies

In this section, we estimate the costs and impacts on private companies from complying with the proposed ATCM. The analysis estimates the overall total statewide cost to private businesses, as well as the cost to a typical individual business, a typical small business, and the total costs to different sectors of the industry.

Description of Private Fleets

The ARB staff does not have access to financial records for most of the companies that would be affected by the proposed ATCM. Based upon information for companies registered with PERP, about 70 percent of the affected businesses would be considered small businesses. These small businesses own 10 percent of the engines registered with PERP.

Total Costs

We estimate the statewide total costs to private companies to be approximately $290-$340 million. Annually, the costs are expected to vary from $2 million to $29 million. The total statewide costs to private businesses are a combination of costs due to early replacement of existing engines, the installation of diesel PM reduction technologies, and registration fees for engines previously not required to operate with a permit. The costs of the diesel PM reduction technologies are derived from the combined present value capital, installation costs, equipment lifetime, and maintenance costs.

Costs to a Typical Small Business

Based on information for small businesses registered with PERP, small businesses typically own five or fewer engines, with the average small business

owning three engines. For a fleet of three engines, the total cost associated with complying with the proposed ATCM, including capital and ongoing costs, to a typical small business is estimated to be between $30,000 and $38,000. This cost would be distributed over a 19-year period, from 2010 through 2028. Annual costs would vary between $400 and $5,200 per year, with the average cost of $2,000 per year over this time period. There would be an additional cost for permitting fees of $270 per year, or $4,000 for the period the proposed ATCM is reducing diesel PM emissions, if the engines have not been previously subject to district permit requirements and therefore would need to be registered with PERP. An example of a cost analysis for a typical small business is included in Appendix H.

The cost to a typical small private business is derived from the average size, age, and number of engines owned. This cost can vary significantly depending upon the characteristics of the engines in the fleet. In the case of the example, the fleet consists of a certified 78 hp engine and two uncertified engines rated at 129- and 360-hp. The cost for compliance with the proposed ATCM would be higher if all the engines were newer engines being replaced with a significant portion of their useful life available. Conversely, the cost would be lower if the engines, at the time of replacement, were at the end of their useful life.

Recurring costs include costs associated with recordkeeping, reporting and maintenance. Cost associated with recordkeeping and reporting is dependent upon the type of engines in the fleet. No expenditure will be necessary for recordkeeping until after January 1, 2010. If none of the engines are subject to recordkeeping requirements for individual engines, recordkeeping will only be necessary for preparing submittals of reports to the ARB. Costs would be expected to be less than $100 per year. Similarly, maintenance costs will not be applicable until a control technology is added to the portable engine, sometime after 2010. Costs for maintaining a diesel particulate filter is estimated at $300 per year per filter, or about $900 for the typical small business.

The ARB staff estimates that overall, small businesses will incur a cost of $60-70 million to satisfy the requirements of the proposed ATCM.

Costs to a Typical Business

The total costs to a typical business complying with the proposed ATCM, including capital and ongoing costs, are estimated to be between $226,000 and $238,000. This cost would be distributed over a 28-year period, from 2010 to 2037. Annual costs would vary between $1,500 and $17,000 per year, with the average cost of $8,200 per year over this time period. In addition, typical businesses are already subject to district permitting requirements, and therefore no additional costs for permitting are included. The cost to a typical private business is derived from the average size, age, and number of engines owned. Based on information for businesses registered with PERP, a typical business

owns 15 engines. The cost for complying with the requirements of the proposed ATCM would be for the early replacement of these portable engines as well as the subsequent addition of retrofit technology. As discussed above, this cost can vary significantly depending upon the characteristics of the engines in the fleet.

Recurring costs include costs associated with recordkeeping, reporting and maintenance. Costs associated with recordkeeping and reporting are dependent upon the type of engines in the fleet. No expenditure will be necessary for recordkeeping until after January 1, 2010. If none of the engines are subject to recordkeeping requirements for individual engines, recordkeeping will only be necessary for preparing submittals of reports to the ARB. Costs would be expected to be less than $100 per year. Similarly, maintenance costs will not be applicable until a control technology is added to the portable engine, sometime after 2010. Costs for maintaining a diesel particulate filter is estimated at $300 per year per filter, or about $4,500 for the typical business.

Some companies registered with PERP own as many as 700 engines. However, the majority of these large engine fleets are owned by rental companies. The practice of most rental companies is to replace engines within their fleets over a short time period. Consequently, rental companies are generally expected to comply with the proposed requirements without any significant impact on their normal business practices. Other industry sectors with large fleets are the oil well services industry, large construction firms, and utilities. Most of these companies are registered with PERP and, as discussed above, are required to replace their engines as necessary such that all engines in the fleet are certified to off-road engine emission standards by January 1, 2010. ARB staff expects that most fleets subject to the proposed ATCM will have fewer engines than the typical fleet used to illustrate the impact of the proposed ATCM.

Costs and Impacts to Various Industry Sectors

ARB staff categorized the private businesses impacted by the proposed ATCM into nine categories. The industry categories are largely based upon the industries registered with PERP. These categories are agriculture, marine construction (including dredging), ground support equipment at airports, general industry applications, land-based construction, oil-well services industry, rental industry (including entertainment industry), utilities (including telecommunication), and recycling of wood wastes. The costs by industry are given in Table VIII-2 and the total costs to private businesses are expected to be about $290 to $340 million over the life of the regulation. Nearly 70 percent of the total costs of complying with the proposed ATCM will be in the construction, oil well services, and general-industry categories.

The methodology used to estimate the costs in Table VIII-2 is the same used to estimate the total statewide costs of the proposed ATCM, except that the individual industry sectors are analyzed separately. Once again, the costs

include only those directly caused by the proposed ATCM. Costs associated with complying with requirements of the PERP are not included. Finally, the proposed regulation provides a significant time period for the regulation to be fully implemented. The economic analysis reflects this by evaluating the impact of the proposed ATCM over a 30-year period.

Table VIII-2: Distribution of Total Costs for Private Businesses (Millions of Dollars)

Business Category	Estimated Total Statewide Costs
Agriculture	$21-27
Marine Construction	$5-6
Ground Support Equipment	$4-5
General Industry Applications	$43-51
Construction	$121-142
Oil Well Services Industry	$33-36
Rental	$19-22
Utilities	$14-17
Recycling of Wood Waste	$26-31

Potential Business Impacts

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

This analysis is based on a comparison of the annual return on owner's equity (ROE) for affected businesses before and after the inclusion of the equipment costs, associated recurring costs, and fees. The analysis also uses publicly available information to assess the impacts on competitiveness, jobs, and business expansion, elimination, or creation. The purpose of this analysis is to indicate whether or not the annual costs would have significant adverse impacts on California businesses and individuals.

A wide range of businesses use diesel-fueled portable engines. The types of businesses that may be impacted include agribusiness, electric utilities,

telecommunication, motion picture and television, refiners, landfills, construction, manufacturing, oil-well servicing, military bases, airports, and industrial cleaning. The staff estimates that there are 2,800 businesses operating 33,000 diesel-fueled portable engines. A list of the affected industries is presented in Table VIII-3 along with their Standard Industrial Classification (SIC) Codes.

Table VIII-3: List of Industries with Affected Businesses

SIC Code	Industry
783	Ornamental shrub and tree services
1389	Oil and gas field services
1442	Construction sand and gravel
1542	General contractors—nonresidential buildings, other than industrial
1649	Heavy construction, not elsewhere classified
1795	Wrecking and demolition work
2951	Asphalt paving mixtures and blocks
3531	Construction machinery and equipment
4581	Airports, flying fields, and airport terminal services
4813	Telephone communications, except radiotelephone
4911	Electrical services
4931	Electric & other services combined
7812	Motion picture and video tape production

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

(1) All affected facilities are identified from companies registered with PERP. SIC codes identified by these businesses are listed in Table VIII-3.

(2) A sample of one to three typical businesses was selected from the facility list for each category.

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

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

(5) These adjusted costs are subtracted from net profit data and the results used to calculate the Return on Owners Equity (ROE). The resulting ROE is then compared with the ROE before the subtraction of the adjusted costs to determine the impact on the profitability of the businesses. A reduction of more than 10 percent in profitability is considered to indicate a potential for

significant adverse economic impacts. This threshold is consistent with the thresholds used by the U.S. EPA and others.

Using Dun and Bradstreet financial data from 2000 to 2002, staff calculated the ROEs, before and after the subtraction of the adjusted annual costs, for the selected businesses from each category. These calculations were based on the following assumptions.

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

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

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

California businesses are affected by the annual cost of the proposed ATCM to the extent that the implementation of the proposed ATCM reduces their profitability. Using ROE to measure profitability, we found that the change in ROE for selected businesses from all categories range from negligible to a decline of about 7 percent in 2006. The average decline over all categories is less than 3 percent. This represents a small decline in the average profitability of the affected businesses. Overall, most affected businesses will be able to absorb the costs of the proposed ATCM with no significant impact on their profitability.

Potential Impact on Business Competitiveness

The proposed ATCM may affect the ability of some California businesses to compete with businesses outside the State due to the cost to satisfy the requirements of the proposed ATCM. Only businesses competing against products imported into the State may be affected. Most businesses use portable engines to perform maintenance, provide capability for emergency response, provide power in locations where grid power is not available, or render a service. The affected businesses provide a service as opposed to producing a product. Consequently, staff expects the ATCM to minimally impact the ability of California's businesses to compete with businesses outside the State.

In addition, the proposed ATCM would require businesses outside the State, if the companies wish to operate portable diesel-fueled engines in California, to satisfy the same requirements as California businesses.

Potential Impact on Employment, Business Competitiveness, Elimination or Expansion

The proposed ATCM applies to, and uses technology from, existing businesses, but may create new or expand business. Businesses that manufacture, sell, install, repair, or perform maintenance on diesel particulate emission control systems or diesel-fueled engines may experience an increase in demand for their products or services, resulting in an expansion of those businesses or the creation of new businesses.

ARB staff believes jobs will not be eliminated as a result of the proposed ATCM, but may lead to the augmentation or alteration of job duties, leading to no net result change in the number of jobs. Staff believes additional training may be required for these additional duties. Staff expects jobs will be created to install, repair, or perform maintenance on particulate filters and diesel-fueled engines.

F. Potential Costs to Local and State Agencies

In this section, we estimate the total costs to governmental agencies. The analysis also estimates the total fiscal costs to local and state agencies. Table VIII-4 shows two economic assessments. As discussed above, the most applicable assessment is determining the economic impact due to the early replacement of portable diesel-fueled engines owned by public agencies. Based on this methodology, the ARB staff estimates the total costs to public agencies to be approximately $62 to $79 million. Additionally, staff has also estimated the capital outlay necessary for public agencies to satisfy the requirements of the proposed ATCM. For this analysis, the capital costs were amortized over a 10-year period at a 5 percent real interest rate. Information for the engine populations were based in part on the results of an ARB survey sent to public agencies and on information from PERP. This type of analysis does not consider that public agencies may have budgeted funding to replace engines at the end of their useful life.

Table VIII-4: Summary of Annualized Costs for Pubic Agency Compliance with the Proposed ATCM (Millions of Dollars)

Category	Economic Impact Based on Useful Life Approach	Total Fiscal Impact	Fiscal Impact on an Annual Basis
Federal	$1.0-1.3	$2-2.9	$0.03-0.25
State	$4.4-5.6	$6.9-11.1	$0.1-1.0
City	$30-38	$55-79	$1-10
County	$5.5-7.1	$10-14.2	$0.2-1.7
Other Local	$21-27	$38-55	$0.7-6.5

Local Public Agencies

The majority of local governments use diesel-fueled portable engines in emergency applications, for maintenance, and to operate equipment at landfills. Emergency applications are one of the most common uses of portable engines by local governments. These applications include providing power for public safety purposes or to prevent flooding. Another major area of portable engine use is maintenance activities. Example of some of these activities includes road maintenance or tree trimming. Finally, diesel-fueled engines are often used in specialized equipment at landfills. Staff estimates that there are about 5,900 diesel-fueled portable engines used in these activities at the local level. The cost for complying with the proposed ATCM, based upon the value lost due to early replacement of engines and the addition of retrofit technology, is estimated to be $56 to $72 million. Actual capital outlay will total $102 to $147 million, the majority of which would be spent from 2008 through 2029. Annual outlay of capitol will vary between $2 to $13 million for all affected public agencies. Maintenance and recordkeeping costs can be as much as $1.8 million annually, although these costs will not be realized until after 2010.

Because the initial requirements of the proposed ATCM become effective January 1, 2010, there will be no initial fiscal impact on local agencies. Staff expects most agencies to modify their fleets during FY2008-2009 and FY2009-2010. To meet the 2010 requirement, staff estimates that on average, a fleet operator will need to replace about 50 percent of the fleet's engines. Based on this estimate, compliance cost for the fiscal years leading up to January 1, 2010 will be between $57 million and $93 million, or $7 to $11 million annually. We note that some public agencies have registered equipment with PERP, and therefore are subject to replacing their engines with an engine certified to an off-road engine emission standard by January 1, 2010. These engines are not included in the economic impact analysis of the ATCM.

Additionally, portable engines that are used exclusively in emergency applications or are designated low-use would not be subject to additional requirements (e.g., install retrofit technologies) until January 1, 2020. Staff estimates that about 65 percent of portable diesel-fueled engines used by local public agencies would be able to take advantage of these provisions. Owners that take advantage of these provisions will be required to maintain annual records for each engine designated as emergency or low-use. Cost of this recordkeeping should not exceed $200 a year for most public fleets.

Fiscal Effect on State Government

Several state agencies use portable diesel-fueled engines, including the Department of Transportation, the University of California and State College education systems, and the state prison system. The Department of

Transportation uses a variety of portable equipment to maintain California's highway and bridge system. Other state departments use portable engines for either emergency applications or maintenance purposes. Staff estimates that 650 engines may be impacted at the State government level by this proposed regulation. The cost for complying with the proposed ATCM, based upon the value lost due to early replacement of engines and the addition of retrofit technology is estimated to be $4.4 to $5.6 million. Actual capital outlay will total $7 to $11 million, the majority of which would be spent from 2008 through 2028. Annual outlay of capital will vary between $0.1 to $1 million for all affected state agencies. Maintenance and recordkeeping costs can be as much as $200,000 annually, although these costs will not be realized until after 2010.

Similarly, because the initial requirements of the proposed ATCM become effective January 1, 2010, there will be no initial fiscal impact. To meet the 2010 requirement, staff estimates that on average, a fleet operator will need to replace about 80 percent of the fleet's engines, and that these replacements will occur during FY2008-2009 and FY2009-2010 for most state agencies. Based on this estimate, compliance cost for the above fiscal years leading up to January 1, 2010 will be between $3.7 and 6.0 million, or $0.5 million to $0.7 million annually. We note that some public agencies have registered equipment with the PERP, and therefore are subject to replacing their engines with engines certified to off-road engine emission standards by January 1, 2010. These engines are not included in the economic impact analysis of the ATCM.

Fiscal Impacts on Federal Agencies

Military bases are the major federal users of portable diesel-fueled engines. Similar to other government entities, the military use portable engines for either emergency applications or maintenance purposes. Staff estimates that 150 federally-owned engines may be impacted by this proposed regulation. The cost for complying with the proposed ATCM, based upon the value lost due to early replacement of engines and the addition of retrofit technology, is estimated to be about $1 to $1.3 million. Actual capital outlay will total $2 to $2.9 million, the majority of which would be spent from 2008 through 2028. Annual outlay of capital will vary between $30,000 and $250,000 for all affected federal agencies. Maintenance and recordkeeping costs can be as much as $50,000 annually, although these costs will not be realized until after 2010.

Similarly, because the initial requirements of the proposed ATCM become effective January 1, 2010, there will be no initial fiscal impact. To meet the 2010 requirement, staff estimates that on average, a fleet operator will need to replace about 75 percent of the fleet's engines, and that these replacements will occur during FY2008-2009 and FY2009-2010. Based on this estimate, compliance cost for the fiscal years leading up to January 1, 2010 will be between $1.2 and 2.0 million, or $150,000 to $250,000 annually. We note that some public agencies have registered equipment with PERP, and therefore are subject to

replacing their engines with an engine certified to an off-road engine emission standard by January 1, 2010. These engines are not included in the economic impact analysis of the ATCM.

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

Under this section, the total cost of the proposed ATCM to both private companies and governmental agencies is estimated. The total costs, based upon the value lost due to early replacement of engines, and annualized statewide costs are listed below in Table VIII-5. As discussed previously, the proposed ATCM provides a significant time period for the regulation to be fully implemented. The economic analysis reflects this by evaluating the impact of the proposed ATCM over a 30-year period. As shown in the table, the corresponding annualized costs will be much lower.

Table VIII-5: Summary of Total and Annualized Costs for Compliance with the Proposed ATCM (Millions of Dollars)

Category	Total Costs	Annualized Costs
Private	$290-$340	$2-$29
Federal	$1.0-$1.3	$0.03-$0.25
State	$4.4-$5.6	$0.1-$1.0
City	$30-$38	$1-$10
County	$5.5-$7.1	$0.2-$1.7
Other Local	$21-$27	$0.7-$6.5
Total	$350-$420	$4-$48

H. Cost-Effectiveness

In this section, the cost-effectiveness of the proposed ATCM is estimated. Cost effectiveness is expressed in terms of control costs (dollars) per air emissions reduced (pounds). As described below, for the proposed ATCM, the cost effectiveness is determined by dividing the total discounted capital costs plus the annual operation and maintenance costs by the annual pounds of diesel PM reduced. The discounted capital cost is based upon the value lost due to early replacement of engines plus the cost of retrofitting. As discussed earlier, staff estimates the proposed ATCM would result in a reduction of 11,000 tons of diesel PM emissions over the life of the ATCM. This reduction is based upon the additional reductions the ATCM achieves over the status quo. The status quo situation includes the reductions achieved through the current PERP. In addition, both the reductions and the anticipated costs of the proposed ATCM occur over a time period spanning 2005 to 2037.

The overall cost effectiveness of the proposed ATCM is $16 to $19 per pound diesel PM reduced. This estimate assumes all the costs of compliance are allocated to diesel PM reduction. Because the ATCM will also result in significant reductions in hydrocarbons and oxides of nitrogen emissions due to the early replacement of older engines with cleaner new engines, staff allocated half of the cost of compliance against these benefits, resulting in cost effectiveness values between $8/lb and $10/lb for diesel PM and less than $2/lb for NOx and ROG reduced. Based on this methodology, the proposed ATCM is also a cost-effective NOx measure.

Staff expects the overall cost effectiveness to improve over time, since the economic impact discussed above is based upon the technologies that are currently available today. As discussed previously, the major option available to reduce diesel PM emissions from portable diesel-fueled engines is replacing older diesel-fueled engines with new engines that emit less diesel PM. No control devices have been certified to Level-3 for off-road applications. The proposed ATCM allows a long lead-time for these technologies to be developed. As these technologies become available, staff expects the costs for the technologies to drop. For example, in the preamble for the proposed Tier 4 off-road engine standards, U.S. EPA staff estimated that diesel particulate traps will drop down to a cost of $15 per horsepower when on-road diesel-fueled vehicles are required to be equipped with diesel particulate traps beginning in 2007. In addition, staff expects many diesel-fueled portable engines that are used sparingly will not be replaced. Instead, staff expects occasional users of portable engines to rent the equipment as necessary.

IX. REFERENCES

CARB, 1998. California Air Resources Board. *Report to the Air Resources Board on the Proposed Identification of Diesel Exhaust as a Toxic Air Contaminant; Appendix III, Part A, Exposure Assessment.* Sacramento, California. April 22, 1998.

CARB, 2000a. California Air Resources Board. *Public Meeting to Consider Approval of California's Emissions Inventory for Off-Road Large Compression-Ignited (CI) Engines (≥ 25 HP).* January 2000.

CARB, 2000b. California Air Resources Board. *Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles.* Sacramento, California. October 2000.

CARB, 2001. California Air Resources Board. *Policies and Actions for Environmental Justice.* Sacramento, California. April 2001.

CARB 2002a. California Air Resources Board. *The 2002 California Almanac of Emission and Air Quality.* 2002.

CARB 2002b. California Air Resources Board. *Public Hearing to Consider Amendments to the Ambient Air Quality Standards for Particulate Matter and Sulfates.* May 2002.

CARB, 2003. California Air Resources Board. *Proposed Airborne Toxic Control Measure for Stationary Compression-Ignition Engines*, Appendix G. Sacramento, California. September 2003.

CEC, 2002. California Energy Commission. *Gas-to-Liquid (GTL) Fuel Fact Sheet.* Sacramento, California. June 2002

DaMassa, 2002. DaMassa, John. *Presentation: Air Quality Effects of Trap-Related Emissions (Updated).* California Air Resources Board. February 6, 2002.

Diaz-Sanchez et al, 1996. Diaz-Sanchez, D.; Tsien, A.; Casillas, A.; Dotson, A. R.; Saxon, A. *Enhanced Nasal Cytokine Production in Human Beings after in vivo Challenge with Diesel Exhaust Particles*; J. Allergy Clin. Immunol. 1996.

Diaz-Sanchez et al, 1999. Diaz-Sanchez, D.; Garcia, M.P.; Wang, M.; Jyrala, M.; Saxon, A. *Nasal Challenge with Diesel Exhaust Particles Can Induce Sensitization to a Neoallergen in a Human Mucosa*; J. Allergy Clin. Immunol. 1999. Vol. 104: pgs. 1183-1188.

Hofman/Solseng, 2002. Hofman, V. and Solseng, E. *Biodiesel Fuel Use in an Unmodified Diesel Engine*, American Society of Agricultural Engineers Annual Meeting; September 27-28, 2002.

Kendall, 2002. Kendall, Tom; Johnson Matthey. *Platinum 2002*; http://www.platinum.matthey.com/publications/1051543656.html. May 2002.

Kendall, 2003. Kendall, Tom; Johnson Matthey. *Platinum 2003*; http://www.platinum.matthey.com/publications/1059138410.html. May 2003.

Khair, 1999. Khair, Magdi; McKinnon, Dale L. *Performance Evaluation of Advanced Emission Control Technologies for Diesel Heavy-Duty Engines*, Society of Automotive Engineers. 1999.

Krewski, 2000. Krewski D.; Burnett R.; Goldberg M.; Hoover K.; Stemiatychi J.; Jerrett M.; Abrahamovicz M.; White W. *Reanalysis of the Harvard Six Cities Study and the American Cancer Society Study of Particulate Air Pollution and Mortality*, Health Effects Institute, Cambridge, MA. 2000.

Lloyd and Cackette, 2001. Lloyd, A. C.; Cackette, T.A. *Diesel Engines: Environmental Impact and Control;* J Air Waste Management Association. 2001, 51: 809-847.

MEAB, 2003. Metallextraktion AB (MEAB). *http://www.meab-mx.se/en/index.htm*. August 2003.

OEHHA, 1998. Office of Environmental Health Hazard Assessment. *Proposed Identification of Diesel Exhaust as a Toxic Air Contaminant: Health Risk Assessment for Diesel Exhaust; Appendix III, Part B*. 1998.

Pope, 1995. Pope, C.A.; Thun, M.J.; Namboodiri, M.M.; Dockery, D.W.; Evans, J.S.; Speizer, F.E.; Heath, C.W. *Particulate Air Pollution as a Predictor of Mortality in Prospective Study of U.S. Adults*, Am. J. Respir. Crit. Care Med. 1995.

Takano et al, 1998. Takano, H.; Ichinose, T.; Miyabara, Y.; Shibuya, T.; Lim, H.B.; Yoshikawa, T.; Sagai, M. *Inhalation of Diesel Exhaust Enhances Allergen-related Eosinophil Recruitment and Airway Hyperresponsiveness in Mice*; Toxicol. Appl. Pharmacol. 1998.

U.S. EPA, 1999. United States Environmental Protection Agency. Report to Congress, *The Benefits and Costs of the Clean Air Acts -- 1990 to 2010, Appendix D*. November 1999.

U.S. EPA, 2000a. United States Environmental Protection Agency. *Guidelines for Preparing Economic Analyses*. September 2000.

U.S. EPA, 2000b. United States Environmental Protection Agency, Assessment and Standards Division, Office of Transportation and Air Quality. *Regulatory Impact Analysis: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements.* EPA420-R-00-026. December 2000.

U.S. EPA, 2002a. United States Environmental Protection Agency, Transportation and Air Quality, Transportation and Regional Programs Division. *Clean Alternative Fuels: Fischer-Tropsch.* EPA420-F-00-036. March 2002.

U.S. EPA, 2002b. United States Environmental Protection Agency, Air and Radiation. *A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions Draft Technical Report.* EPA420-P-02-001. October 2002.

U.S. EPA, 2002c. United States Environmental Protection Agency, Air and Radiation. *Impacts of Lubrizol's PuriNOx Water/Diesel Emulsion on Exhaust Emissions From Heavy-Duty Engines Draft Technical Report.* EPA420-P-02-007. December 2002.

U.S. EPA, 2003a. United States Environmental Protection Agency, Assessment and Standards Division, Office of Transportation and Air Quality. *Draft Regulatory Impact Analysis: Control of Emissions of Air Pollution from Nonroad Diesel Engines and Fuel.* EPA420-R-03-008. April 2003.

U.S. EPA, 2003b. United States Environmental Protection Agency. *Federal Register: 40 CFR Parts 69, 80, 89, et al., Control of Emissions of Air Pollution from Nonroad Diesel Engines and Fuel; Proposed Rule*, Vol. 68, No. 100; pp. 28327-28603. May 23, 2003.

Appendix A

Proposed Regulation Order

Airborne Toxic Control Measure for Diesel Particulate Matter from Portable Engines Greater than 50 Horsepower

PROPOSED REGULATION ORDER

AIRBORNE TOXIC CONTROL MEASURE FOR DIESEL PARTICULATE MATTER FROM PORTABLE ENGINES GREATER THAN 50 HORSEPOWER

Adopt new Sections 93116, 93116.1, 93116.2, 93116.3, 93116.4, and 93116.5, Title 17, California Code of Regulations, to read as follows:

Airborne Toxic Control Measure For Diesel Particulate Matter From Portable Engines Greater Than 50 Horsepower

93116 PURPOSE

The purpose of this airborne toxic control measure (ATCM) is to reduce diesel particulate matter (PM) emissions from portable diesel-fueled engines having a rated brake horsepower greater than 50 (> 50 bhp).

Authority cited: Sections 39600, 39601, 39650, 39658, 39659, 39666, 41752, 43013 and 43018 Health and Safety Code. Reference: Sections 39650, 39666, 41752 Health and Safety Code.

93116.1 APPLICABILITY

(1) Except as provided below, all portable engines having a maximum rated capacity greater than 50 bhp and fueled with diesel are subject to this regulation.

(2) The following portable engines are not subject to this regulation:

(A) Any engine used to propel mobile equipment or a motor vehicle of any kind;

(B) Any portable engine using an alternative fuel;

(C) Dual-fuel diesel pilot engines that use an alternative fuel or an alternative diesel fuel;

(D) Tactical support equipment;

(E) Portable engines operated on either San Clemente or San Nicolas Island; and

(F) Ground support equipment at airports that satisfies the following requirements:

(1) the equipment is subject to an enforceable Memorandum of Understanding (MOU) with the local air district or Air Resources Board that regulates diesel PM emissions; and

(2) the Responsible Official has demonstrated to the satisfaction of the Executive Officer that the diesel PM reductions achieved by satisfying the requirements of the MOU is equivalent to the reductions achieved by satisfying 2020 fleet emission standards, section 93116.3(3)(A).

Authority cited: Sections 39600, 39601, 39650, 39658, 39659, 39666, 41752, 43013 and 43018 Health and Safety Code. Reference: Sections 39650, 39666, 41752 Health and Safety Code.

93116.2 DEFINITIONS

(1) **Air Pollution Control Officer or APCO** means the air pollution control officer of a district, or his/her delegate.

(2) **Alternative fuel** means gasoline, natural gas, propane, ethanol, or methanol.

(3) **Alternative Diesel Fuel** means any fuel used in a compression ignition (CI) engine that is not a reformulated CARB diesel fuel as defined in Title 13 CCR Sections 2281, 2282, and 2284 or an alternative fuel, and does not require engine or fuel system modifications for the engine to operate, although minor modifications (e.g., recalibration of the engine fuel control) may enhance performance. An emission control strategy using a fuel additive will be treated as an alternative diesel fuel based strategy unless:

(A) the additive is supplied to the engine fuel by an on-board dosing mechanism, or

(B) the additive is directly mixed into the base fuel inside the fuel tank of the engine, or

(C) the additive and base fuel are not mixed until engine fueling commences, and no more additive plus base fuel combination is mixed than required for a single fueling of a single engine.

(4) **CARB Diesel Fuel** means any diesel fuel that meets the specifications defined in *Title 13 CCR sections 2281, 2282, and 2284.*

(5) **Certified Nonroad Engine** refers to engines meeting an applicable nonroad engine emission standard as set forth in Title 13 of the California Code of Regulations or CFR 40 Part 89.

(6) **Diesel Particulate Matter (PM)** means the particles found in the exhaust of diesel-fueled CI engines which may agglomerate and adsorb other species to form structures of complex physical and chemical properties.

(7) **District** means a District as defined in Health and Safety Code section 39025.

(8) **Dual-fuel Diesel Pilot Engine** means a dual-fueled engine that uses diesel fuel as a pilot ignition source at an annual average ratio of less than 5 parts diesel fuel to 100 parts total fuel on an energy equivalent basis.

(9) **Emergency** refers to the use of a portable engine after the failure or loss of all or part of normal electrical power, normal natural gas supply, or mechanical work during any of the following events:

(A) the pumping of water or sewage to prevent or mitigate a flood or sewage overflow; or

(B) the pumping of water for fire suppression or protection.

where the failure of loss of electrical power or mechanical use is demonstrated to the satisfaction of the Executive Officer or the APCO, as appropriate, was beyond the reasonable control of the owner or operator of the portable engine.

(10) **Engine** means any piston driven internal combustion engine.

(11) **Executive Officer** means the Executive Officer of the California Air Resources Board or his / her designee.

(12) **Fleet** refers to a portable engine or group of portable engines that are owned and managed by an individual operational entity, such as a business, business unit within a corporation, or individual city or state department under the control of a Responsible Official. Engines that are owned by different business entities that are under the common control of only one Responsible Official shall be treated as a single fleet.

(13) **Fuel Additive** means any substance designed to be added to fuel or fuel systems or other engine-related systems such that it is present in-cylinder during combustion and has any of the following effects: decreased emissions, improved fuel economy, increased performance of the entire

vehicle or one of its component parts, or any combination thereof; or assists diesel emission control strategies in decreasing emissions, or improving fuel economy or increasing performance of a vehicle or component part, or any combination thereof. Fuel additives used in conjunction with diesel fuel may be treated as an alternative diesel fuel.

(14) In-Use Engine refers to portable diesel-fueled engines operating under valid permits or registrations as of December 31, 2005.

(15) Level-3 Verified Technology means a technology that has satisfied the requirements of the "Verification Procedure for In-Use Strategies to Control Emissions from Diesel Engines" in Title 13, California Code of Regulations, commencing with section 2700 and has demonstrated an reduction in diesel particulate matter of 85% or greater.

(16) Location means any single site at a building, structure, facility, or installation.

(17) Low-use Engines refers to portable diesel-fueled engines that operate 80 hours or less in a calendar year.

(18) Maximum Rated Horsepower (brake horsepower (bhp)) is the maximum brake horsepower rating specified by the portable engine manufacturer for continuous duty and listed on the nameplate of the portable engine.

(19) Nonroad Engine means:

(A) Except as discussed in paragraph (B) of this definition, a nonroad engine is any engine:

(1) in or on a piece of equipment that is self-propelled or serves a dual purpose by both propelling itself and performing another function (such as garden tractors, off-highway mobile cranes and bulldozers); or

(2) in or on a piece of equipment that is intended to be propelled while performing its function (such as lawnmowers and string trimmers); or

(3) that, by itself or in or on a piece of equipment, is portable or transportable, meaning designed to be and capable of being carried or moved from one location to another. Indicia of transportability include, but are not limited to, wheels, skids, carrying handles, dolly, trailer, or platform.

(B) An engine is not a nonroad engine if:

(1) the engine is used to propel a motor vehicle or a vehicle used solely for competition, or is subject to standards promulgated under section 202 of the federal Clean Air Act; or

(2) the engine is regulated by a federal New Source Performance Standard promulgated under section 111 of the federal Clean Air Act; or

(3) the engine otherwise included in paragraph (A)(3) of this definition remains or will remain at a location for more than 12 consecutive months or a shorter period of time for an engine located at a seasonal source. Any engine(s) that replace(s) an engine at a location and that is intended to perform the same or similar function as the engine replaced will be included in calculating the consecutive time period. An engine located at a seasonal source is an engine that remains at a seasonal source during the full annual operating period of the seasonal source. A seasonal source is a stationary source that remains in a single location on a permanent basis (at least two years) and that operates at that single location approximately three (or more) months each year.

(20) Off-Road Engine means the same as nonroad engine.

(21) Outer Continental Shelf (OCS) shall have the meaning provided by section 2 of the Outer Continental Shelf Lands Act (43 U.S.C. Section 1331 et seq.).

(22) Permit refers to a certificate issued by the Air Pollution Control Officer acknowledging expected compliance with the applicable requirements of the districts rules and regulations.

(23) Portable means designed and capable of being carried or moved from one location to another. Indicia of portability include, but are not limited to, wheels, skids, carrying handles, dolly, trailer, or platform. For the purposes of this regulation, dredge engines on a boat or barge are considered portable. The engine is not portable if:

(A) the engine or its replacement is attached to a foundation, or if not so attached, will reside at the same location for more than 12 consecutive months. Any engine such as back-up or stand-by engines, that replace engine(s) at a location, and is intended to perform the same or similar function as the engine(s) being replaced, will be included in calculating the consecutive time period. In that

case, the cumulative time of all engine(s) or, including the time between the removal of the original engine(s) and installation of the replacement engine(s), will be counted toward the consecutive time period; or

(B) the engine remains or will reside at a location for less than 12 consecutive months if the engine is located at a seasonal source and operates during the full annual operating period of the seasonal source, where a seasonal source is a stationary source that remains in a single location on a permanent basis (at least two years) and that operates at that single location at least three months each year; or

(C) the engine is moved from one location to another in an attempt to circumvent the portable residence time requirements.

[Note: The period during which the engine is maintained at a storage facility shall be excluded from the residency time determination.]

(24) **Project** means the use of one or more registered or permitted portable engines or equipment units operated at one location under the same or common ownership or control to perform a single activity.

(25) **Registration** refers to either:

(A) a certificate issued by the Executive Officer acknowledging expected compliance with the applicable requirements of the Statewide Portable Equipment Registration Program; or

(B) a certificate issued by the Air Pollution Control Officer acknowledging expected compliance with the applicable requirements of the district's Portable Equipment Registration Program.

(26) **Responsible Official** refers to an individual employed by the company or public agency with the authority to certify that the portable engines under his/her jurisdiction complies with applicable requirements of this regulation. A company or public agency may have more than one Responsible Official. A contracted designee cannot certify compliance in lieu of the Responsible Official.

(27) **School** means any public or private school used for purposes of the education of more than 12 children in kindergarten or any grade 1 to 12, inclusive, but does not include any private school in which education is primarily conducted in private homes. The term includes any building or structure, playground, athletic field, or other area of school property. The term excludes unimproved school property.

(28) **Selective Catalytic Reduction (SCR) System** refers to an air pollution control system that utilizes a proprietary base metal catalyst designed to reduce emissions of oxides of nitrogen (NOx).

(29) **Stationary Source** means any building, structure, facility or installation that emits any affected pollutant directly or as a fugitive emission. Building, structure, facility, or installation includes all pollutant emitting activities which:

(A) are under the same ownership or operation, or which are owned or operated by entities which are under common control; and

(B) belong to the same industrial grouping either by virtue of falling within the same two-digit standard industrial classification code or by virtue of being part of a common industrial process, manufacturing process, or connected process involving a common raw material; and

(C) are located on one or more contiguous or adjacent properties.

[Note: For the purposes of this regulation a stationary source and nonroad engine are mutually exclusive.]

(30) **Storage** means a warehouse, enclosed yard, or other area established for the primary purpose of maintaining portable engines when not in operation.

(31) **Tactical Support Equipment (TSE)** means equipment using a portable engine, including turbines, that meets military specifications, owned by the U.S. Department of Defense and/or the U.S. military services or its allies, and used in combat, combat support, combat service support, tactical or relief operations, or training for such operations. Examples include, but are not limited to, engines associated with portable generators, aircraft start carts, heaters and lighting carts.

(32) **Tier 4 Emission Standards** refers to the final emission standards adopted by the U.S. EPA and CARB for newly manufactured nonroad engines designed to achieve the lowest diesel PM emissions.

(33) **Transportable** means the same as portable.

(34) **Verified Emission Control Strategy** refers to a diesel emission control strategy or system that has received approval from the Executive Officer according to the "Verification Procedure for In-Use Strategies to Control Emissions from Diesel Engines" in Title 13, California Code of Regulations, commencing with section 2700, and incorporated by reference.

(35) U.S. EPA refers to the United States Environmental Protection Agency.

Authority cited: Sections 39600, 39601, 39650, 39658, 39659, 39666, 41752, 43013 and 43018 Health and Safety Code. Reference: Sections 39650, 39666, 41752 Health and Safety Code.

93116.3 REQUIREMENTS

(1) Diesel-fueled portable engines shall use one of the following fuels:

(A) CARB diesel fuel; or

(B) alternative diesel fuel that has been verified through the Verification Procedure for In-Use Strategies to Control Emissions from Diesel Engines; or

(C) CARB diesel fuel utilizing fuel additives that have been verified through the Verification Procedure for In-Use Strategies to Control Emissions from Diesel Engines.

[Note that credit for diesel PM reductions for CARB diesel fuel blends that use biodiesel, Fischer Tropsch fuels, or emulsions of water in diesel fuel is available only for fuel blends that have satisfied the requirements of the Verification Procedure for In-Use Strategies to Control Emissions from Diesel Engines. The credit granted is based upon the verified level approved by the Executive Officer within the Executive Order for the fuel blend.]

(2) Diesel PM Standards

(A) Requirements for in-use engines

(1) Starting January 1, 2010, all portable diesel-fueled engines shall be certified to meet a federal or California standard for newly manufactured nonroad engines pursuant to 40 CFR Part 89 or Title 13 of the California Code of Regulations (that is, certified to Tier 1, 2 or 3 nonroad engine standards).

(2) In lieu of complying with the 2010 requirement, owners of engines used exclusively in emergency applications or engines that qualify as a low-use engines may commit to replacing these engines with Tier 4 engines, subject to the requirements in section 93116.3(2)(D) below.

(3) Starting January 1, 2013 all portable diesel-fueled engines are subject to section 93116.3(3).

(B) Portable diesel-fueled engines that have not been permitted or registered prior to January 1, 2006, are subject to the following requirements:

(1) the portable engine shall meet the most stringent federal or California emission standard for nonroad engines pursuant to 40 CFR Part 89 or Title 13 of the California Code of Regulations (that is, certified to Tier 3 nonroad engine standards or Tier 4 nonroad engine standards, once these engines are available); and

(2) a diesel-fueled portable engine used exclusively for emergency applications or low-use engine designation is subject to the requirements of section 93116.3(2)(C); and

(3) for new applications to permit or register engines after January 1, 2013, the portable engine is subject to section 93116.3(3).

(C) Except as provided in section 93116.3(2)(D), portable diesel-fueled engines used exclusively in emergency applications or qualifying as low-use engines shall satisfy one of the following requirements by January 1, 2020:

(1) the engine is certified to Tier 4 emission standards for newly manufactured nonroad engines; or

(2) the engine is equipped with a properly functioning level-3 verified technology ; or

(3) the engine is equipped with a combination of emission control systems or devices that have been verified together to achieve at least 85% reduction in diesel PM emissions.

(D) Owners that commit to replacing in-use engines with engines certified to the Tier 4 nonroad engine standards in lieu of satisfying the 2010 requirement shall:

(1) submit written notification identifying the specific engines to be replaced with engines certified to the Tier 4 emission standards; and

(2) for each class and category of nonroad engine, replace each engine so identified within two years of the first engine being offered for sale that satisfies the Tier 4 emission standards.

(3) Fleet Requirements

(A) Each fleet is subject to and shall comply with the following weighted PM emission fleet averages expressed as grams per brake horsepower-hour (g/bhp-hr) by the listed compliance dates:

Fleet Standard Compliance Date	Engines <175 hp (g/bhp-hr)	Engines ≥175 to 749 hp (g/bhp-hr)	Engines ≥750 hp (g/bhp-hr)
1/1/13	0.3	0.15	0.25
1/1/17	0.18	0.08	0.08
1/1/20	0.04	0.02	0.02

(B) For the purposes of this regulation, the portable diesel-fueled engines affected by the fleet provisions of this regulation include all portable diesel-fueled engines operated in California, including portable engines registered with the Statewide Portable Equipment Registration Program or permitted or registered with local districts. The California fleet will be further divided into engines rated at less than 175 horsepower, engines rated at 175 horsepower up to 749 horsepower, and engines that are 750 horsepower and larger. Each portion of the fleet would be subject to the above fleet emission standards.

(C) The following portable diesel-fueled engines shall be excluded from a fleet:

(1) Portable diesel-fueled engines operated exclusively outside of California or operated only within the OCS.

(2) Portable diesel-fueled engines used exclusively in emergency applications.

(3) Portable diesel-fueled engines that qualify as a low-use engines.

(D) Portable diesel-fueled engines that qualify as a low-use engine and subsequently exceed the allowed hours of operation in a calendar year or engines that are identified to be used exclusively in emergency applications, but subsequently are used in non-

emergency applications become immediately subject to the requirements of section 93116.3(3).

(E) Portable alternative fueled engines may be included in a fleet if the engine satisfies the requirements in section 93116.3(4)(B)(2).

(F) Diesel-fueled portable engines equipped with SCR systems.

(1) The diesel PM fleet emission standards in section 93116.3(3)(A) do not apply to:

(a) portable diesel-fueled engines equipped with properly operating SCR systems as of January 1, 2004; and

(b) with the approval of the Executive Officer, portable diesel-fueled engines equipped with properly operating SCR systems after January 1, 2004.

(2) At the request of the Responsible Official, portable diesel-fueled engine(s) equipped with a SCR system(s) may be included in the company's fleet for the purpose of complying with an applicable fleet emission standard. Once the engine(s) are included in a company's fleet, the company's compliance with applicable fleet emission standards shall always include these diesel-fueled portable engine(s) equipped with SCR system(s).

(3) For all diesel-fueled portable engines equipped with SCR systems, the following information shall be submitted to the Executive Officer to demonstrate that the SCR system is operating properly:

(a) tests results for NOx, PM, and ammonia slip

(1) the measurements shall be conducted with ARB or district approved test methods; and

(2) diesel PM shall be measured with ARB test method 5 or equivalent district approved test method. For the purposes of this requirement, only the probe catch and filter catch ("front half") is used to determine the emission rate, g/bhp-hr, and shall not include PM captured in the impinger catch or solvent extract; and

(3) the duration of the emission test shall be sufficient to document the typical operation of the engine(s); and

(4) testing shall be performed at the frequency required by the permit or registration. In no event shall the time between emission tests exceed three years.

(G) Beginning on January 1, 2013, the weighted average PM emission rate for the fleet cannot exceed the fleet standard that is in effect. Changes in the fleet, including engine additions and deletions, shall not result in noncompliance with this standard.

(4) Fleet Average Calculations

(A) General Provisions

(1) The average PM emission factor for the fleet is determined by the following formula:

$$\frac{\sum \text{Summation for each engine in the fleet (bhp x emission factor)}}{\sum \text{Summation for each engine in the fleet (bhp)}}$$

where:

bhp = horsepower at maximum rated capacity.

emission factor = diesel PM emission rate, as determined below:

(2) The following diesel PM emission rates shall be used with the above formula to determine the weighted average fleet emission rate:

(a) for diesel-fueled portable engines certified to a nonroad engine standard, the results of emission measurements submitted to either the U.S. EPA or CARB for the purposes of satisfying the appropriate emission standard; or

(b) results from emission measurements from a verification approved by the Executive Officer for an emission control system or strategy may be used in conjunction with engine emission information; or

(c) for diesel-fueled portable engine(s) equipped with SCR system(s), results from valid emission tests.

(B) The following incentives may be used to revise the fleet average, as outlined below:

(1) Where equipment uses grid power for more than 200 hours in lieu of operating a diesel engine for a given project, the time period grid power is used may be used to reduce each affected engine's emission factor. The emission factor for each affected engine will be reduced proportionally by the percentage of time the equipment uses grid power. To receive credit for grid power in the fleet calculation, the recordkeeping and reporting requirements in Section 93116.4(3)(C) shall be satisfied.

(2) Alternative fueled portable engines operating 100 or more hours may be included toward determining compliance with the applicable fleet emission standards. An diesel PM emission rate of zero shall be used in the fleet calculations for these engines.

(3) Tier 4 engines added to a fleet prior to January 1st, 2015 may be counted twice in the company's fleet average determination toward compliance with the 2013 and 2017 fleet emission standards.

Authority cited: Sections 39600, 39601, 39650, 39658, 39659, 39666, 41752, 43013 and 43018 Health and Safety Code. Reference: Sections 39650, 39666, 41752 Health and Safety Code.

93116.4 FLEET RECORDKEEPING AND REPORTING REQUIREMENTS

(1) The owner or operator of a fleet is not subject to the requirements of this section if <u>all</u> portable diesel-fueled engines in the fleet satisfy any one of the following requirements:

(A) the engine is certified to Tier 4 emission standards for newly manufactured nonroad engines; or

(B) the engine is equipped with a properly functioning level-3 verified emission control system; or

(C) the engine is equipped with a combination of emission control systems or devices that have been verified together to achieve at least 85% reduction in diesel PM emissions.

(2) Diesel-fueled portable engine(s) equipped with properly operating SCR system(s) shall be excluded from the requirements of 93116.4(1), if the engine(s) is not subject to section 93116.3(3)(A).

(3) Effective January 1, 2012, the Responsible Official of a fleet shall:

(A) Keep and maintain records for:

(1) alternative-fueled portable engines used as part of a company's fleet average;

(2) engines affected by the use of electrification;

(3) low-use engines; and

(4) engines used exclusively in emergency applications.

(B) the Responsible Official, for all engines subject to section 93116.4(3)(A), shall:

(1) Install or caused to be installed and properly maintain on each portable engine subject to recordkeeping a non-resettable hour-meter; and

(2) Maintain on a calendar year basis a record of the total hours of operation for each portable engine. If the portable engine is used out-of-state, then the records may account for operation within California only, excluding operation within the OCS; and

(3) Maintain all required records at a central place of business for five years. The records shall clearly identify each engine subject to the recordkeeping requirement as well as the annual hours of operation. These records are to be made available, upon request for inspection, to local air pollution control district or CARB personnel. The requested records shall be provided to the appropriate personnel within three business days of the request.

(C) The Responsible Official of a fleet electing to use electrification in determining the fleet average shall:

(1) notify the Executive Officer identifying the dates, location, duration of the project, and a description of the project that will rely on electrification instead of using diesel engines. The notification shall be provided prior to the start of the project; and

(2) identify each affected engine, including: make, model, serial number, year of manufacture for each engine, emission factor (g/bhp-hr) and district permit or State registration number; and

(3) shall clearly identify the electrification activity, including indicating the amount of electricity used and the time period for the project; and

(4) shall retain copies of contracts or other documentation, with the project proponent and/or applicable utility, supporting the use of grid power.

(D) Test results for SCR compliance shall be maintained at a central place of business for five years. At the request of ARB or district personnel, the Responsible Official shall have 3 business days to provide a copy of the most recent test results.

(4) The Responsible Official of the fleet shall provide the following reports as identified below to the Executive Officer:

(A) A status report, due to the Executive Officer by March 1, 2011, that includes the following items:

(1) the fleet's weighted average PM emission rate for the 2010 calendar year, including a summary for each engine that is part of the fleet and each engine's emission rate (g/bhp-hr); and

(2) inventory of portable engines in the fleet identifying whether the engine is state-registered or permitted with the district. Alternative-fueled engines should be identified by fuel type. The inventory shall identify the make, model, serial number, year of manufacture, and primary fuel type for each engine, emission factor (g/bhp-hr), and district permit or State registration number for each engine to be used in the fleet average determination; and

(3) identify, if applicable, each engine that the owner commits to replacing with a Tier 4 engine, including: make, model, serial number, year of manufacture for each engine, and district permit or State registration number; and

(4) listing of engines, if applicable, used exclusively in emergency applications. The listing shall identify each engine claiming use only in emergency applications, including: make, model, serial number, year of manufacture for each engine, emission factor (g/bhp-hr), and district permit or State registration number; and

(5) listing of engines, if applicable, satisfying the low use engine requirements. The listing shall identify each engine, including: make, model, serial number, year of manufacture for each engine, emission factor (g/bhp-hr), and district permit or State registration number; and

(6) for engine(s) equipped with SCR(s), documentation demonstrating that the SCR system is operating properly.

(B) A statement of compliance signed by the Responsible Official that the fleet standards are being achieved and a summary that identifies each portable engine in the fleet and the associated emission rate (g/bhp-hr). Engines included in the fleet are those that are part of the fleet at the time the fleet standard became effective. The engine identification shall include, at a minimum, the make, model, serial number, and year of manufacture for each engine. Alternative-fueled engines should be identified by fuel type. The statements of compliance are due to the Executive Officer by the following dates:

(1) March 1, 2013 for the fleet standards that become effective January 1, 2013; and

(2) March 1, 2017 for the fleet standards that become effective January 1, 2017; and

(3) March 1, 2020 for the fleet standards that become effective January 1, 2020.

(C) The Responsible Official shall identify to the Executive Officer, as part of each compliance report, the specific engines, if any, used exclusively in emergency applications and the specific engines, if any, claimed to be low use engines. The list shall include for each engine: the make, model, serial number, year of manufacture for each engine, emission factor (g/bhp-hr), and district permit or State registration number.

(D) The Responsible Official shall identify to the Executive Officer, as part of each compliance report, the specific engines, if any, excluded from the fleet because the engine operated exclusively outside of California or operated only within the OCS. The list shall include for each engine: the make, model, serial number, year of manufacture, and, district permit or State registration number for each engine.

(E) If compliance with the fleet average includes the use of electrification, then the Responsible Official shall provide documentation supporting the credit claimed for electrification.

(F) As part of each compliance report, the Responsible Official shall, if applicable, certify the following:

(1) All alternative fueled engines included in the fleet average operated at least 100 hours during the previous 12 months prior to the fleet emission standard becoming effective.

(2) For all engines using the emergency designation, the engines were used only for emergency applications.

(3) For all engines using the low-use designation, the engines operated no more than 80 hours for the reporting period.

(4) For all engines equipped with SCR, the engine complies with applicable district or Statewide Portable Equipment Registration Program requirements.

(G) After March 1, 2013, the APCO or the Executive Officer can require the submittal of information demonstrating compliance with the applicable fleet standard. Upon receiving the request, the Responsible Official shall provide the requested information within 30 days.

Authority cited: Sections 39600, 39601, 39650, 39658, 39659, 39666, 41752, 43013 and 43018 Health and Safety Code. Reference: Sections 39650, 39666, 41752 Health and Safety Code.

93116.5 ENFORCEMENT OF FLEET REQUIREMENTS

(1) Both the Executive Officer and the APCO have the authority to review or seek enforcement action for violation of the fleet emission standard.

(2) The ARB will make available to the districts the information the Responsible Official has provided to ARB to demonstrate compliance with the fleet standard.

Authority cited: Sections 39600, 39601, 39650, 39658, 39659, 39666, 41752, 43013 and 43018 Health and Safety Code. Reference: Sections 39650, 39666, 41752 Health and Safety Code.

Appendix B

Public Agency Survey

Public Agency Survey

Background

In an effort to better assess the use of portable diesel-fueled engines by local public agencies, ARB surveyed public agencies, requesting information on the use of the engines, characteristics of the engines (make and model, year of manufacture, and manufacturers rated horsepower), and annual hours of operation. The public agencies surveyed included city and county public works departments, city and county water suppliers, publicly owned treatment facilities, public landfills, universities and colleges, prisons, and other miscellaneous state and local agencies. The ARB staff mailed out over 1,000 surveys in the spring of 2002, and about 15 percent of the public agencies responded. A copy of the survey is attached to this Appendix.

Additional information on portable engines used by public agencies is available from engines registered by public agencies and from a separate survey administered by a consultant under contract with the ARB's Mobile Source Control Division. Information for these engines is included, as appropriate, as part of the survey results discussed below.

Overall, information for about 1,500 portable diesel-fueled engines operated by public agencies was gathered, representing an estimated 25 percent of the total engines used by public agencies.

Survey Results

The following summarizes the results of the survey:

- Portable engines used by public agencies are typically less than 150 horsepower—very few engines are larger than 500 horsepower;
- Most common applications are compressors, generators, water pumps, and wood chippers—representing 75 percent of the applications;
- Most of the pumps and generators, about 70 percent, are operated less than 50 hours per year and about half of the compressors are operated less than 50 hours per year. Overall, about 65 percent of the engines operated by public agencies operate less than 50 hours per year; and
- About 50 percent of the portable diesel-fueled engines used by cities and county public agencies are certified engines, and 25 percent of the portable diesel-fueled engines used by State and federal public agencies are certified engines.

Winston H. Hickox
Agency Secretary

Air Resources Board

Alan C. Lloyd, Ph.D.
Chairman
1001 I Street • P.O. Box 2815 • Sacramento, California 95812 • www.arb.ca.gov

Gray Davis
Governor

March 27, 2002

Dear Sir or Madam:

The California Air Resources Board (ARB) is in the process of developing regulatory measures to reduce particulate matter emissions from diesel-fueled engines, in this case, portable engines. To support this effort, ARB staff is gathering information on the type and operation characteristics of portable diesel-fueled engines owned and operated by state/local governments or municipalities. Staff is also identifying candidate equipment for emissions testing purposes. The test results will be used to help evaluate the feasibility of emission controls for portable diesel-fueled engines.

Portable diesel-fueled engines are engines that perform work but do not remain in one location for more than 12 months. For example, portable diesel-fueled engines include portable electrical generators, pumps and compressors. Portable engines do not include engines that provide power to propel the equipment or vehicles from location to location.

If your agency owns or operates portable equipment powered by diesel-fired engines, we are requesting that you provide some basic information on the equipment, type of engine, and operation frequency.

We would appreciate you taking time to complete the survey on the backside of this letter. When completed, tri-fold and staple the letter, so that the ARB address shows up on the outside. Please return the completed survey by May 1, 2002.

If you have any questions, please contact Mr. Glen Villa of my staff at (916) 322-6456 or by e-mail at gvilla@arb.ca.gov. Thank you for your cooperation.

Sincerely,

Michael Tollstrup, Chief
Project Assessment Branch
Stationary Source Division

----------Fold Here----------

Place
Stamp
Here

California Air Resources Board
Stationary Source Division
Attn: Glen Villa
P.O. Box 2815
Sacramento, CA 95812

Survey of Portable Diesel-Fueled Engines Owned by State / Local Governments or Municipalities

1. List the application(s) of portable diesel-fueled engines at your facility. Application-Use of engine. I.e. pump, compressor, generator. Model Year (MY)-date of manufacture. Horsepower (HP)-manufacturers rated HP. Hrs/yr-How many hours did the engine operate 1/1/01 to1/1/02? See example. (Please make additional copies if needed)

Application Pump Make/Model John Deere 4045DF150 MY 01 HP 106 Hrs/yr 1000

Application _____ Make/Model _____ MY ____ HP ____ Hrs/yr ____

Application _____ Make/Model _____ MY ____ HP ____ Hrs/yr ____

Application _____ Make/Model _____ MY ____ HP ____ Hrs/yr ____

Application _____ Make/Model _____ MY ____ HP ____ Hrs/yr ____

Application _____ Make/Model _____ MY ____ HP ____ Hrs/yr ____

Application _____ Make/Model _____ MY ____ HP ____ Hrs/yr ____

Application _____ Make/Model _____ MY ____ HP ____ Hrs/yr ____

Application _____ Make/Model _____ MY ____ HP ____ Hrs/yr ____

Application _____ Make/Model _____ MY ____ HP ____ Hrs/yr ____

Application _____ Make/Model _____ MY ____ HP ____ Hrs/yr ____

Application _____ Make/Model _____ MY ____ HP ____ Hrs/yr ____

Application _____ Make/Model _____ MY ____ HP ____ Hrs/yr ____

Application _____ Make/Model _____ MY ____ HP ____ Hrs/yr ____

Application _____ Make/Model _____ MY ____ HP ____ Hrs/yr ____

2. Who should we contact if we have additional questions regarding the survey?

Contact Name:_____

Facility Name: _____

Address: _____

Phone Number:_____ Fax Number: _____

E-mail address:_____

Please add me to ARB's mailing list for diesel particulate matter regulatory development activities?

Yes No (Circle One)

Appendix C

Off-Road Compression-Ignition Engine Standards

TABLE 1
Off-Road Compression-Ignition Engine Standards
NMHC+NOx/CO/PM in g/hp-hr (g/kW-hr)
Standards Include an Emissions Durability Period[c,d,e]

hp (kw)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
<11 (8)[f]	See Table 2					7.8 (10.5) 6.0 (8.0) 0.75 (1.0)					5.6 (7.5) 6.0 (8.0) 0.60 (0.80)			
≥11 (8) <25 (19)[f]	See Table 2					7.1 (9.5) 4.9 (6.6) 0.60 (0.80)					5.6 (7.5) 4.9 (6.6) 0.60 (0.80)			
≥25 (19) <50 (37)[f]					7.1 (9.5) 4.1 (5.5) 0.60 (0.80)					5.6 (7.5) 4.1 (5.5) 0.45 (0.60)				
≥50 (37) <100 (75)[f]				N/A[a] 6.9 (9.2) N/A N/A						5.6 (7.5) 3.7 (5.0) 0.30 (0.40)				3.5 (4.7) 3.7 (5.0) (b)
≥100 (75) <175 (130)[f]			N/A[a] 6.9 (9.2) N/A N/A						4.9 (6.6) 3.7 (5.0) 0.22 (0.30)				3.0 (4.0) 3.7 (5.0) (b)	
≥175 (130) <300 (225)[f]		1.0 (1.3)[a] 6.9 (9.2) 8.5 (11.4) 0.40 (0.54)							4.9 (6.6) 2.6 (3.5) 0.15 (0.20)			3.0 (4.0) 2.6 (3.5) (b)		
≥300 (225) <600 (450)[f]		1.0 (1.3)[a] 6.9 (9.2) 8.5 (11.4) 0.40 (0.54)					4.8 (6.4) 2.6 (3.5) 0.15 (0.20)					3.0 (4.0)[g] 2.6 (3.5) (b)		
≥600 (450) <750 (560)[f]		1.0 (1.3)[a] 6.9 (9.2) 8.5 (11.4) 0.40 (0.54)						4.8 (6.4) 2.6 (3.5) 0.15 (0.20)				3.0 (4.0)[g] 2.6 (3.5) (b)		
≥750 (560)[f]						1.0 (1.3)[a] 6.9 (9.2) 8.5 (11.4) 0.40 (0.54)						4.8 (6.4) 2.6 (3.5) 0.15 (0.20)		

(a) Standards given are HC/NOx/CO/PM in g/hp-hr (g/kW-hr).
(b) PM standards have not been specified.
(c) For all engines rated under 19 kW, and for constant speed engines rated under 37 kW with rated speeds greater than or equal to 3,000 rpm, the durability period and useful life is a period of 3,000 hours or five years of use, whichever first occurs.
(d) For all other engines rated at or above 19 kW and under 37 kW, the durability period and useful life is a period of 5,000 hours or seven years of use, whichever first occurs.
(e) For all engines rated at or above 37 kW, the durability period and useful life is a period of 8,000 hours of operation or ten years of use, whichever first occurs.
(f) Prior to the year 2000, these engines were classified as small off-road engines. Refer to the small off-road engine standards for model years prior to 2000.
(g) Manufacturers have agreed to comply with these standards by 2005.

Appendix D

Summary of District Rules that Apply to Portable Engines

District Regulations Affecting Portable Engines

District	Emission Rates	Day/Annual Caps
Antelope Valley	1) Engines >50HP but <117 HP shall not exceed NOx emissions of 10.5 g/hp-hr or be installed with a turbocharger and timing retarded by a min. of 4 degrees from the manufacturer's standard timing; 2) engines >117 HP but <400 HP shall not exceed NOx emissions of 10 g/hp-hr or be installed with a turbocharger and timing retarded by a min. of 4 degrees from the manufacturer's standard timing; 3) engines ≥ 400 HP shall not exceed NOx emissions of 7 g/hp-hr or be installed with a turbocharger with aftercooler and timing retarded by a minimum of 4 degrees from the manufacturer's standard timing; and 4) emission from sulfur shall not exceed 0.05 percent by weight; 5) emission from PM shall not exceed 0.10 grain per standard dry cubic feet. [Rule 2100]	1) NOx or VOC emissions shall not exceed 100 pounds per day for each pollutant, excluding emissions from offroad engines; 2) total PM10 emissions shall not exceed 150 pounds per day, excluding emissions from offroad engines; and 3) emissions shall not exceed 10 tons per year of any affected pollutant when operated in any participating district. [Rule 2100]
	1) Engines > 100 bhp and < 117 bhp shall not exceed 770 ppm of NOx; 2) engines > 117 bhp and < 400 bhp shall not exceed 550 ppm of NOx; and 3) engines ≥ 400 bhp shall not exceed 535 ppm of NOx. [Rule 1110.2]	
BAAQMD	Not Applicable	Equipment shall not emit no more than 10 tons/yr of each pollutant, including POC, CO, NOx, PM10, NPOC or SO2. [Rule 2-1-220]
Mojave Desert	For diesel-cycle engines rated at 500 HP or more and operate more than 100 hours each calendar year, NOx emissions shall not exceed 700 ppmv and CO emission standards shall not exceed 4500 ppmv. [Rule 1160]	Not Applicable

District	Emission Rates	Day/Annual Caps
Northern Sierra	1) NOx emissions from naturally aspirated engines shall not exceed 10 g/bhp-hr; 2) NOx emissions from turbocharged engines shall not exceed 7.2 g/bhp-hr; 3) emission from sulfur shall not exceed 0.05 percent by weight; and 4) emission from PM shall not exceed 0.10 grain per standard dry cubic feet. [Rule 523]	1) Except for emissions from existing emissions units, NOx or VOC emissions shall not exceed 100 lbs/day for each pollutant; 2) except for emissions from existing emissions units, total PM10 emissions shall not exceed 150 lbs/ day; and 3) emissions shall not exceed 10 tons per year of any affected pollutant when operated in any participating district. [Rule 523]
San Diego	1) NOx emissions from naturally aspirated engines shall not exceed 10 g/bhp-hr; 2) NOx emissions from turbocharged engines shall not exceed 7.2 g/bhp-hr; 3) emission from sulfur shall not exceed 0.05 percent by weight; and 4) emission from PM shall not exceed 0.10 grain per standard dry cubic feet. [Rule 12.1 & 20.4]	1) Except for emissions from existing emissions units, NOx or VOC emissions shall not exceed 100 lbs./ day for each pollutant; 2) except for emissions from existing emissions units, total PM10 emissions shall not exceed 150 lbs./ day; and 3) emissions shall not exceed 10 tons per year of any affected pollutant when operated in any participating district. [Rule 12.1]
San Joaquin Valley Unified	1) NOx emissions from naturally aspirated engines shall not exceed 10 g/bhp-hr; 2) NOx emissions from turbocharged engines shall not exceed 7.2 g/bhp-hr; 3) emission from sulfur shall not exceed 0.05 percent by weight; 4) emission from PM shall not exceed 0.10 grain per standard dry cubic feet. [Rule 2280]	1) Except for emissions from existing emissions units, NOx or VOC emissions shall not exceed 100 lbs./ day for each pollutant; 2) except for emissions from existing emissions units, total PM10 emissions shall not exceed 150 lbs./ day; and 3) emissions shall not exceed 10 tons per year of any affected pollutant when operated in any Participating District. [Rule 2280]

District	Emission Rates	Day/Annual Caps
San Luis Obispo	1) NOx emissions from naturally aspirated engines shall not exceed 10 g/bhp-hr; 2) NOx emissions from turbocharged engines shall not exceed 7.2 g/bhp-hr; 3) emission from sulfur shall not exceed 0.05 percent by weight; and 4) emission from PM shall not exceed 0.10 grain per standard dry cubic feet. [Rule 220]	1) NOx or VOC emissions shall not exceed 100 lbs/ day for each pollutant; 2) total PM10 emissions shall not exceed 150 lbs/ day; and 3) emissions shall not exceed 10 tons per year of any affected pollutant when operated in any Participating District. [Rule 220]
SCAQMD	By January 1, 1999, the following apply: 1) Engines >50HP but <117 HP shall not exceed NOx emissions of 10 g/hp-hr or be installed with a turbocharger and timing retarded by a min. of 4 degrees from the manufacturer's standard timing; 2) engines >117 HP but <400 HP shall not exceed NOx emissions of 7.2 g/hp-hr or be installed with a turbocharger and timing retarded by a min. of 4 degrees from the manufacturer's standard timing; and 3) Engines > 400 HP shall not exceed NOx emissions of 7 g/hp-hr or be installed with a turbocharger with aftercooler and timing retarded by a minimum of 4 degrees from the manufacturer's standard timing. By January 1, 2010, portable engines must meet the most stringent emissions standard which is the applicable emissions standard in effect and set forth in Title 13 of the California Code of Regulations for that engine rating. [Rule 1110-2]	Not Applicable
Ventura	All drilling operations shall be powered by grid power unless exempted by Section C of this rule. [Rule 74.16]	Not Applicable
Yolo-Solano	1) NOx emissions from naturally aspirated engines shall not exceed 10 g/bhp-hr; 2) NOx emissions from turbocharged engines shall not exceed 7.2 g/bhp-hr; 3) emission from sulfur shall not exceed 0.05 percent by weight; and 4) emission from PM shall not exceed 0.10 grain per standard dry cubic feet. [Rule 3.3]	1) NOx or VOC emissions shall not exceed 100 lbs/ day for each pollutant; 2) total PM10 emissions shall not exceed 150 lbs/ day; and 3) emissions shall not exceed 10 tons per year of any affected pollutant when operated in any participating district. [Rule 3.3]

Appendix E

Portable Diesel Engine Emission Control Technology

Portable Diesel Engine Emission Control Technologies

In this appendix to the staff report, the ARB staff provides descriptions of PM reduction emission control strategies currently available and projected to be available in the near future. Additional information on the wide variety of emission reduction options for diesel fueled engines is provided in the Diesel Risk Reduction Plan.

There are many types of control technologies available to control diesel particulate matter from portable diesel engines, such as diesel oxidation catalysts, diesel particulate filters, fuel additives and alternative diesel fuels. While most of these technologies are currently being verified by the ARB for on-road vehicles, there are some that may be verified for portable diesel engines. Currently, the diesel oxidation catalyst from Donaldson is the only control technology that has been verified for off-road engine use.

Verification of Diesel Emission Control Devices

In March 2002, the Board adopted the *Verification Procedure, Warranty and In-Use Compliance Requirements of In-Use Strategies to Control Emissions from Diesel Engines* (Verification Procedure) in support of the ARB's regulatory efforts to reduce diesel PM. The Verification Procedure establishes a process through which manufacturers of emission control equipment can demonstrate and verify the emission reduction capabilities of control technologies. Examples of emission control technologies that can be considered for verification include: diesel particulate filters, diesel oxidation catalysts, exhaust gas recirculation, selective catalytic reduction systems, fuel additives and alternative diesel fuel systems. The Verification Procedure is voluntary and applies to emission control technologies for on-road, off-road and stationary applications. A brief discussion on the Verification Procedure is provided below.

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

The results of the Verification Procedure testing determine the control technology classification. The multi-level verification system consists of three PM reduction levels. The Verification Procedure also has provisions for verifying strategies that

reduce oxides of nitrogen (NOx) emissions. Control device verifications for both PM and NOx are classified by level as listed in Table 1.

Table 1: Verification Classifications for Diesel Emission Control Strategies

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

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

Diesel Oxidation Catalyst

Diesel oxidation catalyst (DOC) reduces the emissions of particulate matter (PM), carbon monoxide (CO) and gaseous reactive organic gas (ROG) from diesel engines by catalytic oxidation. The technology is only effective on the soluble organic faction of diesel PM, and therefore the overall reduction that can be achieved by a DOC is limited—the range of reduction is typically between 10 to 30 percent (Khair, 1999).

For off-road applications, the only DOC that is verified to date is the Donaldson DCM diesel oxidation catalyst muffler with 6000 series catalyst formulation plus a closed loop crankcase with the Donaldson Spiracle™ closed crankcase filtration system. This system requires the use of California Diesel fuel. The system is a Level 1, which controls diesel PM to an average of 25 percent. This system may be used in four-stroke, turbocharged diesel engines ranging from 150 horsepower (hp) to 600 hp.

Diesel Particulate filters

Diesel particulate filters (DPF) reduce diesel PM emissions through filtration. This technology is very efficient in controlling diesel PM emissions, and has been demonstrated to reduce diesel PM by over 90 percent. DPF can be categorized into several classifications: passive, active, or flow-through.

Passive DPFs use a catalytic material that allows the trapped PM to be burned-off or oxidized at a lower temperature. For the system to be successful, the engine must be operated such that the exhaust maintains a minimum temperature for a certain period of time. Otherwise, diesel PM will accumulate in the filter, eventually causing operating problems. Several passive DPFs have been verified for on-road

applications. To date no DPFs have been verified for portable engines. The duty cycle for equipment must be such that the engine exhaust temperature and its duration is above the manufacturer's specifications. If temperatures are below the DPF's manufacturer's specifications, soot accumulates in the filter, increasing exhaust backpressure resulting in engine damage. Each engine should be tested to see if its duty cycle would accommodate a passive DPF.

An active DPF performs the same function as a passive DPF. The difference is that the active DPF does not use heat from the engine exhaust to oxidize the trapped PM. An active DPF is better suited for low exhaust temperatures or engines with high PM emissions. Most common methods use electrical regeneration by passing an electrical current through the filter medium, injecting fuel to provide additional heat to oxidize the trapped PM, or adding fuel-borne catalyst or other reagents to initiate regeneration. Some DPFs induce regeneration automatically on-board the vehicle or equipment when a specified back pressure is reached. Others use an indicator, such as a warning light, to alert the operator that regeneration is needed, requiring the operator to initiate the regeneration process. A number of filters are removed and regenerated externally by a regeneration station.

Flow through filter (FTF) technology is a relatively new technology for reducing diesel PM emissions. Unlike a DPF, in which only gasses can pass through the substrate, the FTF does not physically "trap" and accumulate PM. Instead, exhaust flows through a medium (such as wire mesh) that has a high density of interrupted flow channels, thus giving rise to turbulent flow conditions. DOCs have straight flow passages and laminar flow conditions. The FTFs, with its turbulent flow, allow the exhaust gases to have more contact with the catalytic surface and longer residence times. The FTF medium is typically treated with an oxidizing catalyst that is able to reduce emissions of PM, ROG, and CO, or used in conjunction with a fuel-borne catalyst. Any particles that are not oxidized with the FTF flow out with the rest of the exhaust and do not accumulate.

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

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

Fuel Additives

Fuel additives are essentially any substances added to the fuel. These additives can reduce the total mass of PM, with variable effects on CO, NOx and ROG production. Fuel borne catalysts (FBC) are additives to diesel fuel to aid in soot removal in DPFs by lowering the ignition temperatures of the carbonacious particles in the exhaust stream. If the ignition temperature is lower, then more of the carbonaceous portion of the exhaust stream is incinerated and not trapped in the DPF. These FBCs are to be used in conjunction with passive and active DPFs. FBC's use various metals such as cerium, platinum, copper, and iron. Most fuel additives will work with a range of sulfur concentrations as well with other fuels and other fuel additives. FBCs are not verified for portable diesel engines at this time.

Alternative Diesel Fuels

An alternative diesel fuel is a fuel that can be used in a diesel engine without modification to the engine. Alternative diesel fuels include emulsified fuels, biodiesels, Fischer-Tropsch (F-T) fuels and any combination of these fuels with regular diesel fuels.

Water emulsion diesel fuel mixes water with diesel and adds an agent to keep the fuel and water from separating. The water is suspended in the droplets within the fuel, creating a cooling effect in the combustion chamber that decreases NOx emissions. A fuel-water emulsion creates a leaner fuel to air ratio in the combustion chamber, generating less soot at combustion, thus lowering PM emissions. The major manufacturer of this fuel-water emulsion is Lubrizol Corporation, which produces PuriNOx™. According to data submitted for the ARB's fuels certification procedure (Title 13, CCR, Sections 2281, 2282 and 2284), PuriNOx™ achieved a 14 percent reduction in NOx and a 63 percent reduction in PM emissions. Similar results were found in a United States Environmental Protection Agency (U.S. EPA, 2002c) analysis. Some engine manufacturers have stated that using emulsified fuels would void the engine warrantee.

Biodiesel is a mono-alkyl ester-based oxygenated fuel made from vegetable oils, such as oilseed plants or used vegetable oils, or animal fats. Biodiesel has similar properties to petroleum-based diesel fuel, and can be blended into petroleum-based diesel fuel at 20 percent, and is called B20. Pure biodiesel is called B100. U.S. EPA recently evaluated biodiesel using publicly available data and concluded that while biodiesel and biodiesel blends reduce PM, ROG, and CO emission, NOx emissions increase, depending on the biodiesel to diesel fuel blend ratio (U.S. EPA, 2002b). As the portion of biodiesel increase, the PM, ROG and CO emissions decrease while the NOx increases. U.S. EPA predicts that B20 will reduce fuel economy by one to two percent. Biodiesel costs more than double the cost of conventional diesel.

Fischer-Tropsch fuels have been used to some degree since the 1920s. Today, these fuels are being used in South Africa to power buses, trucks and taxicabs. Fischer-Tropsch technology converts coal, natural gas and low-value refinery products into a high-value, clean burning fuel. This fuel is interchangeable with conventional diesel fuel and can be blended with diesel fuel in any ratio with little or no modification (U.S. EPA, 2002a). Fischer-Tropsch fuels do have emissions reduction benefits. A study showed that PM emissions were reduced by 30 percent and NOx emissions by 5 percent (CEC, 2002). No alternative diesel fuels have been verified by the ARB for portable diesel engines.

Although there may be feasible control technology options developed or being developed, only one has been verified to date by the ARB for portable diesel engines. As more companies submit their products under the Verification Procedure, it is expected that more control technology options will be available for portable engine owners and operators in the future.

Appendix F

Exhaust Temperature Data Analysis for Portable Diesel-Fueled Engines

Exhaust Temperature Data Analysis for Portable Diesel-Fueled Engines

The University of California at Riverside's Center for Environmental Research and Technology (CE-CERT), working with ARB staff, recently conducted a stack-temperature profile (i.e., percentage of time at various exhaust temperatures) study to determine if passive diesel particulate filters (DPFs) are a feasible PM control technology for diesel-fueled portable engines. The success of a DPF is dependent on whether an engine achieves and maintains the minimum average exhaust temperature set by the DPF manufacturer. If engine exhaust temperatures are equal to or higher than the minimum temperatures, then passive DPFs could be considered as a potential retrofit control device. If engine exhaust temperatures are below the minimum requirements, then carbonaceous material may accumulate, increasing exhaust back pressure and possibly causing serious engine damage.

Currently, three manufacturers of passive DPFs have submitted their technology to ARB for verification for on-road diesel engine applications. These manufacturers are Johnson-Mathey, Cleair and Englehard. The required minimum average operating temperatures and duration per duty cycle vary among these DPFs. For example, the Johnson-Mathey DPF requires 270 degrees Celsius (C) for 40 to 50 percent of the duty cycle, the Cleair DPF requires 300 degrees C for 30 percent of the duty cycle, and the Englehard DPF requires an average of 225 degrees C. To date, these manufacturers have not requested ARB verification of their technologies for off-road applications, which would include portable diesel engines.

In the study, CE-CERT gathered exhaust temperatures during normal duty cycles from about 80 portable diesel engines in Northern and Southern California. The engines ranged from 77 to 2151 horsepower. The tests consisted of inserting a temperature sensor into the exhaust stream of a diesel engine, after the turbo-charger or exhaust manifold, and measuring the exhaust temperature in one-minute intervals for at least 20 hours of engine operation. Exhaust temperature data was stored on an in-line data logger. The data were downloaded from the data logger to a laptop and a frequency distribution test was applied using a spreadsheet. A frequency distribution test was used on the data to determine what temperature range each engine operated at and the percentage of time it operated within each temperature interval. The resulting data were graphed by temperature verses percent engine operation (See Figures 1-80). Table 1 is a summary of the equipment categories that were tested, the number of engines tested per category, and the percentage of those engines tested where the minimum operating temperature was high enough to install a passive DPF.

Table 1: Results of Exhaust Temperature Tests

Category	Industry	Number of Engines Tested	Passive DPF Yes
			(%)
Wood Chippers	Arborist, University, Govt.	7	43
Generators	Motion Picture, Construction, Sand & Gravel, Oil & Gas	29	73
Paint Stripers (Compressors)	Govt.	6	83
Compressors	Govt., Construction	11	55
Pumps	Govt., Oil & Gas, Agricult.	8	63
Grinders	Govt.	3	100
Grader/Shovel	Govt.	2	50
Welder	Sand and Gravel	1	100
Crane	Construction	1	0
Jet Washer	Oil & Gas	3	0
Drilling Rig	Oil & Gas	1	0
Clamshell Dredger	Construction	2	0
Bow Anchor Winch	Construction	1	0
Truck Mounted Vacuum Pumps	Govt.	5	0

The staff assumed that a minimum average operating temperature above 225 degrees C was needed to successfully retrofit with a passive DPF. The results of the test data showed that not all engines could be retrofitted with DPFs. The duty cycle appears to be the key to determining a successful retrofit of a passive DPF. Although some of the categories did show 100 percent of engines tested were capable of being retrofit with a passive DPF, Grinders and Cranes (Figures 61, 62 and 67), there wasn't enough of a population base to test and confirm if this was true for all engines in this category.

Some categories would be good candidates for a passive DPF, paint stripers for example (Figures 36-41). Paint stripers are either painting or turned off. There is a minimum amount of idling, so that the average exhaust temperatures are higher. As the data shows, 83 percent of these paint stripers could be retrofitted with a passive DPF.

In some categories retrofitting with a passive DPF is on a case by case basis. The generator category (Figures 8-35) is an example of the need to test before

installing a passive DPF. From the test results, 73% could be retrofitted with a passive DPF. For the other 27%, generators appear to run at idle for long periods of time and when electrical power is needed then they are operated at full power. This appears to be the case in the movie industry, where generators of the same horsepower rating had very different duty cycles. Some had very low average exhaust temperatures while other generators maintained operating temperatures much higher than the minimum required temperature. Operators of generators would need to perform exhaust temperature tests to determine if their engine would be a candidate for a passive DPF.

Some categories would not be good candidates for a passive DPF, vacuum trucks for example (Figures 76-80). These trucks vacuum leaves and debris from storm drains, keeping storm drains clear. Data indicated that these vacuum pumps had engines that were larger and more powerful than what was needed to remove the average amount of obstruction. These trucks were designed with reserve power so that if a large amount of debris was in a storm drain it could be removed quickly. During testing, these engines never reached the minimum temperature of 225-degree Celsius for the minimum amount of time.

Based on the exhaust test results, the ARB cannot recommend the use of a passive DPF for all portable diesel engines because in many cases the duty cycle of an engine may not reach the minimum temperatures required for a passive DPF to perform its function. If an operator decides to use a passive DPF, an engine exhaust temperature study is highly recommended to determine if the average engine exhaust temperatures for individual engines do meet the minimum requirements for a passive DPF.

Chippers

Figure 1: Cecert 16 Exhaust Temperature Profile
Application: Chipper

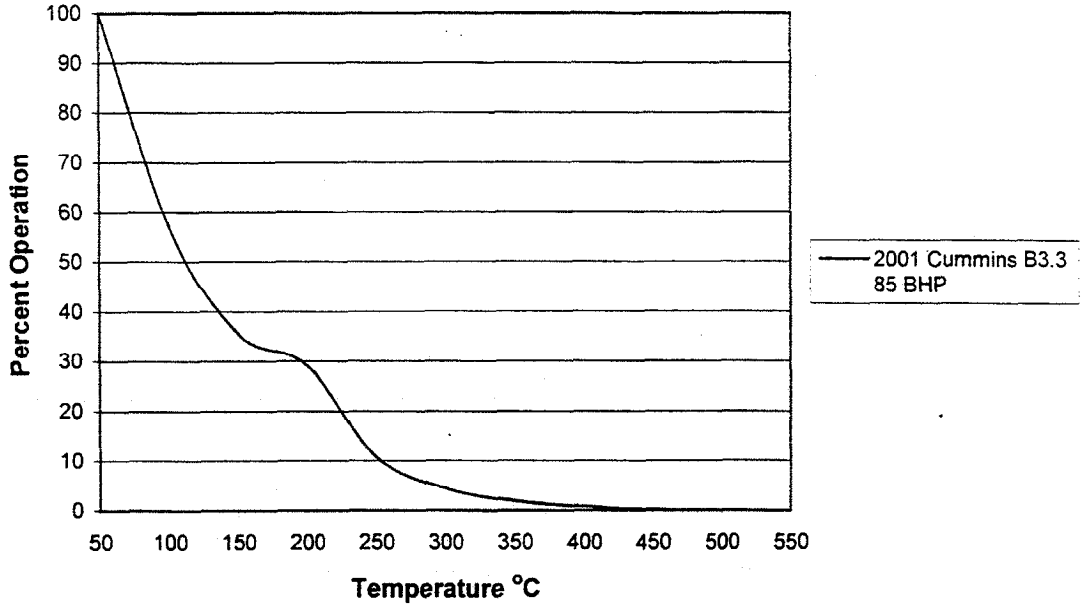


Figure 2: Cecert 17 Exhaust Temperature Profile
Application: Chipper

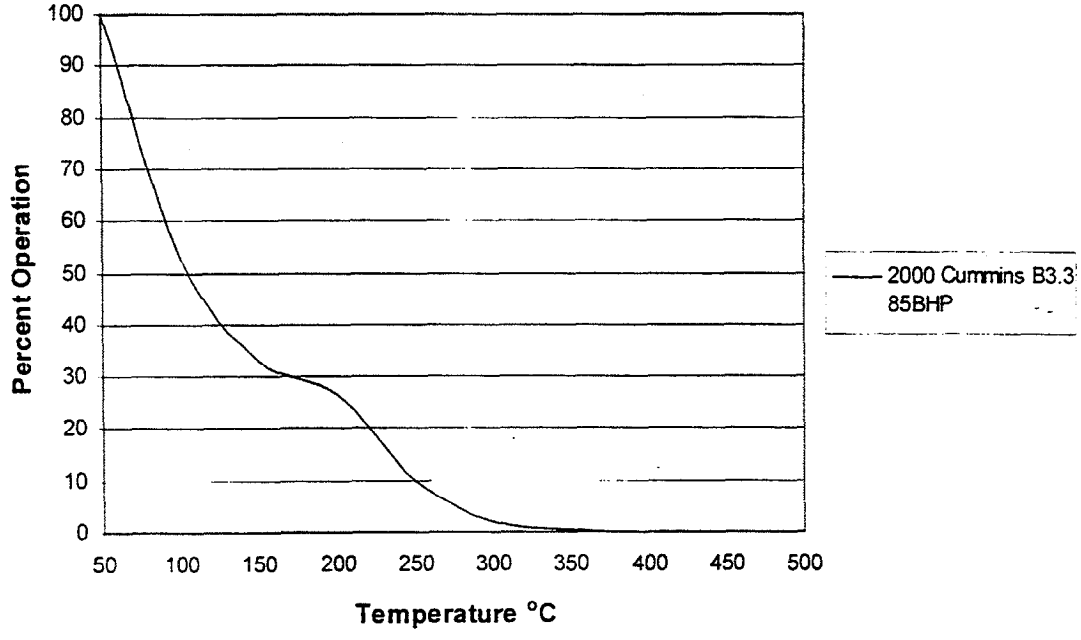


Figure 3: Cecert 18 Exhaust Temperature Profile
Application: Chipper

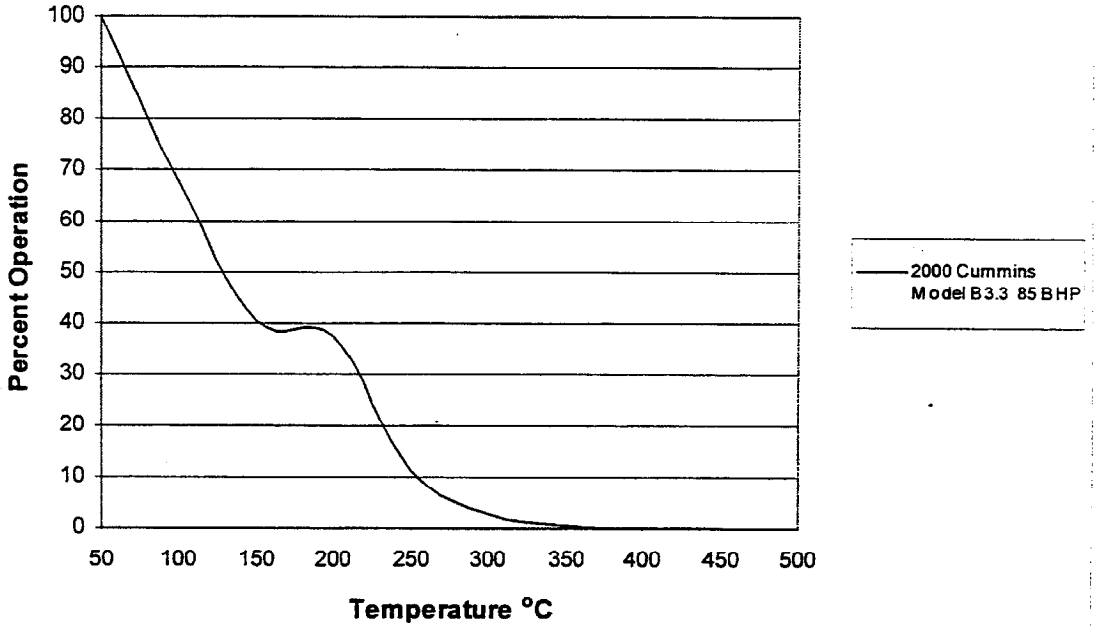


Figure 4: Cecert 23 Exhaust Temperature Profile
Application: Chipper

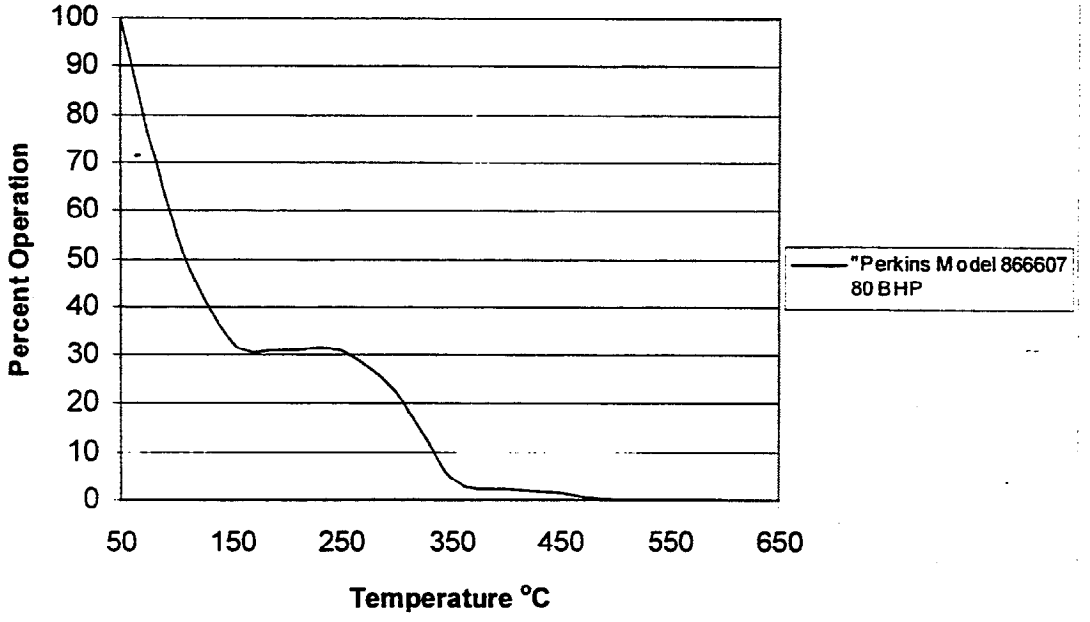


Figure 5: Cecert 24 Exhaust Temperature Profile
Application: Chipper

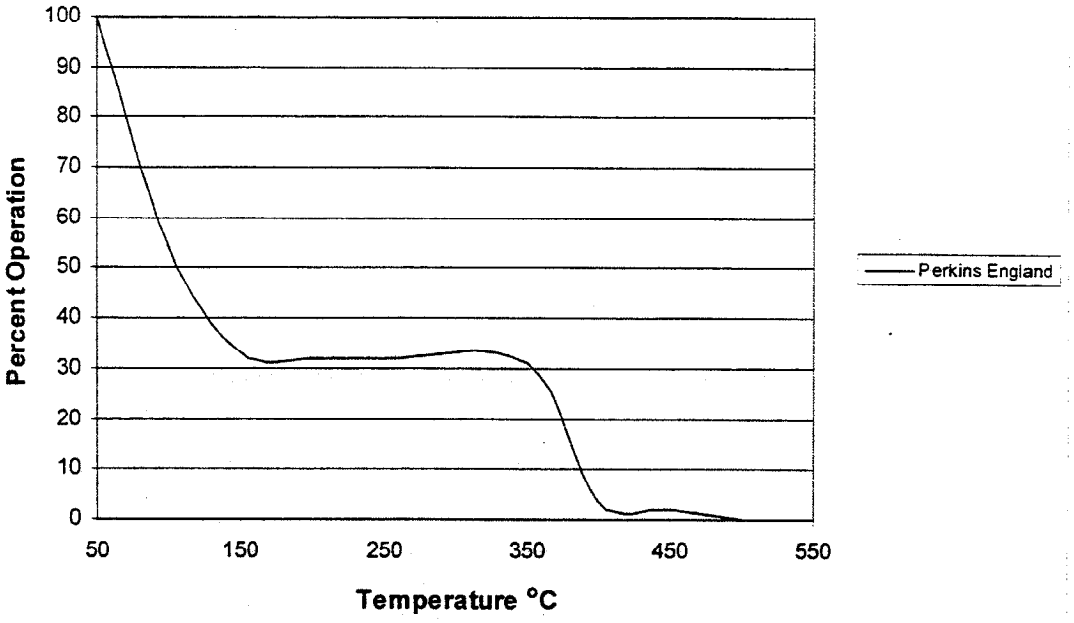


Figure 6: 2526069 Exhaust Temperatures Profile
Application: Chipper

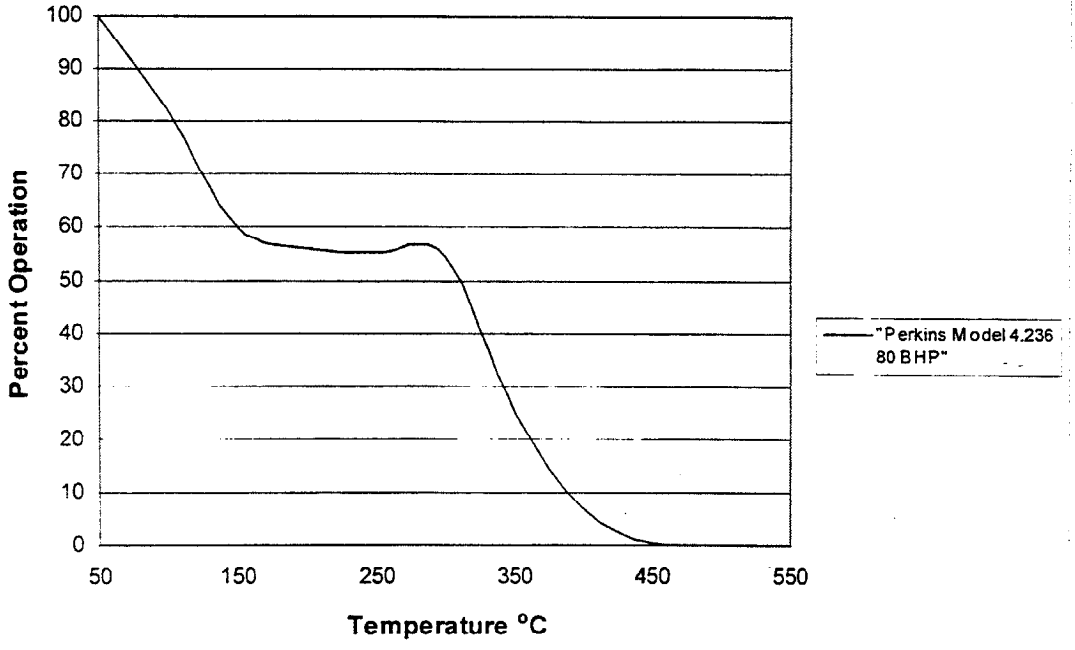
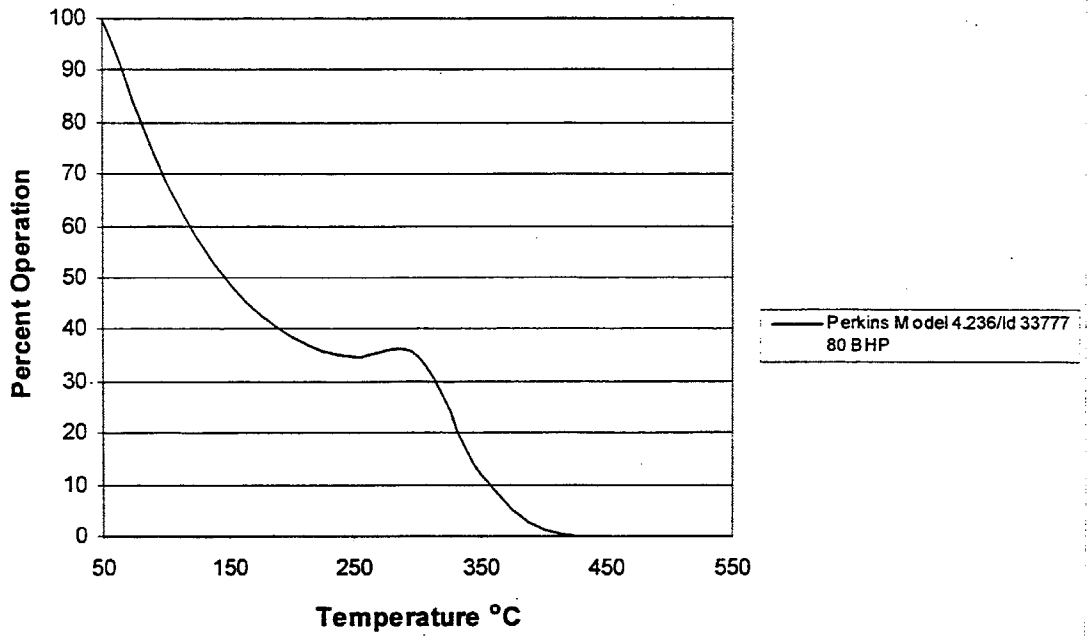


Figure 7: 2526822 Exhaust Temperatures Profile
Application: Chipper



Generators

Figure 8: Cecert 26 Exahust Temperature Profile
Application: Generator for a Water Pump

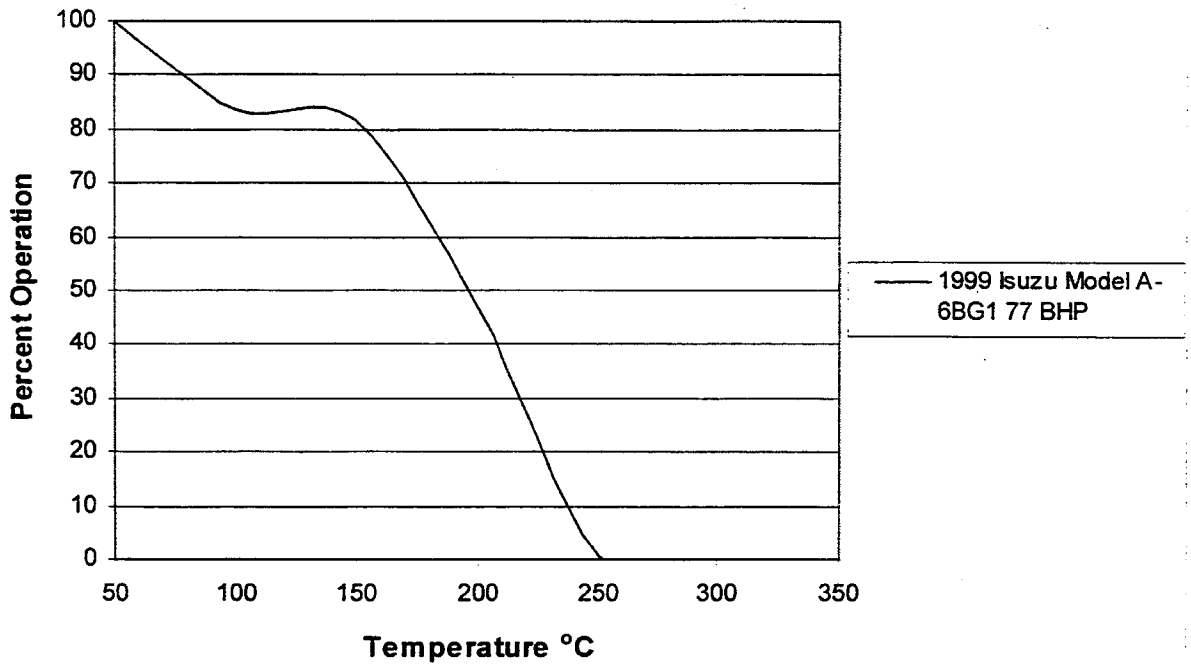


Figure 9: Cecert 27 Exhaust Temperature Profile
Application: Rental Generator

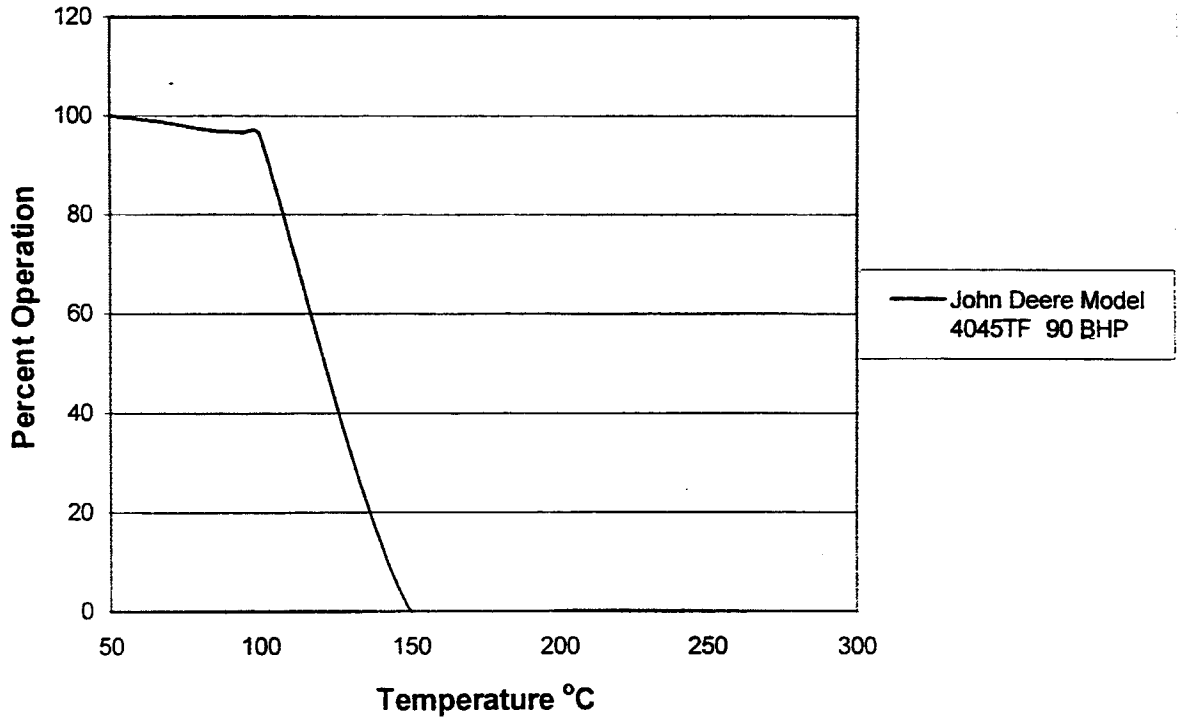


Figure 10: Cecert 28 Exhaust Temperature Profile
Application: Rental Generator

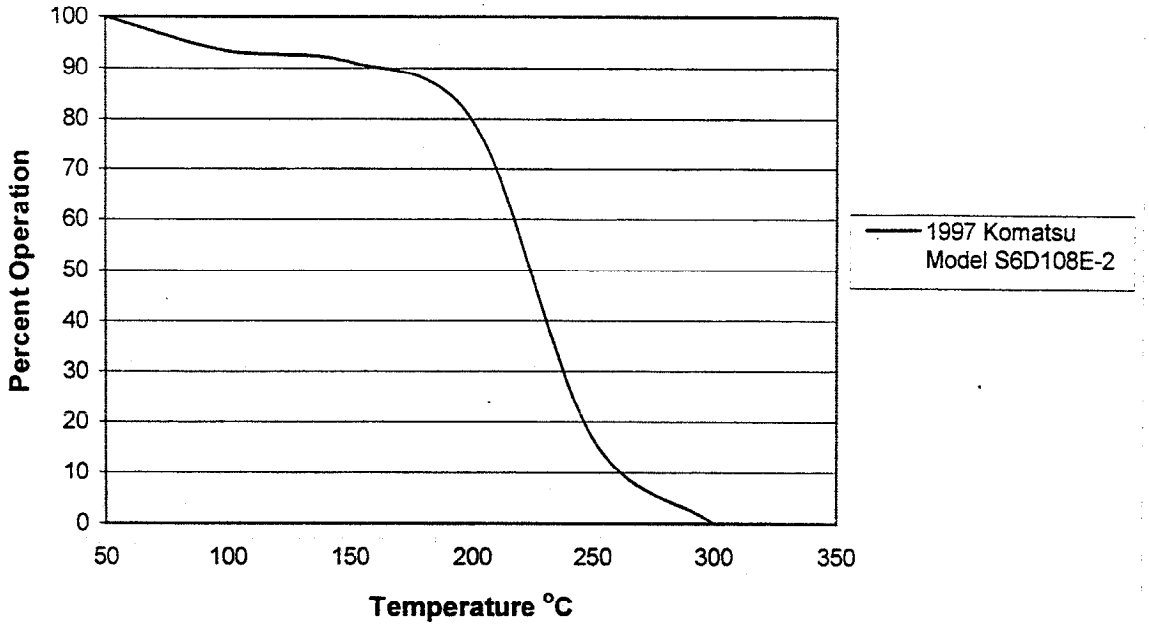


Figure 11: Cecert 29 Exhaust Temperature Profile
Application: Rental Generator

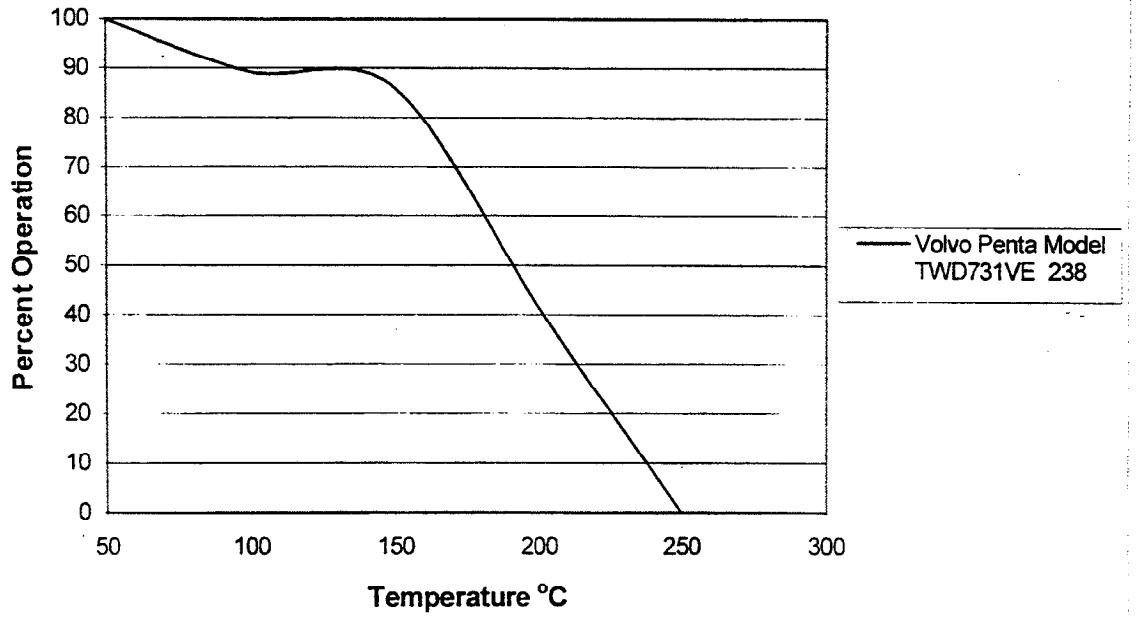


Figure 12: Cecert 30 Exhaust Temperature Profile
Application: Generator

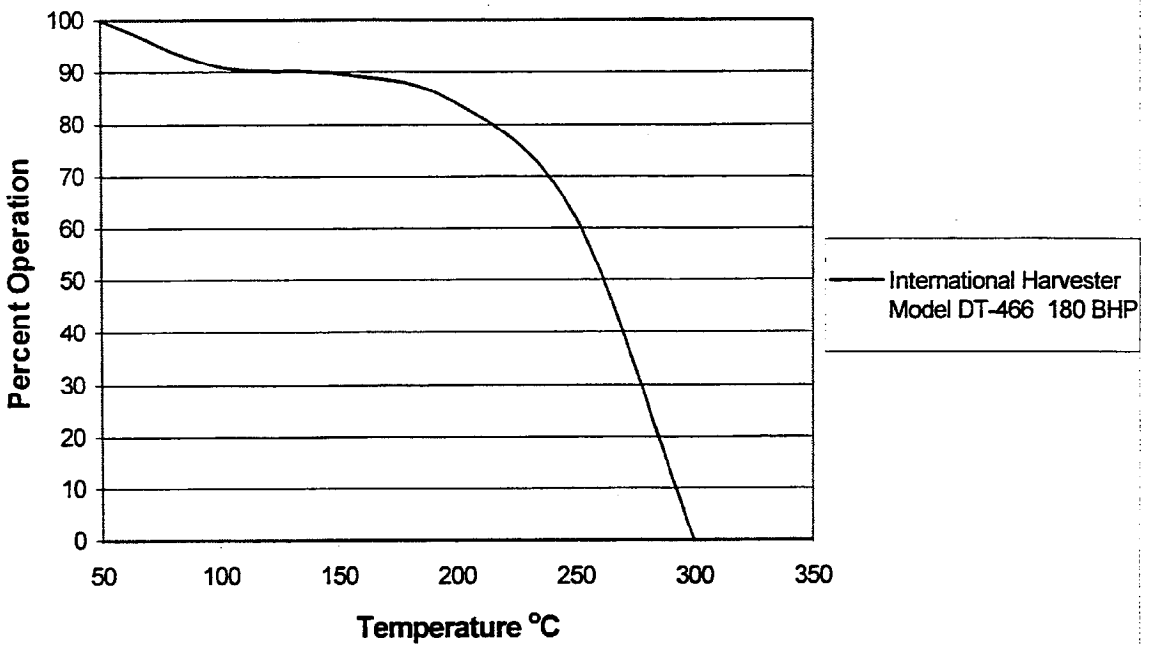


Figure 13: Cecert 32 Exhaust Temperature Profile
Application: Lighting Generator

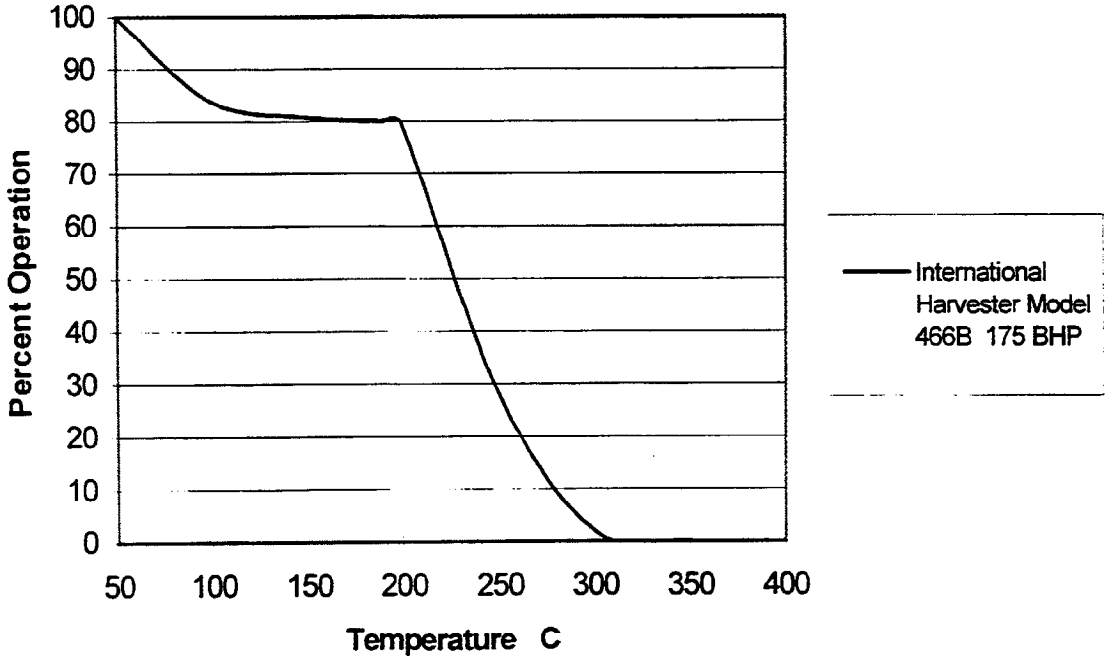


Figure 14: Cecert 33 Exhaust Temperature Profile
Application: Lighting Generator

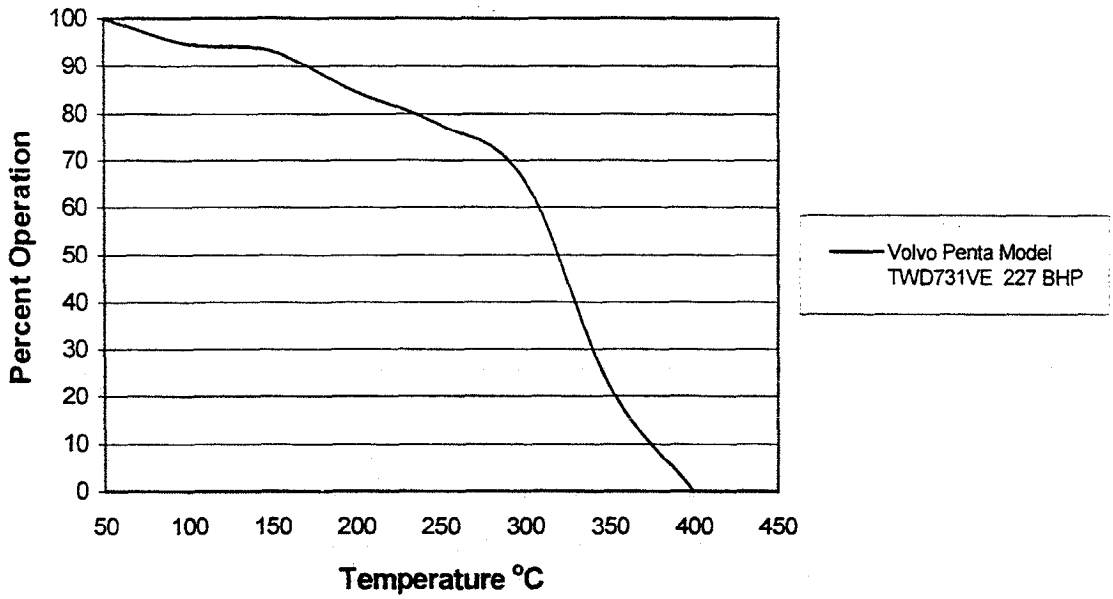


Figure 15: Cecert 34 Exhaust Temperature Profile
Application: Lighting Generator

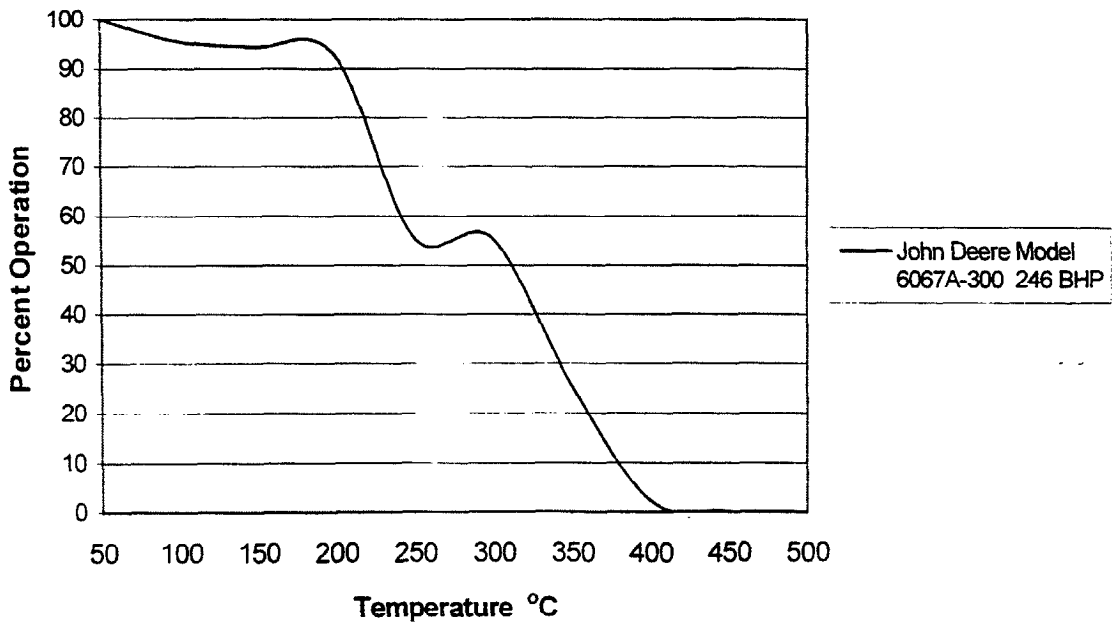


Figure 16: Cecert 36 Exhaust Temperature Profile
Application: Lighting Generator

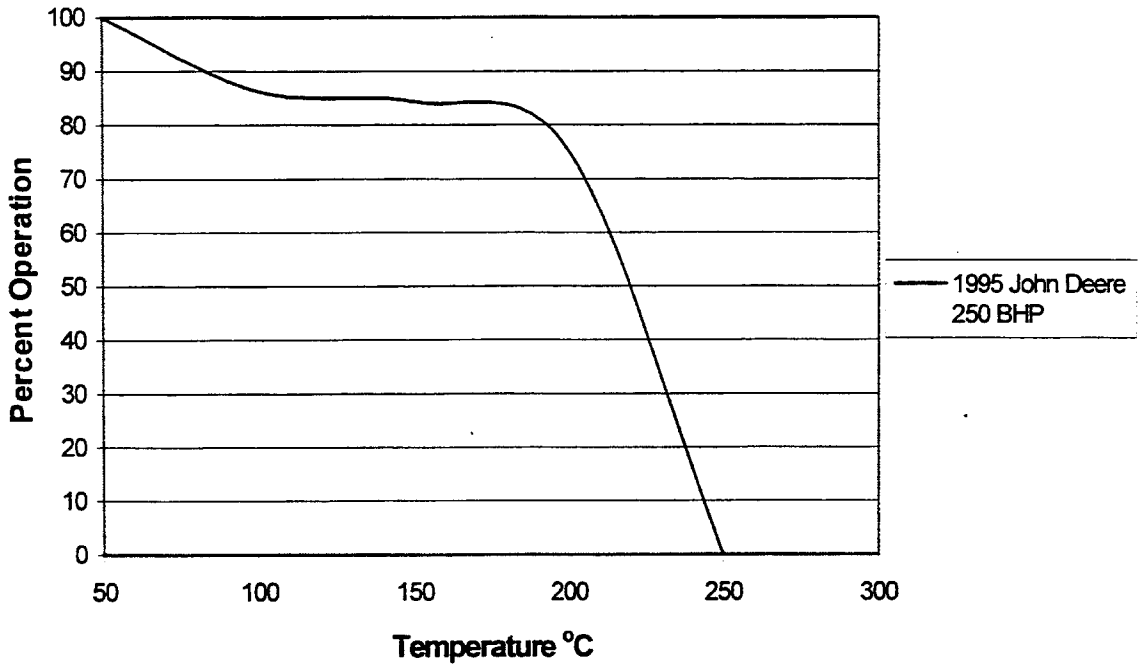


Figure 17: Cecert 37 Exhaust Temperature Profile
Application: Lighting Generator

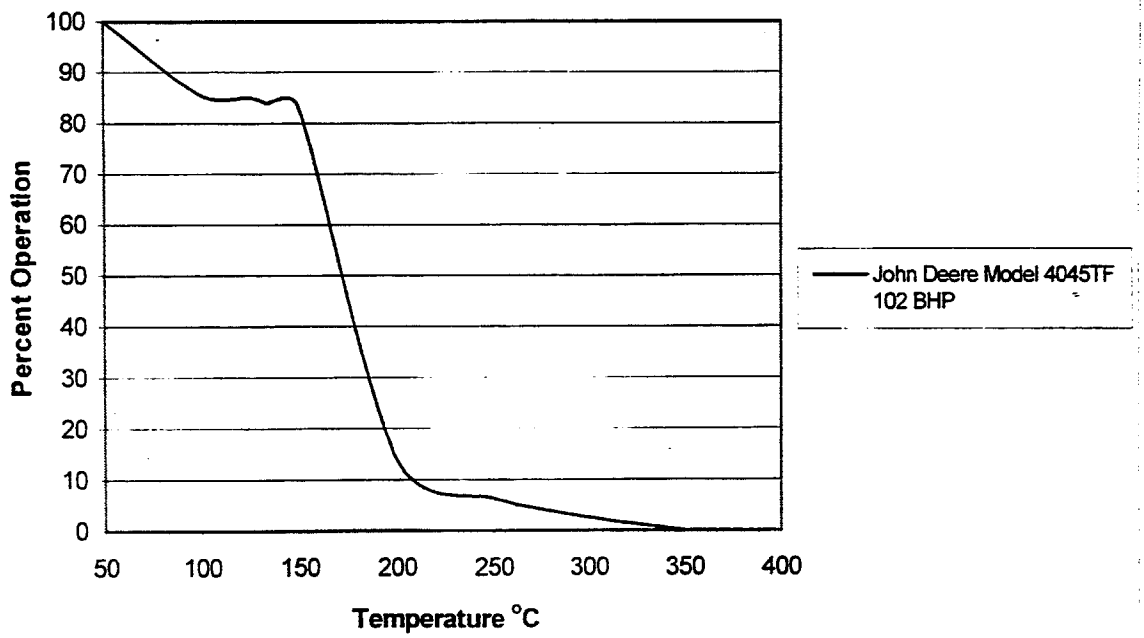


Figure 18: Cecert 38 Exhaust Temperature Profile
Application: Lighting Generator

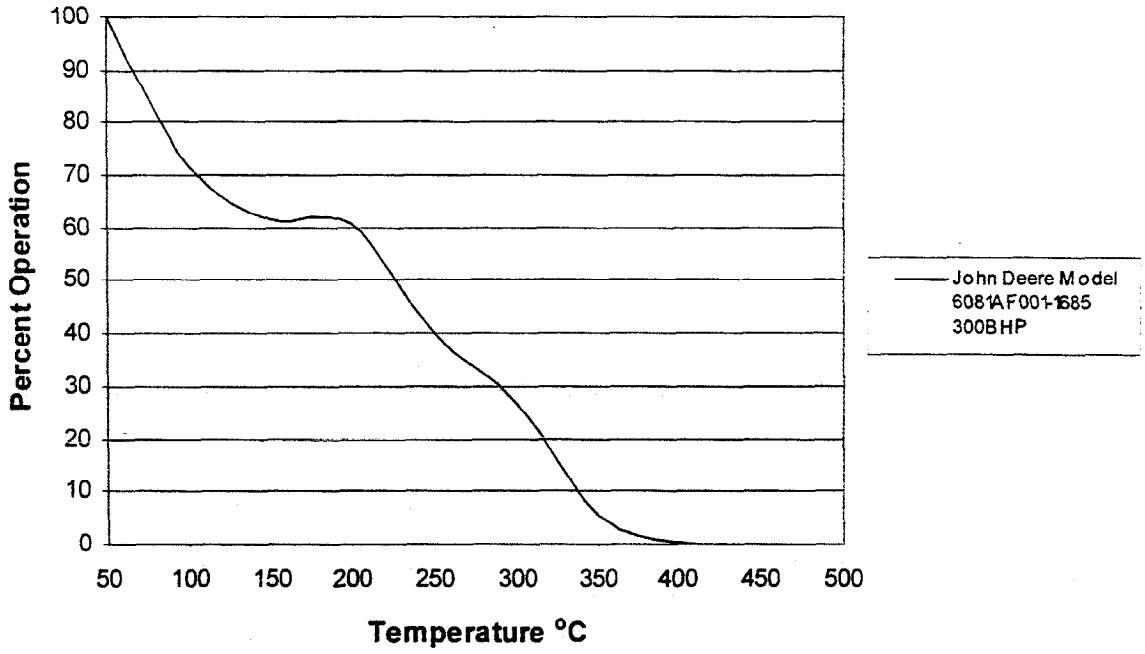


Figure 19: 102261 Exhaust Temperature Profile
Application: Conveyor Generator

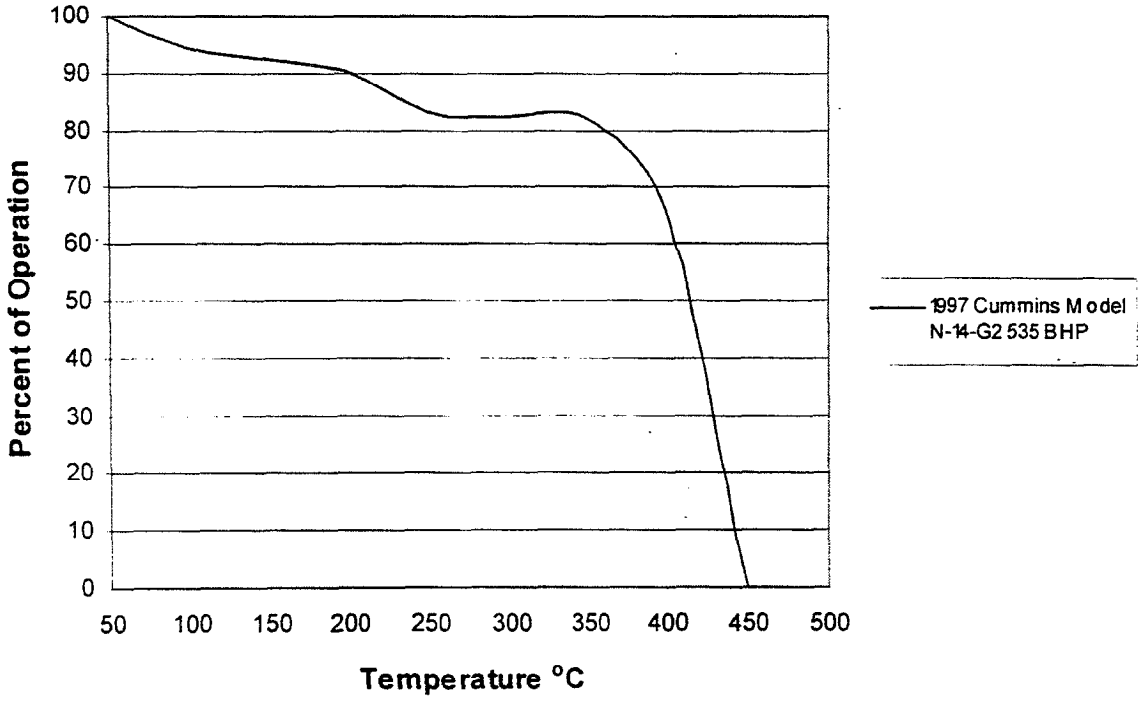


Figure 20: 1022622 Diesel Exhaust Temperature Profile
Application: Conveyor Generator

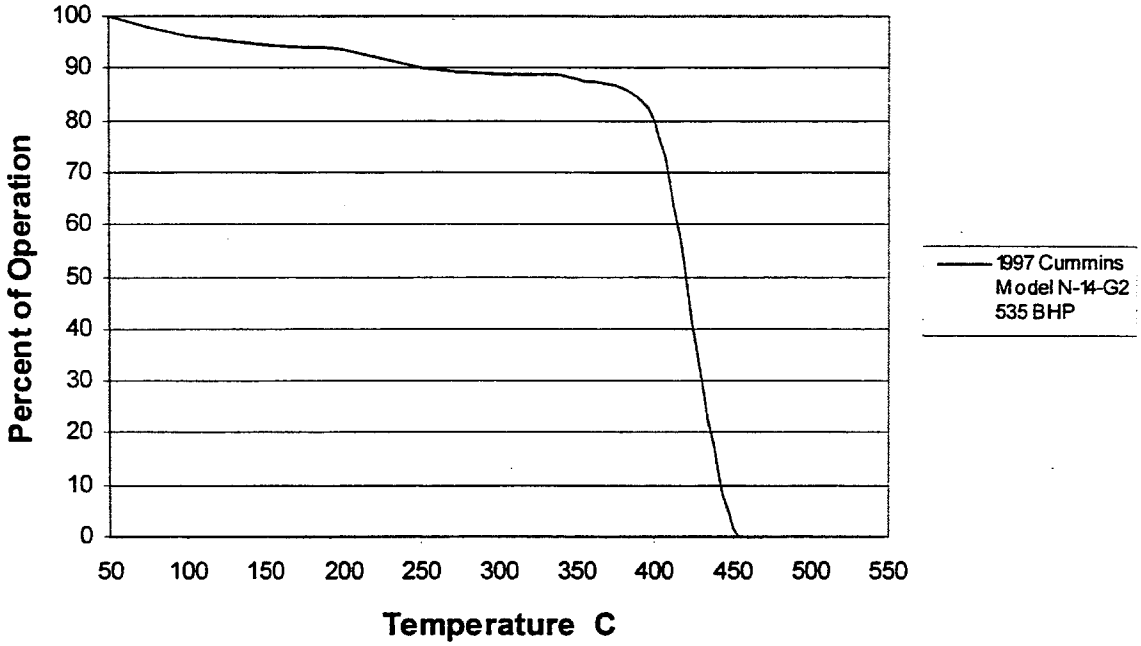


Figure 21: 105571 Engine Exhaust Profile
Application: Powerscreen Generator

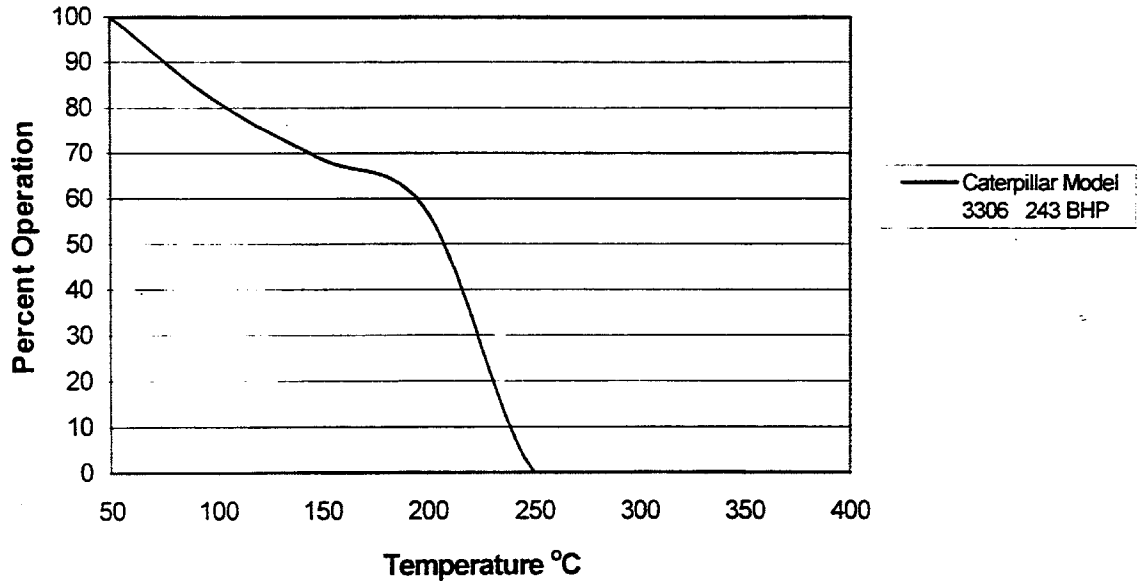


Figure 22: 111223 Exhaust Temperatue Profile
Application: Rock Crushing & Screening Generator

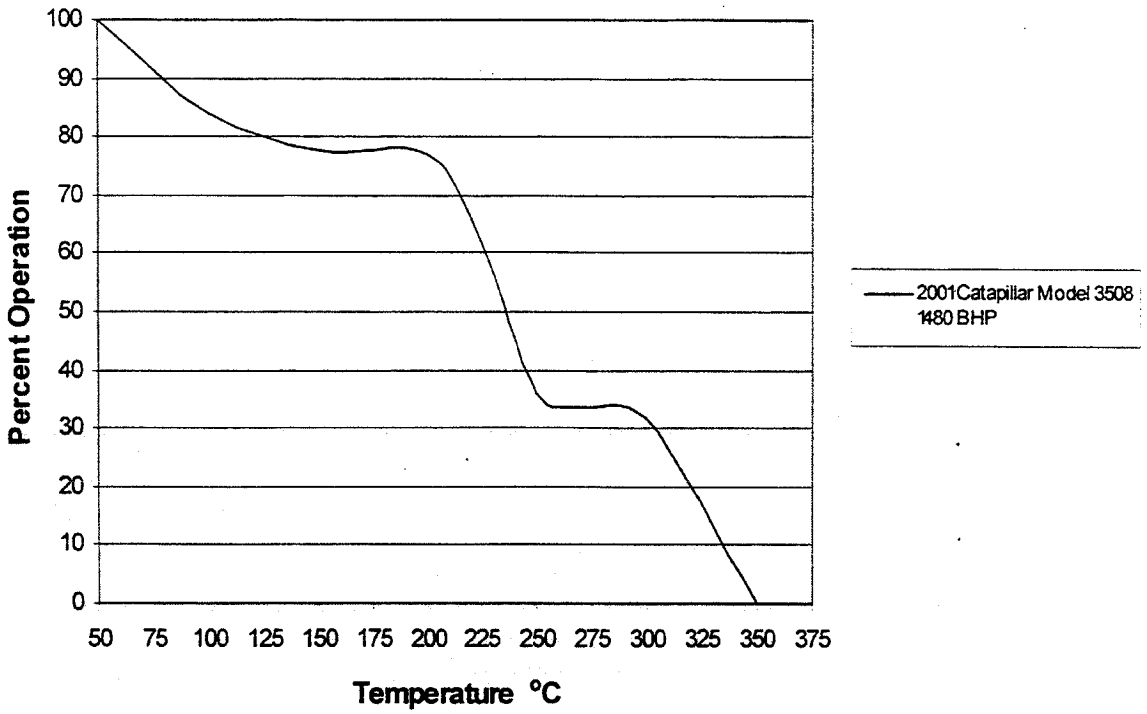


Figure 23: 111226 Exhaust Temperature Profile
Application: Rock Crushing & Screening Generator

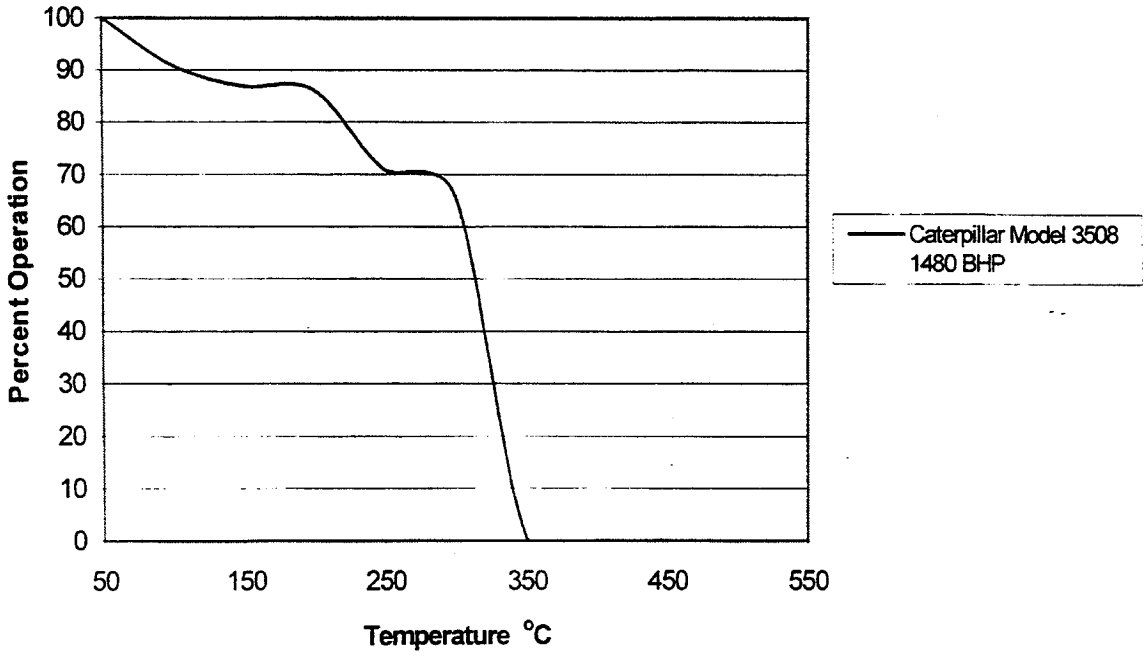


Figure 24: 113879 Exhaust Temperature Profile
Application: Generator Set

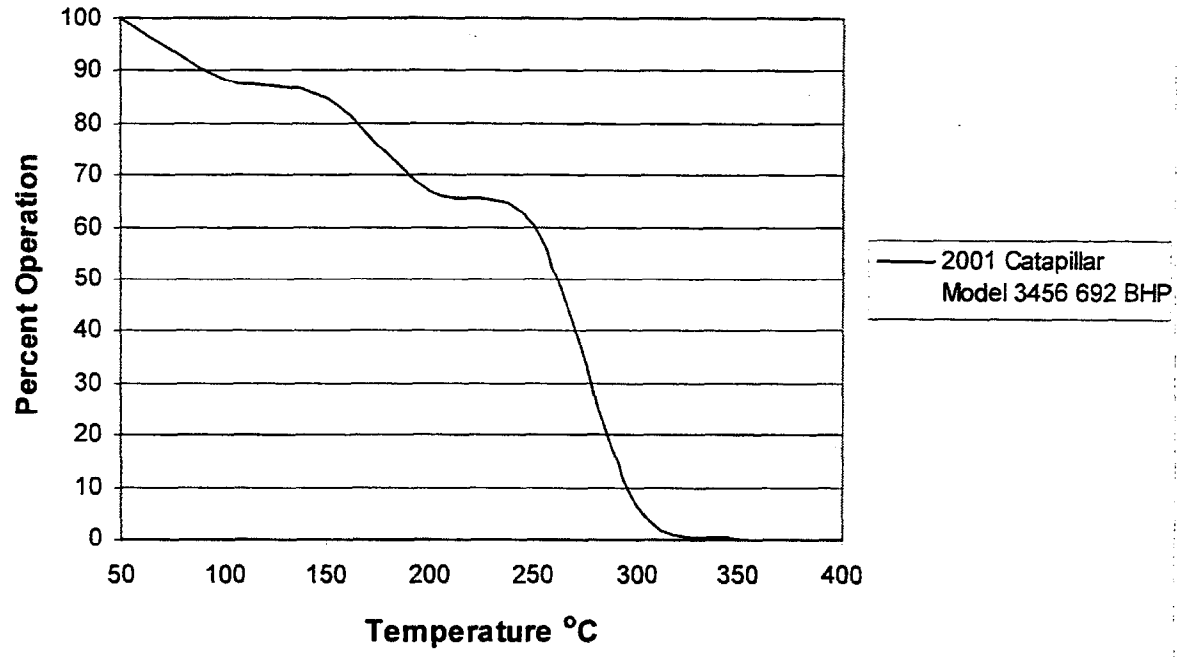


Figure 25: 114235 Exhaust Temperature Profile
Application: Power Conveyor Generator

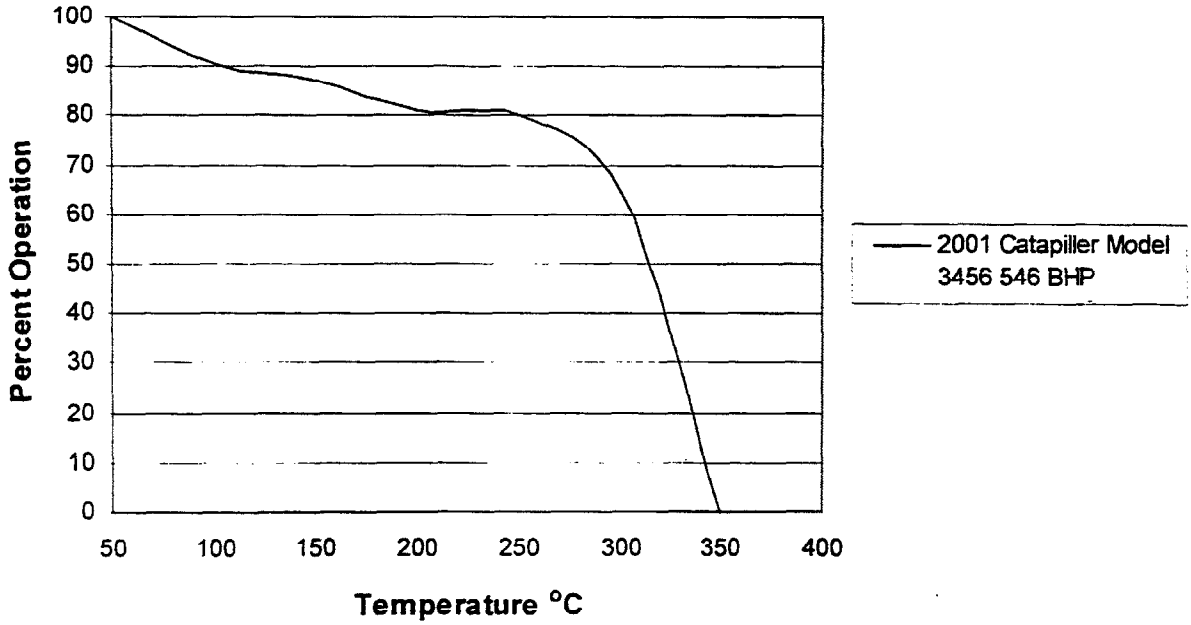


Figure 26: 114750 Exhaust Temperature Profile
Application: Rock Crushing & Screening Generator

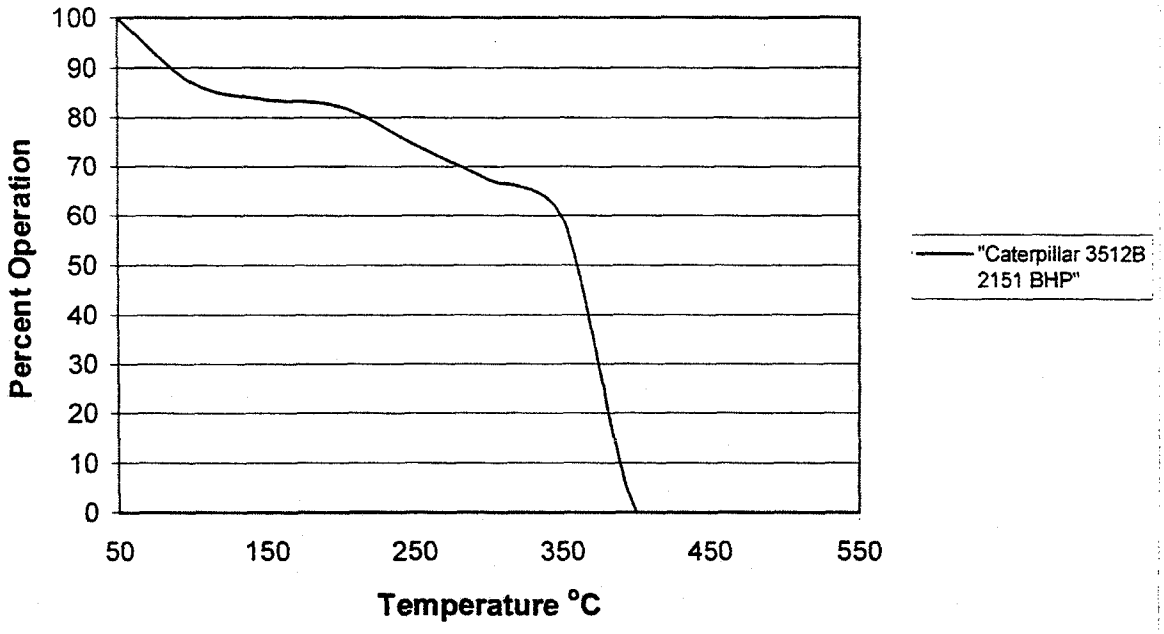


Figure 27: 114775 Exhaust Temperature Profile
Application: Conveyor Generator

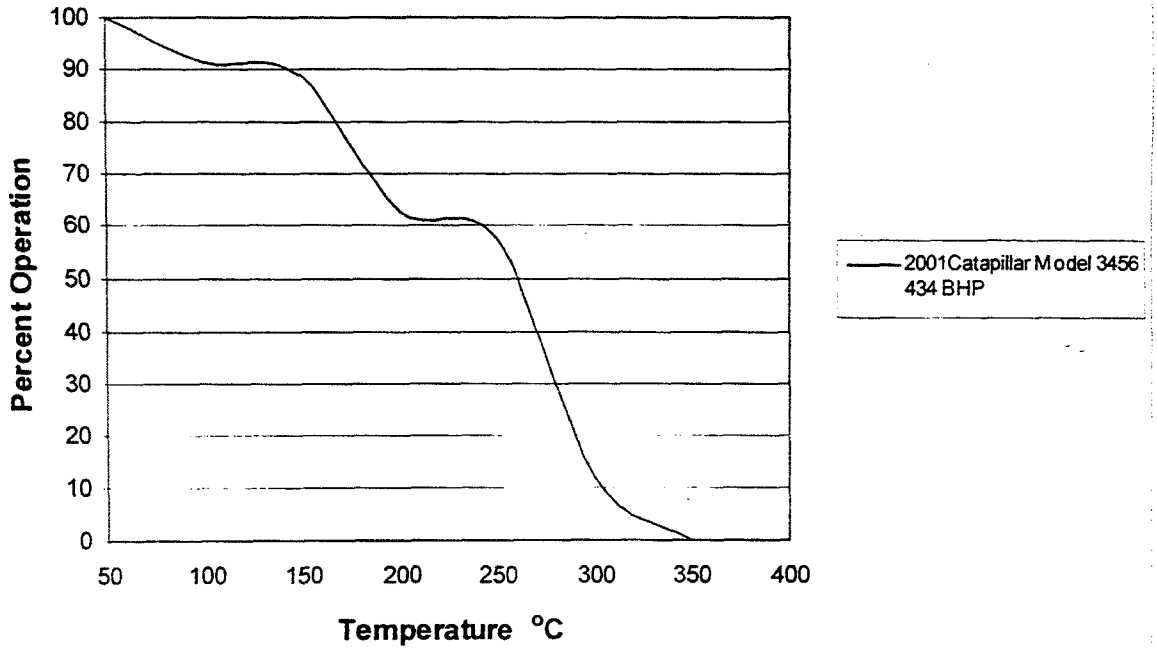


Figure 28: 111624 Exhaust Temperatures Profile
Application: Teichert Powerscreen Diesel Generator

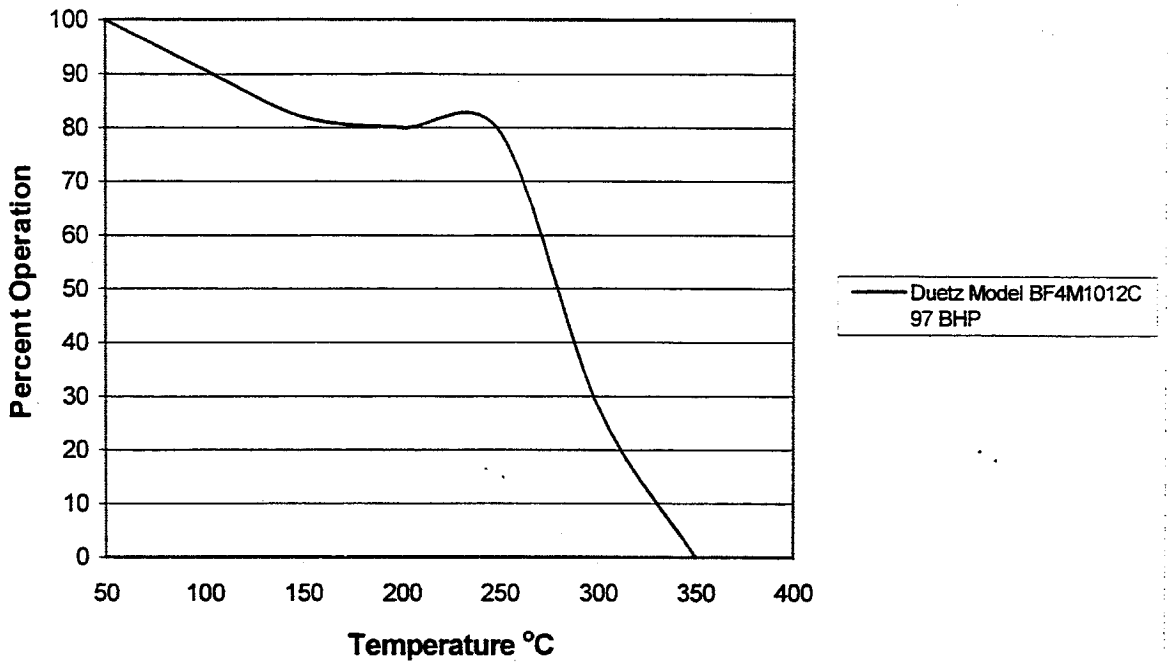


Figure 29: Cecert 14 Exhaust Temperature Profile
Application: F.S.T. Sand and Gravel Screening Plant Generator

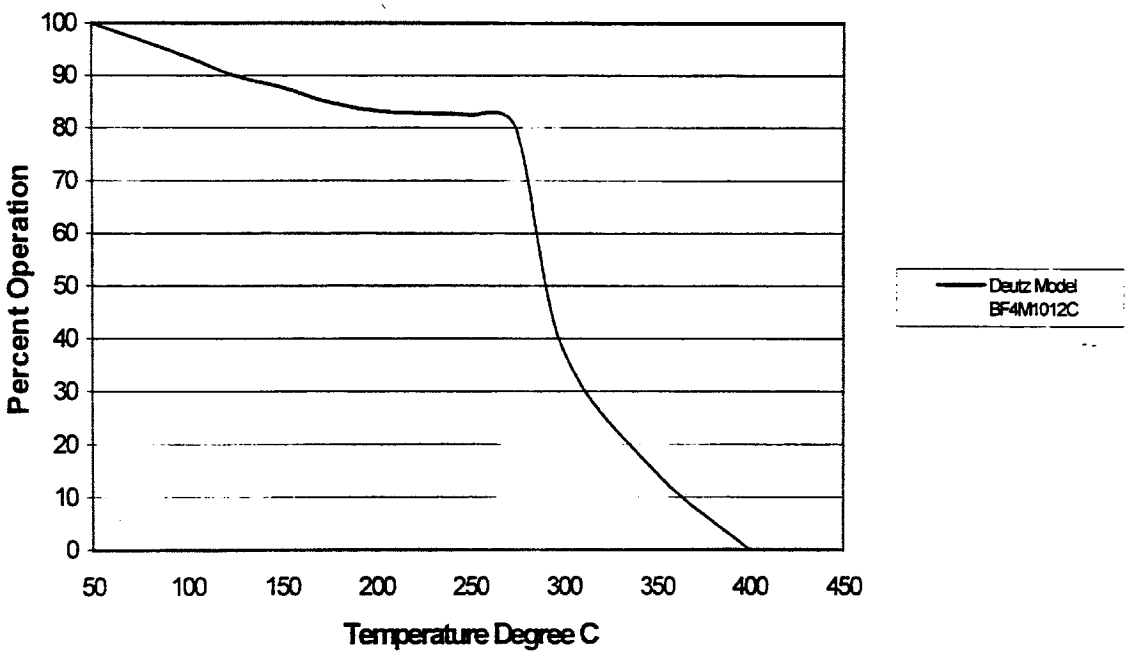


Figure 30: 20004321 Exhaust Temperature Profile
Application: Aggregate Recycler Generator

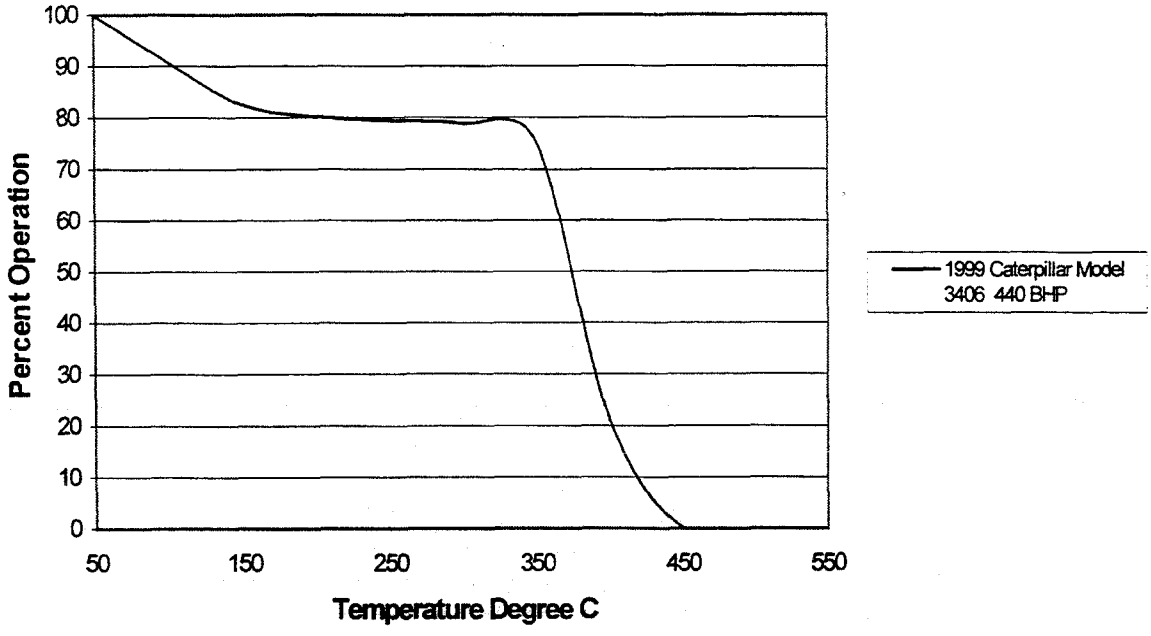


Figure 31: 20022977 Exhaust Temperature Profile
Application: Radial Stacker Generator

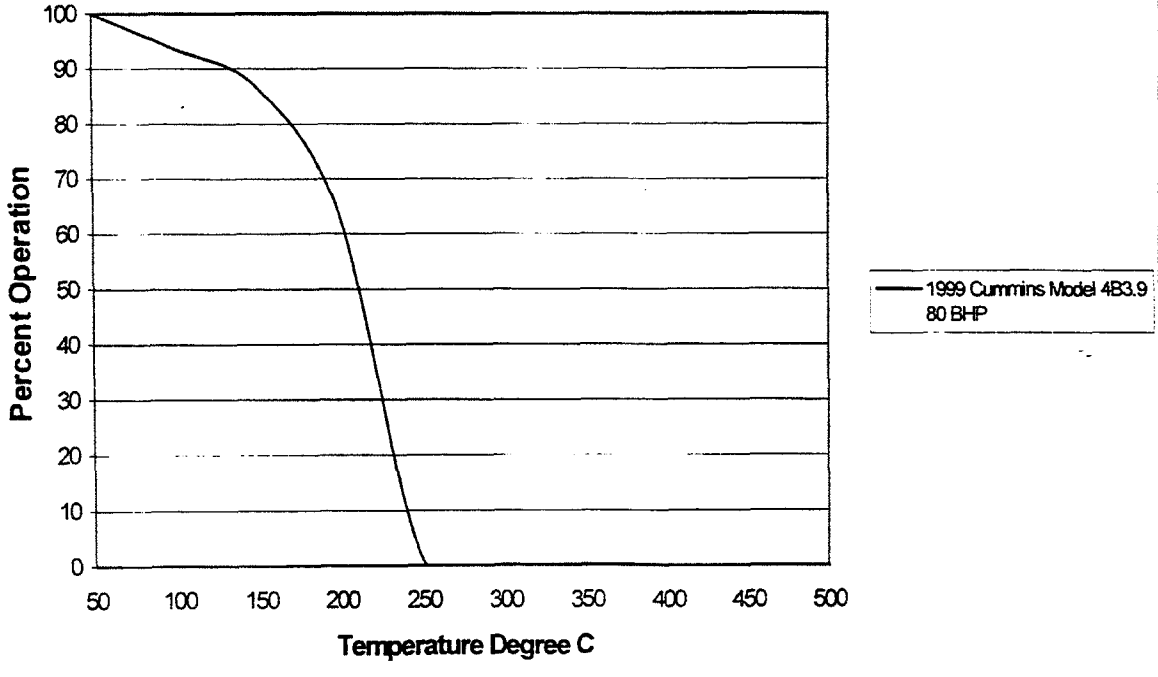


Figure 32: Cecert 43 Exhaust Temperature Profile
Application: R Crusher Generator

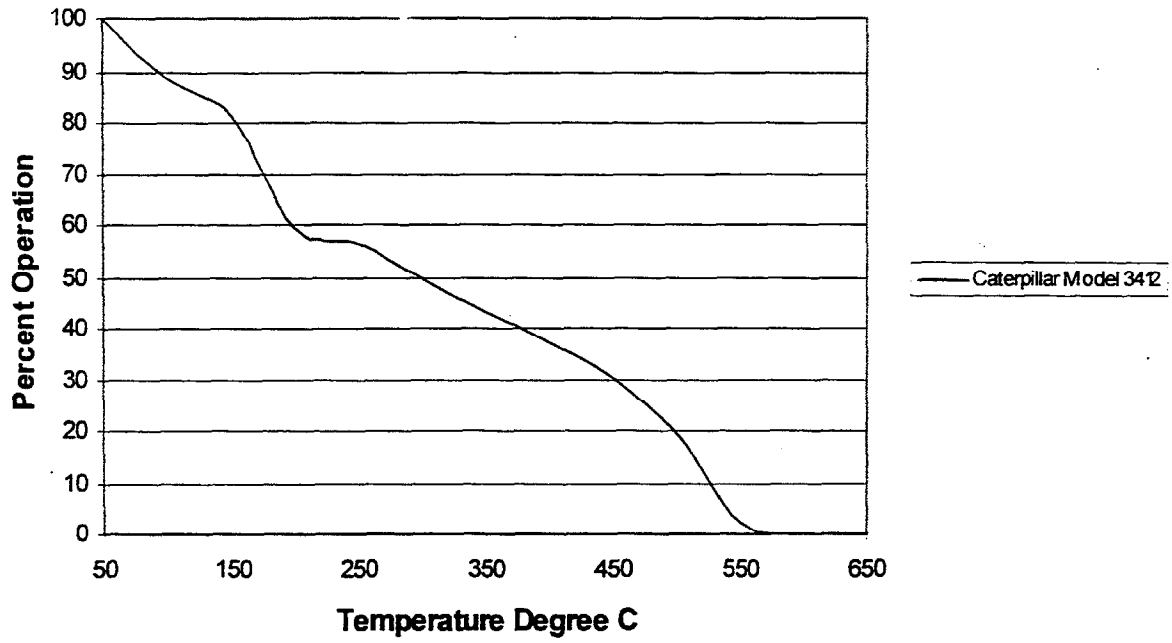


Figure 33: Powerscreen 1800 Exhaust Temperature Profile
Application: Screener Generator

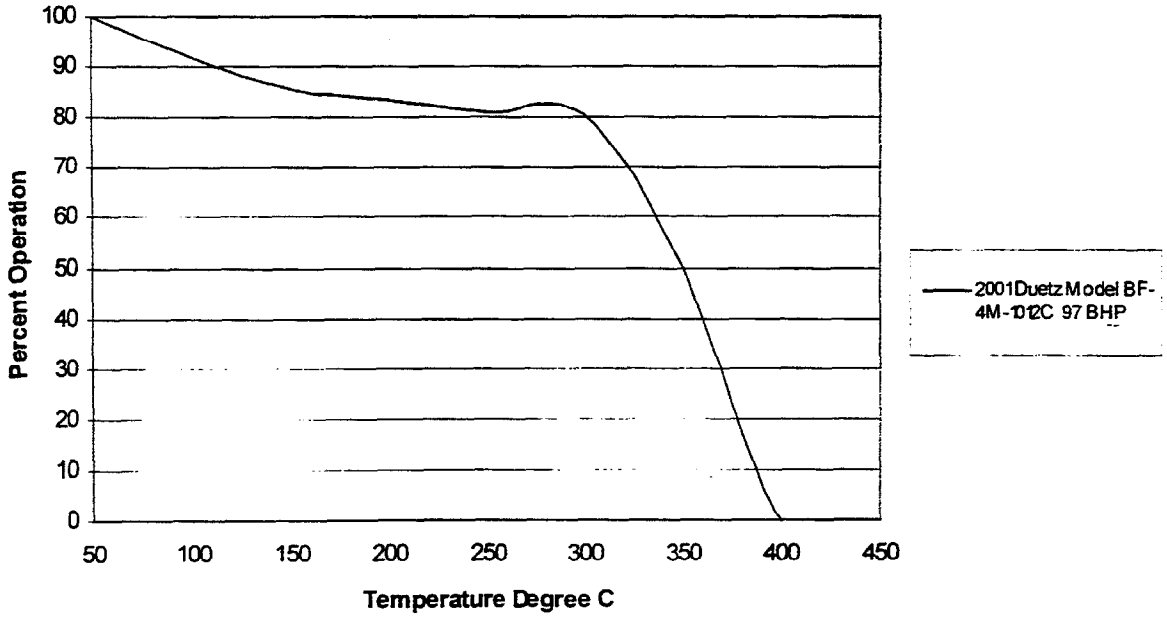


Figure 34: 108739 Engine Exhaust Temperature
Application: Drilling Rig Generator

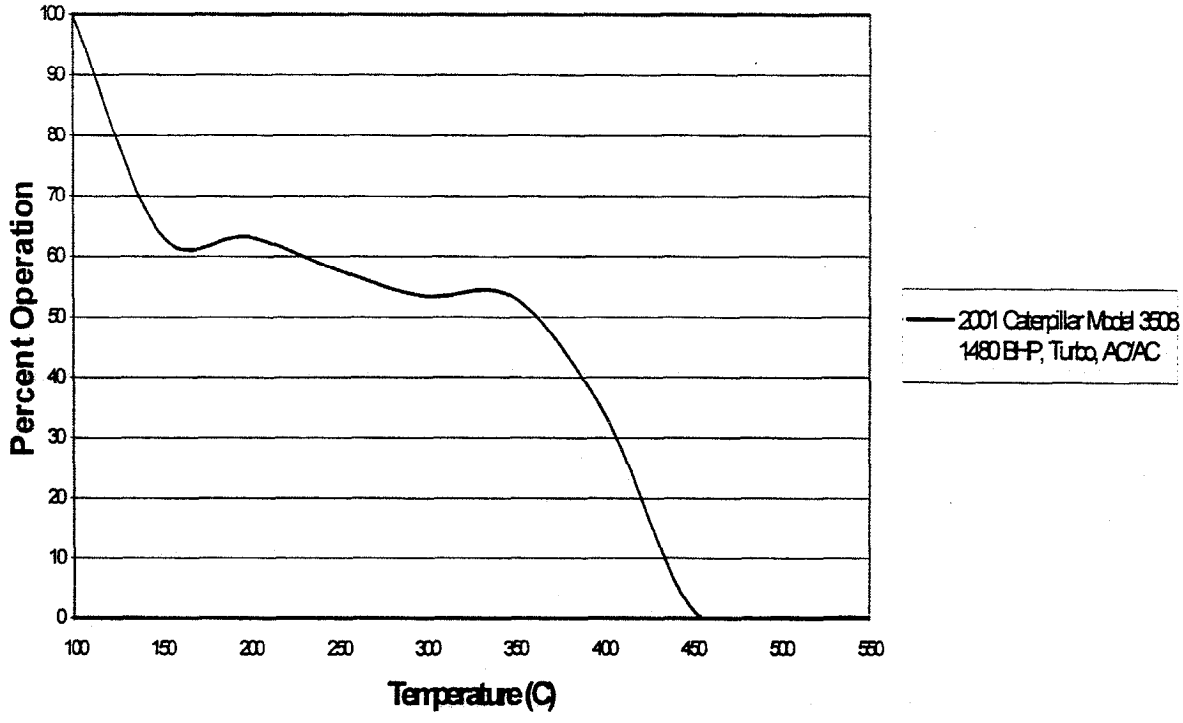
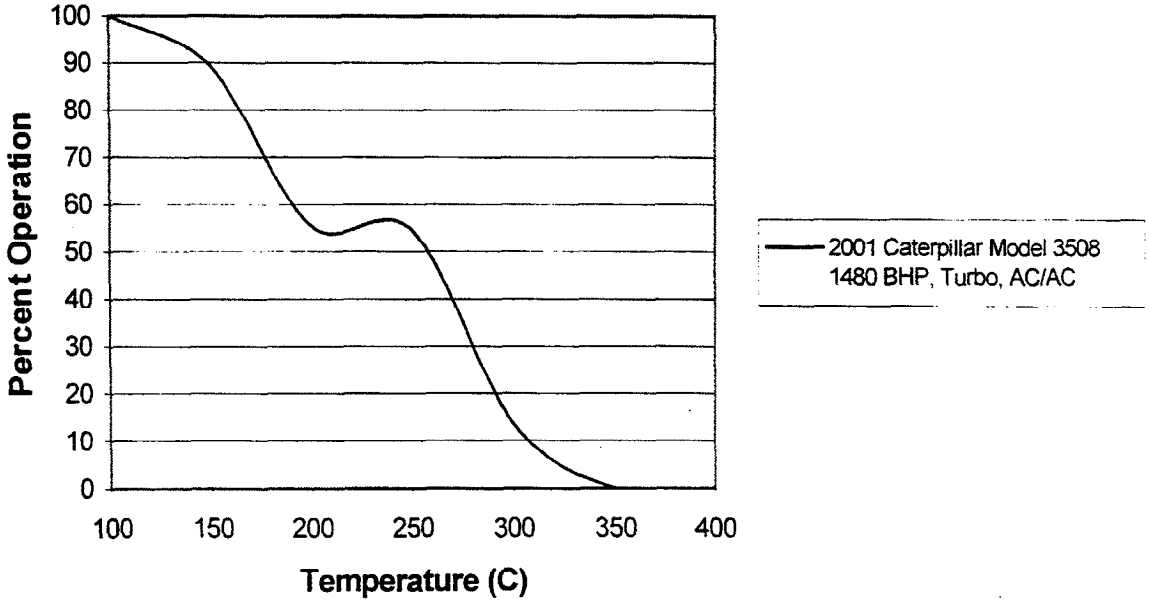


Figure 35: 7810876 Engine Exhaust Temperature Profile
Application: Generator Genrig



Paint Striper Compressor

Figure 36: 0534128 Exhaust Temperature Profile
Application: Paint Striper Compressor

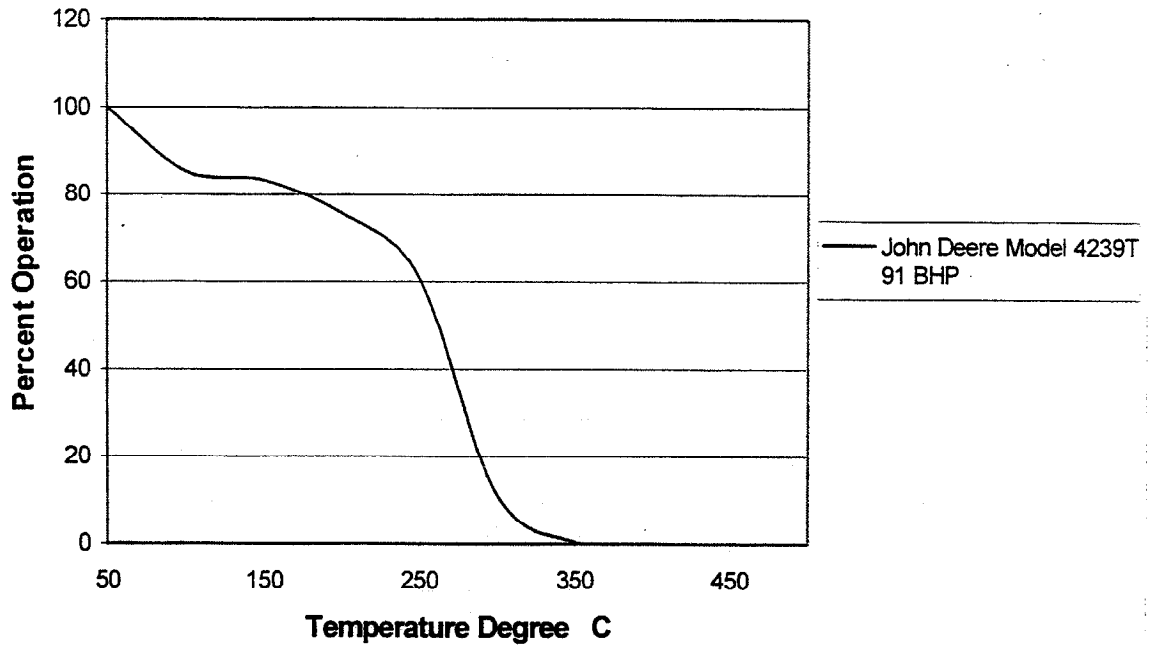
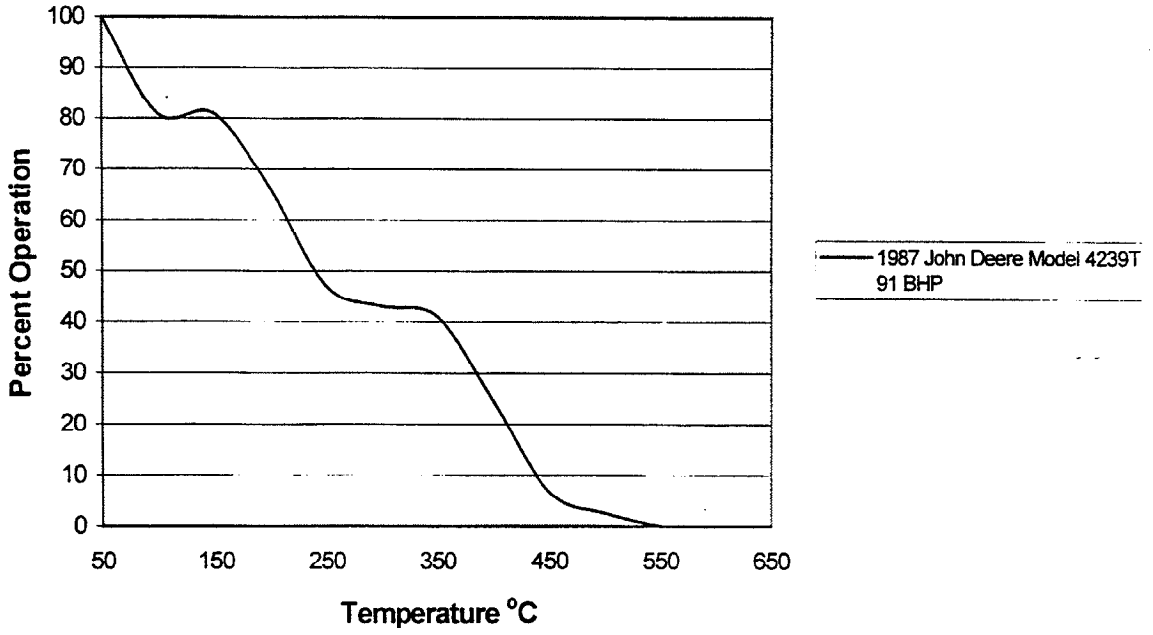


Figure 37: Cecert 1 Exhaust Temperatures Profile
Application: Paint Striper Compressor



1070

Figure 38: Cecert 11 Exhaust Temperature Profile
Application: Paint Striper Compressor

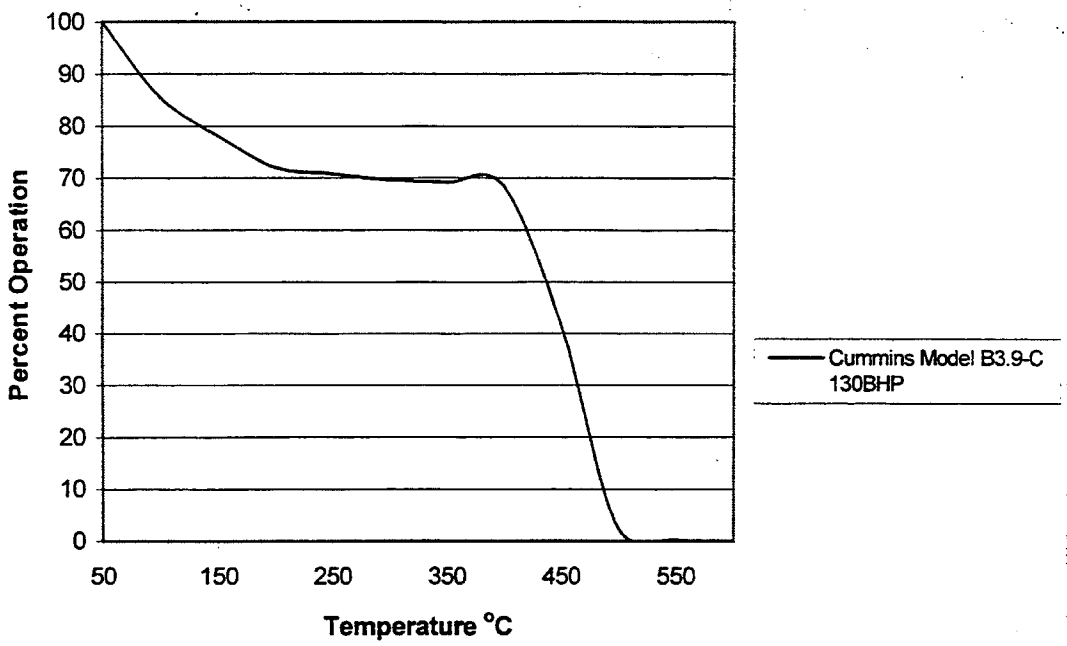


Figure 39: Cecert 22 Exhaust Temperature Profile
Application: Paint Striper Compressor

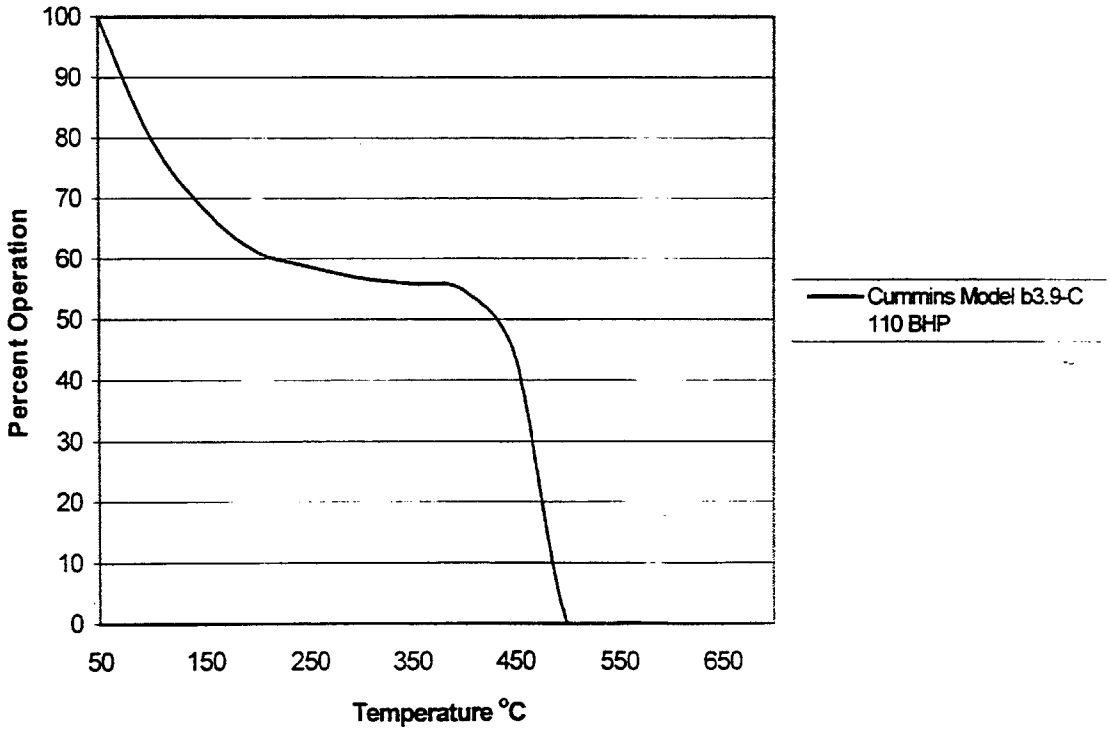


Figure 40: Cecert 3 Exhaust Temperature Profile
Application: Paint Striper Compressor

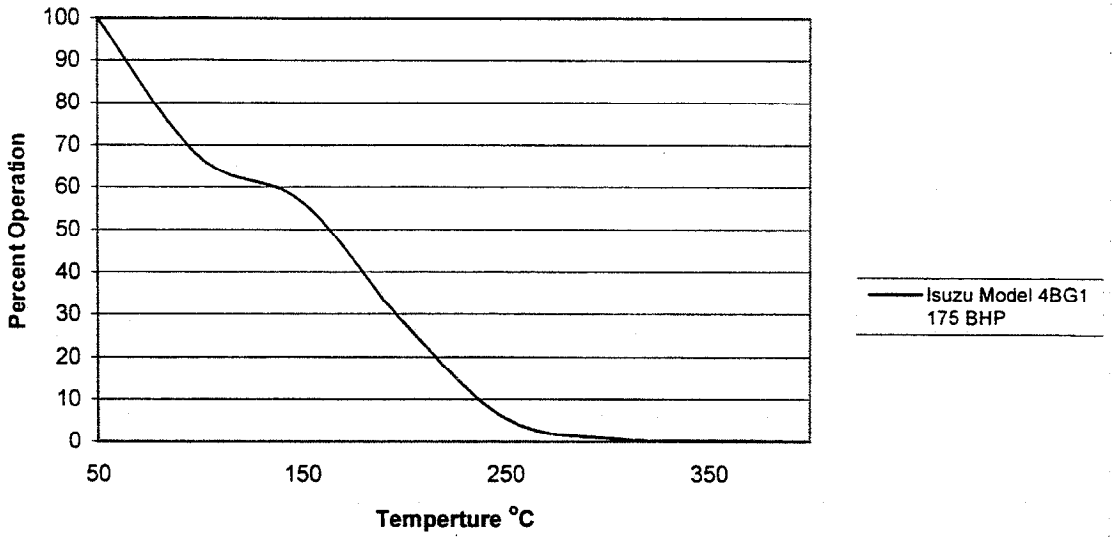
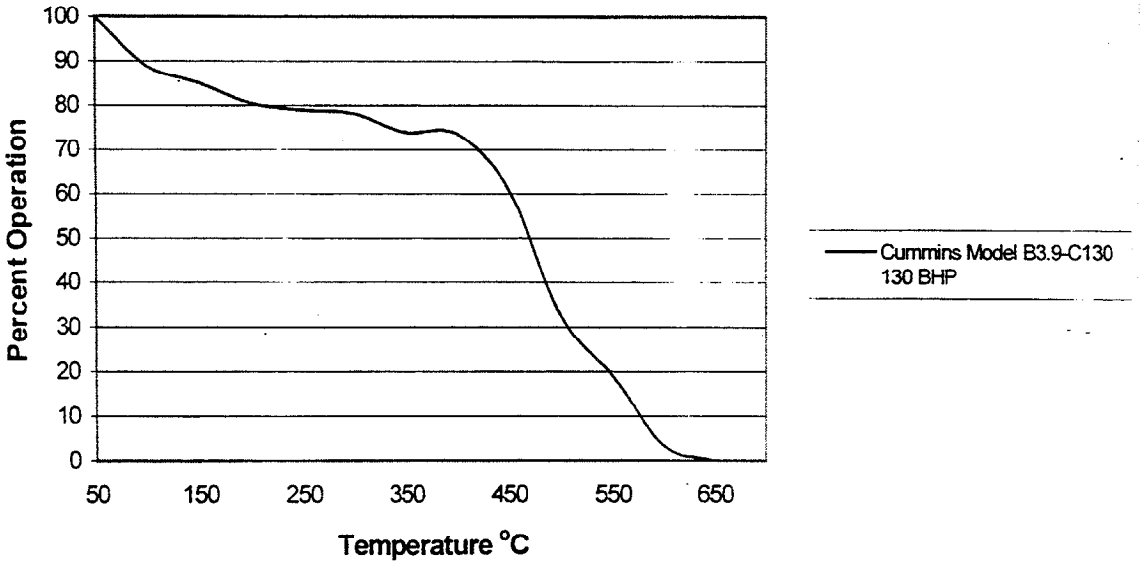


Figure 41: Cecert 4 Exhaust Temperature Profile
Application: Paint Striper Compressor



Compressors

Figure 42: Cecert 15 Exhaust Temperature Profile
Application: Compressor

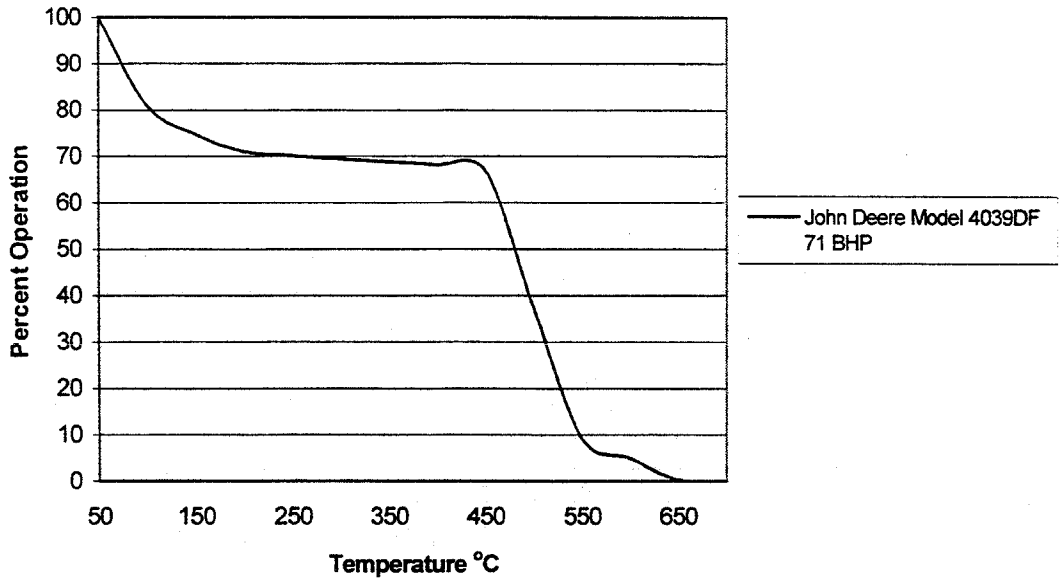


Figure 43: Cecert 2 Exhaust Temperature Profile
Application: Post Hole Digger Compressor

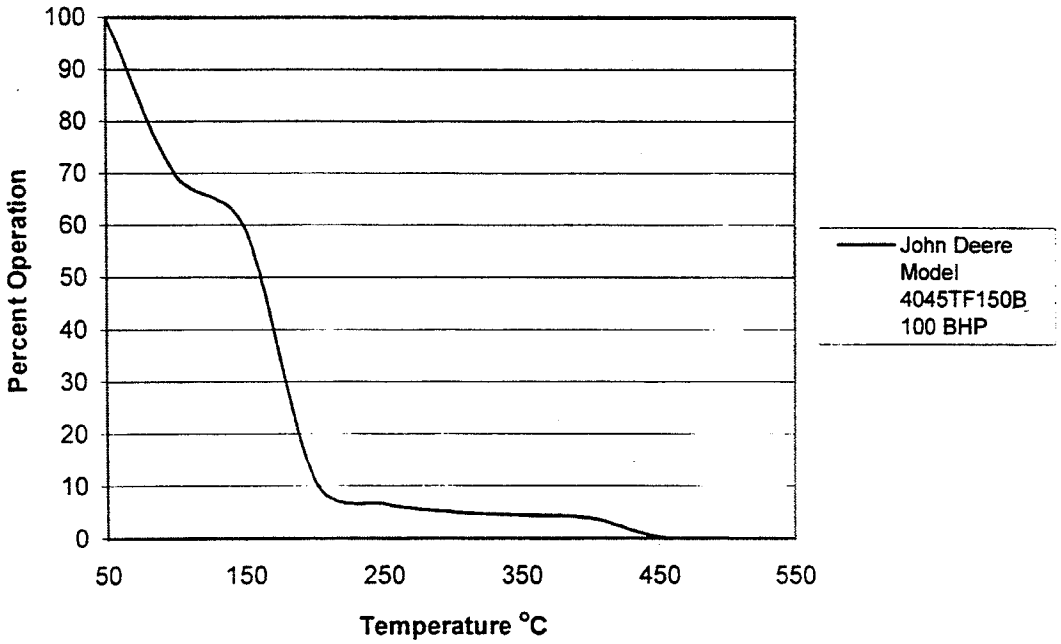


Figure 44: Cecert 25 Exhaust Temperatur Profile
Application: Compressor

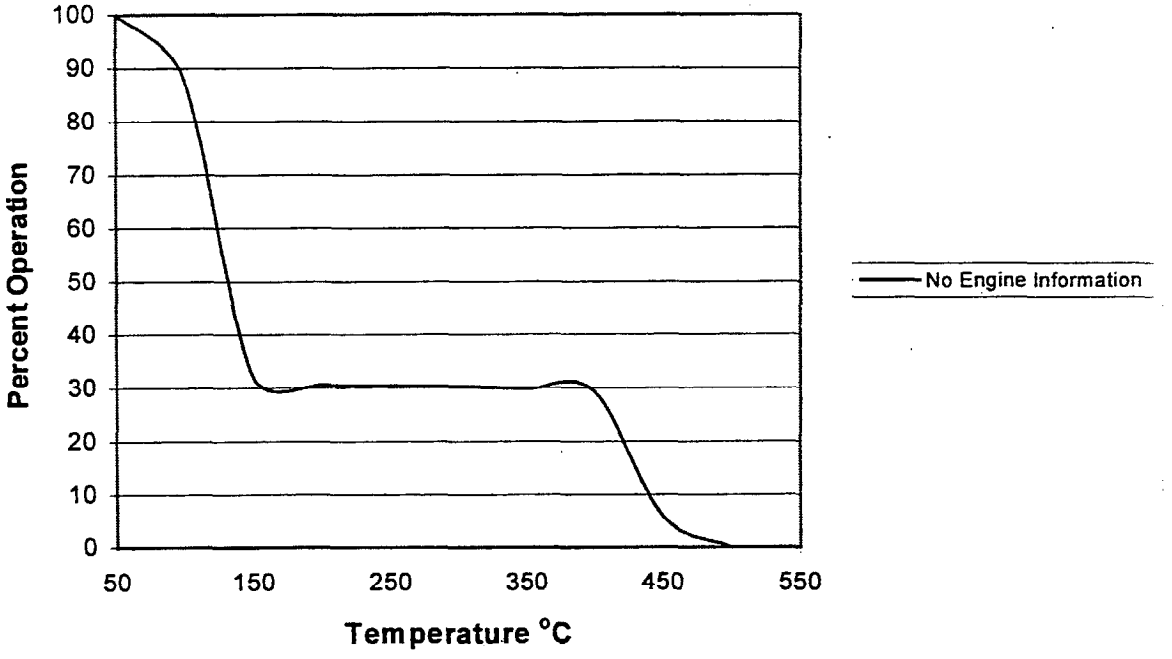


Figure 45: 2714006 Exhaust Temperature Profile
Application: Compressor

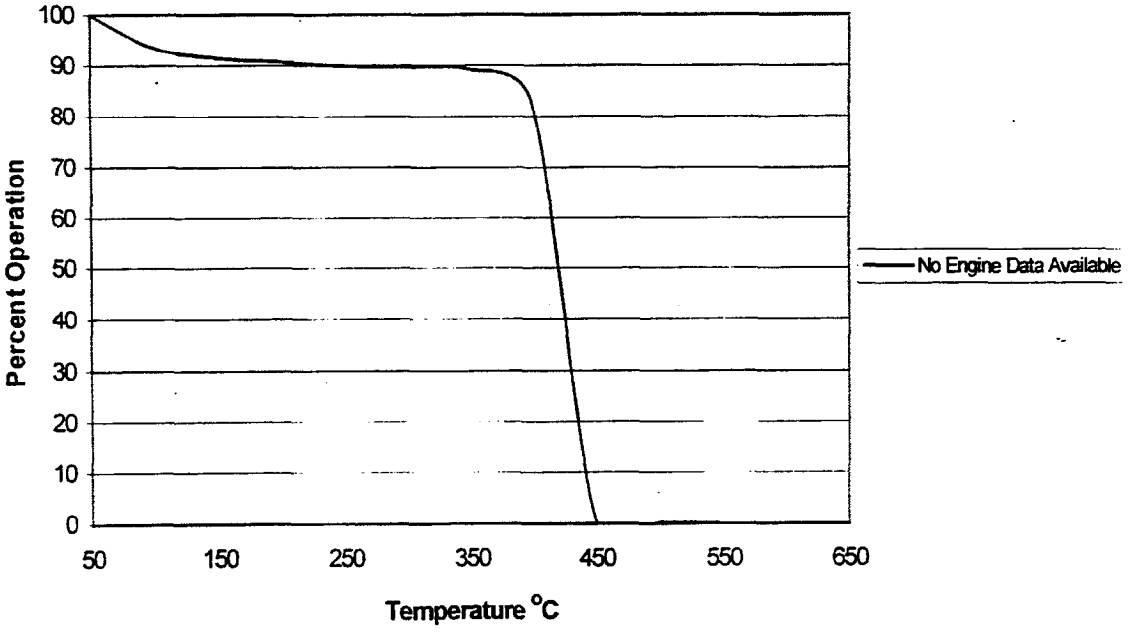


Figure 46: 2715368 Exhaust Temperature Profile
Application: Compressor

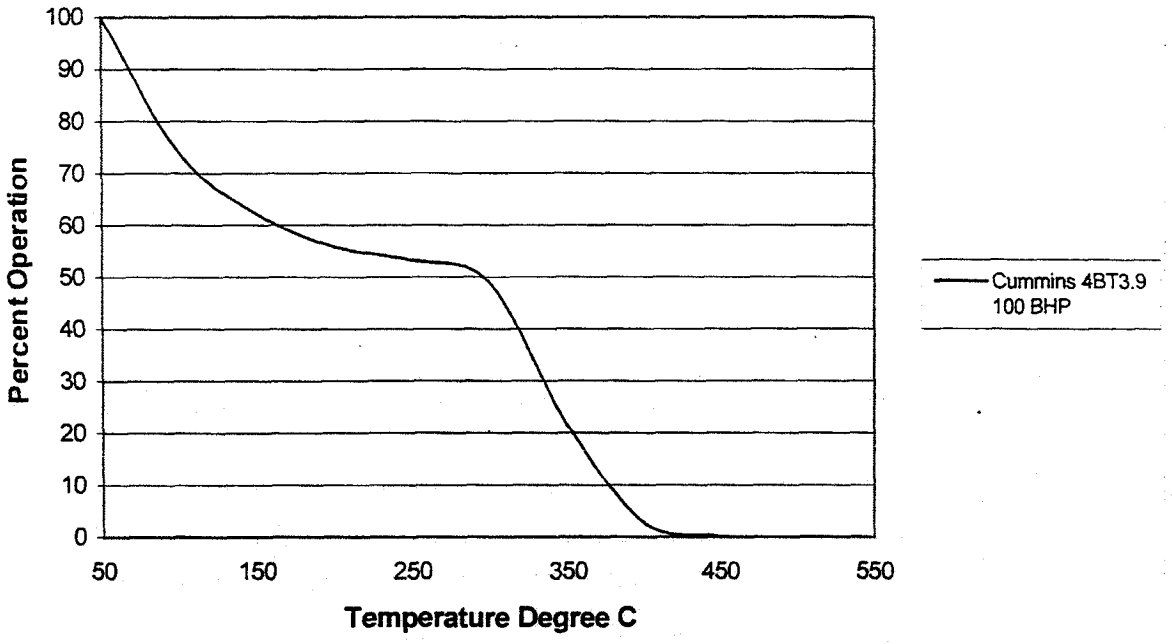


Figure 47: 2716020 Exhaust Temperature Profile
Application: Compressor

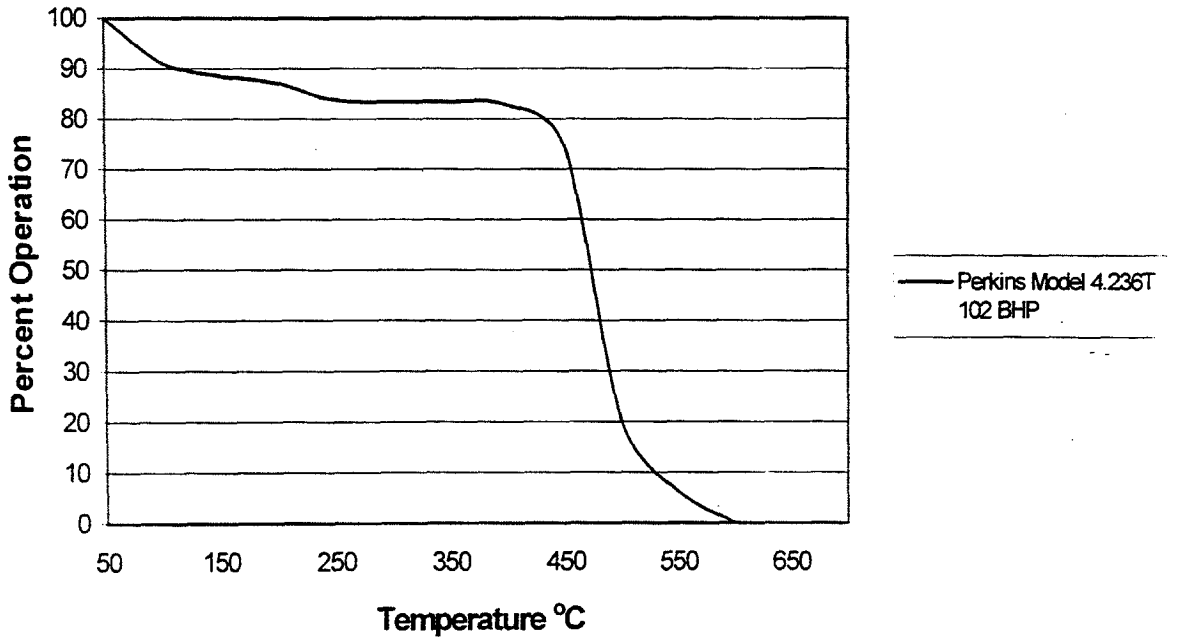


Figure 48: Cecert 45 Exhaust Temperature Profile
Application: Compressor

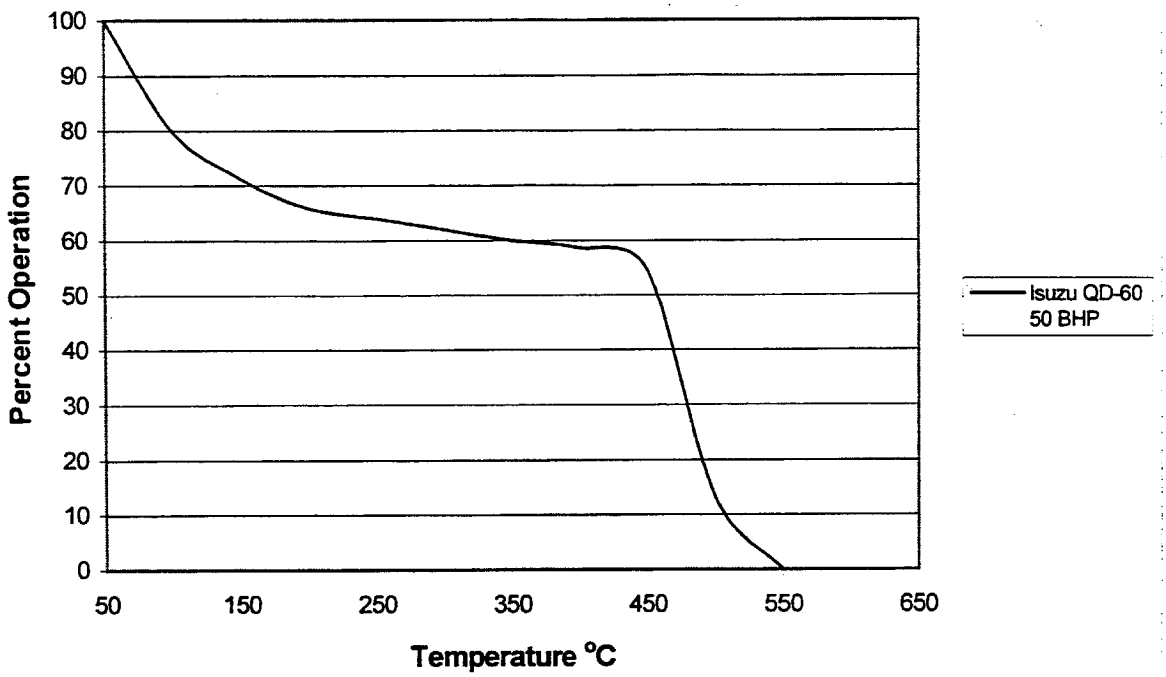


Figure 49: Cecert 8 Exhaust Temperature Profile
Application: Compressor

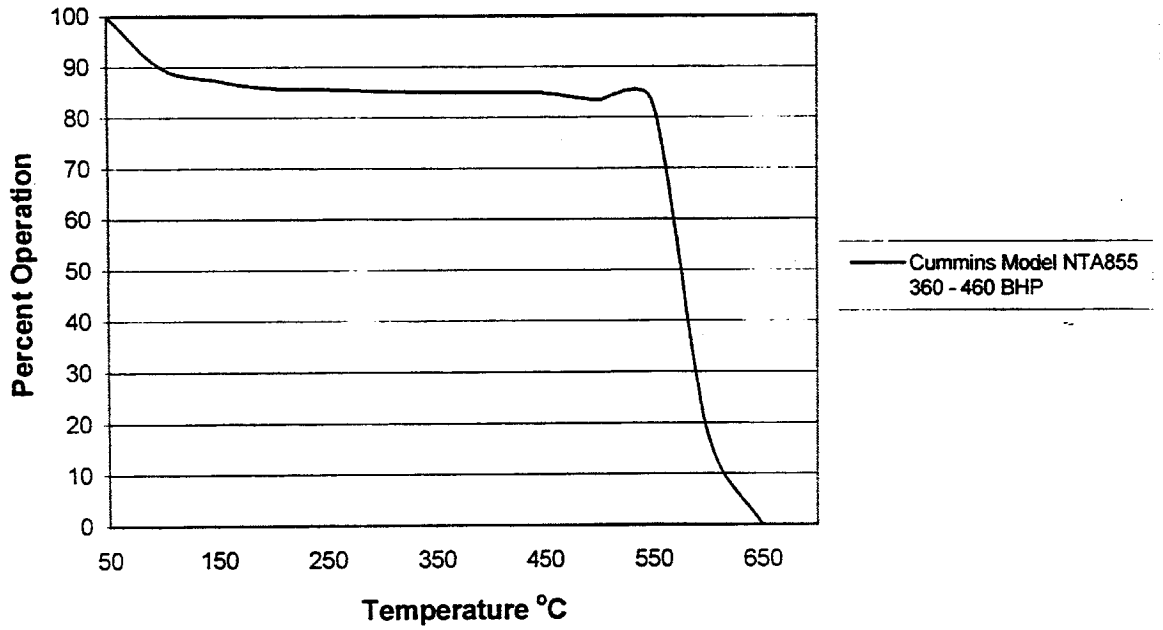
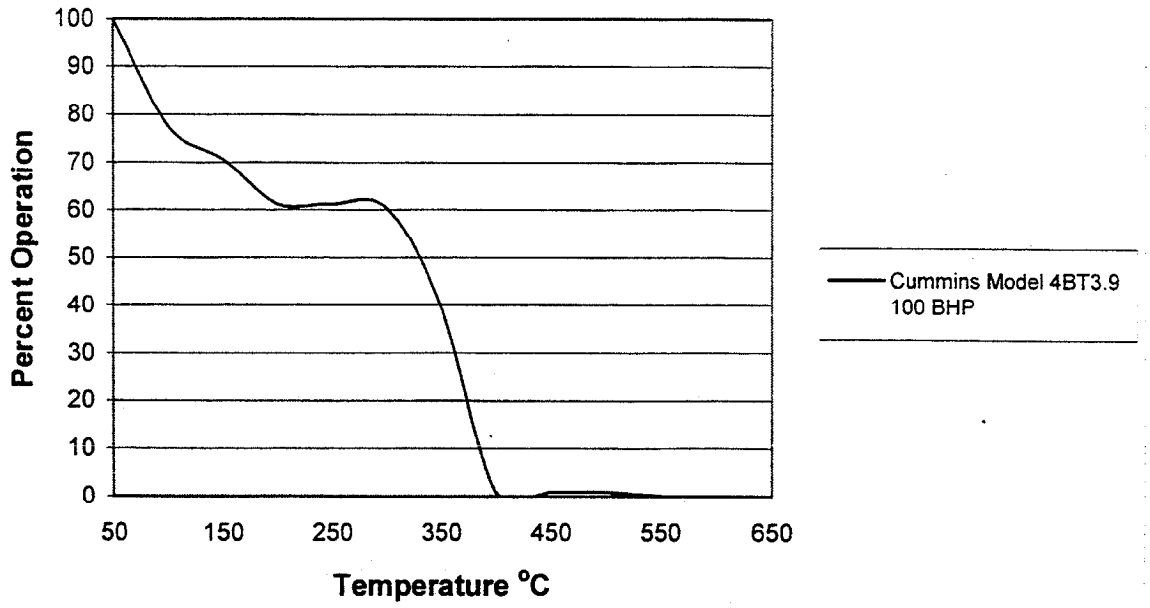


Figure 50: Cecert 9 Exhaust Temperature Profile
Application: Compressor



Pumps

Figure 51: 107393 Exhaust Temperature Profile
Application: Water Pump

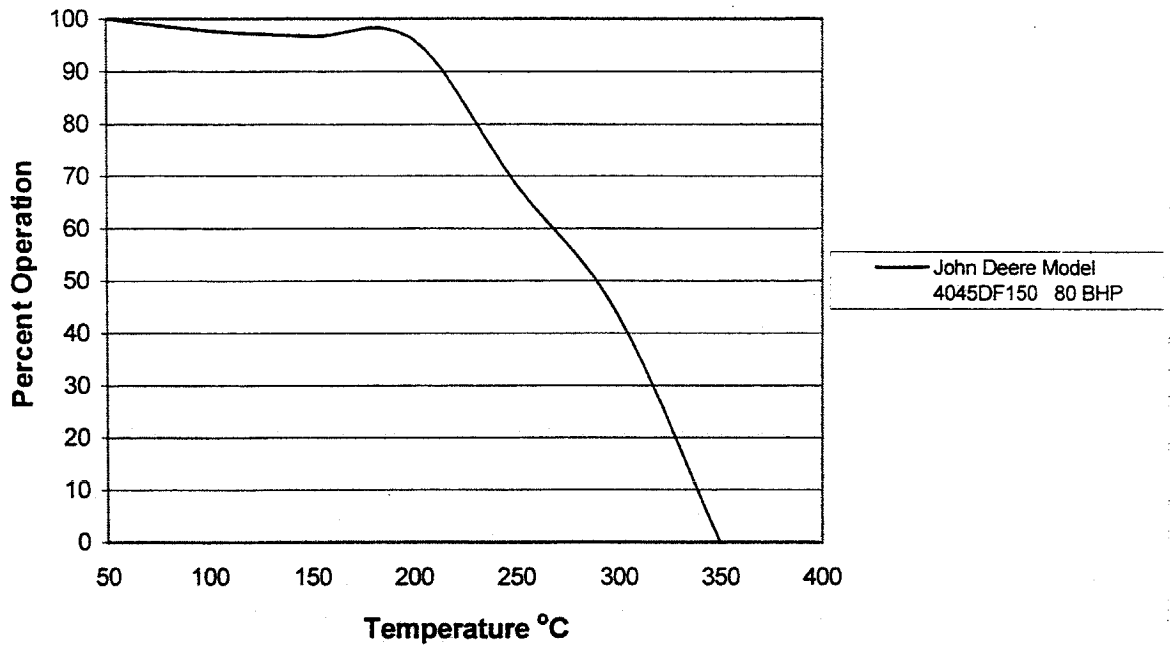


Figure 52: Cecert 19 Exhaust Temperature Profile
Appication: Water Pump

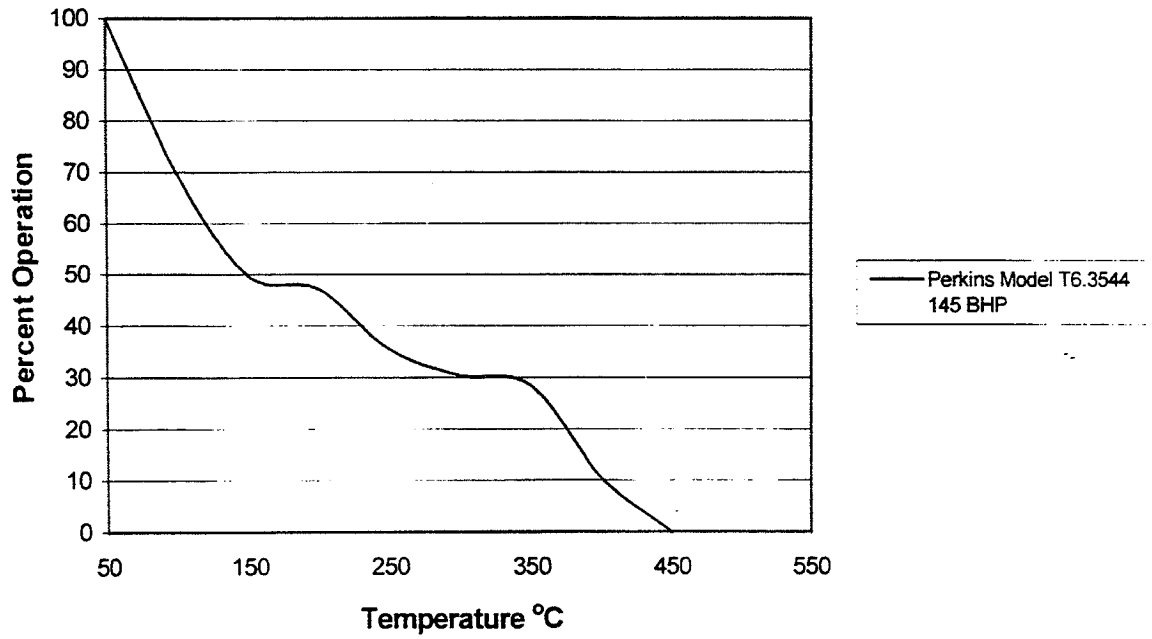


Figure 53: Cecert 20 Exhaust Temperature Profile
Application: Water Pump

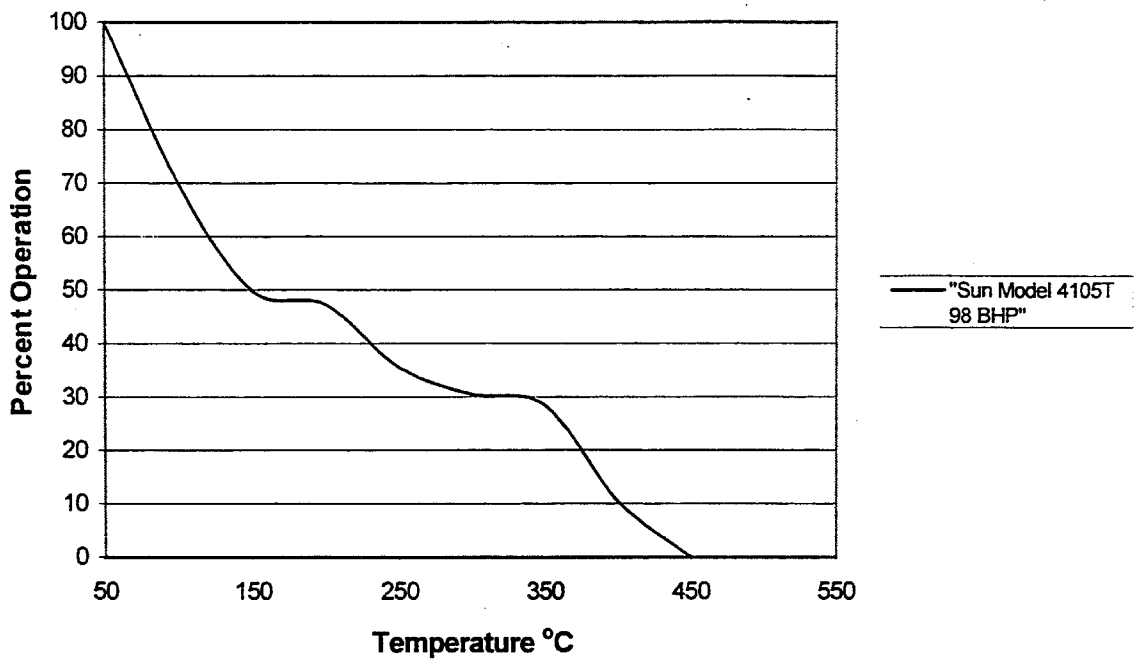


Figure 54: Cecert 21 Exhaust Temperature Profile
Application: Water Pump

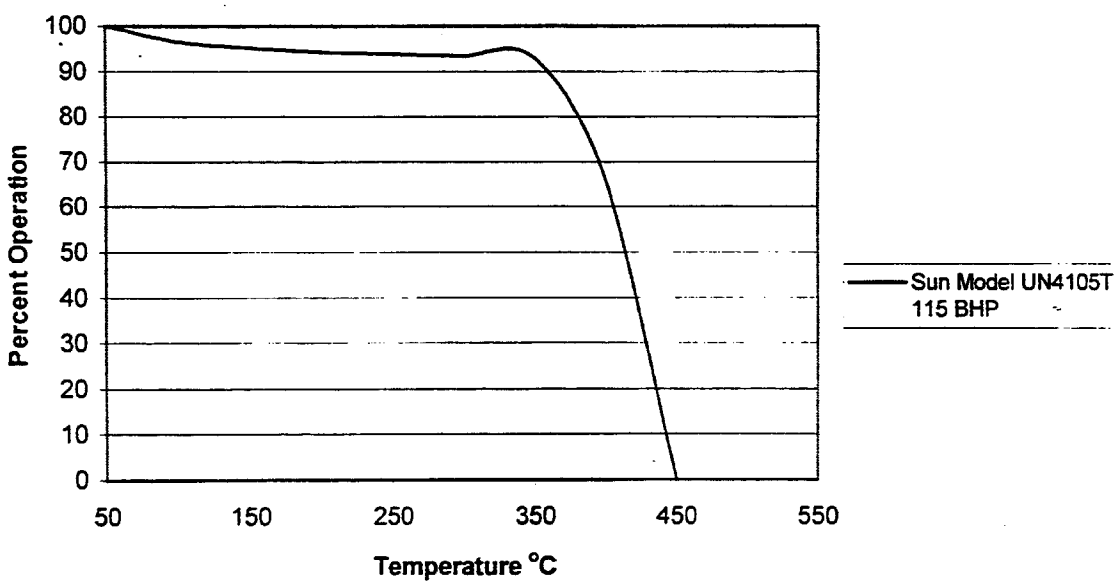


Figure 55: Cecert 31 Exhaust Temperature Profile
Application: Water Pump

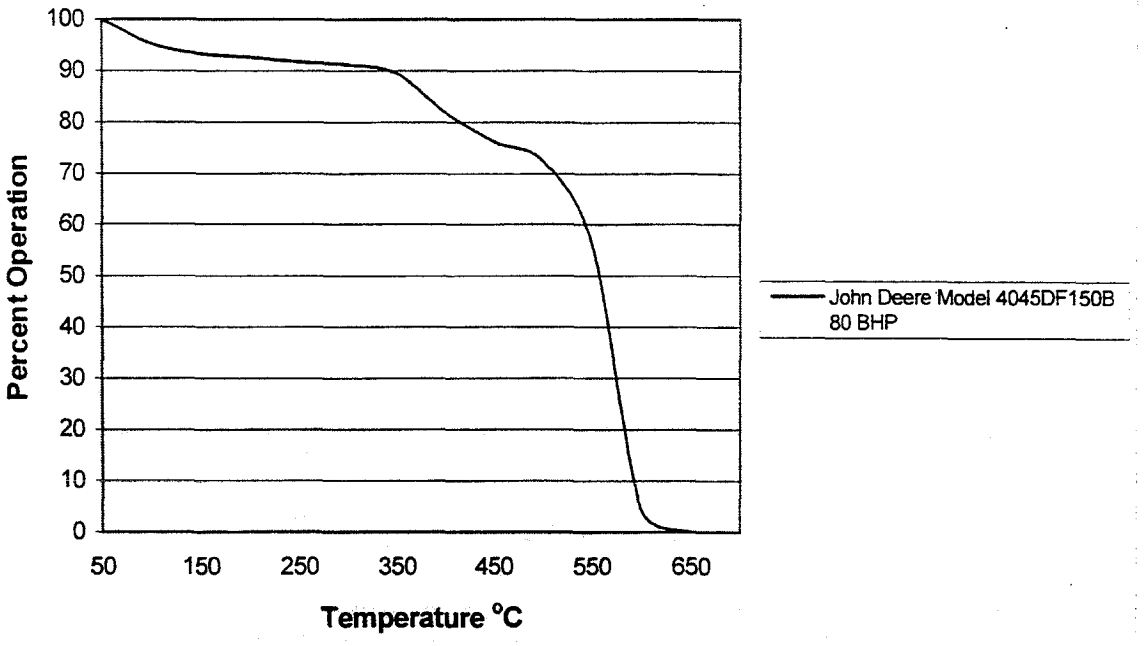


Figure 56: Cecert 47 Exhaust Temperature Profile
Application: Production Pump

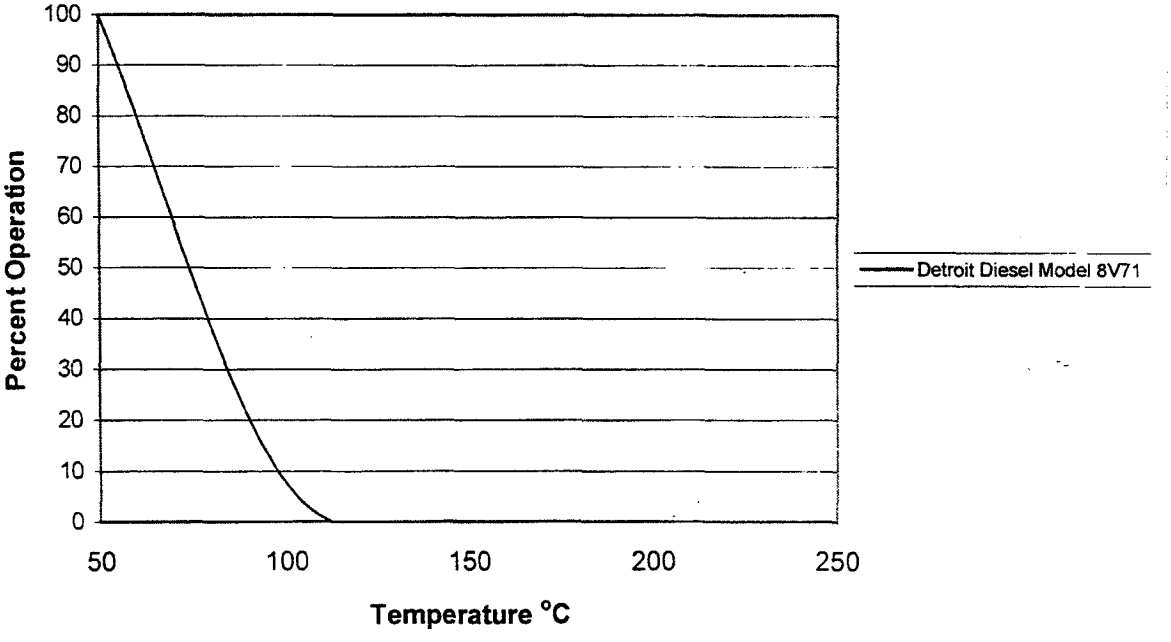


Figure 57: R38 Exhaust Temperature Profile
Application: Drilling Rig Pump

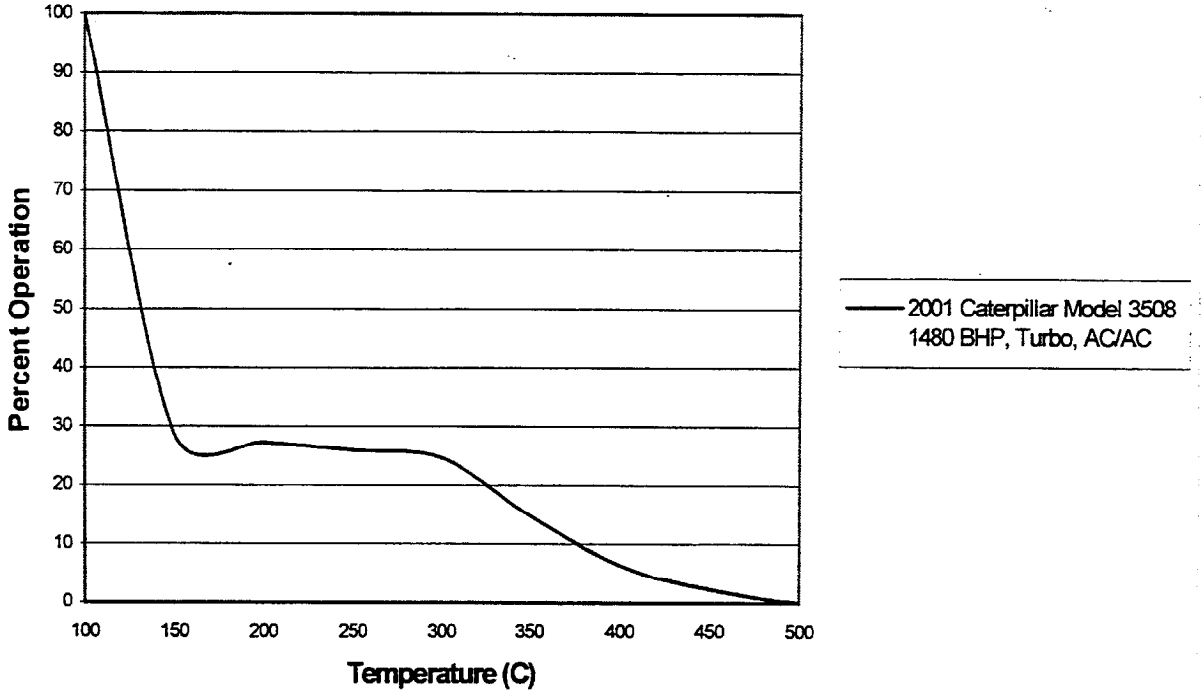


Figure 58: R38 Exhaust Temperature Profile
Application: Drilling Rig Pump

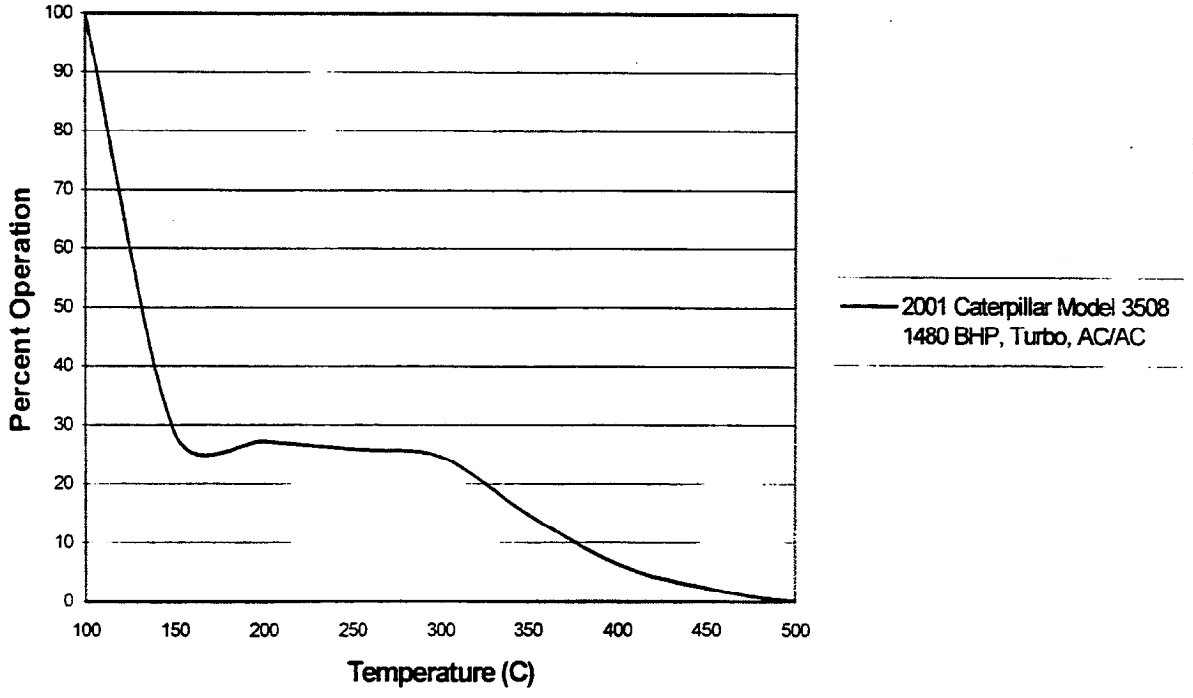


Figure 59: R38 Exhaust Temperature Profile
Application: Drilling Rig Pump

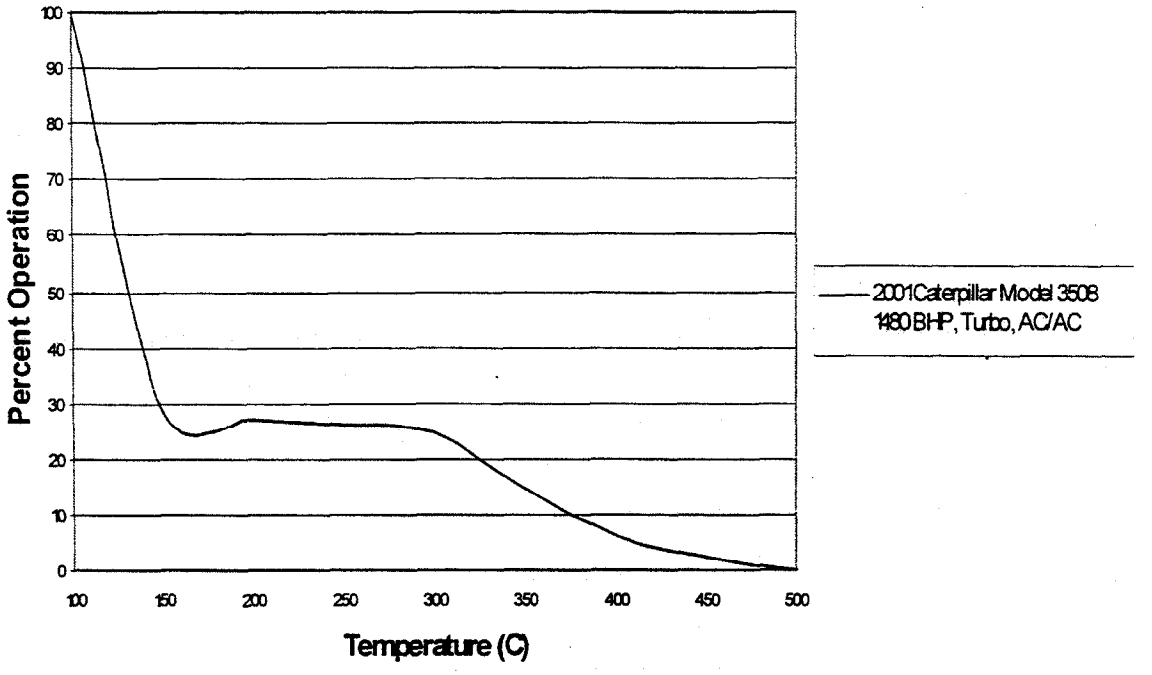
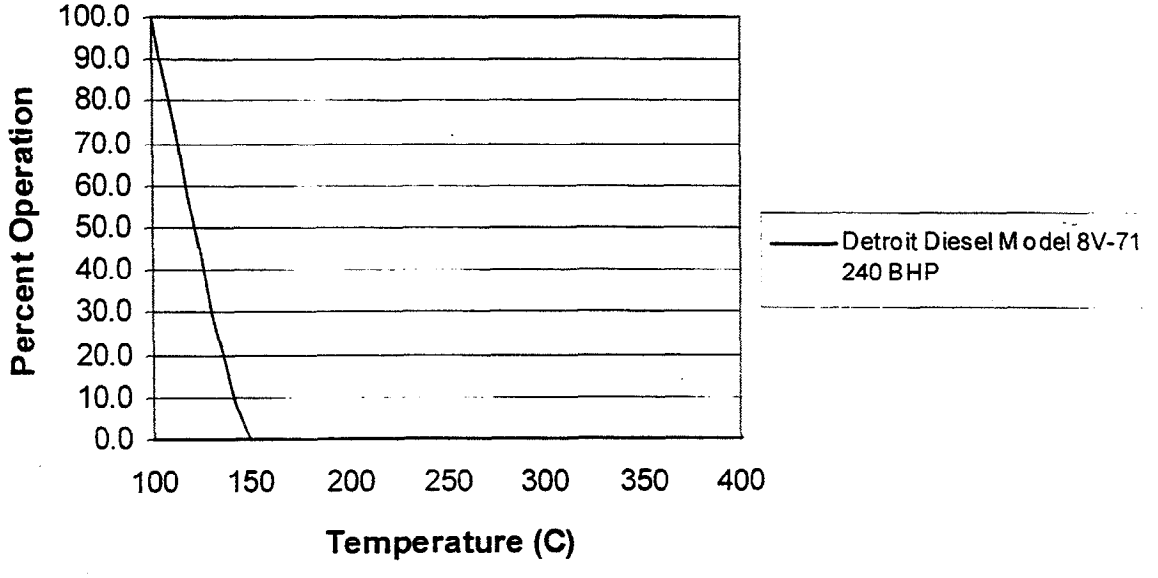


Figure 60: 108758 Engine Exhaust Temperature
Application: Drilling Pump



Grinders

Figure 61: 116369 Exhaust Temperature Profile
Application: Horizontal Grinder

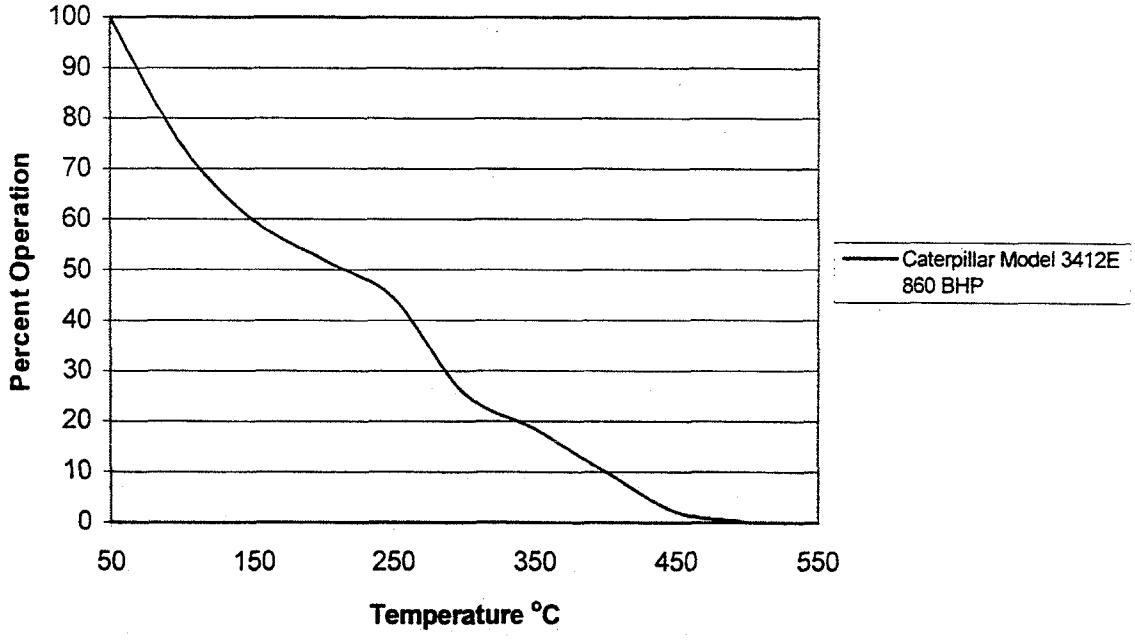
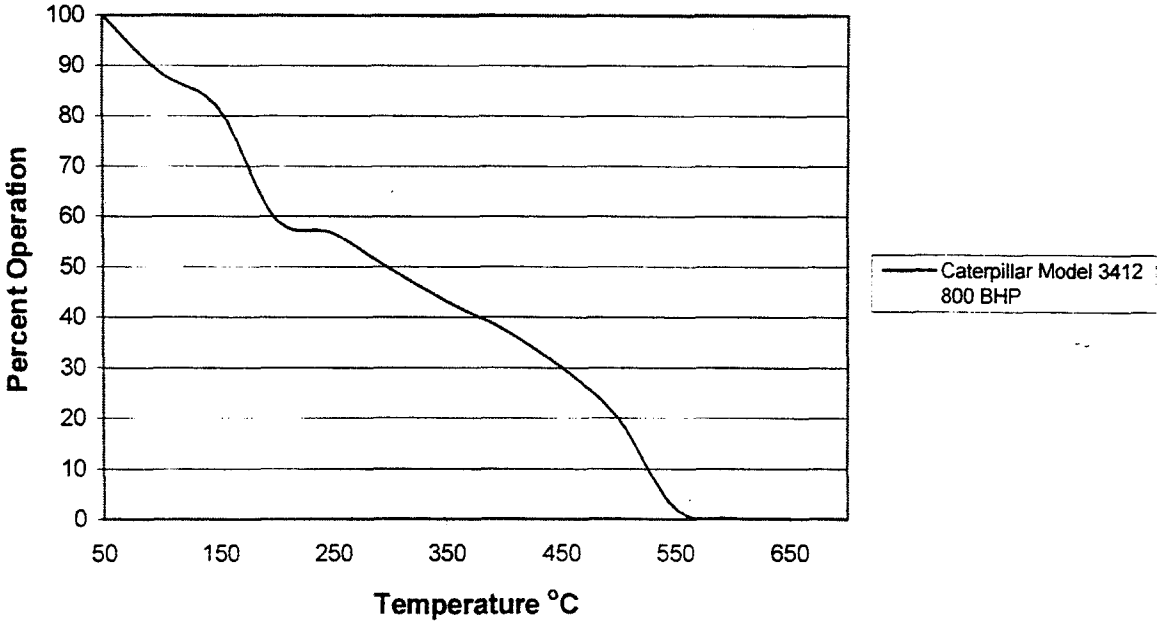


Figure 62: Cecert 41 Exhaust Temperature Profile
Application: Grinder



Grader/Shovels

Figure 63: Cecert 35 Exhaust Temperature Profile
Application: Grader Shovel

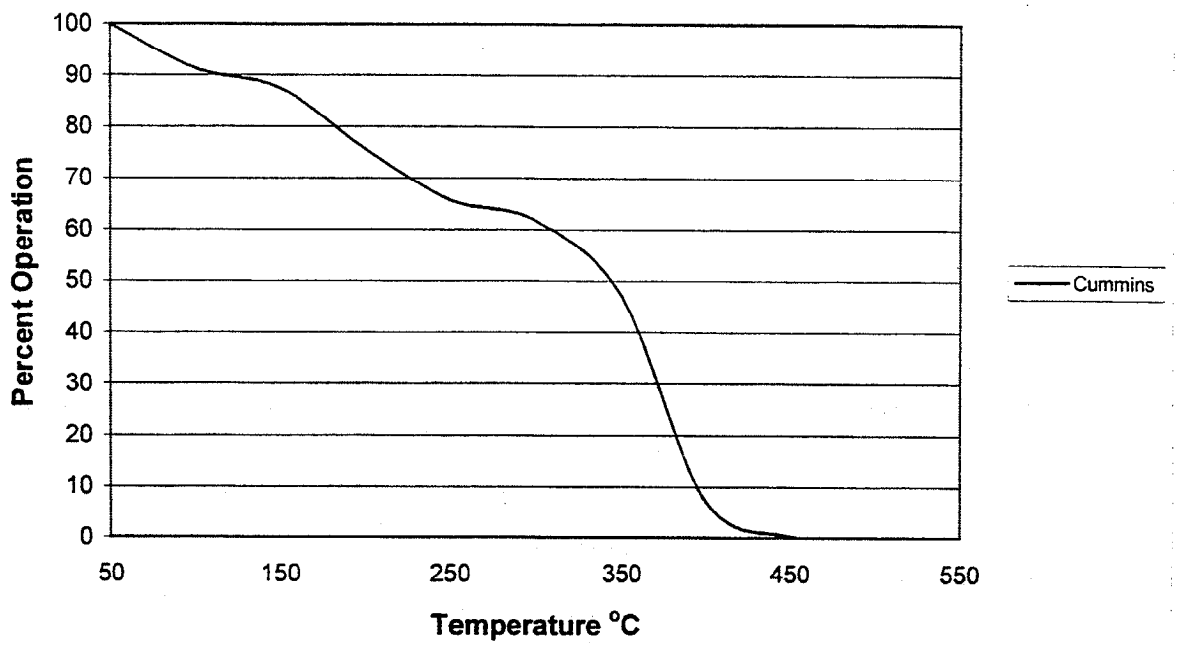
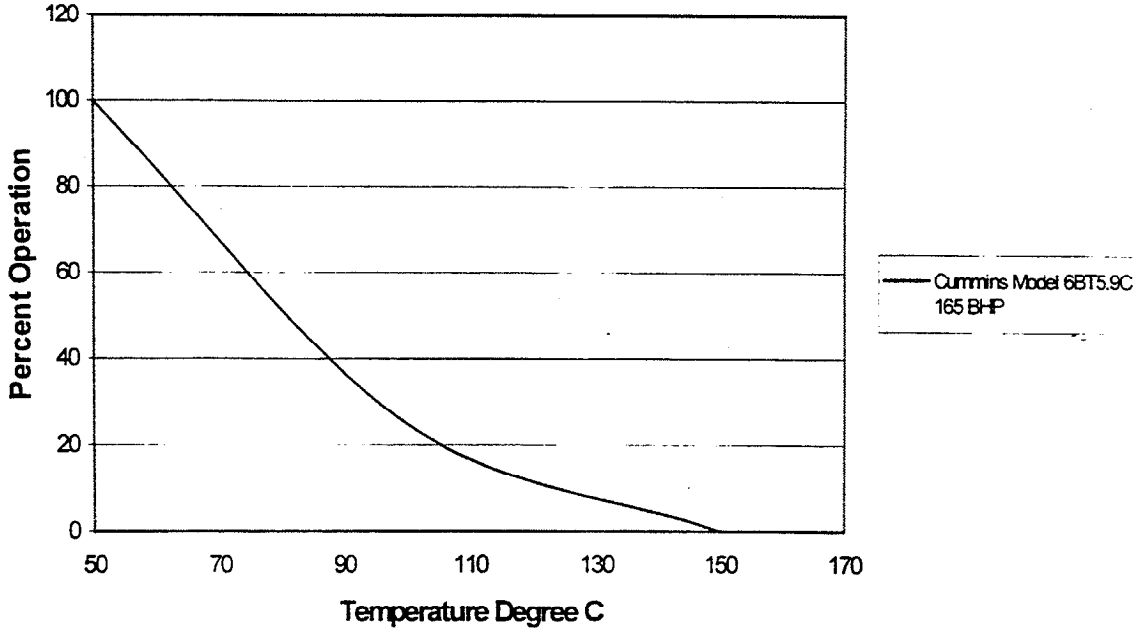
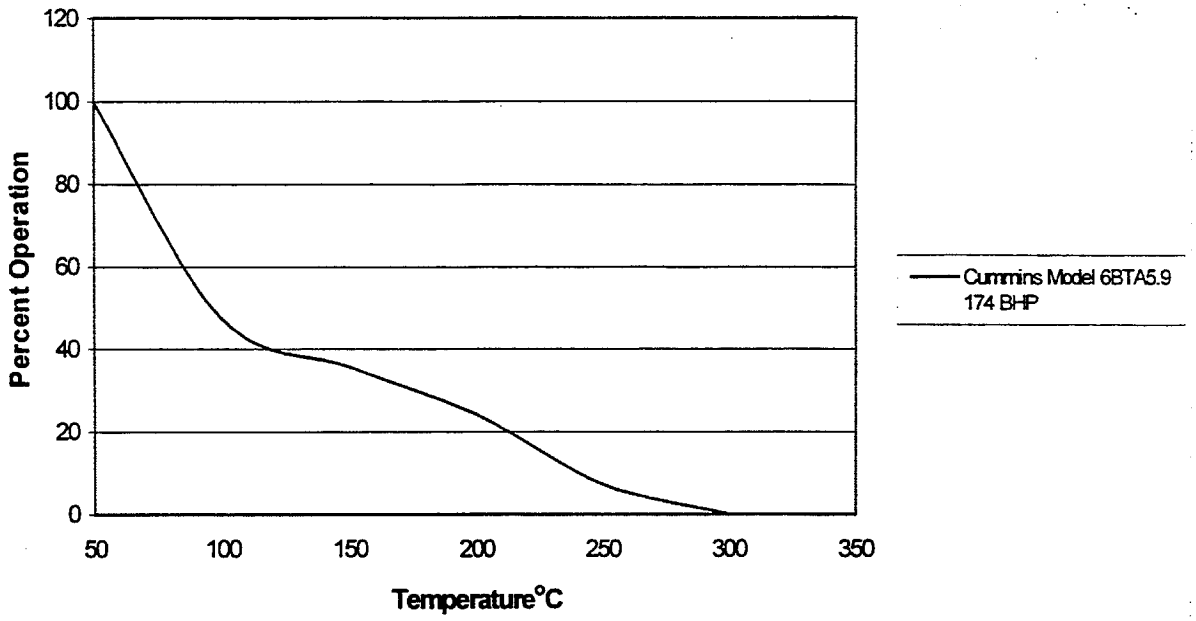


Figure 64: Cecert 40 Exhaust Temperature Profile
Application: Grader



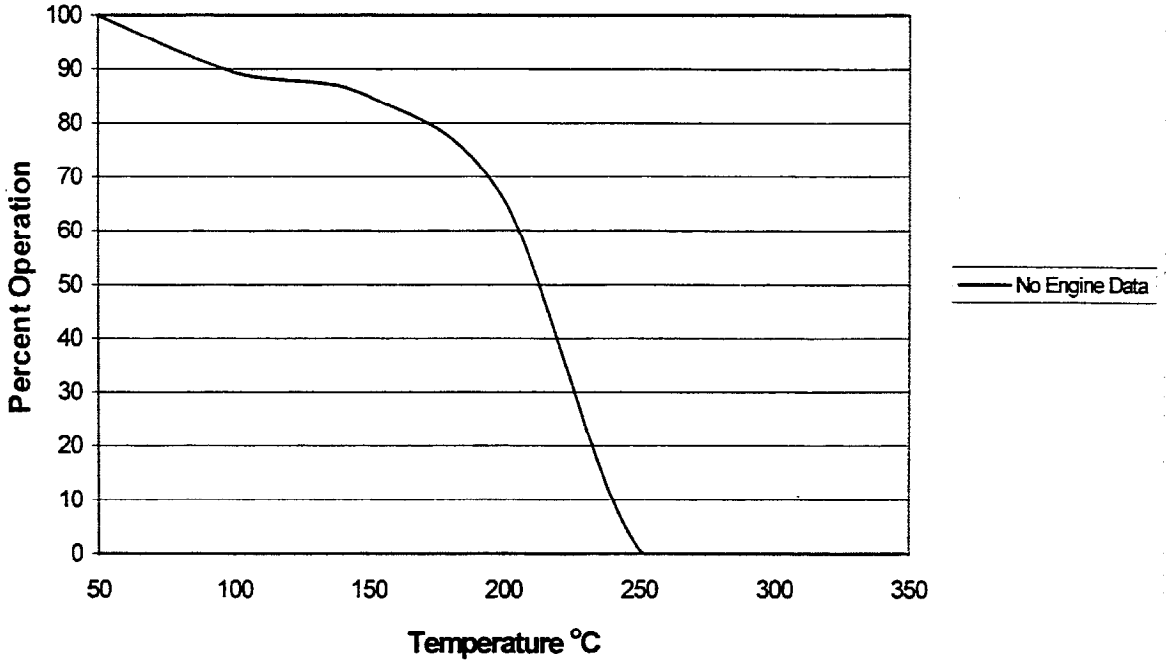
1088

Figure 65: Cecert 6 Exhaust Temperature Profile
Application: Shovel



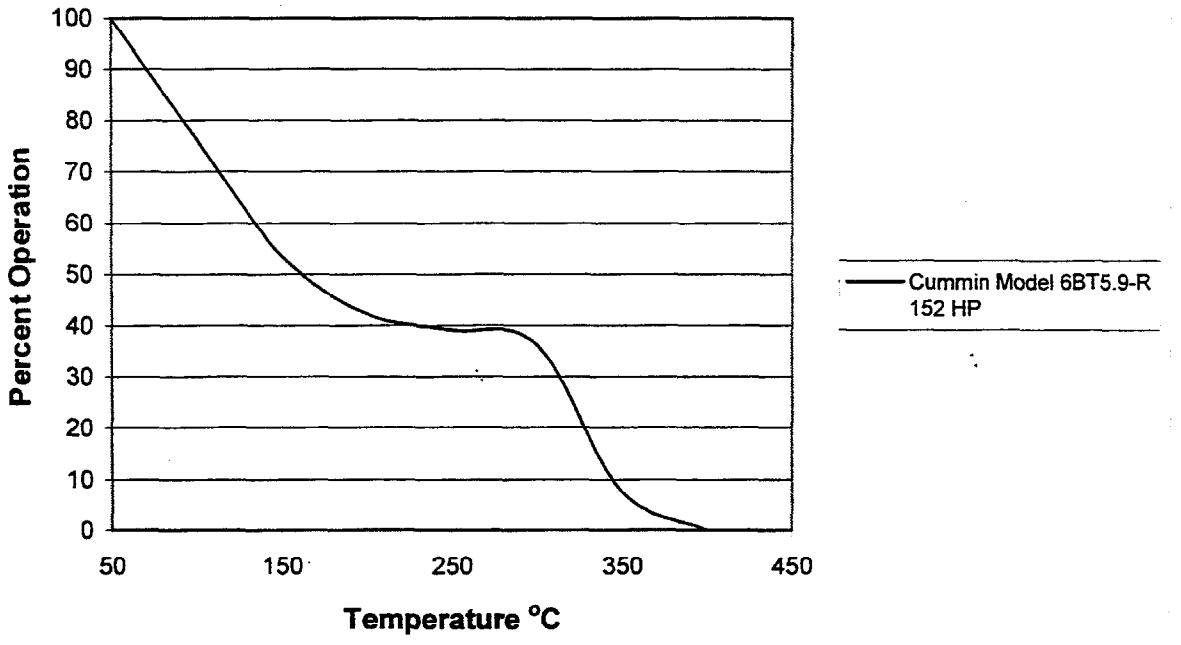
Welder

Figure 66: Cecert 44 Exhaust Temperature Profile
Application: Welder



Crane

Figure 67: Cecert 39 Exhaust Temperature Profile
Application: Crane



Jet Washers

Figure 68: Cecert 46 Exhaust Temperature Profile
Application: Drilling Jet Washer

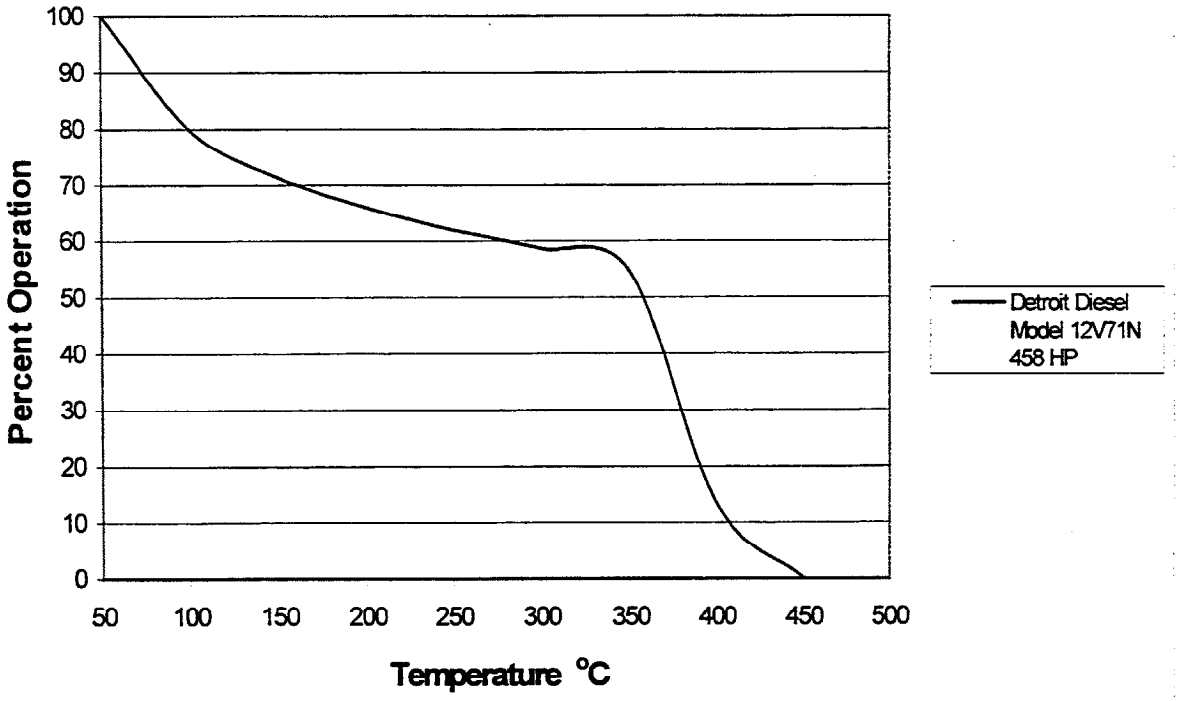


Figure 69: 107824 Engine Exhaust Temperature Profile
Application: Jet Washer

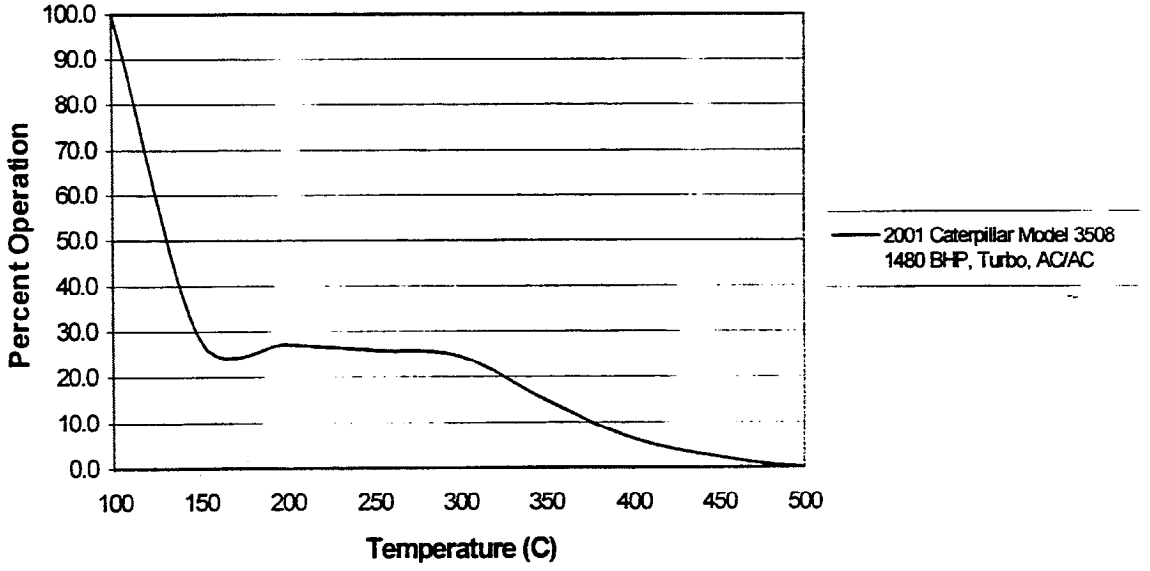
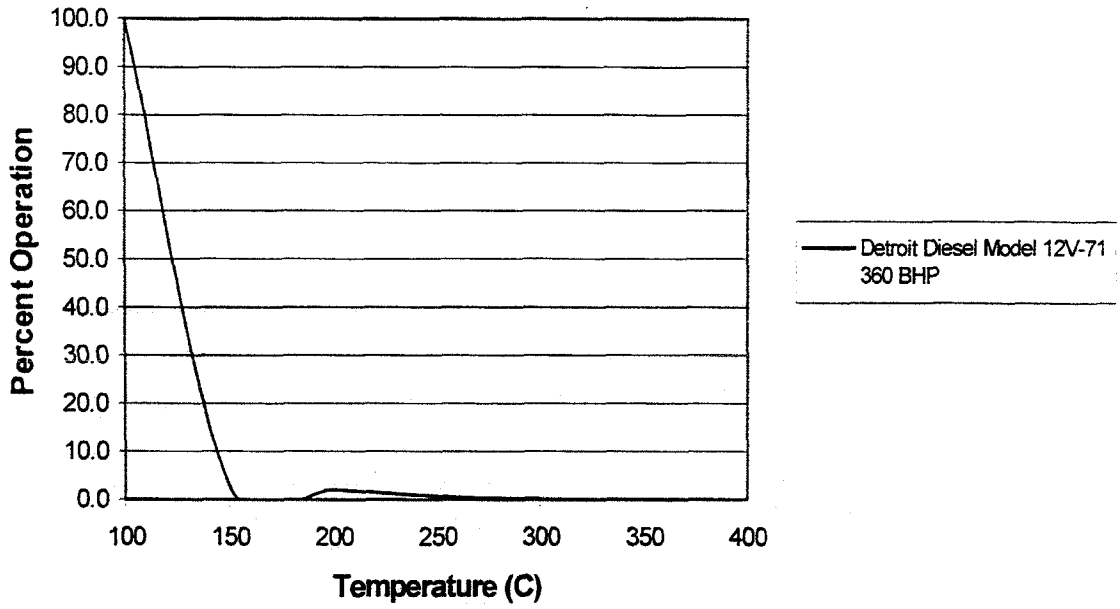


Figure 70: 107822 Engine Exhaust Temperature Profile
Application: Jet Washer



Drilling Rigs

Figure 71: 106222 Engine Temperature Profile
Application: Drilling Rig

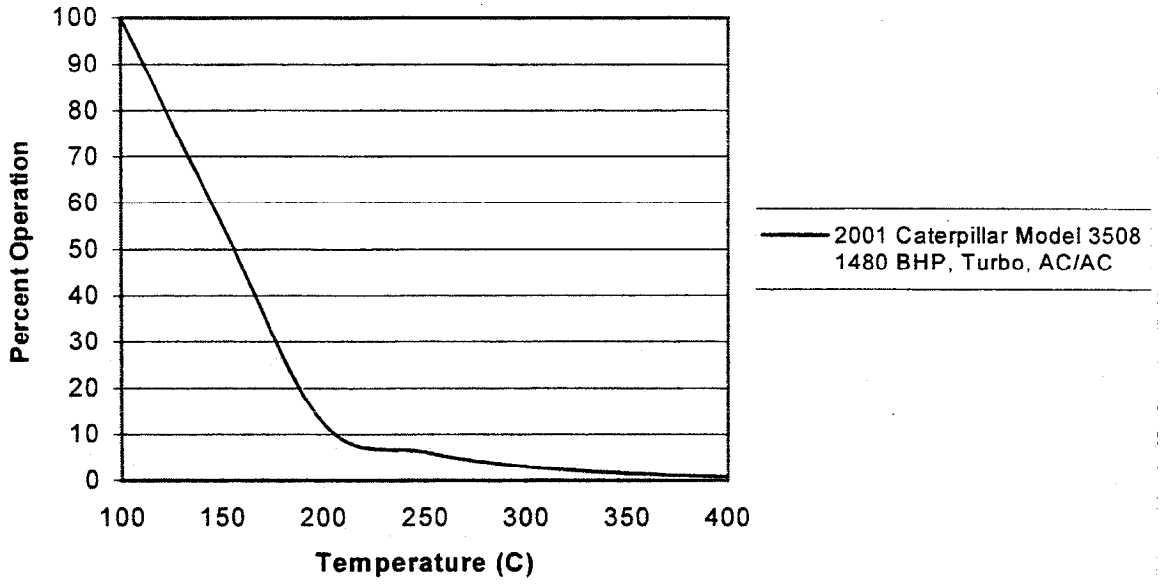
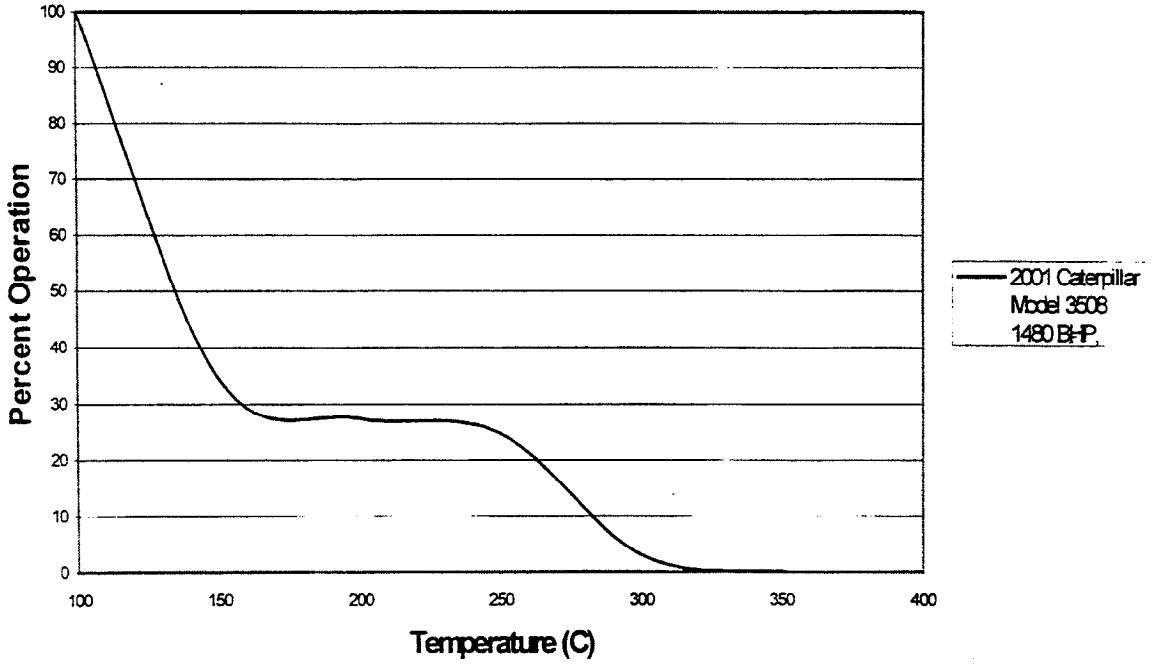


Figure 72: 115176 Engine Exhaust Temperature Profile
Application: Top Head Drive Rig



Clamshell Dredge

Figure 73: Cecert 53 Exhaust Temperature Profile
Application: Clamshell Dredge

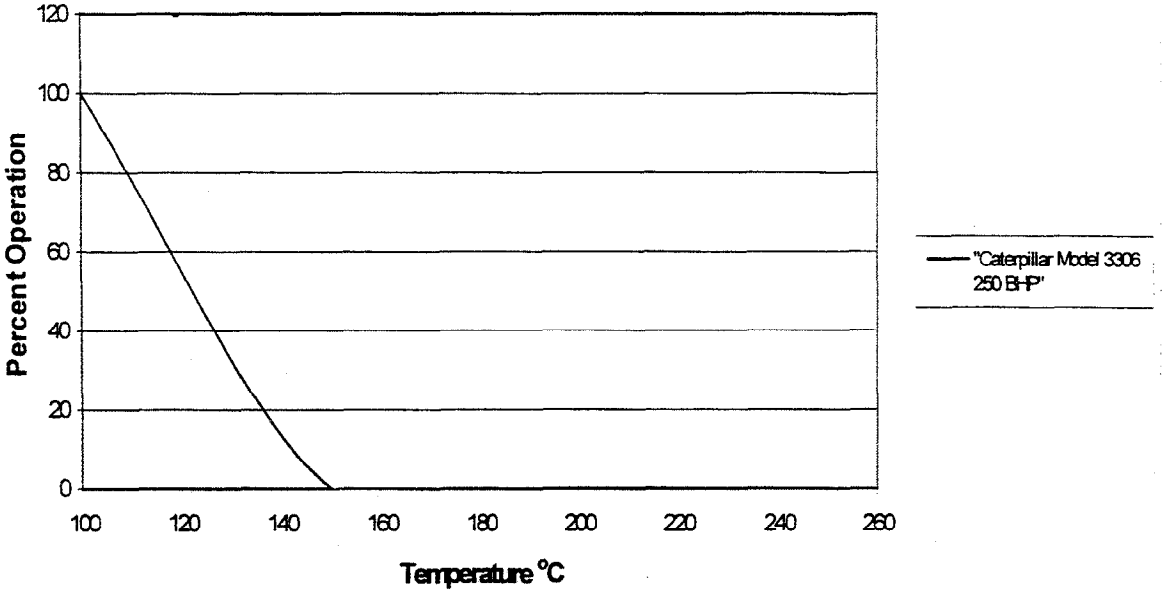
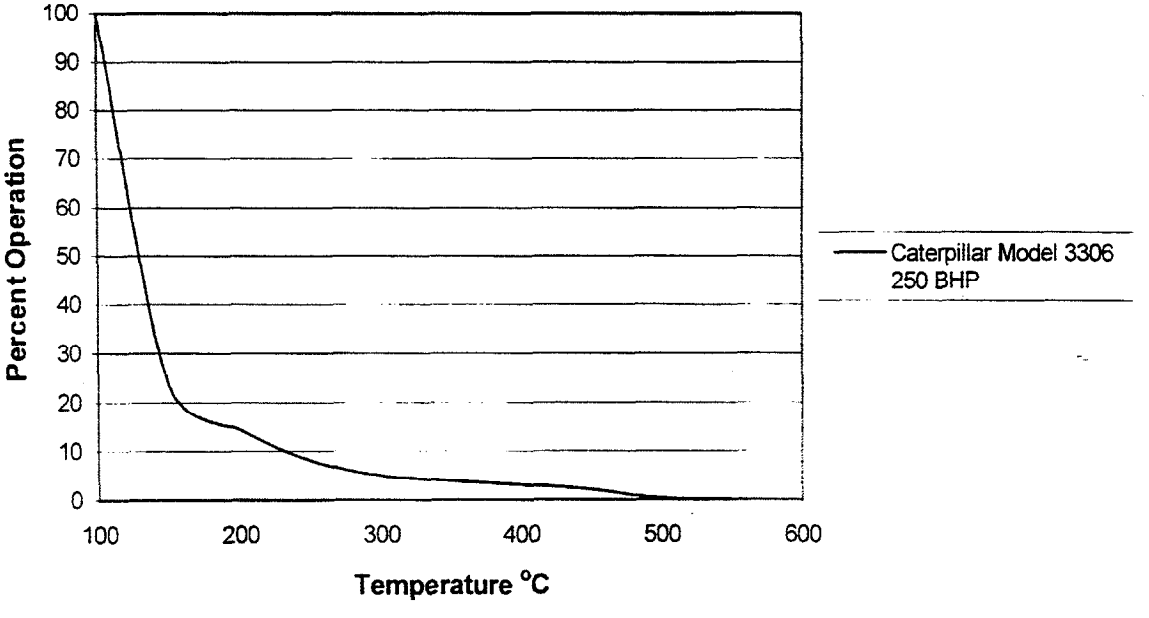
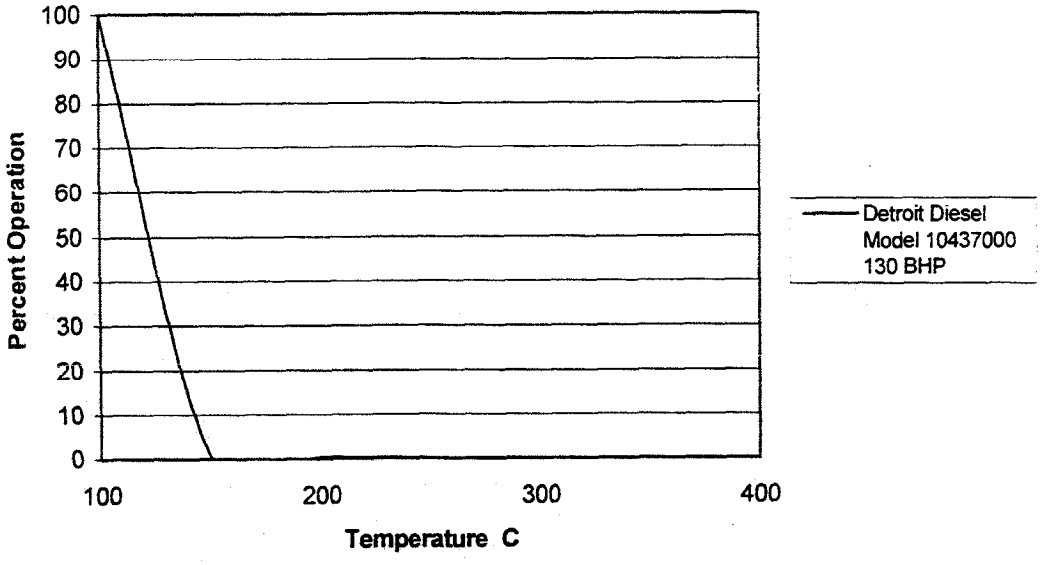


Figure 74: Cecert 52 Exhaust Temperature Profile
Application: Clamshell Dredger



Bow Anchor Winch

Figure 75: Cecert 50 Exhaust Temperature Profile
Application: Bow Anchor Winch



Vacuum Pumps

Figure 76: Cecert 10 Exhaust Temperature Profile
Application: Vacuum Pump

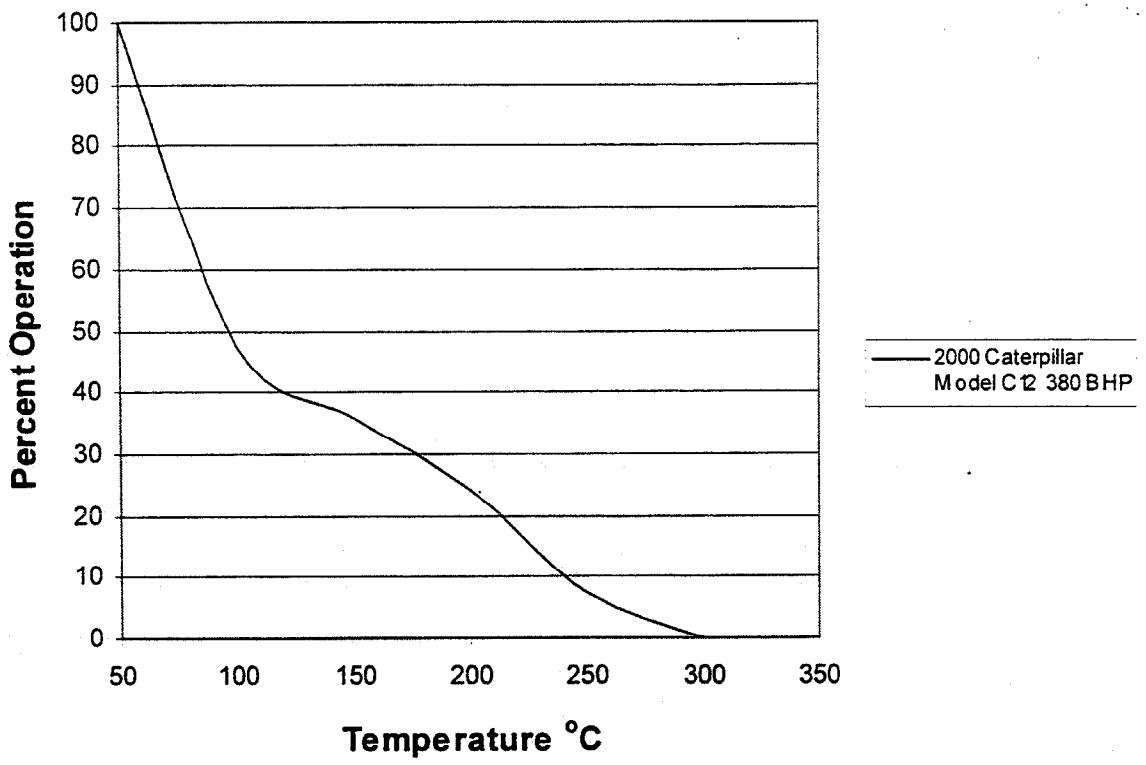


Figure 77:Cecert 12 Exhaust Temperature Profile
Application: Vacuum Pump

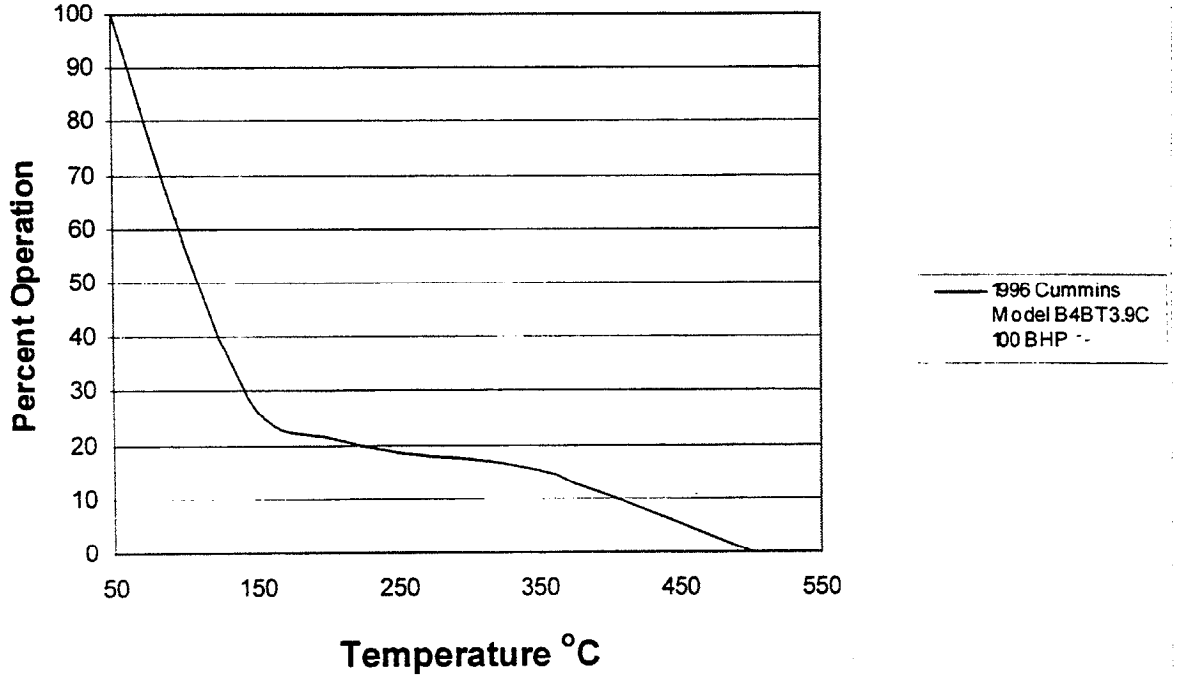


Figure 78: Cecert 13 Exhaust Temperature Profile
Application: Vacuum Pump

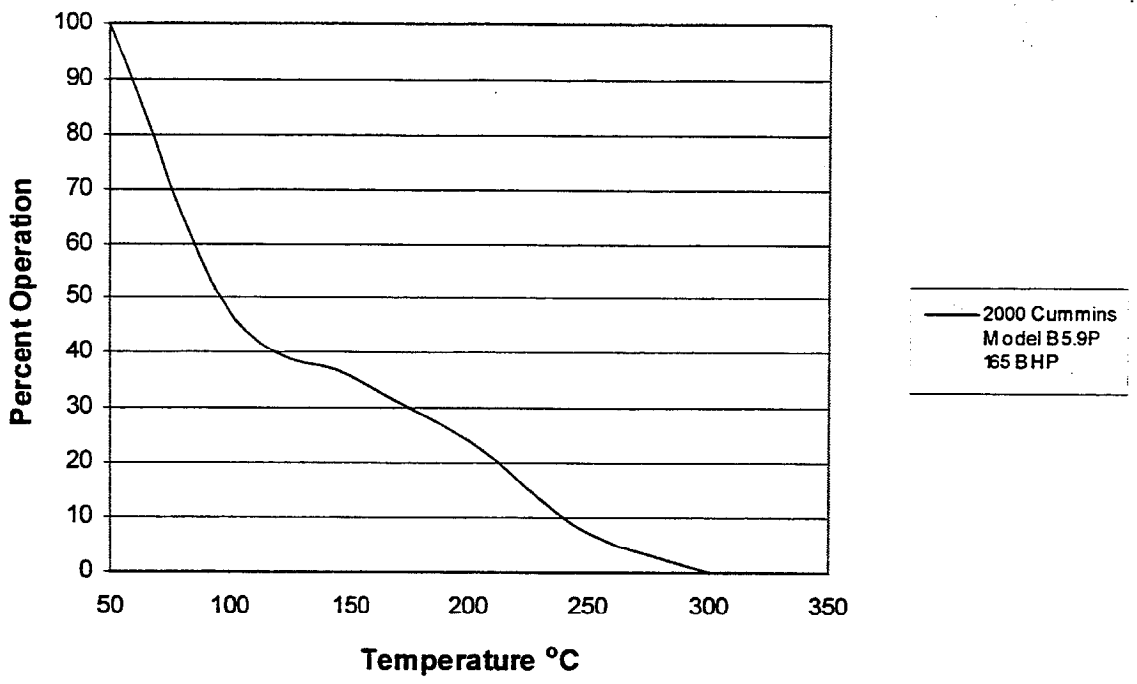


Figure 79: Cecert 5 Exhaust Temperature Profile
Application: Vacuum Pump

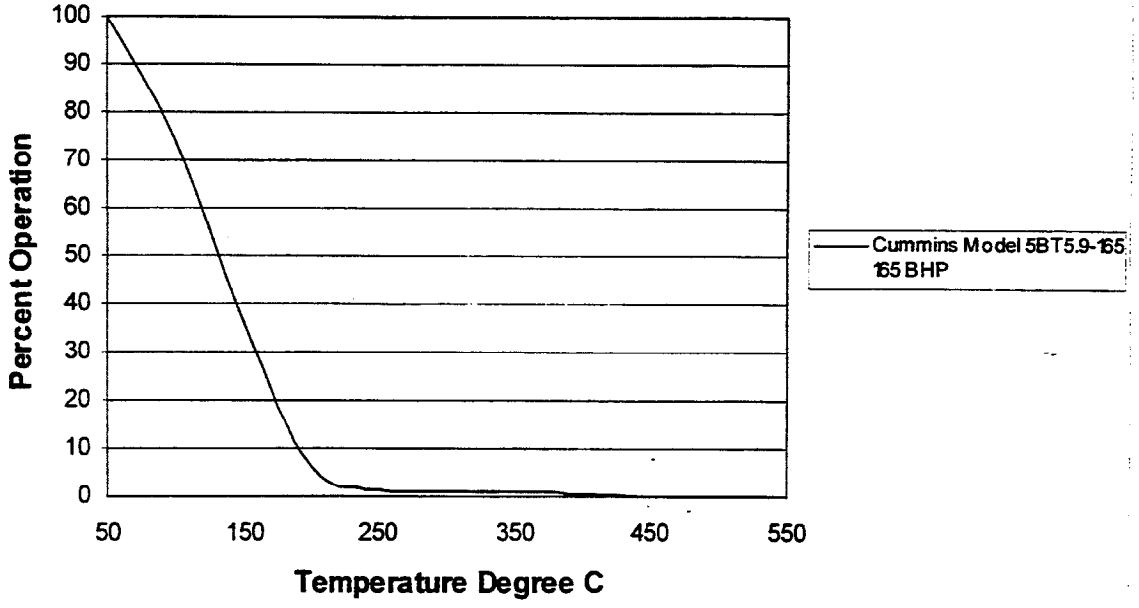
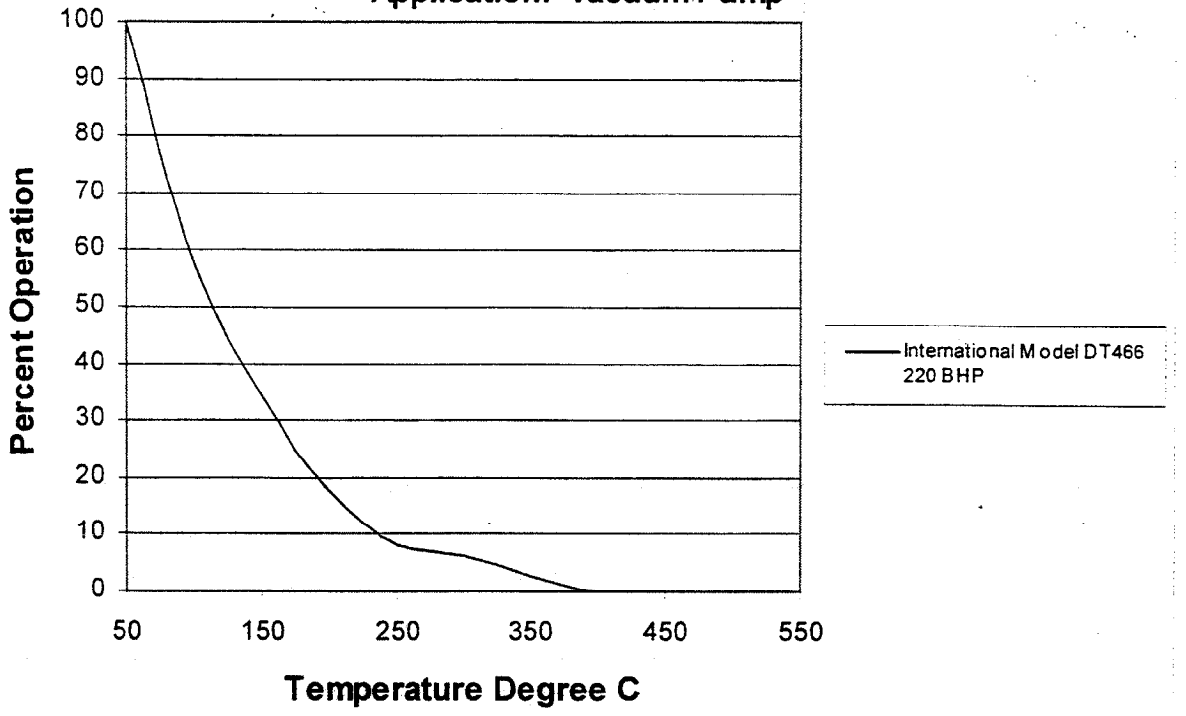


Figure 80: Cecert 7 Exhaust TemperatureProfile
Application: Vacuum Pump



Appendix G

Economic Impact Analysis Methodology

Economic Impact Analysis Methodology

The major factors affecting the economic impact of the proposed ATCM are: (1) the number and characteristics of engines affected; (2) changes in the overall portable diesel-fueled engine population due to implementation of the proposed ATCM; (3) the cost and timing of early replacement of engines before the end of their useful life; and (4) the cost and timing associated with the addition of diesel PM control technologies.

Engine Population

Staff estimates that there are 33,000 portable diesel-fueled engines larger than 50 horsepower operating within California. This estimate is based upon the number of engines identified for the year 2000 emissions inventory, with updated information for agricultural irrigation pumps.

Information for engines registered with the Statewide Portable Equipment Registration Program (PERP) and assumptions used for estimating the year 2000 emissions inventory was used to characterized the engines. There are about 14,000 diesel-fueled engines registered with PERP. For each of these engines, the owners registering the engines were required to provide the following information as part of the application for registration: the size of the engine based upon horsepower rating, age of the engine, and application description for the engine (for example, the engine was used to power a compressor). In addition, emissions were estimated using operating hours that were used to establish the 2000 inventory.

Because permits have not been required for agricultural activities, there is limited information regarding the use of agricultural irrigation pumps. Staff relied on information provided by local district staff as well as data collected for the Carl Moyer Program. Based upon these information sources, staff assumed that the average irrigation pump is 99 horsepower and operates about 1,000 hours annually.

For the other 16,000 engines, information for engines registered with PERP was used to characterize these engines. All the engines registered in PERP, as a whole, are probably not reflective of all the portable diesel-fueled engines that operate in California. PERP is more heavily populated with engines associated with the rental, oil-well services, and marine construction industries. The rental industry has the newest fleets in California, while both the oil-well services and marine construction industries use very large engines that tend to comprise some of the oldest fleet of portable engines in California. Removing these particular categories of engine applications from PERP, the ARB staff believes that the remaining PERP engines collectively represent the rest of the portable engines in California.

Overview of Impact of Proposed ATCM

The proposed ATCM initially requires all portable diesel-fueled engines to be certified to an emission standard for newly manufactured off-road engines by January 1, 2010. Owners of portable diesel engines will meet with this requirement by replacing any noncertified engines in their fleets with new certified engines. Fleet emission standards then become applicable January 1, 2013 and January 1, 2017, with full compliance by January 1, 2020. These standards are expected to be satisfied by a combination of engine replacement and add-on retrofit technology.

Engines used exclusively in emergency applications or designated as low-use engines are subject to the 2010 requirement, but are not subject to the fleet emission standards. Nevertheless, these engines are required by January 1, 2020, to be either certified to a Tier-4 emission standard or equipped with a Level-3 verified technology.

Costs

The economic impact for the proposed ATCM is based upon replacing an engine prematurely and the costs associated with the addition of air pollution equipment. Costs were projected from 2005 to 2037, the last year a cost would be attributed to the proposed ATCM.

The proposed regulation will require the early replacement of existing portable diesel-fueled engines with newer cleaner engines. The cost attributed to engine replacement or repower would be the economic value to the owner for each year the engine has been prematurely replaced. Based on information used for the emissions inventory and the PERP, staff assumed the useful life of a diesel-fueled portable engine to be about 25 years. The lost useful life would be the difference between 25 years and the average age of the affected engines at the time a standard becomes effective that forces the replacement of the engines. The average age of each affected group of engines was based upon the age of engines for similar types of engines registered with the PERP. Conversely, for the purposes of this analysis, engines that are more than 25 years old have reached the end of their useful life, and no cost was include in the economic impact of the proposed ATCM for the replacement of this group of engines.

To estimate the economic impact caused by early replacement of portable engines, staff estimates the annual value for each year of lost useful life as the cost of the engine annualized over a 25-year period. The cost to replace or repower a portable engine is expected to range between $135-220/horsepower. The $135 dollars per horsepower represents replacement and installation of the engine and the $220 dollars per horsepower represents the cost of replacing an entire unit, such as a generator set.

The use of verified Level-3 control technologies will be necessary to satisfy the proposed fleet standards that become effective by January 1st, 2017. For the purposes of evaluating the economic impact associated with these standards, the cost is based upon retrofitting the engines with diesel PM particulate filters. The cost of a filter is estimated at $40/horsepower and this cost would be paid out over 10-year period. Based upon current manufacturer's guarantees of 8,000 hours of use for a particulate trap and the average operation of a portable diesel-fueled engine, the particulate trap should have a useful life of 16 years. In some cases, an additional particulate trap was included in the cost analysis.

All costs are reported as 2002 dollars. Where future costs are mentioned, they have also been adjusted to 2002 dollars using standard accepted economic procedures. An annual interest rate of five percent is used. In addition, no cost or benefit was included for the ATCM for engines registered with PERP for the purposes of complying with the 2010 requirement. Engines registered with the PERP are already required to be replaced by January 1st, 2010.

2010 Requirement that All Engines Must be Certified

This requirement is expected to affect 11,500 engines. At January 1st, 2010, these engines would have five years of useful life at the time the engine was replaced. Cost associated with early replacement would be distributed from 2010 to 2014. In addition, agricultural irrigation pump engines were assumed to have five years of useful life at the time the engine was replaced.

No costs were assumed for engines that are already at the end of their useful life. This was true of 25% of the engines that are less than 175 horsepower and 37% of the engines that are 175 horsepower and larger.

2013 Fleet Emission Standard

The proposed fleet standard would require the replacement or use of retrofit technology on nearly all Tier 1 engines that are less than 750 horsepower. This requirement is expected to affect about 6,000 engines. At January 1st, 2013, these engines would have operated 9-17 years or would have a remaining useful life of 8-16 years at the time the engine was replaced. Cost associated with early replacement would be distributed from 2010 to 2028.

The engines that are less than 175 horsepower would be replaced with a Tier 3 engine, since the Tier 4 engines are not expected to be available for this horsepower range until 2012 or 2013. For engines that are 175 horsepower and larger, Tier 4 engine are expected to be available since 2011. The economic impact analysis assumes that all engines within this size range would be replaced with a Tier 4 engine. In addition, staff included in the analysis the purchase of an additional diesel particulate filter 15 years after the initial engine purchase.

2017 and 2020 Fleet Emission Standard

The proposed fleet standards will require the retrofit of 30,000 engines. About half of the retrofits would occur by January 1st 2017 and the remainder would be completed by January 1st, 2020. In addition, engines that have not been subject to the fleet requirements (engines used only in emergency applications or are low-use engines) would be required to either retrofit or replace the engine.

Appendix H

Cost Analysis Example

For a Typical Small Business Complying with the Proposed ATCM Requirements

Cost Analysis Example

For a Typical Small Business Complying with the Proposed ATCM Requirements

Background

The following is an example of a cost analysis for a typical small business complying with the proposed ATCM requirements. Small businesses typically have five or fewer portable diesel-fueled engines, with the average small business owning three engines.

The small business (Company A) fleet consists of:

78-horsepower (hp) certified engine (manufactured 1998)
129-hp non-certified engine (manufactured 1988)
363-hp non-certified engine (manufactured 1988)

These engines reflect the size and age for the average engine in a typical fleet.

Complying with 2010 requirement

To comply with the 2010 requirement, the 129-hp and 363-hp engine would need to be replaced. The 78-hp engine is already a certified engine.

Cost for replacement is assumed to be $220 per horsepower. This is based upon complete replacement of an existing unit, including engine and related engine equipment, trailer, and enclosure. Cost can be lower, particularly if an owner elects to repower or replace the existing engine versus total replacement of the unit.

129-hp engine: replacement engine costs = $28,380
363-hp engine: replacement engine costs = $79,860

The cost for early replacement of the above engines would be based on: 1) the loss of useful life resulting from complying with the regulation, which is the difference between 25 years (assumed useful life of a diesel engine) and the age of the engines at time of replacement (or 2010), and 2) the value for each year of useful life, which is based upon the annualized cost of an engine over 25 years at an effective interest rate of 5 percent.

The annualized cost for the engines are:

129-hp engine: $2,060/year
363-hp engine: $5,790/year

As of January 1, 2010, each engine would have a remaining useful life of three years (2010 - 1988 = 22 years). Therefore, the cost for compliance with the 2010 requirement would be:

129-hp engine: $2,060 each year 2010 to 2012 inclusive = $6,180, which has a present worth value of $3,986
363-hp engine: $5,790 each year 2010 to 2012 inclusive = $17,370, which has a present worth value of $11,205

Complying with 2013 fleet standards

Company A is subject to two fleet standards on January 1, 2013. The 78-hp and 129-hp engines must satisfy the fleet average of 0.3 g/bhp-hr that applies to engines that are less than 175-hp. Similarly, the 363-hp engine must satisfy the fleet average of 0.15 g/bhp-hr for engines 175-749 hp.

<175-hp fleet average = (78-hp*0.69 g/bhp-hr + 129-hp*0.22 g/bhp-hr)/(78-hp +129-hp)

= 0.397 g/bhp-hr

>175-hp fleet average = (363-hp*0.15 g/bhp-hr)/363-hp

= 0.15 g/bhp-hr

To comply with the 2013 fleet requirement, Company A will need to replace the 78-hp engine. Because the 129-hp and 363-hp engines were replaced to satisfy the 2010 requirement, these engines are certified to Tier 2/3 levels. Tier 2/3 engines would individually comply with the 2013 fleet standards.

If the 78-hp engine, which is certified to a Tier 1 level (no PM standard is applicable for Tier 1 engines of this size), were replaced with an engine certified to Tier 2/3 levels, Company A's fleet average for the <175-hp fleet average would be 0.25 g/bhp-hr.

Using the same criteria used above to assess the economic impact to replace the 129-hp and 363-hp engines, the following would apply for replacing the 78-hp engine:

- Replacement engine costs = $17,160
- The annualized cost = $1,241/year
- At 2013, the engine would have a remaining useful life of 10 years (2013 – 1998 = 15 years)

The cost for compliance with the 2013 requirement would be:

$1,241 each year 2013 to 2022 inclusive = $12,410, which has a present worth value of $5,882.

Complying with 2017 fleet standards

Company A is subject to two new fleet standards on January 1, 2017. The 78-hp and 129-hp engines must satisfy a fleet average of 0.18 g/bhp-hr that applies to engines that are less than 175 hp. Similarly, the 363-hp engine must satisfy a fleet average of 0.08 g/bhp-hr for engines 175 to 749 hp. To comply with the 2017 fleet requirement, Company A will need to retrofit the 129-hp engine and 363-hp engine with particulate filters. In these calculations, the filter is assumed to be 85 percent efficient or to reduce the engine's diesel PM emissions to 15 percent of engine's certified emission levels.

<175-hp fleet average = (78-hp * 0.3 g/bhp-hr + 129-hp *0.22 g/bhp-hr *0.15 control factor)/(78-hp+129-hp)

= 0.13 g/bhp-hr

>175-hp fleet average = 363-hp *0.15 g/bhp-hr*0.15 control factor /363-hp

= 0.02 g/bhp-hr

Note that Company A is now in compliance with the 2020 fleet standard for engines rated between 175 to 749 hp.

To assess the economic impact of adding particulate filters, the cost was based upon $40 per hp.

129-hp engine: filter costs of $5,160
363-hp engine: replacement engine costs $14,520

The cost was annualized over a 10 year period at an effective interest rate of 5 percent. The annualized cost for the filters are:

129-hp engine: $1,000/year
363-hp engine: $2,220/year

In summary, the cost for satisfying the 2017 fleet standard would be:

129-hp engine: $1,000 each year 2016 to 2025 inclusive = $10,000, which has a present worth value of $4,094)
363-hp engine: $2,220 each year 2016 to 2025 inclusive = $22,200, which has a present worth value of $9,090)

Complying with 2020 fleet standards

To comply with the 2020 fleet standards for engines rated at less than 175 hp, Company A will need to retrofit the 78-hp engine with a particulate filter.

Using the same criteria used above to assess the economic impact for adding particulate filters to the 129-hp and 363-hp engines, the following would apply for the 78-hp engine:

- Filter costs = $3,140
- Annualized costs of filter = $730 a year

Cost for compliance would be $730 each year from 2019 to 2028 inclusive ($7,300, which has a present worth value of $2,263)

Total costs (present worth in 2002 dollars)

The total costs for the small business would be about $36,500, with the cost occurring from 2010 to 2028.

Appendix I

List of Acronyms and Abbreviations

LIST OF ACRONYMS AND ABBREVIATIONS

AB	Assembly Bill
ARB	Air Resources Board
ATCM	Airborne Toxic Control Measure
BACT	Best available control technology
Board	Air Resources Board
Bhp	Brake horsepower which is equivalent to horsepower
CAA	Federal Clean Air Act
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resource Board
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
Certified engine	An engine certified to ARB/federal newly manufactured off-road engine emission standards
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CI	Confidence Interval
Diesel PM	Diesel Particulate Matter
District	Air pollution control or air quality management district
Diesel Risk Reduction Plan	Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles
DOC	Diesel Oxidation Catalyst
DOF	Department of Finance
DPF	Diesel particulate filter
DTSC	Department of Toxic Substance Control
EO	Executive Officer of the Air Resources Board
FSOR	Final Statement of Reasons
FTF	Flow-through filter
g/bhp-hr	Grams per brake horsepower-hour
GSE	Ground Support Equipment
HC	Hydrocarbon
hp	Horsepower which is equivalent to brake horsepower
H&SC	California Health and Safety Code
ISOR	Initial Statement of Reasons
$\mu g/m^3$	Microgram per cubic meter
MOU	Memorandum of Understanding

NAAQS	National Ambient Air Quality Standard
NO	Nitrogen oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
OCS	Outer Continental Shelf
OEHHA	Office of Environmental Health Hazard Assessment
Off-Road Model	Off-Road Emissions Model
PAH	Polycyclic Aromatic Hydrocarbons
PERP	ARB's Statewide Portable Equipment Registration Program
PM	Particulate matter
PM_{10}	Particulate matter 10 microns or less in diameter
$PM_{2.5}$	Particulate matter less then 2.5 microns in diameter
ppm	Parts per million
Proposed ATCM	Proposed air toxic control measure for diesel-fueled portable engines
ROE	Return on Owner's Equity
ROG	Reactive Organic Gases
SCR	Selective Catalytic Reduction
SIC	Standard Industrial Classification
SRP	Scientific Review Panel
SCAQMD	South Coast Air Quality Management District
SOF	Soluble Organic Fraction
SO_2	Sulfur Dioxide
TAC	Toxic air contaminant
Tier 1-3 engine	Engines certified to California/federal newly manufactured Tier 1, 2 or 3 off-road engine emission standards
Tier 4 engine	Engines certified to United States Environmental Protection Agency's proposed Tier 4 off-road engine emission standards
tpd	Tons per day
TSE	Tactical Support Equipment
UL	Underwriters Lab
Uncertified engine	Engines that are not certified to a California/federal newly manufactured off-road engine emission standard
U. S. EPA	United States Environmental Protection Agency