



California Environmental Protection Agency
AIR RESOURCES BOARD

**STAFF REPORT: INITIAL STATEMENT OF REASONS
FOR THE PROPOSED RULEMAKING**



**AMENDMENTS TO THE REGULATIONS TO REDUCE
EMISSIONS FROM DIESEL ENGINES ON COMMERCIAL
HARBOR CRAFT OPERATED WITHIN CALIFORNIA WATERS
AND 24 NAUTICAL MILES OF THE CALIFORNIA BASELINE**

**Stationary Source Division
Emissions Assessment Branch**

May 2010

**STAFF REPORT:
INITIAL STATEMENT OF REASONS
FOR THE PROPOSED RULEMAKING**

Public Hearing to Consider

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FROM DIESEL ENGINES ON
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AND 24 NAUTICAL MILES OF THE CALIFORNIA BASELINE**

To be considered by the Air Resources Board on June 24, 2010 at:

California Environmental Protection Agency
Headquarters Building
Byron Sher Auditorium
1001 I Street
Sacramento, California

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TABLE OF CONTENTS

<u>Contents</u>	<u>Page</u>
Executive Summary	ES-1
1. Introduction.....	1
A. Overview	1
B. Need for the Regulation	1
C. Regulatory Authority	3
2. Emissions Inventory	4
A. Updating the Crew and Supply Vessel and Engine Data	5
B. Updated Emissions from Crew and Supply Vessel Engines	7
C. Barge and Dredge Vessel Data	8
D. Emissions from Barge and Dredge Vessel Engines.....	10
E. Total Combined Emissions from Crew and Supply Vessels and Barge and Dredge Vessels	10
3. Health Risk	11
A. Potential Cancer Risk.....	11
B. Non-Cancer Risk.....	11
4. Summary of the Proposed Amendments.....	12
A. Background Information on Emission Standards for Marine Engines	12
B. Background Information on Emission Standards for Off-Road Engines.....	13
C. In-Use Requirements for Crew and Supply Vessels, Barge, and Dredge Vessels.....	14
D. Other Proposed Amendments.....	17
5. Environmental and Health Impacts of Proposed Amendments	22
A. Emissions Reductions Statewide	22
B. Santa Barbara County APCD and Ventura County APCD Crew and Supply Vessel Engine Emission Reductions	27
C. Health Impacts	29
D. Environmental Impact	29
E. Impact on Global Warming.....	29
6. Economic Impacts	31
A. Regulatory and New Equipment Costs	31
B. Return on Owner’s Equity	31
C. Cost to Local, State, and Federal Agencies	32
D. Cost-Effectiveness	33
E. Alternatives Considered	34

TABLE OF CONTENTS (CONT.)

<u>Contents</u>	<u>Page</u>
7. Public Outreach and Comments.....	40
A. Public Outreach.....	40
B. Environmental Justice	40
C. Public Comments.....	40
8. Recommendation	43
References.....	44

TABLE OF CONTENTS (CONT.)

<u>List of Tables</u>	<u>Page</u>
Table 1: Overview of Surveys, Reports, and Inventories.....	4
Table 2: Commercial Harbor Craft Vessels and Engines (2008).....	5
Table 3: Crew and Supply Vessels and Engines Inventories	5
Table 4: Annual Engine Hours of Operation for Crew and Supply Vessels	6
Table 5: Hours of Operation by Distance From Shore.....	6
Table 6: 2008 Emissions from Crew and Supply Vessels	7
Table 7: Proportion of Emissions from Crew and Supply Vessel Engines by District	8
Table 8: Barge and Dredge Vessels and Engines 2008 Inventory Overview	9
Table 9: Annual Engine Hours of Operation for Barge and Dredge Vessels	9
Table 10: Percent of Barge and Dredge Vessel Engine Operations by Distance from Shore (2009 Survey).....	10
Table 11: Barge and Dredge Vessel Engine Emissions.....	10
Table 12: Combined Total Emissions from Crew and Supply Vessels and Barge and Dredge Vessels – 2008 Inventory	10
Table 13: U.S. EPA Marine Engine Categories Used in Commercial Harbor Craft	12
Table 14: U.S. EPA Marine Engine Standards Effective Dates and Emissions Limits for Category 1 and Category 2 Engines Used in Commercial Harbor Craft.....	13
Table 15: ARB and U.S. EPA Diesel PM and NOx Emission Standards for New Off-Road Engines (300 – 600 hp)	14
Table 16: Compliance Dates for Crew and Supply Vessel Engines Statewide	16
Table 17: Compliance Dates for Barge and Dredge Vessel Engines Statewide	16
Table 18: Estimated Population of In-Use Crew and Supply and Barge and Dredge Vessel Engines Subject to Amendments to CHC Regulation Emission Limits	17
Table 19: ARB and U.S. EPA Diesel Fuel Standards.....	19
Table 20: Total Statewide Diesel PM and NOx Emission Reductions Associated with the Proposed Regulatory Amendments.....	27
Table 21: Affected Businesses with Change in ROE	32
Table 22: Summary of Cost-Effectiveness of the Proposed Amendments for the Period 2011-2022 (2009 dollars)	34
Table 23: Diesel PM Cost-Effectiveness of the Proposal and Other Regulations/Measures (All Costs Attributed to Diesel PM Reduction)	34
Table 24: Alternative 1: Alternative Compliance Table to Accelerate Barge and Dredge Vessel Engine Compliance	35
Table 25: Alternative 1: Statewide Annual In-Use Engine Replacements.....	36
Table 26: Alternative 2: Alternative Compliance Tables to Decelerate Compliance for Crew and Supply Vessels and Barge and Dredge Vessels	38
Table 27: Alternative 2: Statewide Annual In-Use Engine Replacements.....	39
Table 28: Summary of Average Cost-Effectiveness of the Proposed Amendmnets and Both Alternatives for the Period 2011-2022	39

TABLE OF CONTENTS (CONT.)

<u>List of Figures</u>	<u>Page</u>
Figure 1: Distribution of Crew and Supply Vessels by District.....	7
Figure 2: Projected Statewide Diesel PM Emissions for Crew and Supply Vessel Diesel-Fueled Engines	23
Figure 3: Projected Statewide NOx Emissions for Crew and Supply Vessel Diesel- Fueled Engines	24
Figure 4: Projected Statewide Diesel PM Emissions for Barge and Dredge Vessel Diesel-Fueled Engines	25
Figure 5: Projected Statewide NOx Emissions for Barge and Dredge Vessel Diesel- Fueled Engines	26
Figure 6: Projected Santa Barbara County and Ventura County APCD Diesel PM Emissions for Crew and Supply Vessel Diesel-Fueled Engines.....	28
Figure 7: Projected Santa Barbara County and Ventura County APCD NOx Emissions for Crew and Supply Vessel Diesel-Fueled Engines.....	28
Figure 8: Estimated Numbers of Commercial Harbor Craft Engines Replaced Annually Due to Implementation of the Current Commercial Harbor Craft Regulation and the Proposed Amended Regulation	41

<u>Appendices</u>	<u>Page</u>
Appendix A: Proposed Regulation Orders (section 2299.5 and section 93118.5).....	A-1
Appendix B: Summary of Survey Results.....	B-1
Appendix C: Emission Inventory Methodology	C-1
Appendix D: Methodology of Estimating Economic Impacts	D-1

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EXECUTIVE SUMMARY

Summary of Proposed Action

The California Air Resources Board (ARB or Board) staff is proposing amendments to the regulations affecting commercial harbor craft.¹ These proposed amendments primarily affect the Commercial Harbor Craft Regulation (CHC regulation) that the Board adopted on November 17, 2007. This regulation became effective on January 1, 2009. In addition, the staff is proposing minor conforming amendments to a complimentary regulation, the Low Sulfur Fuel Requirement for Commercial Harbor Craft, to align numbering changes due to the proposed amendments to the CHC regulation. A copy of the proposed amendments to both regulations is provided in Appendix A of this report. (ARB, 2007a) (ARB, 2007b) (ARB, 2007c)

The primary purpose of the proposed amendments is to subject diesel-fueled engines on crew and supply, barge, and dredge vessels to in-use engine requirements of the CHC regulation. The staff is proposing to add crew and supply vessels because updated information shows that these vessels have similar or greater emissions than vessel categories currently controlled by the CHC regulation. The addition of barge and dredge vessels will amend a situation where this class of vessels are subject to two different statewide regulations. Approximately 175 crew and supply, barge, and dredge vessels operate in California, and are equipped with about 640 diesel-fueled engines. These engines emit about 66 tons per year of diesel particulate matter (PM) and 1,430 tons per year oxides of nitrogen (NO_x). Other amendments are being proposed to clarify requirements and to address issues that have arisen during the implementation of the 2007 CHC regulation.

In developing the proposed amendments, ARB staff worked closely with stakeholders including vessel owner/operators, marine engine industry representatives, and staff from air pollution control and air quality management air districts (districts). The early turnover of in-use, pre-Tier 1 and Tier 1 diesel-engines on crew and supply, barge, and dredge vessels to lower emitting Tier 2 and Tier 3 marine or off-road engines would reduce diesel PM, NO_x, and other air pollutant emissions. These emission reductions will reduce exposures and health risks across California, particularly along the shoreline and near ports. The proposed amendments are technologically feasible, cost-effective, and necessary to carry out the Board's responsibilities and goals, including; 1) the goal of the Diesel Risk Reduction Plan to reduce diesel PM emissions from all sources by 85 percent by 2020; and 2) the Emissions Reduction Plan for Ports and Goods Movement that the Board approved in April 2006. Finally, the emission reductions from

¹Title 17, CCR section 93118.5 is known as the Commercial Harbor Craft Regulation (CHC regulation) and establishes emission standards, reporting, recordkeeping, fuel, and monitoring requirements for certain categories of marine vessels. Title 13, CCR section 2299.5 is the corresponding Low Sulfur Fuel Regulation for Commercial Harbor Craft.

the proposed amendments are necessary to help attain and maintain ambient air quality standards for fine particulate matter (PM_{2.5}) and ozone.

Proposed Amendments

The proposed amendments to the CHC regulation would:

- Establish in-use emission limits and compliance schedules for auxiliary and propulsion diesel-fueled engines on crew and supply, barge, and dredge vessels that operate in Regulated California Waters. The compliance schedules are based on engine model years and annual hours of operation, and are designed to remove the oldest, dirtiest engines first.
- Eliminate the current exemption for vessel engines registered in PERP or that were permitted by districts before January 1, 2009.
- Allow the use of certified off-road or nonroad engines as auxiliary engines.
- Allow CHC vessels that cannot obtain CARB diesel fuel outside of California to use United States Environmental Protection Agency (U.S. EPA) on-road or nonroad diesel when travelling from their non-California home port.
- Add a definition of “swing engine” and require these engines to meet applicable in-use emission limits and recordkeeping provisions.
- Delete the definition of “multipurpose harbor craft” and “low use exemption”, and reword the in-use engine section to clarify that vessels in categories with in-use emissions limits do not have to comply with those limits for engines if they operate less than 300 hours in any single regulated vessel category or combination of categories (or 80 hours for barge and dredge vessels).
- Add a deadline of February 28 for submitting the annual Alternative Control of Emission plans.
- Clarify that the initial reporting and compliance plan reporting requirements also apply to out-of-state vessels that operate in California.
- Allow owners/operators of vessels with multiple engines to apply for an exemption from the new engine requirements if one engine has a catastrophic failure.
- Reword the new ferry vessels Best Available Control Technology section for clarity.
- Allow the use of an available engine to replace an older engine subject to in-use requirements until the original scheduled compliance date of the older engine.
- Make other changes to definitions and edits to regulatory language to improve clarity.

Staff is also proposing minor amendments to the Low Sulfur Fuel Regulation (section 2299.5, title 13, CCR) to align numbering with the amendments to the CHC regulation.

Background

Commercial Harbor Craft

Commercial harbor craft (CHC) include ferries, excursion vessels, tugboats, towboats, crew and supply vessels, work boats, commercial and charter fishing boats, and barge and dredge vessels. Staff estimates there are approximately 4,300 commercial harbor craft vessels with 8,700 diesel-fueled engines operating in California coastal waters.

2007 Commercial Harbor Craft Regulation

In 2007, ARB adopted the CHC regulation, which requires engines on all new vessels to meet applicable U.S. EPA marine engine emission standards at the time the vessel is acquired. The marine emission standards are divided into four increasingly stringent levels (Tiers); the allowed emission level and effective dates vary with horsepower. Replacement engines installed on any in-use harbor craft are required to meet the Tier 2 or Tier 3 standards in effect at the time of purchase of the engine. Existing or in-use engines on ferries, excursion vessels, tugboats, towboats, and pushboats must meet U.S. EPA Tier 2 or Tier 3 standards based on phased-in compliance schedule.

Authority

ARB has authority under California law to adopt the proposed regulation. California Health and Safety Code (HSC) sections 43000, 43000.5, 43013(b) and 43018 provide broad authority for ARB to adopt emission standards and other regulations to reduce emissions from new and in-use vehicular and other mobile sources. Under HSC sections 43013(b) and 43018, ARB is authorized to adopt emission standards for off-road vehicular sources, as expeditiously as possible, to meet State ambient air quality standards. ARB is further mandated by HSC section 39666 to adopt airborne toxic control measures (ATCM) for new and in-use vehicular sources, including Commercial Harbor Craft, for identified toxic air contaminants, such as diesel PM.

Public Outreach

Staff has made a concerted effort to provide opportunities for public participation in this rulemaking action. Staff's public outreach efforts included three public workshops at which draft regulatory concepts, language, and cost estimates were provided. In addition, the Commercial Harbor Craft website was updated with all workshop materials. Staff also held meetings with owner/operators of crew and supply, barge, and dredge vessels, districts, and other interested parties.

Basis for the Proposed Amendments

Crew and Supply Vessels

Crew and supply vessels are primarily used to transport equipment and personnel to and from offshore oil rigs and other offshore vessels. About 60 percent of the companies that own crew and supply vessels are considered small businesses, having less than 100 employees. When ARB adopted the CHC regulation in 2007, crew and supply vessels were subject to the new engine provisions, but existing vessels were not required to meet in-use engine emission limits, because information at that time showed

these vessels had limited hours of operation and emissions. We are now proposing to require existing crew and supply vessels to meet in-use engine emission standards because updated information shows their emissions are similar in magnitude to the emissions from other vessels that are currently subject to the CHC regulation's in-use requirements. Approximately 70 crew and supply vessels with about 240 engines operate in California Regulated Waters. In 2008, these vessels emitted approximately 33 tons of diesel PM and 670 tons of NO_x.

Barge and Dredge Vessels

Barges are marine vessels, usually moved by tugboats or towboats, are used to transport fuel or equipment via water. Dredges are marine vessels used to remove bottom sediment from waterways. Approximately half of the businesses operating barges and dredges are considered small business. Historically, most barge and dredge vessel engines were either regulated under the Portable Engine ATCM by being registered in the Portable Equipment Registration Program (PERP) or subject to district permits. Registration in PERP allows a piece of equipment to operate anywhere in the State, but subject to district authorization. The 2007 CHC regulation was designed to allow barge and dredge vessels that had been registered in PERP or subject to a district permit prior to January 1, 2009, to continue to be subject to the requirements of the Portable Engine ATCM or the district permit. Barge and dredge vessels that were not in PERP or permitted by a district by that date were subject to the requirements of the CHC regulation. However, in-use emission limits were not established for these vessel engines. (ARB, 2007d) (ARB, 2009)

During 2009, it became clear that having some barge and dredges subject to the Portable Engine ATCM and others subject to the CHC regulation was creating compliance and enforcement issues and was confusing to the regulated industry. To address this issue, ARB staff proposed modifying the PERP and the CHC regulation to allow permanently installed auxiliary engines on barges and dredges to register in PERP, and to make these engines subject to the CHC regulation instead of the Portable Engine ATCM. In January 2010, the PERP regulation was amended to allow certified marine engines to register in PERP. These amendments will align the two regulations and allow auxiliary engines on harbor craft vessels to be registered in PERP, but subject only to the requirements of a single statewide regulation - the CHC regulation. Approximately 100 barge and dredge vessels with about 400 engines operate in California Regulated Waters. In 2008, these vessels emitted approximately 33 tons of diesel PM and 760 tons of NO_x.

Two separate compliance schedules are being proposed. One compliance schedule is for crew and supply vessels and one compliance schedule is for barge and dredge vessels. Separate compliance schedules were developed in consideration of the profile of the engine fleets and to provide a transition period for barge and dredge operators from planned compliance with the Portable Engine ATCM to the CHC regulation.

Impacts of the Proposed Amendments

Anticipated Actions to Comply

ARB staff anticipates that, in most cases, engine replacement will be the option used by most vessel owner/operators to meet the proposed emission standards for vessel engines. However, other options such as retrofitting and rebuilding can be used to comply.

Emission Reductions

The proposed amendments would reduce diesel PM and NO_x emissions in coastal areas of the State. The proposed amendments affect about 60 percent of the diesel engines in the crew and supply vessel fleet and 30 percent of the engines in the barge and dredge fleet. Many engines in these vessel fleets are either already at Tier 2 or Tier 3, or exempt due to engine size, or annual hours of operation. Staff estimates about a 55 percent reduction in diesel PM emissions and a 25 percent reduction in NO_x emissions from crew and supply, barge, and dredge vessels due to the proposed amendments in 2025. Staff estimates that the proposed in-use requirements will provide reductions of about 275 tons of diesel PM and 3,475 tons NO_x emissions between 2011 and 2025.

The current impacts of the economy are not expected to significantly affect the estimated emission reductions because crew and supply vessels primarily service oil platforms which have continued production despite the economic downturn. Many barge vessels are used to transport petroleum products which also have not seen significant changes despite the economic downturn. Additionally, dredge operations related to the maintenance of waterways are essential in nature. A slight reduction in GHG emissions should occur due to the replacement of older engines with more fuel efficient new engines.

Public Health Benefits

The proposed amendments will reduce public health risk from exposure to emissions of diesel PM and NO_x. ARB listed Diesel PM as a toxic air contaminant in 1998. In addition, NO_x is a precursor to the formation of ozone and contributes to secondarily formed PM in the lower atmosphere.

Cost to Industry

Staff estimates that the regulatory costs for complying with the proposed amendments would be approximately \$15 million (2009 dollars), or about \$1.3 million annually over the 2011 through 2022 compliance time period. These regulatory costs are the incremental costs of compliance, and include those costs associated with the early replacement of engines (the residual value of the engine being replaced), the residual value of the most recent engine rebuild work, and the time value of money associated with the early engine replacement. Staff also estimated the new equipment or out-of-pocket cost to industry at approximately \$46 million (2009 dollars) over the 2011 through 2022 time period. The new equipment costs are ones that the vessel

owner would eventually pay, but the proposed amendments require this service to be performed earlier than normal.

Economic Impact to Industry

Staff estimated the economic impact of complying with the in-use engine requirements on the crew and supply, barge, and dredge vessel businesses by evaluating the impact of the regulatory cost on typical businesses' "return on owner's equity" (ROE), and found that the overall change in ROE is a 0.95 percent decline for the average regulated business. A decrease in ROE within this range is not considered to represent a significant impact on profitability. These values are based on the regulatory cost of compliance.

Cost to Public Agencies

Staff has determined that a few public agencies would be impacted by the proposed amendments. One state agency, the California Department of Parks and Recreation, owns two crew and supply vessels that are used to service Angel Island in the San Francisco Bay and would be impacted by the in-use engine requirements. Regulatory cost to this state agency would be about \$60,000 over the life of the regulation. Barge and dredge vessels are owned and operated by two local agencies in Santa Cruz and Monterey and by the federal agency, the United States Army Corps of Engineers. The estimated regulatory costs range from approximately \$1,900 to \$46,000 over the life of the regulation for these agencies that operate barge and dredge vessels.

ARB staff will implement and enforce the proposed amendments. An additional enforcement staff person may be needed to enforce the proposed amendments.

Cost-Effectiveness

The cost-effectiveness of the proposed amendments is estimated, based on the regulatory costs, to be about \$35 per pound (2009 dollars) of diesel PM reduced if all the cost is attributed to diesel PM reductions. The cost-effectiveness for this regulation is consistent with those of other diesel PM regulations adopted by the Board.

Incentive Funding

Carl Moyer Program funding is a potential funding source for companies that comply early or achieve emission reductions beyond the amendments. However, Carl Moyer funds are only available to self-propelled marine vessels and most barge and dredge vessels would not be eligible. Proposition 1B funds should also be available to specific commercial harbor craft operators. At the Board meeting held on March 25, 2010, the *Proposed Update to the Proposition 1B Program Guidelines* were approved, which included project options for the harbor craft category. The total amount of funding available will depend upon bond sales.

Environmental Justice

The proposed amendments are consistent with ARB environmental justice policies. The proposed amendments will reduce diesel PM and NO_x emissions in coastal areas and near ports where crew and supply, barge, and dredge vessels operate.

Public Comments

Comments have been made by barge and dredge owners regarding the implementation of the proposed amendments in relation to the PERP program. Pursuant to the PERP regulation, districts can establish additional requirements beyond the statewide regulation for auxiliary engines on marine vessels that operate within three nautical miles of shore. The authority for districts to establish additional requirements is provided by the PERP regulation in order to allow the districts to mitigate any potential local emissions impacts. Barge and dredge vessel owner/operators have stated that the districts requirements can be burdensome and vary greatly by district. Staff has begun discussions with some of the affected districts to identify ways to achieve greater consistency and develop an effective solution. Staff is committed to continue to meet with affected stakeholders to discuss options.

Recommendation

ARB staff recommends the Board approve the proposed amendments to the regulations as presented in Appendix A of the Staff Report.

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1. INTRODUCTION

A. Overview

This Staff Report: Initial Statement of Reasons (Staff Report) provides the basis for the Air Resources Board (ARB or Board) staff's proposal to amend the regulations affecting commercial harbor craft.² The primary purpose of the proposed amendments is to require the diesel-fueled engines on crew and supply, barge, and dredge vessels to be subject to in-use engine requirements of the Commercial Harbor Craft (CHC) regulation. Several other clarifying and/or editorial amendments are also proposed to the CHC regulation. Staff is also proposing minor amendments to the Low Sulfur Fuel Regulation to align numbering with the CHC regulation. The proposed amendments would reduce diesel particulate matter (PM) and oxides of nitrogen (NO_x) emissions from CHC in California. The proposed amendments are provided in Appendix A of this Staff Report.

The staff is proposing to add crew and supply vessels because updated information shows that these vessels have similar or greater emissions than vessel categories currently controlled by the CHC regulation. The addition of barge and dredge vessels will amend a situation where this class of vessels are subject to two different statewide regulations. Approximately 175 crew and supply, barge, and dredge vessels operate in California, and are equipped with about 640 diesel-fueled engines. These engines emit about 66 tons per year of diesel PM and 1,430 tons per year NO_x.

This report discusses California's estimated population of crew and supply, barge, and dredge vessels and associated emissions, the regulatory proposal to require these vessel categories to be subject to in-use engine requirements of the original CHC regulation, other proposed amendments, regulatory alternatives considered, and potential environmental and economic impacts. The basis of the original CHC regulation and background information can be found in the *Staff Report: Initial Statement of Reasons for Regulations to Reduce Emissions from Diesel Engines on Commercial Harbor Craft Operated Within California Waters and 24 Nautical Miles of the California Baseline*, September 2007, and the accompanying *Technical Support Document*. For the remainder of this report, the 2007 report will be referred to as the September 2007 Staff Report.

B. Need for the Regulation

The ARB's mission is to protect public health, welfare, and ecological resources through the effective and efficient reduction of air pollutants, while recognizing and considering the effects on the economy of the State. The ARB's vision is that all individuals in California, especially children and the elderly, can live, work, and play in a healthful environment – free from potential harmful exposure to air pollution. To help achieve

²Title 17, CCR section 93118.5. is known as the Commercial Harbor Craft Regulation (CHC regulation) and establishes emission standards, reporting, record keeping, fuel, and monitoring requirements for certain categories of marine vessels. Title 13, CCR section 2299.5 is the corresponding Low Sulfur Fuel Regulation for Commercial Harbor Craft.

this, ARB has adopted numerous regulations to control emissions from many different sources, including diesel-fueled engines. Diesel-fueled engine exhaust is a significant health concern because it is a source of unhealthy air pollutants including particulate matter, gaseous and particulate-phase toxic air contaminants (TACs), NO_x, carbon monoxide, and hydrocarbons.

In 1998, the Board identified diesel PM as a TAC with no specified threshold exposure level to which adverse health impacts would be expected, pursuant to Health and Safety Code (HSC) sections 39650 through 39675. A needs assessment for diesel PM was conducted between 1998 and 2000 pursuant to HSC sections 39658, 39665, and 39666. This resulted in ARB staff developing, and the Board approving, the *Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles* (Diesel RRP) in 2000. The Diesel RRP presented information on the available options for reducing diesel PM and recommended regulations to achieve these reductions. The Diesel RRP's scope was broad, addressing all categories of mobile and stationary diesel engines. It included control measures for off-road diesel PM sources, such as those covered by the proposed amendments to the CHC regulation. The ultimate goal of the Diesel RRP is to reduce, by 2020, California's diesel PM emissions and associated potential cancer risks by 85 percent from the 2000 levels.

In January 2005, the Goods Movement Cabinet Workgroup – created by Governor Schwarzenegger and led by the California Environmental Protection Agency and the Business, Transportation and Housing Agency – established a policy for goods movement and ports to improve and expand California's goods movement industry and infrastructure while improving air quality and protecting public health. The workgroup worked collaboratively with the logistics industry, local and regional governments, neighboring communities, business, labor, environmental groups, and other interested stakeholders to create a two-phased Goods Movement Action Plan (Action Plan), which outlines a comprehensive strategy to address the economic and environmental issues associated with moving goods via the State's highways, railways, and ports. In April 2006, the Board approved the *Emissions Reduction Plan for Ports and Goods Movement in California* as part of the Action Plan. The final phase of the Action Plan was completed in January 2007 and includes a framework that identifies the key contributors to goods movement-related emissions. The Action Plan emission reduction goals for existing harbor craft engines are 25 percent reductions for both diesel PM and NO_x compared to baseline 2001 levels by 2010, 30 percent reductions compared to 2001 baseline levels by 2015, and 40 percent reduction by 2020. (ARB, 2006)

The federal Clean Air Act (CAA) requires the United States Environmental Protection Agency (U.S. EPA) to establish National Ambient Air Quality Standards (standards) for pollutants considered harmful to public health, including fine particulate matter (PM_{2.5}) and ozone. The South Coast and San Joaquin Valley Air Basins are the two areas in the State that exceed the annual PM_{2.5} standards. These air basins are required by federal law to develop State Implementation Plans (SIPs) describing how they will attain the standards by 2015. The U.S. EPA further requires that all necessary emission

reductions be achieved one calendar year sooner – by 2014 – in recognition of the annual average form of the standard. Reductions of NO_x emissions are needed because NO_x contributes to the formation in the atmosphere of both ozone and PM_{2.5}; diesel PM emission reductions are needed because diesel PM contributes to ambient concentrations of PM_{2.5}. The South Coast and San Joaquin Valley air basins are also in non-attainment for the federal ozone standard. However, they have until 2023 to attain the federal ozone standard, by invoking the “bump-up” provision in the CAA.

While all sources of PM and NO_x emissions are important, marine vessels play an especially significant role in California’s efforts to reach attainment. About one third of the 2008 inventory of diesel PM and NO_x emissions from crew and supply, barge and dredge vessels are estimated to be in the South Coast Air Basin. Emissions from marine vessels, which include CHC engines, collectively represent one of several key contributors to ambient PM_{2.5} levels. Successfully controlling these sources is essential in determining whether California is able to meet the 2014 deadline for PM_{2.5} attainment in the South Coast Air Basin.

C. Regulatory Authority

ARB has authority under California law to adopt the proposed regulation. California Health and Safety Code (HSC) sections 43013(b) and 43018 provide broad authority for ARB to adopt emission standards and other regulations to reduce emissions from new and in-use nonvehicular sources. Under HSC sections 43013(b) and 43018, ARB is directly authorized to adopt emission standards for marine vessels as expeditiously as possible to meet State ambient air quality standards and to the extent permitted by federal law. The ARB is further mandated by California law under HSC section 39666 to adopt airborne toxic control measures (ATCM) for new and in-use nonvehicular sources, including commercial harbor craft, for identified toxic air contaminants such as diesel PM.

Under federal and California law, ARB is the primary agency in California responsible for ensuring that all regions of the State attain and maintain state and federal ambient air quality standards (HSC section 39606; CAA section 110). To achieve this, California must adopt all feasible measures to obtain the necessary emission reductions, including measures for mobile sources. (HSC sections 39602.5 and 43013(h)). The federal Clean Air Act section 209(e)(1) conclusively preempts states, including California, from adopting requirements for locomotive engines and new off-road engines less than 175 horsepower that are used in farm or construction equipment. However, the proposed regulation addresses off-road engines used in marine vessels, rather than those used in locomotives or farm or construction equipment.

Under CAA section 209(e)(2), California may adopt and enforce emission standards and other requirements for off-road engines and equipment not conclusively preempted by section 209(e)(1), if California applies for and receives authorization from the Administrator of U.S. EPA.

2. EMISSIONS INVENTORY

ARB staff used several sources to gather the most accurate information regarding CHC vessels. Staff conducted a 2008 survey that was used to evaluate the need for the proposed amendments for crew and supply vessels. Staff also developed the emissions inventories presented in this section with the most current information obtained from the 2009 “Initial Reports” (required by the 2007 CHC regulation), the PERP database, a survey of barge and dredge vessels, and information from districts. Table 1 below presents an overview of the various surveys and reports used by staff to develop the corresponding emission inventories.

Table 1: Overview of Surveys, Reports, and Inventories

Year Data Submitted	Data Source: Surveys and Reports	Inventory Year	Inventories Developed
2004	ARB CHC Survey	2004	CHC Emissions Inventory*
2008	ARB Crew and Supply Vessel Survey	2007	Interim Crew and Supply Inventory Used in Evaluating Need for Proposed Amendments
2009	CHC Initial Reports	2008	Crew and Supply Vessels Emissions Inventory
2009	ARB Barge and Dredge Survey, PERP Database, and CHC Initial Reports	2008	Barge and Dredge Vessel Emissions Inventory

*As presented in the 2007 Staff Report

Approximately 8,700 marine engines currently operate on about 4,300 CHC in California. These vessels are mostly located along the California coastline, with some on inland waterways. A summary of the estimated number of vessels and engines in each category are provided in Table 2 below.

Table 2: Commercial Harbor Craft Vessels and Engines (2008)*

Vessel Category	Number of Vessels	Number of Engines
Commercial Fishing	2,727	4,308
Charter Fishing	563	1,419
Ferries/Excursion	416	1,348
Tug	128	450
Tow	35	115
Barge	88	318
Crew and Supply	70	236
Workboats	89	158
Dredge	18	83
Pilot	27	50
Other	136	214
Total	4,297	8,699

*Estimates are updated for crew and supply boats and barge and dredge vessels from the 2004 CHC Survey.

Detailed information on the updated emissions inventory and methodology used to estimate emissions is included in Appendix C.

A. Updating the Crew and Supply Vessel and Engine Data

The September 2007 Staff Report inventory for crew and supply vessels and engines was based on the 2004 Statewide Commercial Harbor Craft Survey (2004 Survey). The following overview compares the 2004 inventory from the September 2007 Staff Report and an updated inventory of the crew and supply vessels which is derived primarily from the 2009 Initial Reports.

Table 3 shows that the total number of engines did not change significantly, but engine average horsepower (hp) was larger for both propulsion and auxiliary engines than previously estimated.

Table 3: Crew and Supply Vessels and Engines Inventories

	2004 Inventory	2008 Updated Inventory
Total Number of Vessels	64	70
Total Number of Engines	230	236
Number of Propulsion Engines	160	163
Average Horsepower of Propulsion Engines	440	500
Number of Auxiliary Engines	70	73
Average Horsepower of Auxiliary Engines	90	110

While the total number of crew and supply vessel engines did not change dramatically from the estimates used in the September 2007 Staff Report, the total average annual hours of operation did significantly change for the propulsion engines, the most significant engines in this class of vessels. Table 4 presents the updated average annual hours of operation.

Table 4: Annual Engine Hours of Operation for Crew and Supply Vessels

	2004 Inventory	2008 Updated Inventory
Propulsion Engine Average Annual Hours	800	1,800
Auxiliary Engine Average Annual Hours	3,000	2,300

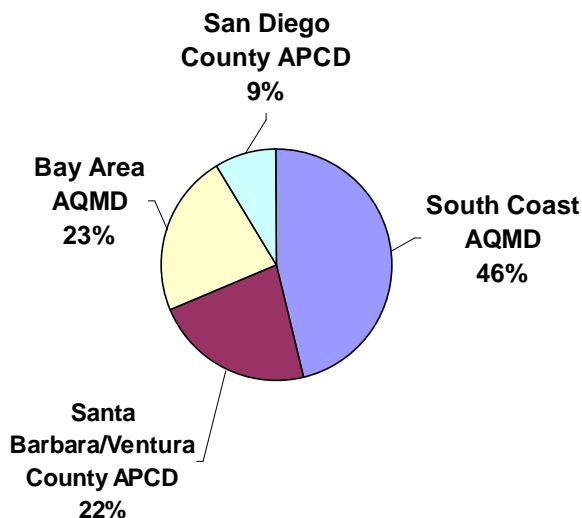
The distance that crew and supply vessels operate from shore is also important to consider. These vessels typically operate in harbors and generally close to shore. Therefore, most of the related emissions impact communities near ports. Information on the total hours of operation by distance from shore was gathered through the 2008 survey and Initial Reports. Table 5 shows the percentage of time that crew and supply vessels operate by distance from shore.

Table 5: Hours of Operation by Distance from Shore

Vessel Type	% Total Annual Hours (Distance from Shore)		
	0-3 nm	3-24 nm	>24 nm
Crew	86%	5%	9%
Supply	33%	65%	2%

All of these vessels primarily operate within five APCD's: South Coast Air Quality Management District (AQMD), Ventura County APCD, Santa Barbara County APCD, San Diego County APCD, and Bay Area AQMD. Figure 1 shows the distribution of crew and supply vessels by district.

Figure 1. Distribution of Crew and Supply Vessels by District



B. Updated Emissions from Crew and Supply Vessel Engines

The emissions from crew and supply vessel engines were derived from several sources and show an increase in emissions compared to the emission estimates reported in the September 2007 Staff Report. The updated crew and supply vessel emissions inventory was compiled from the “Initial Reports” and input from Santa Barbara County and Ventura County districts. Using this data, we estimate that the diesel PM emissions from crew and supply vessel engines are approximately 75 percent higher than estimated in the September 2007 Staff Report, and NO_x emissions are about 60 percent higher. In the September 2007 Staff Report, crew and supply vessel emissions were based on the average emission factors for all CHC. Diesel PM emissions from crew and supply vessels are now estimated to be 33 tons per year (tpy) and NO_x emissions are estimated to be 670 tpy as shown in Table 6 below.

Table 6: 2008 Emissions from Crew and Supply Vessels

	Original 2008 Inventory*	Updated 2008 Inventory**
PM Emissions (tpy)	19	33
NO _x Emissions (tpy)	420	670

* 2008 emissions estimates based on 2004 CHC Emissions Inventory

** Inventory based on 2009 Initial Reports and data from Santa Barbara and Ventura County districts

As shown in Figure 1, over 22 percent of crew and supply vessels operate in the districts Santa Barbara County and Ventura County. In these two districts, crew and supply vessels make up a much higher portion of the total emissions from CHC. This

distribution and proportional emissions impact from crew and supply boats in Santa Barbara County and Ventura County districts in comparison to the other districts that have crew and supply vessels is shown in Table 7. ARB estimates that about 20 percent of the CHC emissions in the Santa Barbara County and Ventura County districts are from diesel-fueled engines on crew and supply vessels. Currently, permitted crew and supply vessels operating in Santa Barbara County APCD are required to use turbo charging, enhanced inter-cooling, and 4 degrees of timing retard on their engines to reduce the NO_x emissions. The impact of these changes on emissions has been accounted for in the emissions inventory.

Table 7: Proportion of Emissions from Crew and Supply Vessel Engines by District

District	NO _x (tpy)			Diesel PM (tpy)		
	Crew & Supply Vessels	Total Harbor Craft	% Harbor Craft	Crew & Supply Vessels	Total Harbor Craft	% Harbor Craft
Santa Barbara / Ventura	280	1,650	17%	17	75	22%
South Coast	340	6,350	5%	14	270	6%
Bay Area	40	8,950	< 1%	1.0	380	< 1%
San Diego	10	3,100	< 1%	< 1	130	< 1%
Statewide Total*	670*	20,000	3%	33	855	4%

* Rounded using conventional rounding practices.

C. Barge and Dredge Vessel Data

Barge and dredge vessels were included in the September 2007 Staff Report as “Other CHC Vessels.” The following section provides a detailed look at the population of barge and dredge vessels and associated engines operating in Regulated California Waters. ARB staff compiled the information by using data from PERP, a barge and dredge survey conducted by ARB staff in August 2009, district permits, and information from the “Initial Reports” required by the 2007 CHC regulation. Staff combined these sources of information to develop a statewide inventory of barge and dredge vessels, engines, and emissions.

Approximately 400 engines currently operate on barge and dredge vessels in California. Auxiliary engines on barges and dredges are mainly off-road (nonroad) engines. These vessels are located mostly along the California coastline, with some on inland waterways. Fuel barges are the most common barge used in California. The engines on fuel barges power pumps and generators. Construction barges are also common and the engines on these vessels typically power winches, generators, and hoists.

Dredge vessels are used to excavate underwater material for cleaning waterways, construction projects, restoration projects, and various other excavation activities. Table 8 provides an overview of the numbers of barge and dredge vessels and engines and the average horsepower of those engines.

Table 8: Barge and Dredge Vessels and Engines 2008 Inventory Overview

	Barge	Dredge
Total Number of Vessels	88	18
Total Number of Engines	318	83
Number of Auxiliary Engines	314	77
Average Horsepower of Auxiliary Engines	346	812
Number of Propulsion Engines	4	6
Average Horsepower of Propulsion Engines	251	2,708

As shown in Table 8, only a few barge and dredge vessels have propulsion engines. Most of these vessels are towed or pushed by other vessels. The total average annual hours of operation for barges and dredges is shown in Table 9. Propulsion engines have much higher annual hours of operation compared to auxiliary engines. Auxiliary engines have lower average annual hours, but have a larger population. Because of the large population, auxiliary engines make up the majority of barge and dredge emissions.

Table 9: Annual Engine Hours of Operation for Barge and Dredge Vessels

	2008 Inventory
Propulsion Engine Average Annual Hours	1,510*
Auxiliary Engine Average Annual Hours	550

* Average annual hours for propulsion engines is from the 2009 barge and dredge survey based on very few data points, given small number of engines.

Table 10 shows the percentage of time that barge and dredge vessels operate by distance from shore. Like crew and supply vessels, the distance that barge and dredge vessels operate from shore is important to consider. These vessels typically operate in harbor and generally close to shore. Therefore, most of the related emissions impact those communities near the ports.

Table 10: Percent of Barge and Dredge Vessel Engine Operations by Distance from Shore (2009 Survey)

Vessel Type	% Total Annual Hours (Distance from Shore)		
	0-3 nm	3-24 nm	>24 nm
Barge	83%	2%	15%
Dredge	100%	0%	0%

D. Emissions from Barge and Dredge Vessel Engines

Emissions from barge and dredge vessel engines are estimated to be 33 tpy of diesel PM and 760 tpy of NO_x as shown in Table 11 below.

Table 11: Barge and Dredge Vessel Engine Emissions

	2008 Inventory
PM Emissions (tpy)	33
NO _x Emissions (tpy)	760

E. Total Combined Emissions from Crew and Supply Vessels and Barge and Dredge Vessels

Table 12 presents the total 2008 baseline emissions inventory for crew and supply, barge, and dredge vessels. Total combined emissions from both vessel categories are 66 tpy of diesel PM and 1,430 tpy of NO_x.

Table 12: Combined Total Emissions from Crew and Supply Vessels and Barge and Dredge Vessels – 2008 Inventory

	Crew and Supply	Barges and Dredges	Total Combined Emissions
PM Emissions (tpy)	33	33	66
NO _x Emissions (tpy)	670	760	1,430

3. HEALTH RISK

The Board listed Diesel PM as a toxic air contaminant in 1998 based on its potential to cause cancer, premature death, and other health effects. NO_x is a precursor to the formation of ozone and contributes to secondarily formed PM in the lower atmosphere. Therefore, the reductions in diesel PM emissions and NO_x emissions will benefit public health by reducing exposure to diesel PM and helping to attain ambient air quality standards. The estimated potential cancer and non-cancer risks from CHC that were presented in the September 2007 Staff Report are not expected to change significantly as a result of the proposed amendments. Crew and supply, barge, and dredge vessel emissions are a small percentage of the total overall CHC emissions statewide. In the September 2007 Staff Report, crew and supply vessels accounted for about 2 percent of the total statewide 2004 CHC diesel PM emissions. However, using the updated emission estimates for crew and supply, barge, and dredge vessels, the overall increase contribution to the total 2004 CHC statewide inventory less than 10 percent. This increase in the total statewide CHC inventory is not expected to significantly affect the results of the health risk analysis done for the September 2007 Staff Report. A summary of the risks reported in the September 2007 Staff Report are provided below.

A. Potential Cancer Risk

In the September 2007 Staff Report, ARB staff estimated potential cancer risks from CHC using the results from a risk assessment for the Ports of Los Angeles and Long Beach (POLA/LB). The POLA/LB health risk assessment estimated that CHC are responsible for the third highest impact on cancer risk from port activities. That analysis showed that approximately 1.7 million people are exposed to a 10 in a million risk from all CHC emissions.

Estimates of potential cancer risks from harbor craft activity at these two ports would represent the upper range of cancer risks, given the magnitude of CHC emissions in the area and the proximity of the emissions to highly urbanized areas. Qualitative estimates of the relative impact of CHC emissions for other areas can be made based on a comparison of the relative magnitude of emissions and the proximity of the emissions to urbanized areas.

B. Non-Cancer Risk

In the September 2007 Staff Report, staff estimated that exposures to direct and secondary diesel PM emissions from all harbor craft can be associated with about 90 premature deaths per year. Approximately half of these premature deaths are due to direct diesel PM and half from secondary diesel PM. A complete discussion of the methodology used to develop this estimate is found in the *Technical Support Document* of the September 2007 Staff Report. ARB staff is currently updating the methodology to estimate non-cancer health risks from diesel PM. The new methodology is anticipated to project somewhat fewer premature deaths than those reported in the September 2007 Staff Report and in this report.

4. SUMMARY OF THE PROPOSED AMENDMENTS

Staff is proposing to amend the CHC Regulation³ to require the vessel categories of crew and supply, barge, and dredge vessels to be subject to in-use engine requirements. Staff anticipates that in most cases, engine replacement will be the option used by vessel owner/operators to meet the proposed emission standards for vessel engines. The accelerated phase-in of newer engines will result in emission reductions of diesel PM and NO_x. Additional clarifying amendments are also proposed. The following sections provide background information on marine and nonroad engine standards and more details regarding the proposed amendments.

A. Background Information on Emission Standards for Marine Engines

Under the staff's proposal, the emission limits for PM and NO_x from a regulated diesel-fueled marine engine would be identical to those specified by the U.S. EPA marine engine standards for new engines in effect at the time compliance is required. The U.S. EPA marine engine emission standards have phased effective dates and emission levels dependent on the engine size.

The U.S. EPA classifies marine engines as either Category 1, 2, or 3, depending on engine size or cylinder displacement, with the engine size increasing with the higher category number. All of the marine engines used in California's CHC are Category 1 or 2 engines, with about 90 percent of the engines being Category 1 engines. The engine size and approximate maximum horsepower (hp) rating for Category 1 and 2 engines are provided in Table 13. Category 1 engines are rated at less than 5.0 liters per cylinder and can range as high as 2,500 hp. Category 2 engines range in size from 5.0 liters per cylinder to 30 liters per cylinder and from about 750 to 5,000 hp.

Table 13: U.S. EPA Marine Engine Categories Used in Commercial Harbor Craft

Category	Liters per Engine Cylinder	Approximate Horsepower
Category 1	< 5.0 ^A	50 ^B to <~2500 hp
Category 2	5.0 to ≤30 ^A	≥750 to <5000 hp

^A U.S. EPA Tier 3 and Tier 4 marine standards established Category 1 to < 7.0 L/cyl. and Category 2 to 7.0 to 30 L/cyl.

^B Category 1 Tier 3 standards include engines rated less than 50 hp.

The emission limits for Category 1 and 2 engines used in CHC are summarized in Table 14.

³ Title 17, California Code of Regulations (CCR) section 93118.5, and title 13, CCR section 2299.5.

Table 14: U.S. EPA Marine Engine Standards Effective Dates and Emissions Limits for Category 1 and Category 2 Engines Used in Commercial Harbor Craft

Category	Tier Level	Adoption Date	Effective Date	PM (g/bhp-hr)	NOx (g/bhp-hr)
1	1	IMO 1997 U.S EPA 2003	2000 2004	N/A	7.3 – 12.7 ^B
	2	U.S. EPA 1999	2004-2007	0.15-0.3	5.4-5.6 ^C
	3	U.S. EPA 2007	2009-2014	0.08-0.3	3.5-5.6 ^C
	4 ^A	U.S. EPA 2007	2017	0.03	1.3
2	1	IMO 1997 U.S EPA 2003	2000 2004	N/A	7.3 – 12.7 ^B
	2	U.S. EPA 1999	2007	0.2	5.8 ^C
	3	U.S. EPA 2007	2013	0.1	4.6 ^C
	4 ^A	U.S. EPA 2007	2016-2017	0.03	1.3

(40 CFR Part 94) (40 CFR Part 1042)

^A Applies only to engines with maximum horsepower rating of 800 hp (600 kW) or more.

^B Standard is a function of engine speed, revolutions per minute (rpm). Standard=12.7 for engines with engine speed ≥ 2000 rpm. Standard=7.3 for engines with engine speed ≤ 130 rpm. For engines between 130 and 2000 rpm, standard = $33.57 \times \text{rpm}^{-0.2}$.

^C NOx is NOx + total HC.

B. Background Information on Emission Standards for Off-Road Engines

Generally, barge and dredge vessels utilize off-road engines to power pumps, winches, and cranes. Since the mid-1980's, new engine standards adopted by U.S. EPA and ARB have required new off-road engines to become progressively cleaner. In developing the new engine standards, ARB staff worked closely with U.S. EPA to develop a harmonized federal and State program to more effectively control emissions from off-road equipment. The emission standards are divided into four increasingly stringent levels (Tiers); the allowed emission level and effective dates vary with horsepower. Until the mid-1990's, off-road diesel engines were not subject to any emission standards (commonly referred to as Tier 0 or "uncontrolled engines"). In 1996 through 2000, the Tier 1 standards took effect. By 2006, all engine sizes were subject to Tier 2 standards. Between 2006 and 2008, Tier 3 standards took effect for some horsepower groups. Tier 4 standards are divided into two stages: interim Tier 4, which begins between 2008 and 2012 for most engines, and final Tier 4, which is effective for all off-road engines by 2015. The final Tier 4 standards will require the use of advanced exhaust after-treatment technologies to control both PM and NO_x, and will result in diesel engines that will be over 90 percent cleaner than Tier 0 engines. Table 15 illustrates how these standards change over time for one horsepower group, 300 to

600 horsepower engines. The numerical standards vary by horsepower group, but the downward trend in emissions is the same for all horsepower groups.

Table 15: ARB and U.S. EPA Diesel PM and NOx Emission Standards for New Off-Road Engines (300 – 600 hp)

Engine Tier	Off-Road Engines (600 hp)			Marine Engines (Category 1 600 hp)		
	PM Standard*	NOx+HC Standard*	Effective Date	PM Standard*	NOx+HC Standard*	Effective Date
Tier 0	NA	NA		NA	NA	
Tier 1	0.40	7.90	1996	NA	7.3	2004
Tier 2	0.15	4.80	2004	0.15	5.4	2007
Tier 3	0.15	3.00	2006	0.08	4.2	2013
Tier 4 interim	0.01	1.64	2011	NA	NA	NA
Tier 4 final	0.01	0.44	2014	0.03	1.3	2016-2017

*Emission rates expressed in grams per brake horsepower-hour (g/bhp-hr)

C. In-Use Requirements for Crew and Supply Vessels, Barge, and Dredge Vessels

The proposed amendments would primarily establish in-use emission limits for diesel-fueled engines on crew and supply, barge, and dredge vessels that are consistent with the U.S. EPA marine or off-road engine standards, similar to that already required for excursion vessels, ferries, tugboats, and towboats. Two compliance schedules are being proposed; one for crew and supply vessel engines and another for barge and dredge vessel engines. Separate compliance schedules were developed in consideration of the profile of the engine fleets and to provide a transition period for barge and dredge operators from planned compliance with the Portable Engine ATCM to the CHC regulation.

1. Crew and Supply, Barge, and Dredge Vessel Engine Compliance Options

Staff is proposing that in-use Tier 0 (pre-Tier 1) and Tier 1 engines on crew and supply, barge, dredge vessel engines meet emission limits equal to or cleaner than current U.S. EPA marine engine standards. In auxiliary applications, staff is proposing that in-use Tier 0 (pre-Tier 1) and Tier 1 engines meet emission limits equal to or cleaner than engines meeting Tier 2 or Tier 3 marine or off-road engine standards. Engine compliance options vary depending upon the proposed compliance schedule, horsepower, and liters/cylinder. The proposed amendments do not require compliance with Tier 4 (after-treatment based) U.S. EPA standards for in-use engines due to issues with the additional engine weight and space requirements associated with applying after-treatment technologies to existing vessels.

While the primary method for compliance with the proposed in-use engine requirements will likely be the replacement of in-use engines with new certified engines, the proposed amendments include other options for compliance. These options include:

- demonstrating that the existing engine meets the applicable U.S. EPA marine or off-road engine standards;
- demonstrating that the existing crew and supply vessel engine has not and will not operate 300 hours or more per calendar year; or
- demonstrating that the existing barge and dredge vessel engine has not and will not operate 80 hours or more per calendar year.

If the propulsion engine is replaced with a Tier 2 or 3 marine standard engine, or if an auxiliary engine is replaced with a Tier 2 or 3 off-road auxiliary engine, or can be shown to meet the applicable standards, all compliance requirements for that engine will have been met.

2. Crew and Supply Vessel and Barge and Dredge Engine Compliance Schedules

The proposed compliance schedules are shown in Table 16 and Table 17 for crew and supply and barge and dredge engines, respectively. Compliance dates are based on the model year of the engine and the annual hours of operation. Table 18 shows the distribution of engines by compliance year that would need to comply with the proposed amendments.

The engine model year would be determined by one of three methods. In most cases, the engine's actual model year of manufacture would be used to determine the required compliance date. However, the regulation provides two additional options using an "effective model year" different from the actual engine model year. The first of those options is to implement an emission control strategy that achieves at least a 25 percent reduction in either PM or NO_x; this would extend the engine model year by five years. This is referred to as the "Engine's Model Year + 5" method. The date by which the engine must meet the U.S. EPA marine engine standards would be based on the actual engine model year plus five years. The second option is to demonstrate that the engine has been rebuilt to Tier 1 standards or cleaner prior to January 1, 2008; this would allow the date of rebuild to be used as the engine's model year for determining when the engine must meet the U.S. EPA marine engine standards. This is referred to as the "Engine's Tier 1 Rebuild Model Year."

Table 16: Compliance Dates for Crew and Supply Vessel Engines Statewide

Engine Model Year	Total Annual Hours of Operation	Compliance Date
1985 and earlier	>1500	12/31/2011
1985 and earlier	> 300 – 1500	12/31/2012
1986 - 1995	>1500	12/31/2013
1986 - 1995	> 300 – 1500	12/31/2014
1996 - 2000	>1500	12/31/2015
1996 - 2000	> 300 – 1500	12/31/2016
2001 - 2002	>300	12/31/2017
2003	>300	12/31/2018
2004	>300	12/31/2019
2005	>300	12/31/2020
2006	>300	12/31/2021
2007	>300	12/31/2022

Table 17: Compliance Dates for Barge and Dredge Vessel Engines Statewide

Engine Model Year	Total Annual Hours of Operation	Compliance Date
1975 and earlier	>80	12/31/2011
1976 - 1980	>80	12/31/2012
1981 - 1985	>80	12/31/2013
1986 - 1990	>80	12/31/2014
1991 - 1995	>80	12/31/2015
1996 - 1999	>80	12/31/2016
2000 - 2001	>80	12/31/2017
2002	>80	12/31/2018
2003	>80	12/31/2019
2004	>80	12/31/2020
2005	>80	12/31/2021
2006	>80	12/31/2022

Table 18: Estimated Population of In-Use Crew and Supply and Barge and Dredge Vessel Engines Subject to Amendments to CHC Regulation Emission Limits

Year	Crew and Supply Engines	Barge and Dredge Engines	Total
2011	33	5	38
2012	6	3	9
2013	3	7	10
2014	3	6	9
2015	10	5	15
2016	3	43	46
2017	14	45	59
2018	12	6	18
2019	14	4	18
2020	19	3	22
2021	8	1	9
2022	25	2	27
Total	150	130	280

D. Other Proposed Amendments

Additional clarifying amendments are also being proposed. The most substantive proposals are listed below that clarify requirements and to address issues that have arisen during the implementation of the 2007 regulation including additional definitions. All amendments are included in the proposed language shown in Appendix A.

1. Deleting Exemption for Vessels in PERP or Under District Permit Prior to January 1, 2009

Staff is proposing to remove the exemption (17 CCR section 93118.5 (c)(7)(C)) that excluded vessels registered in PERP or permitted by the districts before January 1, 2009 from the CHC regulation. This amendment will provide consistency to CHC vessels. Marine vessel auxiliary engines that were registered in PERP were subject to the Portable Engine ATCM. During 2009, it became clear that having some barge and dredges subject to the Portable Engine ATCM and others subject to the CHC regulation was creating compliance and enforcement issues. In January 2010, PERP was amended to make engines used on marine vessels that were registered in that program subject to the requirements of the CHC regulation.⁴ The goal of the amendments to PERP and the proposed amendments to the CHC regulation is to allow harbor craft vessels to be subject to a single regulation, regardless if they are registered in PERP or not.

⁴ Final PERP amendments pending completion of rulemaking process.

ARB staff also became aware that some districts did not permit barge and dredge vessels, leaving some in-use engines on these vessels uncontrolled. Since the current CHC regulation has no in-use requirements for barge and dredge vessel engines, staff proposes to amend this regulation for consistency, and to require all barge and dredge vessel engines, including those currently registered in PERP or under district permits, to be subject to the CHC regulation.

2. Allowing Certified Off-Road or Nonroad Engines to be Used as Auxiliary Engines

The current CHC regulation requires vessel owner/operators' in-use engines to meet Tier 2 and Tier 3 marine engine standards. The proposed amendments will allow vessel owner/operators more flexibility to comply with the current CHC regulation by allowing them to use currently available Tier 2 or higher certified off-road engines to meet the in-use requirements for auxiliary engines. Owner/operators can install a Tier 2 or Tier 3 (marine or off-road) engine on a vessel as a replacement auxiliary engine even after Tier 4 marine, or interim Tier 4 and final Tier 4 off-road standards are in effect. Tier 4 standards will require integration of exhaust aftertreatment into the engine design. Generally, these design changes make these engines larger and heavier. These larger and heavier Tier 4 engines may not be practical for some CHC engine replacements due to space limitations in the engine compartments of those vessels. In addition, there may be situations where the harsh marine environment may have adverse effects on off-road engines. Vessel owner/operators must assess these factors when deciding to use an off-road engine.

3. Adding a Definition of "Swing Engine" and Requirements for Their Inclusion in Recordkeeping

Swing engines are defined and requirements for their inclusion in reporting and recordkeeping are included in the proposed amendments. One standard maintenance practice of CHC fleet owner/operators includes the use of swing engines. These engines match the engines currently on a vessel or fleet of vessels. The engines are standing by, ready to be installed on a vessel when the existing engine is not functioning properly, or during the normal maintenance cycle, thereby preventing excessive vessel downtime. All swing engines used on a regulated vessel categories would be considered in-use engines and must meet the applicable in-use engine compliance requirements.

4. Delete Multipurpose Harbor Craft Definition and Low Use Exemption

Staff is proposing to delete the "multipurpose harbor craft" term and the low use exemption in title 17, CCR section 93118.5(c)(12) from the CHC regulation which was often confusing and overly burdensome to some vessel owners. This change will allow vessel owner/operators more flexibility to operate vessel engines for up to 300 hours

per year in any one of the regulated vessel categories without having to comply with the in-use engine requirements. This allows vessel owner/operators to be exempt from the in-use engine compliance requirements as long as the total engine hours of operation stays below 300 hours when operating as a regulated in-use vessel type. For example, an owner of a fishing vessel engines may operate unlimited annual hours because fishing vessels are an unregulated in-use vessel type. The fishing vessel could also offer whale watching excursions on his vessel which is a regulated in-use vessel type. The fishing vessel engines would not be required to comply with the in-use compliance schedule unless the vessel engines are used for whale watching excursions for more than 300 hours per year.

Barge and dredge vessels are limited to operating less than 80 hours to be exempt from the in-use engine compliance requirements. This 80 hour limitation is necessary for barge and dredge vessels to remain consistent with Portable Engine ATCM requirements that many have been subject to by their registration in PERP.

5. Special Circumstances to Use Non-CARB Diesel Fuel

The current CHC regulation requires the use of CARB diesel fuel or specific alternative diesel fuel. The proposed amendments will allow vessel engines to operate using U.S. EPA on-road fuel or U.S. EPA nonroad diesel fuel, in the event a vessel operator cannot obtain CARB diesel fuel prior to operating in Regulated California Waters. Table 19 compares ARB and U.S. EPA on-road and nonroad diesel fuel standards.

Table 19: ARB and U.S. EPA Diesel Fuel Standards

Fuel Type	Implementation Date	Maximum Sulfur Level (ppmv)	Aromatics Maximum (% by volume)	Cetane Index (Minimum)
CARB	2006	15	10	40
U.S. EPA On-road	2006	15	35	40
U.S. EPA Nonroad	2010	15	35	40

6. Deadline for Alternative Control of Emission Plans

The current CHC regulation does not state a date by which a vessel owner/operator that utilizes an Alternative Control of Emission (ACE) Plan must submit that plan. The proposed amendments would require the ACE plan to be submitted prior to or before February 28 of the year the vessel engine compliance is required.

7. In-Use Out-of-State Vessels Operating in California

The current CHC regulation requires all harbor craft, including those from out-of state, to be subject to the in-use engine requirements and to provide an initial report and a compliance plan when operating in Regulated California Waters. There has been some confusion among out-of-state CHC vessels operators about the need to comply with the

reporting requirements. The proposed amendments would clarify that out-of-state CHC vessels are required to complete an initial report within 30 days of a vessel being brought into California to operate in Regulated California Waters and to submit a Compliance Plan within 90 days of being subject to an in-use engine requirement.

8. Replacement Engine Exemption

The current CHC regulation requires that if an engine is replaced, the replacement engine must meet the current U.S. EPA model year marine engine standards. There may be compliance situations when a vessel's engines are already complying with the CHC regulation with Tier 2 engines. A situation may arise when a vessel with multiple propulsion or auxiliary engines experiences a catastrophic failure of one of the engines. If Tier 3 engines are currently available, a Tier 3 engine may not be compatible with the other existing Tier 2 engines. The proposed amendment provides vessel owner/operators an exemption in specific cases allowing a non-compliant engine to be installed on a vessel if there are no suitable engine replacements available, or if the new engine does not synchronize with the existing engines. The proposed amendments include specific requirements that must be met in order to use a noncompliant engine. The proposed amendments allow replacement of an engine not meeting current standards if the vessel owner/operator can demonstrate that a compliant engine, or one meeting required physical or performance characteristics, is not available. To demonstrate this, the vessel owner/operator must evaluate the current engine tier and each previous engine tier. Approval must be obtained from the ARB Executive Officer.

9. Allowing the Use of an Available Engine to Replace an Older Engine Subject to In-use Requirements

The proposed regulation would, in certain situations, allow an engine that does not meet the Tier 2 or Tier 3 requirements to be used on a temporary basis. The engine must be within the same fleet, and the original compliance date of the older, replaced engine must be kept.

10. Clarification of Requirements Applicable to Newly Acquired Vessels and Ferry Vessels

The proposed amendments have been reworded to clarify existing requirements that owners/operators of new ferries having the capacity to transport 75 or more passengers are required to equip diesel propulsion engines that meet either Tier 2 or Tier 3 marine standards with Best Available Control Technology (BACT). BACT is not required for diesel propulsion engines that are certified to Tier 4 marine standards.

11. Compliance Extensions

The proposed amendments would expand the availability of the current compliance extension of title 17, CCR section (e)(6)(E)4 to allow an owner to also request a compliance extension in situations where that owner has multiple vessels that are

subject to compliance dates of 2011 or 2012 for crew and supply, barge, and dredge vessels, similar to the current compliance extension allowed for ferries, excursion vessels, tugboats, towboats, and push boats.

12. Definitions Added

The proposed amendments revise section (d) of the existing regulation by adding several definitions and deleting one to clarify the proposed amended language. Definitions that were added include, “certified nonroad engine”, “dredge”, “family emission limit”, “permanently affixed to a harbor craft”, “regulated in-use vessel”, “swing engine”, “tier 2 off-road or nonroad emission standards”, “tier 3 off-road or nonroad emission standards”, “tier 4 final off-road or nonroad emission standards”, “tier 4 interim off-road or nonroad emission standards”, deleting the definition of “multipurpose harbor craft”, clarifying “temporary emergency rescue/recovery vessel” definition.

13. Update Low Sulfur Fuel Regulation

Staff is also proposing minor amendments to the Low Sulfur Fuel Regulation (section 2299.5, title 13, CCR) to align definition numbers with section 93118.5, title 17, CCR.

5. ENVIRONMENTAL AND HEALTH IMPACTS OF PROPOSED AMENDMENTS

A. Emissions Reductions Statewide

ARB staff has estimated the emissions reductions of the proposed amendments for crew and supply, barge, and dredge vessel engines. As stated earlier, statewide emissions from these specific vessel categories are a small portion of the total harbor craft emissions. However, these emission reductions are important in achieving the Board's goals in the Diesel Risk Reduction Plan and Emission Reduction Plan for Ports and Goods, as well as attaining and maintaining ambient air quality standards. Additionally, these emissions represent a significant portion of the total CHC emissions in Santa Barbara County and Ventura County districts. The emissions reductions for these two districts are presented in Section B of this chapter.

1. Crew and Supply Boat Emission Reductions Statewide

The projected statewide annual emissions for crew and supply vessels are presented in Figure 2. Statewide, the baseline uncontrolled diesel PM emissions from crew and supply vessels are estimated to be about 33 tpy in 2008, dropping to about 22 tpy in 2025. The reduction in uncontrolled emission over this period is due to the anticipated or planned replacement of older engines. With the proposed amendments in place accelerating engine turnover, diesel PM emissions would be reduced in 2025 from 22 tpy to less than 10 tpy. The proposed amendments affect about 150 of the 236 crew and supply vessel engines, as some engines are exempt due to size or annual hours of operation or are already at Tier 2 or Tier 3. The total estimated diesel PM emission reductions from crew and supply vessels from 2011 to 2015 would be about 187 tons.

Figure 2: Projected Statewide Diesel PM Emissions for Crew and Supply Vessel Diesel-Fueled Engines

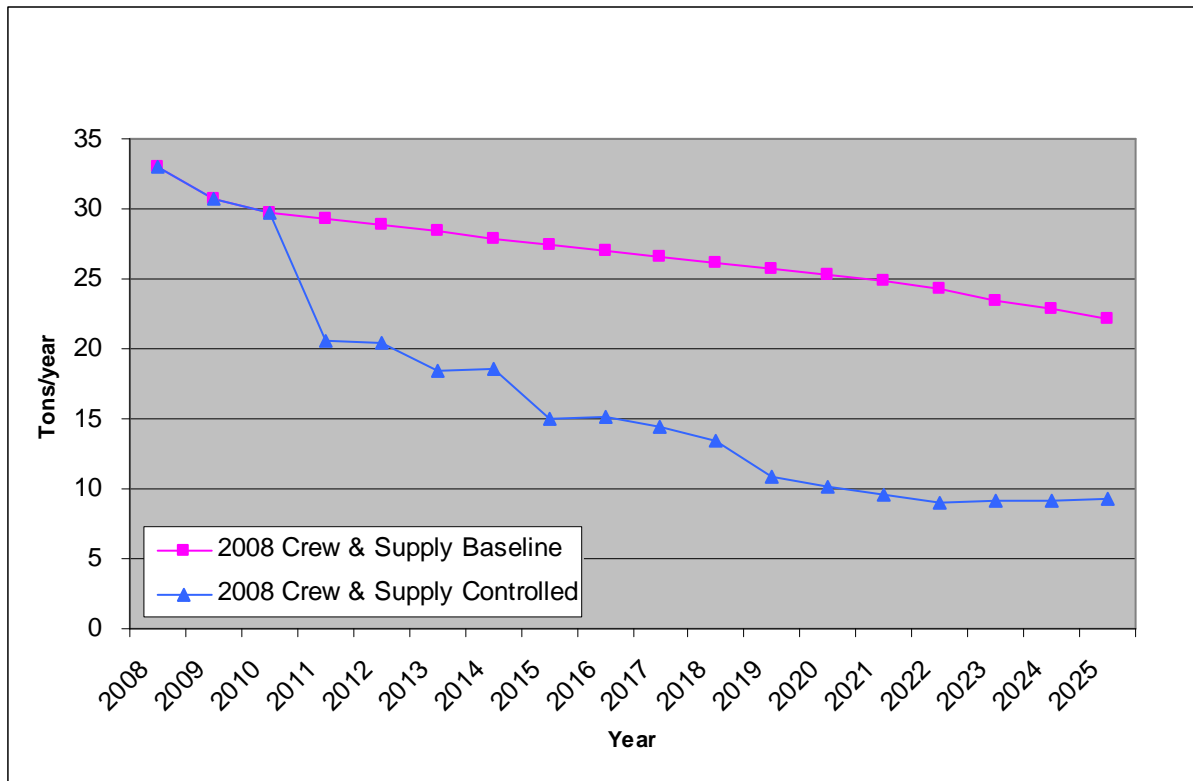
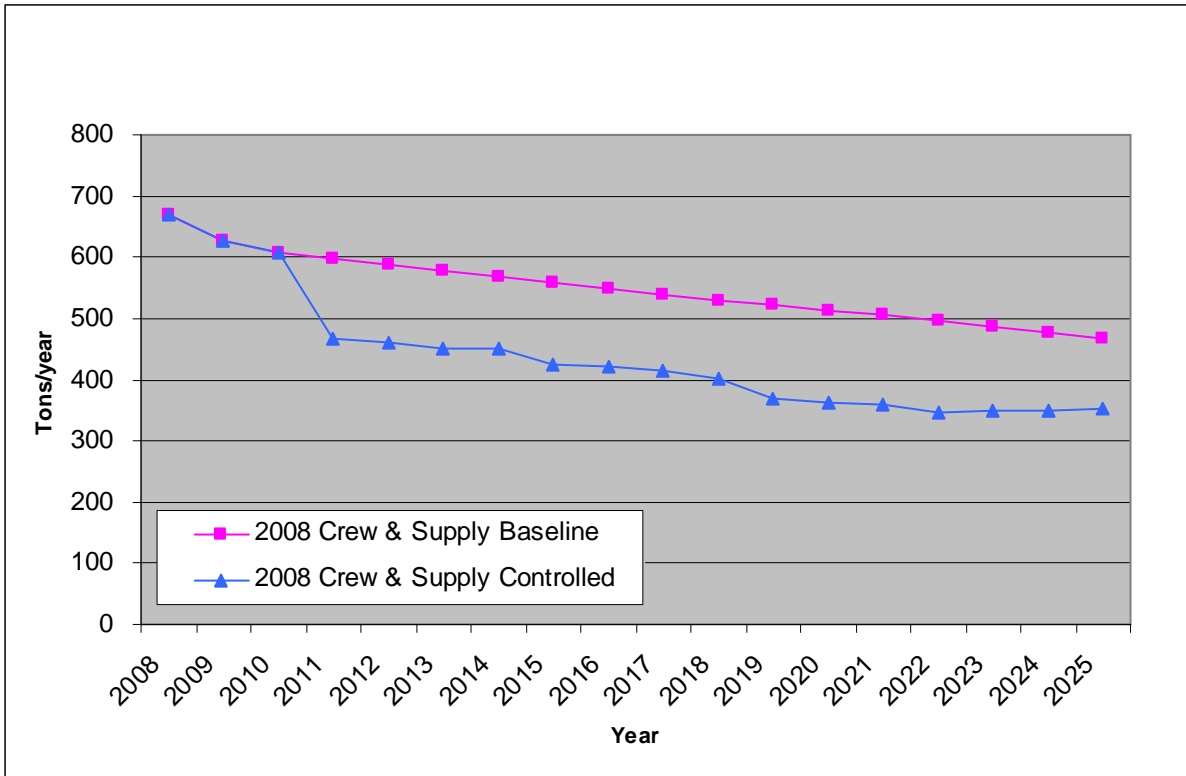


Figure 3 shows that the projected statewide NO_x emissions from and supply vessels are estimated to be about 670 tpy in 2008, dropping to about 466 tpy in 2025 without the proposed amendments. With the proposed amendments in place, the NO_x emissions would be further reduced from 466 tpy to about 350 tpy in 2025. The total estimated NO_x emission reductions from crew and supply vessels from 2011 to 2025 would be about 2,000 tons.

Figure 3: Projected Statewide NO_x Emissions for Crew and Supply Vessel Diesel-Fueled Engines



2. Barge and Dredge Vessel Emission Reductions Statewide

Figure 4 illustrates the statewide barge and dredge vessel engine diesel PM emissions with and without the proposed amendments. Statewide, the baseline uncontrolled diesel PM emissions from barges and dredges are estimated to be about 33 tpy in 2008, dropping to about 12 tpy in 2025. The reduction in uncontrolled emissions over this period is due to the anticipated or planned replacement of older engines. With the proposed amendments in place accelerating engine turnover, diesel PM emissions would be reduced in 2025 from 12 tpy to less than 7 tpy. The proposed amendments affect 129 of the 400 barge and dredge vessel engines statewide, as some engines are exempt due to size or annual hours of operation or are already at Tier 2 or Tier 3. The total estimated diesel PM emission reductions from barges and dredges from 2011 to 2025 would be about 90 tons.

Figure 4: Projected Statewide Diesel PM Emissions for Barge and Dredge Vessel Diesel-Fueled Engines

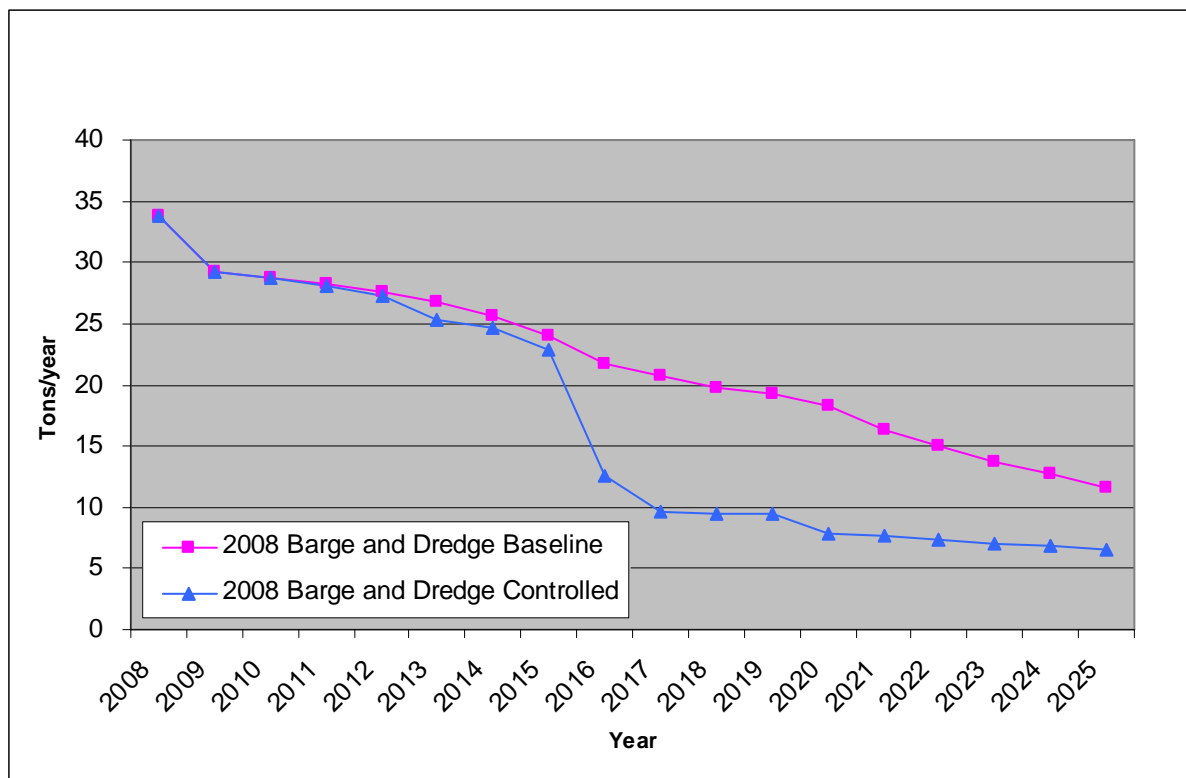
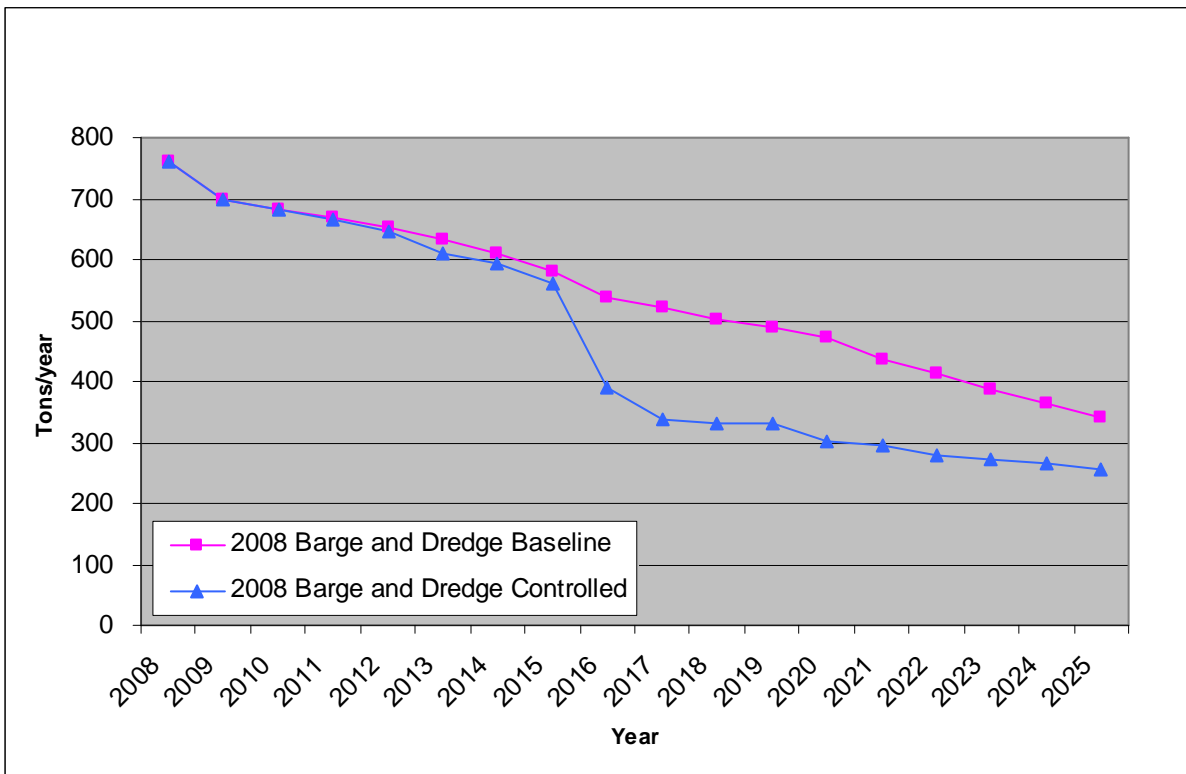


Figure 5 shows that the projected statewide NO_x emissions from barge and dredge vessels are estimated to be about 760 tpy in 2008, dropping to about 340 tpy in 2025 without the proposed amendments. With the proposed amendments in place, the NO_x emissions would be further reduced from 340 tpy to about 255 tpy in 2025. The total estimated NO_x emission reductions from barges and dredges from 2011 to 2025 would be about 1,475 tons.

Figure 5: Projected Statewide NO_x Emissions for Barge and Dredge Vessel Diesel-Fueled Engines



Total Statewide Combined Emission Reductions for Diesel PM and NO_x from Crew and Supply Vessels and Barge and Dredge Vessels

Table 20 below shows the total statewide diesel PM and NO_x emission reductions from crew and supply vessels and barge and dredge vessels associated with the proposed CHC regulatory amendments. These reductions are the cumulative reductions from 2011 to 2025. The total statewide emissions reductions of diesel PM from crew and supply vessels and barge and dredge vessels would be 277 tons. The total statewide emission reductions of NO_x from crew and supply vessels and barges and dredge vessels would be 3,475 tons.

Table 20: Total Statewide Diesel PM and NO_x Emission Reductions Associated with the Proposed Regulatory Amendments

	Diesel PM Reductions (2011 – 2025) (tons)	NO_x Reductions (2011 – 2025) (tons)
Crew and Supply Vessels	187	2,000
Barge and Dredge Vessels	90	1,475
Statewide Total	277	3,475

B. Santa Barbara County APCD and Ventura County APCD Crew and Supply Vessel Engine Emission Reductions

Crew and supply vessels are a small segment (less than 2 percent) of the California CHC fleets, but their engines contribute a significant portion of the CHC emissions in Santa Barbara County and Ventura County districts. Figures 6 and 7 present estimated annual diesel PM and NO_x emissions from crew and supply vessels in Santa Barbara County and Ventura County districts. In 2025, after full implementation of the proposed amendments to the regulation, diesel PM emissions from crew and supply vessels in the Santa Barbara County and Ventura County district would be reduced from the 2008 baseline of 17 tpy to about 5 tpy and NO_x emissions would be reduced from about 280 tpy to about 170 tpy.

Over the period 2011 through 2025, 95 tons of diesel PM and 600 tons of NO_x would be reduced as a result of the proposed amendments. These reductions are in addition to the reductions obtained from the 2007 CHC regulation and are of greater significance to Santa Barbara County and Ventura County districts. In Santa Barbara and Ventura County districts crew and supply vessel emissions make up about 20 percent of all CHC emissions. The proposed amended regulation will also reduce emissions from barge and dredge vessel engines in these districts, even though barge and dredge engine emissions do not make up a significant portion of the CHC emissions in the Santa Barbara and Ventura area.

Many of the owner/operators of crew and supply vessel engines servicing oil platforms were required by the Santa Barbara County APCD to utilize NO_x emission reduction engine modifications, including turbo charging, enhanced inter-cooling, and retarding the engine timing by 4 degrees. These engine modifications result in NO_x emission reductions, but may result in an increase in diesel PM emissions. The proposed amended regulation will require the vessel engines to meet performance standards for both PM and NO_x emissions.

Figure 6: Projected Santa Barbara County and Ventura County APCD Diesel PM Emissions for Crew and Supply Vessel Diesel-Fueled Engines

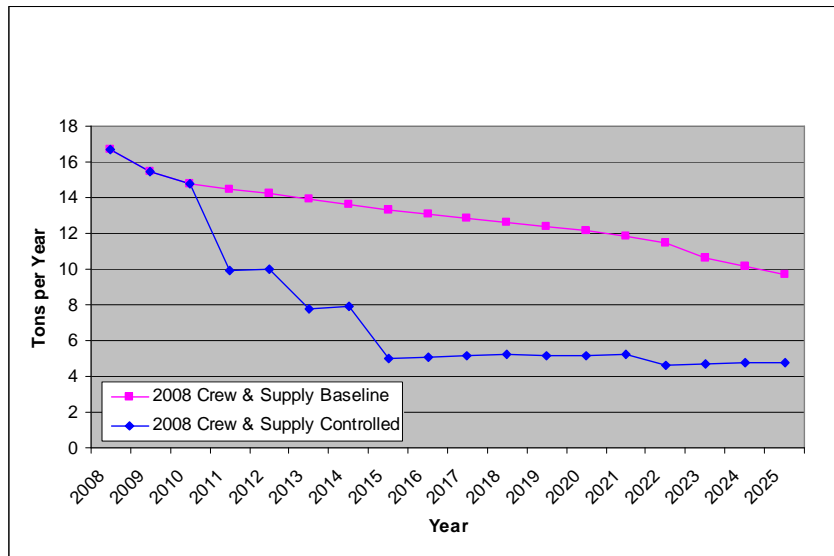
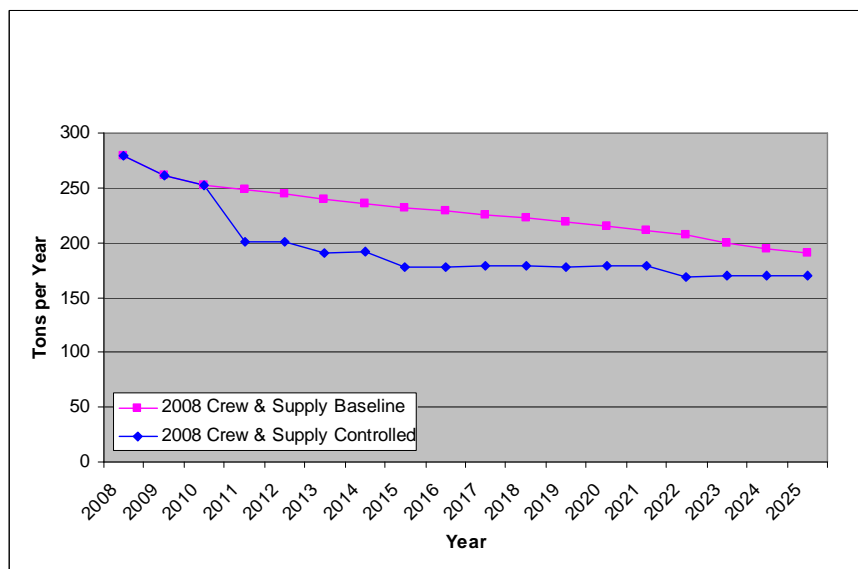


Figure 7: Projected Santa Barbara County and Ventura County APCD NO_x Emissions for Crew and Supply Vessel Diesel-Fueled Engines



C. Health Impacts

The emission reductions associated with the proposed amendments would result in lower ambient PM levels and reductions in exposure to diesel PM and NO_x. These reductions would result in a corresponding reduction in potential cancer risk and premature deaths.

Estimating the impact of the diesel PM reductions on potential cancer risk are highly dependent on the specific location of the emission reduction. The diesel PM emission reductions due to the proposed amendments, about 275 tons between 2011 and 2025, are about 10 percent of the 2,400 tons diesel PM reductions estimated under the 2007 rule. While it is not possible to identify the impact of this 10 percent reduction on the number of persons exposed to various risk levels as staff did in the September 2007 Staff Report without extensive computer modeling, it is reasonable to assume that there will be a small – up to 10 percent – reduction in risk levels due to the proposed amendments. A similar reduction in premature deaths would also be expected.

D. Environmental Impact

The ARB staff anticipates that, in most cases, engine replacement will be the option chosen by vessel owner/operators to meet the proposed emission standards for vessel engines and that the accelerated phase-in of these newer engines will provide diesel PM and NO_x emissions reductions. In addition, the newer engines are typically more energy efficient and have emission reduction technologies, thereby reducing criteria, toxic, and greenhouse gas (GHG) emissions. No significant adverse environmental impacts are expected to occur from the adoption of, and compliance with, the proposed amendments for crew and supply, barge, and dredge vessel engines.

E. Impact on Global Warming

The accelerated replacement of older technology engines required by the proposed amendments should reduce GHG emissions. However, some actions required by the proposed amendments could result in slightly increased carbon dioxide (CO₂) for some applications. For example, an increase in CO₂ could occur if crew and supply vessel or barge and dredge vessel owner/operators choose to comply with the regulation by using exhaust treatment technologies that use vessel power (e.g., scrubbers, selective catalytic reduction), increase the weight of the vessel, or require a larger engine to be installed on the vessel. While this potentially could occur, staff does not believe many crew and supply, barge, or dredge vessel operators are likely to select these as compliance options and will elect instead to install new engines. Newer marine engines are expected to have slightly improved fuel economy compared to unregulated engines, thereby reducing some GHG emissions.

The proposed amendments would reduce emissions of PM and NO_x. The following section provides an overview of the current understanding of the potential climate impacts of these pollutants.

Particulate Matter (PM): PM from marine diesel engine exhaust is composed of combustion particles consisting of elemental and organic carbon and sulfate, all of which can form aerosols. Atmospheric aerosols play an important role in the climate system through modifications of the global energy budget: directly, by the scattering and absorption of radiation; indirectly, by the modification of cloud properties. Black carbon typically emitted as a fraction of PM from combustion processes, is the main light-absorbing component of aerosols and thereby causes global warming. In recent years, there has been increased attention to black carbon for its global warming potential through direct and semi-direct effects. Due to the relatively short atmospheric residence time of black carbon, reductions in black carbon emissions represent a potential near term opportunity to postpone the effects of rising GHG levels on the global climate. The heightened interest in black carbon also builds on the long-known association of these emissions with localized air pollution and associated negative health impacts. Therefore, reducing black carbon emissions promises significant co-benefits by improving the health of local people while contributing to the global climate change effort.

Overall, the climate impact assessment of PM emitted by shipping is rather complex: radiative forcing of black carbon is positive (climate warming impact), while radiative forcing of sulfate particles is negative (cooling impact). The particles emitted from marine diesel engines represent a variety of compositions and sizes. The magnitude of the overall direct climate impact of black carbon emitted from marine engines and information on emissions of ship-exhaust particles, such as detailed characterization of chemical composition, microphysical characteristics and the fate of the particles in the marine environment are not well known. (ARB, 2008). A better characterization of marine diesel engine emissions are needed to improve the understanding of the climate change benefits from emission reduction strategies

Nitrogen oxides (NO_x): Through the production of tropospheric ozone, emissions of NO_x have a climate warming impact. However, by affecting the concentration of hydroxyl radical (OH) they reduce the levels of methane, providing a cooling effect. The net climate impact of changes in NO_x emissions will depend on whether ozone or methane production dominates. At this time, there is no consensus on which action is likely to dominate or on the overall magnitude of the impact due to changes in NO_x emissions resulting from the regulation. (ARB, 2008)

In summary, efforts to reduce marine diesel emissions will reduce both positive and negative climate forcing substances. Thus, staff expects the proposed regulation amendments to have an overall negligible effect on global warming, with some slight GHG reductions due to newer, more fuel efficient engines.

6. ECONOMIC IMPACTS

This chapter discusses the estimated costs and economic impacts associated with implementation of the proposed amendments to the CHC regulation. The expected capital and recurring costs for potential compliance options, the cost and associated economic impacts on businesses, as well as an analysis of the cost-effectiveness of proposed amendments to the regulation are presented. Estimates in this section are based on the costs incurred and emissions reduced during the compliance years of 2011 to 2022. However, the proposed amendments will continue to have additional emission reductions after 2022, and the emission reductions through 2025 are examined in the previous section of this report. Generally, costs contained in this section are presented in 2009 dollars. The costs, adjusted for net present value (NPV), are included with an explanation of the methodology used in Appendix D.

A. Regulatory and New Equipment Costs

In assessing the costs associated with the proposed amendments to the CHC regulation, ARB staff developed two different estimates, one for regulatory costs and another for new equipment costs. Regulatory costs are the estimated costs resulting from the proposed amendments taking into consideration the residual value of the in-use engine being replaced, the residual value of the most recent engine rebuild work, recordkeeping and reporting costs, and the time value of money associated with the early engine replacement. Staff estimates the lifetime regulatory cost for compliance with the proposed amendments to the regulation to be approximately \$15 million (2009 dollars or \$10 million adjusted to NPV) from 2011 through 2022.

New equipment costs are the estimated total out-of-pocket costs for purchasing and installing a new engine (engine replacement cost) in crew and supply, barge, and dredge vessels. New equipment costs are estimated to be approximately \$46 million (2009 dollars) over the compliance years of the proposed amendments (2011 to 2022). New equipment costs are the total costs of complying with the regulation, not taking into consideration the remaining useful life of the engine being replaced. The cost of purchasing and installing a new engine are costs that the vessel owner/operator would eventually incur, but the proposed amendments to the CHC regulation requires this expenditure earlier than normal.

B. Return on Owner's Equity

Staff evaluated the economic impacts of the proposed amended regulation by estimating the effect of the regulatory cost on typical businesses' "return on owner's equity" (ROE). The ROE is a measure of a businesses' profitability and is expressed as a percentage. As shown in Table 21, the average ROE of the businesses in the categories listed declined by about 0.95 percent. The decline in profitability was 1.44 percent for crew and supply vessels, and 0.45 percent for barge and dredge vessels. Generally, ARB considers a 10 percent change in ROE to be the threshold at which businesses experience a significant adverse impact.

Table 21: Affected Businesses with Change in ROE

Category	ROE % Change
Crew and Supply	-1.44%
Barge and Dredge	-0.45%
Average	-0.95%

These businesses, however, are unlikely to have to absorb the entire cost of the proposed amended regulation. To the extent that they are able to pass on the cost of the proposed amended regulation, the impact on their profitability should be less than estimated here. Thus, ARB staff expects most affected businesses to be able to absorb the cost of the proposed amended regulation with no significant adverse impact on their profitability. About 55 percent of the total number of businesses impacted are considered small businesses; with about 60 percent of the crew and supply vessel businesses and about 50 percent of the barge and dredge businesses being considered small businesses.

These businesses may be able to reduce the impact of the proposed amended regulation on their businesses by taking advantage of available incentive or grant funding. The cost impacts presented here do not take into consideration the impact of incentive or grant funding. Carl Moyer Program funding is a potential funding source for companies that comply early or achieve emission reductions beyond the amendments. California has one of the largest clean air incentive programs in the nation – the Carl Moyer Program – with up to \$140 million available each year through State and local funds. In 2009, almost \$3 million went to repowering marine vessels. Proposition 1B funds will also be available to eligible commercial harbor craft operators for repowering engines, retrofitting vessels with hybrid systems, and replacing vessels with cleaner models. At the Board meeting held on March 25, 2010, the *Proposed Update to the Proposition 1B Program Guidelines* were approved, which included project options that would fund up to 80% of the cost for non-regulated vessels and up to 50% for the early compliance of regulated vessels. The Board will award the next Proposition 1B funding allocations to local agencies in June 2010 with additional funding to be made available as bond monies are received by ARB. (ARB, 2008a)

C. Cost to Local, State, and Federal Agencies

One state agency would be impacted by the proposed amendments to the regulation. The California Department of Parks and Recreation operates two crew and supply vessels used to service Angel Island in the San Francisco Bay Area and would be impacted by the in-use engine requirements. The regulatory cost to this state agency is estimated to be about \$60,000. Barge and dredge vessels are owned and operated by two local agencies in Santa Cruz and Monterey and by the federal agency, the United States Army Corps of Engineers. The estimated regulatory costs range from \$1,900 to

\$46,000 over the life of the regulation for these agencies that operate barge and dredge vessels.

The proposed amendments to the regulation should not add significant costs above those already required to implement and enforce the proposed amended regulation. One additional ARB enforcement staff may be needed, at a cost of \$175,000 and \$12,000 for yearly travel. The ARB's administrative costs for outreach, educational efforts, and technical assistance would be absorbed within existing budgets and resources.

D. Cost-Effectiveness

Cost-effectiveness is expressed in terms of costs in dollars per unit of emissions reduced (pounds or tons). The cost-effectiveness for the proposed amendments is determined by dividing the regulatory costs (cost specifically due to compliance with the proposed amended regulation) by the total pounds of diesel PM and tons of NO_x reduced during the years 2011 to 2022. The cost-effectiveness of the proposed amendments is estimated, based on the regulatory costs, to be about \$35 per pound of diesel PM reduced if all the cost is attributed to diesel PM reductions (2009 dollars or \$23 per pound adjusted to NPV). If the costs are split evenly between diesel PM and NO_x, the cost effectiveness is estimated at about \$17 per pound for diesel PM and \$2,700 per ton of NO_x. If the costs are attributed to the combined total of diesel PM and NO_x reductions, cost-effectiveness would be about \$2.50 per pound. The net present value (NPV) estimates "today's dollars" of future net cash are presented in Appendix D.

Table 22 shows the cost-effectiveness estimate for the proposed amended regulation expressed three ways. First, all costs assigned to PM, second, cost divided equally between PM and NO_x, and third, PM and NO_x emissions are combined.

Table 22: Summary of Cost-Effectiveness of the Proposed Amendments for the Period 2011-2022 (2009 dollars)

Emissions	Total Regulatory Cost 2011 – 2022	Total Emissions Reduced 2011 – 2022	Total Cost- Effectiveness
<i>All Costs Assigned to PM</i>			
PM	\$15,000,000	435,000 lbs	\$35/lb
<i>Divide Costs Equally Between PM and NOx</i>			
PM	\$7,500,000	435,000 lbs	\$17/lb
NOx	\$7,500,000	2,800 tons	\$2,700/ton
<i>Combine PM and NOx Emissions</i>			
PM + NOx	\$15,000,000	6,000,000 lbs	\$2.50/lb

All values rounded

The cost-effectiveness values of the amended CHC regulation are within the range of cost-effectiveness for other diesel-fueled engine regulations adopted by the Board, as shown in Table 23.

Table 23: Diesel PM Cost-Effectiveness of the Proposal and Other Regulations/Measures (All Costs Attributed to Diesel PM Reduction)

Regulation or Airborne Toxic Control Measure	Diesel PM Cost-Effectiveness
	Dollars/ Pound PM
Stationary Diesel Engine ATCM	\$4 - \$26
Transport Refrigeration Unit ATCM	\$10 - \$20
Solid Waste Collection Vehicle Rule	\$28
Commercial Harbor Craft (2007)	\$29
Commercial Harbor Craft (2010 amendments)	\$35
Cargo Handling Equipment	\$41

E. Alternatives Considered

The ARB staff considered two alternatives to the proposed amended CHC regulation. Alternative 1 accelerates the barge and dredge vessel engine compliance timeline and retains the proposed crew and supply compliance timeline. Alternative 2 slows down both the crew and supply vessel engine compliance timeline and the barge and dredge vessel compliance timeline and allows more time to replace the older, dirtier engines.

Alternative 1: Accelerate the Statewide Barge and Dredge Vessel Engine Compliance Timeline

For Alternative 1, barges and dredge vessels throughout the State would be subject to a 2011 to 2020 compliance schedule as shown in Table 24. This alternative would speed up the engine replacements in the first five years and keep barge and dredge vessels more in sync with the Portable Engine ATCM 2020 fleet average. Crew and supply vessels would still be subject to the 2011 to 2022 compliance schedule. Table 25 presents the engine distribution by compliance year. More engines would be required to comply with the regulation under this Alternative due to the age and useful life of the engines in the fleets. The regulatory cost would be \$19 million or about \$4 million more than the proposed amendments. The estimated new equipment cost of this alternative would be \$52 million which is about \$6 million higher than the proposed amendments' new equipment compliance cost. The total PM emissions reduced with this alternative would be higher than with the proposed schedule by about 40 tons of diesel PM and 600 tons of NO_x during the compliance schedule from 2011 to 2022. The resulting cost-effectiveness for this alternative would be slightly higher than the proposed amended regulation, \$38 per pound of diesel PM reduced, as opposed to the \$35 per pound of diesel PM for the proposed amendments. The resulting cost-effectiveness, dividing the cost equally between diesel PM and NO_x, would be \$19 per pound of diesel PM reduced and \$2,850 per ton of NO_x reduced.

Table 24: Alternative 1: Alternative Compliance Table to Accelerate Barge and Dredge Vessel Engine Compliance

Barge and Dredge

Engine Model Year	Total Annual Hours of Operation	Compliance Date
1995 and earlier	>80	12/31/2011
1996 – 1997	>80	12/31/2012
1998 – 1999	>80	12/31/2013
2000	>80	12/31/2014
2001	>80	12/31/2015
2002	>80	12/31/2016
2003	>80	12/31/2017
2004	>80	12/31/2018
2005	>80	12/31/2019
2006	>80	12/31/2020

Table 25: Alternative 1: Statewide Annual In-Use Engine Replacements

Year	Engines
2011	69
2012	15
2013	65
2014	15
2015	45
2016	9
2017	19
2018	14
2019	15
2020	21
2021	8
2022	25
Total	320

Alternative 1 was not chosen because it is less cost-effective than the proposed emissions reduction strategy. Accelerating the compliance dates for barge and dredge vessels would keep their compliance timeframe more in sync with the 2020 fleet average requirements of the Portable Engine ATCM. However, implementing such a strategy would put barge and dredge vessel owner/operators at an unfair economic disadvantage when compared with other CHC vessel categories. Owners and operators of barge and dredge vessels need time to switch between the Portable Engine ATCM and the CHC regulation. In addition, some incentive funding opportunities, such as Carl Moyer funding, are not allowed if the marine vessel is not self-propelled.

Alternative 2: Decelerate the Statewide Compliance Timeline for Crew and Supply Vessels and Barge and Dredge Vessels

For Alternative 2, compliance requirements for both the crew and supply vessel engines and the barge and dredge vessel engines would be decelerated. This would result in many engines being replaced later than the proposed amended regulation, but would allow more time for businesses to obtain funding and transition between the Portable Engine ATCM and the CHC regulation. For Alternative 2, crew and supply vessels and barge and dredge vessels throughout the State would still be subject to a 2011 to 2022 compliance schedule as shown in Table 26. Table 27 presents the engine distribution by compliance year. Fewer engines would be required to comply with the regulation under this Alternative due to the age and useful life of the engines in the fleets. However, this alternative would slow down the engine replacements for the older, dirtier

engines. The regulatory cost would be \$14 million, or about \$1 million less than the proposed amendments. The estimated new equipment cost of this alternative would be \$44 million which is about \$2 million lower than the proposed amendments' new equipment compliance cost. The total diesel PM emissions reduced with this alternative would be 53 tons less than with the proposed schedule. As a result, the cost-effectiveness for this alternative would be higher than the proposed amended regulation at \$43 per pound of diesel PM reduced. The total NO_x reduction for this same time period would be 2,100 tons, which is about 670 tons less than the proposed amendments. The resulting cost-effectiveness, dividing the cost equally between diesel PM and NO_x, would be about \$21 per pound of diesel PM reduced and \$3,320 per ton of NO_x reduced.

Table 26: Alternative 2: Alternative Compliance Tables to Decelerate Compliance for Crew and Supply Vessels and Barge and Dredge Vessels

Crew and Supply Vessels

Engine Model Year	Total Annual Hours of Operation	Compliance Date
1975 and earlier	>1500	12/31/2011
1975 and earlier	>300 -- <1500	12/31/2012
1976 - 1985	>1500	12/31/2013
1976 - 1985	>300 -- <1500	12/31/2014
1986 - 1995	>1500	12/31/2015
1986 - 1995	>300 -- <1500	12/31/2016
1996 - 1999	>1500	12/31/2017
1996 - 1999	>300 -- <1500	12/31/2018
2000 - 2001	>300	12/31/2019
2002 - 2003	>300	12/31/2020
2004 - 2005	>300	12/31/2021
2006 - 2007	>300	12/31/2022

Barge and Dredge

Engine Model Year	Total Annual Hours of Operation	Compliance Date
1975 and earlier	>1500	12/31/2011
1975 and earlier	>80 -- <1500	12/31/2012
1976 - 1985	>1500	12/31/2013
1976 - 1985	>80 -- <1500	12/31/2014
1986 - 1995	>1500	12/31/2015
1986 - 1995	>80 -- <1500	12/31/2016
1996 - 1999	>1500	12/31/2017
1996 - 1999	>80 -- <1500	12/31/2018
2000 - 2001	>80	12/31/2019
2002 - 2003	>80	12/31/2020
2004 - 2005	>80	12/31/2021
2006	>80	12/31/2022

Table 27: Alternative 2: Statewide Annual In-Use Engine Replacements

Year	Engines
2011	12
2012	7
2013	18
2014	9
2015	3
2016	9
2017	10
2018	37
2019	47
2020	32
2021	36
2022	35
Total	255

The primary reason that Alternative 2 was not chosen was because it is less cost-effective than the emissions reduction strategy in the proposed amendments and would delay the health benefits associated with the reduction of emissions of diesel PM and NO_x from crew and supply, barge, and dredge vessels. Staff has determined that the reduced cost-effectiveness and the delay in achieving emissions reductions associated with this alternative outweigh the reduced fiscal impacts on companies that own/operate crew and supply, barge, and dredge vessels.

Presented below in Table 28 is a comparison of the cost effectiveness of the proposed amendments with Alternatives 1 and 2 (2009 dollars).

Table 28: Summary of Average Cost-Effectiveness of Proposed Amendments and Both Alternatives for the Period 2011- 2022

Emissions	Proposed Amendment (2009 dollars)	Alternative 1	Alternative 2
All costs assigned to PM			
PM (\$/lb)	\$35	+ 9%	+ 23%
Divide Costs Equally Between PM and NOx			
PM (\$/lb)	\$17	+ 12%	+ 24%
NOx (\$/ton)	\$2,690	+ 6%	+ 23%
Combined PM and NOx Emissions			
PM + NOx (\$/lb)	\$2.50	No Change	+ 20%

7. PUBLIC OUTREACH AND COMMENTS

A. Public Outreach

Staff has provided opportunities for participation in the rulemaking process. Staff's public outreach efforts included three public workshops at which draft regulatory concepts, language and cost estimates were provided. Staff's public outreach efforts included meetings and teleconferences with stakeholders, owner/operators of crew and supply vessels, districts, and other interested parties. Staff also created a website and maintained an email address list to automatically update interested parties about rulemaking developments. The website can be accessed at <http://www.arb.ca.gov/ports/marinevess/harborcraft.htm>.

B. Environmental Justice

The proposed amendments will reduce diesel PM and NO_x emissions in all coastal areas and near ports where crew and supply, barge and dredge vessels operate. Communities near ports are often more heavily impacted by the goods movement emission sources operating at these locations. On December 13, 2001, the Board approved "Policies and Actions for Environmental Justice," which formally established a framework for integration of environmental justice into ARB's programs, consistent with the directive of California state law. These policies apply to all communities in California; however, environmental justice issues have been raised specifically in the context of low-income areas and ethnically diverse communities. The proposed amendments are consistent with our environmental justice policy to reduce health risk in all communities, including those with low-income and ethnically diverse populations.

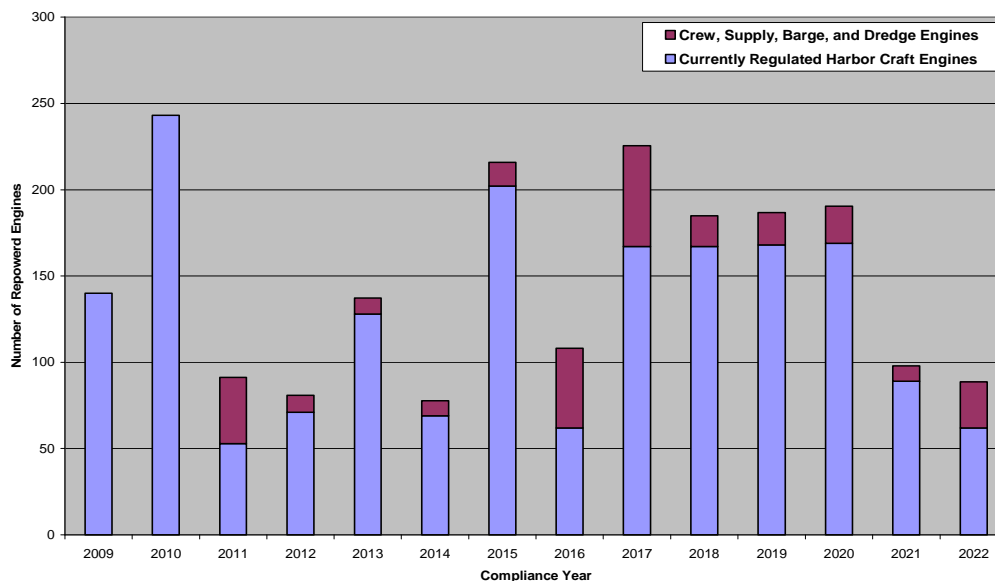
C. Public Comments

1. Engine Repower Capacity

The ARB staff believes that engine replacement would be the primary compliance option chosen to meet the proposed in-use engine requirements. During the development of the 2007 CHC regulation, the capacity of the State's boat yard/repair facilities to handle the number of engine replacements was raised as a concern. Staff has determined that the number of engine replacements that likely would occur due to the proposed amendments' compliance schedule would be achievable with the State's current capacity for engine replacements, but may place some strain on this capacity. Staff estimates that, under the proposed compliance schedule, an average of about 23 crew and supply, barge, and dredge engine replacements of both auxiliary and propulsion engines per year will occur over the compliance period. Because auxiliary engine replacements are less involved and do not necessarily require a dry dock facility, staff assume dry docking for the propulsion engine replacements would be the limiting factor for the State's capacity.

Staff conducted a phone survey in 2007 contacting owner/operators of boat yards, boat building facilities, and boat repair facilities in California to determine the annual statewide capacity for CHC engine replacements. Based on the survey, staff estimates that there is sufficient capacity even at the maximum repower rate to still allow current facilities to conduct other repowering and non-repowering activities. Additional facilities and capacity that may be built in response to this proposed amended regulation would further ensure that the State will have sufficient capacity to conduct the expected number of repowers, though some years may be strained. Figure 8 illustrates the repowers assumed per year and the additional crew and supply, barge, and dredge vessel engine repowers that will be needed to comply with the proposed amended regulation. ARB staff believes that California’s boat yards, boat builders, and boat repairers currently have the capacity to absorb the numbers of engine replacements that would result from the implementation of the proposed amended regulation.

Figure 8: Estimated Numbers of Commercial Harbor Craft Engines Replaced Annually Due to Implementation of the Current Commercial Harbor Craft Regulation and the Proposed Amended Regulation



2. District Authority to Require Additional Reductions

Comments have been made by barge and dredge owners regarding the implementation of the proposed amendments in relation to the PERP program. Pursuant to the PERP regulation, districts can establish additional requirements beyond the statewide regulation for auxiliary engines on marine vessels that operate within three nautical

miles of shore. The authority for districts to establish additional requirements is provided by the PERP regulation in order to allow the districts to mitigate any potential local emissions impacts. Barge and dredge vessel owner/operators have stated they the districts requirements are overly burdensome and can vary greatly by district. Staff has begun discussions with some of the affected districts to identify ways to achieve greater consistency and develop an effective solution. Staff is committed to continue to meet with affected stakeholders to discuss options.

8. RECOMMENDATION

In developing the proposed amendments, ARB staff worked closely with stakeholders including vessel owner/operators, marine engine industry representatives, and districts. ARB staff recommends the Board approve the proposed amendments to the regulations, as presented in Appendix A, for the following reasons:

- the early turnover of in-use, pre-Tier 1 and Tier-1 diesel-fueled engines on crew and supply, barge, and dredge vessels to lower emitting Tier 2 and Tier 3 engines would reduce diesel PM, NO_x, and other air pollutant emissions, exposure, and potential health risk across California, particularly along the shoreline and California ports;
- the proposed amendments are technologically feasible, cost-effective, and necessary to carry out the Board's responsibilities;
- the proposed amendments will help the ARB achieve the goal of the Diesel Risk Reduction Plan to reduce diesel PM emissions from all sources by 85 percent by 2020;
- the proposed amendments will help achieve the emission reduction goals of the Emissions Reduction Plan for Ports and Goods Movement approved by the Board in April 2006; and
- the emission reductions from the proposed amendments are necessary to help attain and maintain ambient air quality standards for fine particulate matter (PM_{2.5}) and ozone.

REFERENCES:

(ARB, 2006) California Air Resources Board, *Emission Reduction Plan for Ports and Goods Movement in California*; March 2006.

(ARB, 2007a) Air Resources Board, *Staff Report: Initial Statement of Reasons for Regulations to Reduce Emissions from Diesel Engines on Commercial Harbor Craft Operated Within California Waters and 24 Nautical Miles of the California Baseline*. September 2007.

(ARB, 2007b) Air Resources Board, *Technical Support Document: Initial Statement of Reasons for Regulations to Reduce Emissions from Diesel Engines on Commercial Harbor Craft Operated Within California Waters and 24 Nautical Miles of the California Baseline*. September 2007.

(ARB, 2007c) Title 17, California Code of Regulations section 93118.5, *Airborne Toxic Control Measure for Diesel Engines on Commercial Harbor Craft Operated Within California Waters and 24 Nautical Miles of the California Baseline*. 2007.

(ARB, 2007d) Title 17, California Code of Regulations, section 93116.1-93116.3, *Airborne Toxic Control Measure for Diesel Engine Particulate Matter from Portable Engines Rated at 50 horsepower and Greater*. 2007.

(ARB, 2008) Air Resources Board, *Initial Statement of Reasons for Proposed Rulemaking: Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels Within California Waters and 24 Nautical Miles of the California Baseline*. June 2008.

(ARB, 2008a) Air Resources Board, *The Carl Moyer Program Guidelines*, April 22, 2008.

(ARB, 2009) Air Resources Board, *Staff Report: Initial Statement of Reasons for the Proposed Amendments to the Regulations Applicable to Portable Diesel Engines and Diesel Engines Used in Off-Road and On-Road Vehicles*. December 10, 2009.

(40 CFR Part 94) U.S. Environmental Protection Agency, *Control of Emissions from Marine Compression – Ignition Engines*.

(40 CFR Part 1042) U.S. Environmental Protection Agency, *Control of Emissions from New and In-Use Marine Compression Ignition Engines and Vessels*