California Environmental Protection Agency
AIR RESOURCES BOARD

Staff Report:
Initial Statement of Reasons for the Proposed Rulemaking

Regulations to Reduce Emissions from Diesel Auxiliary Engines on Ocean-Going Vessels While At-Berth at a California Port

Stationary Source Division
Project Assessment Branch

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State of California
AIR RESOURCES BOARD

STAFF REPORT:
INITIAL STATEMENT OF REASONS
FOR THE PROPOSED RULEMAKING

Public Hearing to Consider

ADOPTION OF PROPOSED REGULATIONS TO REDUCE EMISSIONS FROM DIESEL AUXILIARY ENGINES ON OCEAN-GOING VESSELS WHILE AT-BERTH AT A CALIFORNIA PORT

To be considered by the Air Resources Board on December 6 and 7, 2007, at:

Air Resources Board
Auditorium
9530 Telstar Avenue
El Monte, California 91731

Stationary Source Division
Robert Fletcher, Chief
Robert Barham, Ph.D., Assistant Chief
Project Assessment Branch
Michael Tollstrup, Chief
Health and Exposure Assessment Branch (RD)
Linda Smith, Ph.D., Chief
Technical Analysis Section
Peggy Taricco, Manager
Health and Ecosystems Assessment Section (RD)
Hien Tran, Ph.D., Manager
Project Assessment Section
Michael Waugh, Manager
Regulatory Support Section (PTSD)
Todd Sax, D. Env., Manager

State of California
AIR RESOURCES BOARD

REGULATIONS TO REDUCE EMISSIONS FROM DIESEL AUXILIARY ENGINES ON OCEAN-GOING VESSELS WHILE AT-BERTH AT A CALIFORNIA PORT

Contributing Authors

Andrew Alexis
Alvaro Alvarado, Ph.D.
Raymond Asregadoo, P.E.
Joe Calavita
Grant Chin
Pingkuan Di, Ph.D., P.E.
Reza Mahdavi, Ph.D.
Lori Miyasato, Ph.D.
Brad Penick
Marcelle Surovik
Kelly Weatherford

Legal Counsel

Floyd Vergara, P.E., Office of Legal Affairs

Supporting Divisions

Planning and Technical Support Division (PTSD)
Research Division (RD)

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TABLE OF CONTENTS

List of Tables

Contents **Page**

List of Figures

Contents **Page**

EXECUTIVE SUMMARY

The California Air Resources Board (ARB or Board) staff is proposing two essentially identical regulations to reduce diesel particulate matter (PM) and oxides of nitrogen (NOx) from diesel-fueled auxiliary engines used aboard ocean-going ships while docked or at-berth, at a California port. For the remainder of this report, the regulations will collectively be referred to as "the regulation." The proposed Regulations to Reduce Emissions from Diesel Auxiliary Engines on Ocean-Going Vessels While At Berth at a California Port (regulation) is part of ARB's ongoing effort to reduce PM and NOx emissions from diesel-fueled engines and vehicles and improve air quality associated with goods movement. A copy of the proposed regulation is provided in Appendix A of this report.

Auxiliary engines are run to power lighting, ventilation, pumps, communication, and other onboard equipment while a ship is docked at a berth, or "hotelled." The proposed regulation would require operators of vessels meeting specified criteria to turn off their auxiliary engines for most of their stay in port. We anticipate that such vessels would then receive their electrical power from the shore, or use an alternative, but equally effective, means of emission reductions. The process of shutting off engines and connecting to power on shore is sometimes referred to as "shore power" or "cold-ironing." The term "cold-ironing" is derived from the metal aboard the ships "going cold" when combustion equipment is shut down.

There are six major categories of ocean-going vessels that visit California ports: container ships, passenger ships, refrigerated cargo ships (reefers), bulk ships, tankers, and vehicle carriers. Over 2000 of these ocean-going vessels call at California ports each year. In 2006, about 1.8 tons per day (TPD) of diesel PM and 21.1 TPD of NOx were emitted from diesel-fueled auxiliary engines on ocean-going vessels while at-berth in California ports.

Staff is proposing to reduce hotelling emissions from three out of the six major vessel categories noted above; through a separate rulemaking, staff will address the hotelling emissions from the other three categories at a later date. This bifurcation of regulated vessel categories was based on information presented in an earlier ARB report, *Evaluation of Cold-ironing Ocean-Going Vessels at California Ports* (Evaluation Report), which was released as a draft in March 2006. The purpose of the Evaluation Report was to present an analysis of the feasibility and cost-effectiveness of requiring ships to shut off auxiliary engines, while in port and connect to power provided at the berth, as a potential emission control measure. The Evaluation Report was intended as a prelude to this rulemaking and was therefore never published as a final report. Nevertheless, the Evaluation Report provided a useful foundation on which this Staff Report was based.

From the Evaluation Report, staff found the most attractive ship candidates for shore power to be those ships that make frequent visits to a California port, spend a sufficient number of hours at berth, and have an ample power demand while hotelled. Accordingly, the proposal specifically targets hotelling emissions from ship categories that meet these criteria—container ships, passenger ships, and reefer ships—and the California ports where these ships frequently visit—the Ports of Los Angeles, Long Beach, Oakland, San Diego, San Francisco, and Hueneme.

As noted, staff will be proposing a separate rulemaking to reduce emissions from the other ship categories that were not considered as good candidates for shore power at this time—i.e., bulk ships, tankers, and vehicle carriers. Staff anticipates presenting to the Board a proposal covering those other ship categories in late 2008. We expect that at-berth emissions from tugboats operating at California ports will also be addressed at that time.

Diesel PM was identified as a toxic air contaminant in 1998. Long-term exposures to diesel PM increase the risk of developing lung cancer. Non-cancer health effects, including premature deaths and respiratory disease, are associated with exposure to directly emitted diesel PM and secondary diesel PM formed when NOx emissions from diesel engines react in the atmosphere to form nitrates. A recent ARB exposure study at the ports of Los Angeles and Long Beach shows that over two million people live in areas around the ports with predicted cancer risks of greater than 10 in a million due to hotelling emissions from ocean-going vessels. From that study and information developed for this rulemaking, staff estimates that about 61 premature deaths per year are attributable to current exposure to direct and secondary diesel PM from hotelling emissions.

The proposed regulation allows for two main options to reduce hotelling emissions. First, ship operators can shut down their auxiliary engines while in port, except for three or five permissible hours of total operation per visit ("limited engine use" option). Alternatively, operators can implement a fleet-based option to reduce the emissions from the auxiliary engines in the fleet by specified percentages while docked ("emissions reduction option").

The "limited engine use" option requires that the operators of container ships, passenger ships, and reefers that visit California ports shut down their auxiliary engines for most of their stay while hotelling. Auxiliary engines would be allowed to run for three or five hours per visit. Specifically, these auxiliary engines must be shut down for at least 50 percent of a fleet's total visits to a California port in 2014 and at least 80 percent of the fleet's total visits to a port in 2020. While auxiliary engines are shut down, the ship's onboard electrical needs must be satisfied by some other source of power, presumably the region's electrical grid.

An alternative compliance option is the “emissions reduction option,” in which ship operators would be required to reduce their fleet’s auxiliary engine emissions at a port by specific percentages and by specific dates. The specified percent reductions apply to the fleet’s engines, rather than to individual engines. The compliance dates for this option vary based on the emission reduction technique applied to the fleets.

The emission reduction techniques that could be applied to a fleet include: 1) using selected vessels for grid-supplied power based on potential auxiliary engine emission reductions rather than fleet visit percentages; 2) using distributed generation equipment to provide power to a vessel; 3) using alternative emission controls onboard a vessel or located adjacent to the vessel; and 4) using a combination of these techniques.

Vessel owners or operators, terminals, and ports would also be subject to recordkeeping and reporting requirements.

Staff projects that the proposed regulation would reduce hotelling diesel PM and NOx emissions from container ships, passenger ships, and refrigerated cargo ships by nearly 50 percent relative to levels otherwise expected to be emitted in 2014, and 75 percent relative to levels otherwise expected to be emitted in 2020. These emission reductions will occur in areas at and near ports where community impacts are of most concern. These emission reductions would play an essential role in assisting the South Coast Air Basin with meeting its 2014 fine particulate matter ($PM_{2.5}$) deadline in its State Implementation Plan as well as its future ozone deadlines.

In addition, hotelling CO_2 emissions are expected to be reduced by 122,000 to 242,000 metric tons in 2020, which will assist the State with meeting the Assembly Bill (AB) 32 targets for greenhouse gas reductions.

The emission reductions from the proposed regulation would result in lower ambient PM levels and reduced exposure to diesel PM. Staff estimates that approximately 280 premature deaths statewide would be avoided by year 2020 from implementation of the proposed regulation. The estimated cost benefit of the avoided premature deaths and other health benefits due to the emission reductions are estimated to range from $1.3 to $1.9 billion.

The reduction in potential cancer risk was assessed based on the overall projected reduction in hotelling emissions from the proposed regulation. It was estimated that the population exposed to a risk of 10 in a million would be reduced by about 70 percent by 2020 due to these emission reductions. More importantly, all higher risk levels of greater than 100 in a million are eliminated due to implementation of the proposed regulation.

Staff estimates the statewide total regulatory costs for affected businesses and port authorities to comply with the proposed regulation to be approximately $1.8 billion, in 2006 dollars. This includes costs to comply with the regulation, which are primarily those incurred by vessel operators when they shut down their auxiliary engines at dock, as well as costs that are not strictly required to comply with the regulation but are nonetheless anticipated by ARB (e.g., installation of electrical infrastructure or distributed generation by shoreside entities).

Annually, the costs are expected to vary from $30 million to $137 million. The low end of the range represents a year when the only major capital expenditures are for retrofitting container ships due to repositioning, and the high end of the range represents a year when capital expenditures are being made for shoreside infrastructure and for retrofitting a considerable number of ships to meet the 2020 milestone. The total statewide annual costs to private business include recovery of capital expenditures, both aboard the ships and at the ports, and operating costs, which are labor costs and net energy costs. The Proposition 1B Bond program (Goods Movement Emission Reduction Program) potentially could provide funding for shore power projects. ARB is currently holding workshops for determining minimum requirements of shore power projects and other Prop 1B Bond projects.

The governmental agencies affected by the proposed regulation are the port authorities, which are branches of the local city governments. The ports affected by the proposed regulation are the Ports of Hueneme, Long Beach, Los Angeles, Oakland, San Diego, and San Francisco. Additionally, the cruise terminal at the Port of Long Beach is owned by the City of Long Beach. The costs to be expended by the port authorities to add shore-power equipment to their facilities ranges from $4 million to $86 million.

The overall cost-effectiveness of the regulation based on the regulatory costs and projected emission reductions is estimated to be $690,000 per ton if the total annualized cost is attributed solely to the PM reduction. Staff estimates the overall cost-effectiveness of the proposed regulation, in terms of dollars per ton of NOx emission reduction, to be about $12,800 per ton. This would be the cost-effectiveness if the total cost were attributed solely to the NOx emission reductions.

The cost-effectiveness for this regulation is consistent with those of other recent rulemakings, such as the Bus Fleet Rule, which was estimated to have a cost-effectiveness of nearly $68,000 per ton of NOx reduced, based on attributing all of the costs toward NOx emissions reductions. Because the proposed regulation reduces significant amounts of both NOx and PM, staff also evaluated cost-effectiveness by attributing half the total annualized cost to the PM emission reductions and half to the NOx emission reductions. The resulting cost-effectiveness values using that method are $6,400 per ton of NOx reduced and $345,000 per ton of PM reduced.

As noted, the proposal will reduce CO_2 emissions by 122,000 to 242,000 metric tons in 2020. The proposed regulation achieves these reductions automatically as a co-benefit of the diesel PM and NOx emission reductions. Because the proposed regulation is primarily a diesel PM and NOx control measure, and it will not mandate any additional requirements in order to reduce CO_2 emissions, there will be effectively zero costs involved in achieving these CO_2 emission reductions. Therefore, the cost-effectiveness for reducing CO_2 as a co-benefit of achieving the primary reductions in diesel PM and NOx emissions is essentially zero dollars per pound of CO_2 reduced.

INTRODUCTION

This Initial Statement of Reasons (Staff Report) presents an evaluation of the need to reduce emission from ocean-going vessels while at-berth. The evaluation looks at the corresponding health effects from such emissions, a summary of the proposed regulation (two essentially identical regulations collectively referred to hereinafter in the singular), and the projected emissions reductions along with the associated reduction in health risk. The Staff Report presents estimated costs for regulation compliance, for both industry and local governments, along with the alternative proposals considered. A copy of the proposed regulation is provided in Appendix A. The Technical Support Document, an addendum to the Staff Report, provides more detailed analyses of these subjects and supporting documentation for the proposal. The Technical Support Document is provided under separate cover.

Staff is proposing a regulation to reduce emissions of diesel particulate matter (PM) and nitrogen oxides (NOx) from diesel-fueled auxiliary engines used aboard ocean-going ships while docked at a California port. The proposal reduces emissions in a relatively straightforward way—by limiting the operation of auxiliary engines while the vessels are docked.

Auxiliary engines are run to power lighting, ventilation, pumps, communication, and other onboard equipment while a ship is docked at a berth, or "hotelled." The proposed regulation would require operators of vessels meeting specified criteria to turn off their auxiliary engines for most of their stay in port. We anticipate that such vessels would then receive their electrical power from shore, or would use an alternative, but equally effective, means of emissions reductions. This process of shutting off engines and connecting to power on shore is sometimes referred to as "shore power" or "cold-ironing." The term "cold-ironing" is derived from the metal aboard the ships "going cold" when combustion equipment is shut down.

The California Air Resources Board's (ARB or Board) 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 harmful exposure to air pollution. To help achieve this, ARB has adopted numerous regulations to control emissions from many different sources, including diesel engines. Diesel engine exhaust is a significant health concern because it is a source of unhealthful air pollutants, including gaseous and particulate-phase toxic air contaminants (TAC), particulate matter (PM), oxides of nitrogen (NOx), carbon monoxide, and hydrocarbons.

In 1998, the Board identified diesel PM as a TAC with no Board-specified threshold exposure level, 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 engines. It included control measures for all off-road diesel sources, such as those covered by the proposed regulation. The ultimate goal of the Diesel RRP is to reduce, by 2020, California's diesel PM emissions and associated cancer risks by 85 percent from the 2000 levels. The proposed regulation would reduce diesel PM emissions and the local health impacts from ships docked in California's ports and would assist the Board with meeting the 2020 Diesel RRP goal.

In April 2006, the Board approved the *Emission Reduction Plan for the Ports and Goods Movement in California* (GMERP). The GMERP identifies strategies for reducing emissions created from the movement of goods through California ports and into other regions of the State. The GMERP is part of the broader Goods Movement Action Plan (GMAP) being jointly carried out by the California Environmental Protection Agency and the Business, Transportation, and Housing Agency. Phase I of the GMAP was released in September 2005 and highlighted the air pollution impacts of goods movement and the urgent need to mitigate localized health risk in affected communities. The final GMAP was released in January 2007 and includes a framework that identifies the key contributors to goods movement-related emissions.

The GMERP identifies numerous strategies for reducing emissions from all significant emission sources involved in goods movement, including ocean-going vessels, harbor craft, cargo handling equipment, locomotives, and trucks. The GMERP identifies several strategies for reducing emissions from ocean-going vessels. Specific to hotelling emissions, the GMERP establishes a goal of utilizing shore power for 20 percent of the ship visits to California ports by 2010, 60 percent of visits by 2015, and 80 percent of visits by 2020. The proposed regulation would represent a significant first step toward satisfying the GMERP goals by requiring specific vessel types to shut down their engines while docked. Shutting an engine down is a necessary condition for using shore power; the proposed regulation makes it possible for 50 percent of a fleet's visits to a port to be electrified by 2014, which rises to 80 percent of visits by 2020. Furthermore, emission reductions would begin in 2010 for vessel owners or operators choosing an alternative emission control technology to reduce their hotelling emissions.

The federal Clean Air Act (CAA) requires the United States Environmental Protection Agency (U.S. EPA) to establish National Ambient Air Quality Standards (national standards) for pollutants considered harmful to public health, including fine particulate matter ($PM_{2.5}$) and ozone. Set to protect public health, the national standards are adopted based on a review of health studies by experts and a public process. The South Coast Air Basin (Air Basin), which is home to the two largest ports in California, the Ports of Los Angeles and Long Beach, exceeds the national standards for both ozone and $PM_{2.5}$. Consequently, a State Implementation Plan (SIP) is required for the Air Basin that outlines how and when the region will attain the national standards. The U.S. EPA requires the Air Basin to meet the $PM_{2.5}$ standards by 2015, but the emission reductions must be in place by 2014.

Significant reductions of NOx are crucial to meet the federal standards. For example, at this time, the strategy to achieve attainment of the $PM_{2.5}$ standards in the South Coast Air Basin includes staff estimates that a 55 percent reduction in NOx emissions (secondary PM) from 2006 levels (i.e., a total reduction of hundreds of tons per day) and a 15 percent reduction in direct $PM_{2.5}$ emissions from 2006 baseline levels will be necessary for attainment of the $PM_{2.5}$ standards in the South Coast Air Basin. The proposed regulation would reduce hotelling NOx emissions from container ships, passenger ships, and refrigerated cargo ships by 50 percent relative to levels expected to be emitted in 2014 and nearly 75 percent relative to levels expected to be emitted in 2020. Consequently, the emission reductions from the proposed regulation would play an essential role in assisting the South Coast Air Basin with meeting its 2014 $PM_{2.5}$ deadline as well as its future ozone deadlines.

The federal Clean Air Act permits states to adopt more stringent air quality standards, and California has set standards for particulate matter and ozone that are more protective of public health than respective federal standards. The Bay Area, South Coast, and San Diego areas are nonattainment for the State standards for ozone and $PM_{2.5}$. Health and Safety Code (HSC) section 40911 requires the local air districts to submit plans to the Board for attaining the State ambient air quality standards, and HSC section 40924 requires triennial updates of those plans. The NOx and $PM_{2.5}$ emission reductions from the proposed regulation would also assist the local air districts in achieving attainment of the State ambient air quality standards.

In June 2005, Governor Arnold Schwarzenegger signed Executive Order S-3-05, which established targets for reducing greenhouse gas (GHG) emissions in California: roll back GHG emissions to 2000 levels by 2010, to 1990 levels by 2020, and finally to 80 percent below 1990 levels by 2050. In 2006, the Governor signed Assembly Bill 32 (AB 32) (Stats. 2006, ch. 488), which established the 2020 GHG emission reduction goal in State law (HSC § 38500 et

seq.) and made the ARB responsible for monitoring and reducing GHG emissions.

AB 32 requires the Board, by January 1, 2009, to design and adopt an overall plan to reduce GHG emissions to 1990 levels by 2020. The Board has until January 1, 2011, to adopt the necessary regulations to implement that plan. Implementation begins no later than January 1, 2012, and the emission reduction target must be fully achieved by January 1, 2020. AB 32 also required the Board to identify a list of discrete early action GHG reduction measures by June 30, 2007. AB 32 defines discrete early action measures as regulations that are to be adopted by the Board and be enforceable by January 1, 2010.

In April 2007, ARB staff released a report identifying 37 proposed early action items the Board could undertake to mitigate GHG emissions in California. Port electrification was identified as a GHG emission reduction measure in this report. In September 2007, ARB staff recommended reclassifying port electrification (now called Green Ports) from an early action measure to a discrete early action measure. Staff's recommended reclassifications will be considered by the Board at its October 2007 hearing.

The proposed regulation, while primarily aimed at reducing diesel PM and NOx emissions, will also reduce CO_2 emissions as a co-benefit of requiring cleaner electrical generation for ocean-going vessels that "plug in" while docked. These CO_2 emission reductions will help California meet its 2020 greenhouse gas emission reduction goal.

2. DETERMINATION OF AFFECTED OCEAN-GOING VESSEL CATEGORIES

Staff is proposing to initially regulate hotelling emissions from three out of the six categories of ocean-going vessels that visit California ports and to address the hotelling emissions from the other three categories at a later date. This bifurcation was based on information presented in an earlier ARB report, *Evaluation of Cold-ironing Ocean-Going Vessels at California Ports* (Evaluation Report), which was released as a draft in March 2006. The purpose of the Evaluation Report was to present an analysis of the feasibility and cost-effectiveness of requiring ships to shut off auxiliary engines while in port and connect to power provided at the berth as a potential emission control measure. While not finalized, the results of the Evaluation Report nevertheless formed a good basis for ARB's further development of the proposed regulation.

In the Evaluation Report, ARB staff calculated, for screening purposes, the cost-effectiveness of shore power as an emission reduction strategy using three major sets of variables: ship categories, ship power loads, and pollutants reduced. ARB staff divided the ocean-going vessels visiting California ports in 2004 into

six categories: container ships, passenger ships, refrigerated cargo ships, tankers, bulk/cargo ships, and vehicle carriers. Cost-effectiveness values were calculated for each ship category. The cost-effectiveness values were based on the total cost of implementing cold-ironing— shore-side and ship-side— and the emission reductions expected from cold-ironing the ships.

For the screening analysis, staff analyzed three scenarios; 1) all ships being cold-ironed at all California ports; 2) cold-ironing ships that made at least three visits per year to a California port; 3) and cold-ironing ships that made at least six visits per year to a California port. ARB staff also calculated the cost-effectiveness values using three approaches for air pollutants reduced: (1) "all pollutants" emissions reductions (NOx, PM, volatile organic compounds [VOC], and oxides of sulfur [SOx]); (2) NOx emissions reductions only; and (3) PM emissions reductions only.

Based on the screening analysis noted above, the Evaluation Report concluded that the most attractive vessel candidates for cold-ironing are container ships, refrigerated cargo (reefer) ships, and passenger ships, and the most likely locations for cold-ironing in California are the Ports of Los Angeles, Long Beach, Oakland, San Diego, San Francisco, and Hueneme. The most attractive ship candidates were found to be those ships that make frequent visits to a California port, spend a sufficient number of hours at berth, and have an ample power demand while hotelled. These findings formed the foundation on which the proposed rulemaking was based.

Of the three remaining types of vessels that visit California, the Evaluation Report showed that it was not as cost-effective at this time to cold-iron bulk and general cargo ships and vehicle carriers, relative to container ships, passenger ships and reefers, because the former categories generally have a low number of repeat visits to any single port and lower power loads. Further, crude-oil tankers were found to have higher average cost-effectiveness values because there are only a handful of diesel-electric tankers that visit California, and only two are expected to visit frequently. Indeed, most crude-oil tankers use steam turbines to drive their cargo pumps. These cargo pumps represent the majority of the power needed by tankers when they are berthed. The rest of the ship's power needs are modest. Finally, product tankers make few visits to California ports, and their berthing times are short, making them a much less attractive candidate for cold-ironing.

The proposed regulation specifically addresses hotelling emission reduction requirements for categories of ships that were found at this time to be attractive candidates for shore power in the Evaluation Report—container ships, passenger ships, reefer ships— and the California ports where these ships frequently visit. As noted earlier, staff is proposing to develop separate requirements for other ship categories that were not considered to be good candidates at this time for

shore power -- bulk ships, tankers, and vehicle carriers—at a later date. Staff anticipates presenting proposed hotelling emission reduction requirements for these other ships to the Board in late 2008. We expect that at-berth emissions from tugboats operating at California ports will also be addressed at that time.

3. EMISSIONS INVENTORY

Hotelling emissions are associated with the use of diesel-fueled auxiliary engines on ocean-going ships to power the vessels' electrical systems while the ships are docked. These emissions are a function of how often the ship visits a California port, how long the ship is at berth, the emissions rate of the engines, and the typical operating load of the auxiliary engines while the ship is at berth.

ARB staff estimates that in 2006, the statewide hotelling emissions from approximately 2000 ocean-going vessels was 1.8 tons per day (TPD) of diesel PM emissions, and 21.1 TPD of NOx emissions. Table I presents hotelling emissions for the six major categories of ocean-going vessels that visit California ports—container ships, passenger ships, reefer ships, vessel carriers, bulk ships, and tankers. As can be seen in this table, hotelling emissions from the three affected ship categories, container ships, passenger ships, and reefer ships, represent over 80 percent of total statewide hotelling emissions.

Table 1: Estimated 2006 Hotelling Emissions by Ship Category

Ship Category	2006 Emissions, Tons/Day	
	NOx	PM
Container	13.8	1.1
Passenger	2.8	0.2
Reefers	0.9	0.1
Tanker	2.0	0.2
Bulk/General	1.0	0.1
Vehicle Carriers	0.6	0.1
Totals	21.1	1.8

The proposed regulation would affect ships visiting the Ports of Los Angeles and Long Beach (which, for the proposed regulation, would be considered one port), Oakland, San Diego, Hueneme, and San Francisco. To provide a perspective of

the shipping activities at these ports compared to all other ports in California, staff presents total hotelling emission by California port in Table 2.

Table 2: Estimated 2006 Hotelling Emissions by Port (Tons per Day)

Port	NOx	PM
Los Angeles/Long Beach	14.3	1.2
Oakland	2.6	0.2
San Diego	1.1	0.1
Hueneme	0.7	0.1
San Francisco	0.5	0.1
Other Ports	1.2	0.2
Total	21.1	1.8

As can be seen in this table, most of the shipping activities and hotelling emissions occur at the largest ports in California: Los Angeles and Long Beach followed by Oakland. The six ports affected by the proposed regulation account for over 90 percent of total hotelling emissions at California ports.

Staff developed growth factors for each ship category to project future hotelling emissions. In general, the growth in vessel hotelling emissions is directly proportional to the growth in vessel visits, ship size, berthing times, and, in the case of container ships, the number of refrigerated containers aboard.

Hotelling emissions from ocean-going ships are predicted to increase from 2006. Container ship and passenger ship emissions are expected to double by 2020. Reefer ship emissions are expected to decline at the Ports of Long Beach and Los Angeles, slightly increase at the Port of Hueneme, and triple at the Port of San Diego by 2020.

Table 3 presents projected 2014 and 2020 emission estimates for container ships, passenger ships, and reefer ships. In December 2005, the Board adopted an auxiliary engine fuel regulation that would limit the sulfur content of fuel used with auxiliary engines starting in 2007. At the time this staff report was published, the regulation had been challenged in federal district court and is undergoing appeal at the Ninth Circuit Court of Appeals. The future emission projections were based on the assumption that the auxiliary engine regulation would ultimately be upheld and the auxiliary engines would be operating on low-sulfur fuel.

Table 3: Projected 2014 and 2020 Emissions from Container Ships, Passenger Ships, and Reefer Ships

Ship Category	Projected 2014 Emissions Tons per Day		Projected 2020 Emissions Tons per Day	
	NOx	PM	NOx	PM
Container	21.4	0.38	30.8	0.55
Passenger	3.6	0.07	5.2	0.09
Reefer	1.0	0.02	1.3	0.02
Totals	26	0.47	37.3	0.67

4. HEALTH RISK

A. Cancer Risk

To provide a perspective on the potential cancer risk from exposure to hotelling emissions, staff used an existing analysis from 2004 of diesel PM emissions from port related activities (including hotelling emissions) at the Port of Los Angles and the Port of Long Beach. Staff then adjusted the results of that study to reflect 2006 estimated hotelling emissions. Based on the adjusted results, we estimate that over two million people live in the area around the ports that has predicted cancer risks of greater than 10 in a million due to hotelling emissions from ocean-going vessels.

Estimates of potential cancer risks from hotelling emissions at these two ports would represent the upper range of cancer risks, given the magnitude of hotelling emissions in the San Pedro Bay area and the proximity of the emissions to highly urbanized areas. Semi-quantitative estimates of the relative impact of hotelling 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. For example, one would expect that the potential cancer risk estimate for the Port of Oakland would be about 20 percent of the estimate for the Ports of Los Angeles and Long Beach, while the cancer risk estimates for the Port of San Diego would be about 90 percent lower.

ARB staff is currently conducting a diesel PM exposure assessment study for the West Oakland community which includes the Port of Oakland that will be similar in scope as the study completed for the Ports of Los Angeles and Long Beach. Staff expects a draft report on the West Oakland study to be released in late November.

B. Non-Cancer Risk

Staff estimates that current exposure to direct and secondary diesel PM emissions from at-berth ocean-going vessel auxiliary engines can be associated with about 61 premature deaths per year. Due to the location of the ocean-going vessels' operations, their emissions were assumed to affect the population only within the county in which the vessels are docked.

Using the 2006 statewide estimate of directly emitted diesel PM hotelling emissions and the relationship of diesel PM to PM-mortality derived from Pope et al. (2002), we estimate approximately 39 premature deaths (11 to 68, 95 percent confidence interval (95% CI)) per year statewide due to uncontrolled, directly emitted diesel PM from at-berth ocean-going vessel auxiliary engines.

Staff actually developed basin-specific factors for the health impacts assessment of emissions from the operation of auxiliary engines on at-berth ocean-going vessels. These basin-specific factors were developed using basin-specific diesel PM concentrations and emissions for the year 2000. The basin-specific factors were applied to the county where each port is located to estimate health impacts.

Using these basin-specific factors and after adjusting for population changes between 2000 and 2006, staff estimates that 580 tons of emissions from the operation of auxiliary engines on at-berth ocean-going vessels for the year 2006 are associated with approximately 39 annual deaths (11 – 68, 95% CI). Estimates of other health impacts, such as hospitalizations and asthma symptoms, were calculated using basin-specific factors developed from other health studies. Details on the methodology used to calculate these estimates can be found in Appendix A of the Emission Reduction Plan for Ports and Goods Movement in California (ARB, 2006).

In addition to directly emitted PM, diesel exhaust contains NOx, which is a precursor to nitrates, a secondary diesel-related PM formed in the atmosphere. Lloyd and Cackette (2001) estimated that secondary diesel $PM_{2.5}$ exposures from NOx emissions can lead to additional health impacts beyond those associated with directly emitted diesel $PM_{2.5}$ (Lloyd and Cackette, 2001). To quantify such impacts, staff developed population-weighted nitrate concentrations for each air basin, as described in the Technical Support Document, Chapter V.

Using the 2006 statewide estimate of NOx hotelling emissions and the relationship of NOx/nitrate to PM-mortality, we estimated approximately 22 (6 – 36, 95% CI) premature deaths per year statewide due to uncontrolled, secondary diesel PM from at-berth ocean-going vessel diesel auxiliary engines.

In addition to PM-mortality, we estimate that the 2006 estimated emissions (directly emitted and secondary sources) from at-berth ocean-going vessel auxiliary engines will result in the following non-cancer health impacts:

- 13 hospital admissions due to respiratory causes (8 – 18, 95% CI)
- 24 hospital admissions due to cardiovascular causes (15 – 37, 95% CI)
- 1,800 cases of asthma-related and other lower respiratory symptoms (700 – 2,800, 95% CI)
- 150 cases of acute bronchitis (0 – 320, 95% CI)
- 11,000 work loss days (9,000 – 12,000, 95% CI)
- 61,000 minor restricted activity days (50,000 – 72,000, 95% CI)

5. SUMMARY OF THE PROPOSED REGULATION

Staff is proposing that the Board approve adoption of a regulation, pursuant to its authority under HSC sections 38500 et seq., 43013 and 43018, which would apply to the emissions from diesel auxiliary engines on oceangoing vessels docked at California ports. As a companion to that regulation, staff is proposing that the Board also approve adoption of identical provisions as an airborne toxic control measure (ATCM), pursuant to its authority under HSC section 39666, which would complement the regulation and provide maximum notice to the regulated community of the regulatory requirements on ocean-going vessels. The regulation and ATCM are hereinafter collectively referred to in the singular. The following sections provide more details about the proposed regulation.

Applicability

The regulation would apply to any person who owns, operates, charters, rents, or leases any container ship, passenger ship, or refrigerated cargo ship (also known as “reefer”) that visits a California port. The regulation would also apply to any person who owns or operates a port or terminal located at a port where container, passenger, or refrigerated cargo (reefer) ships visit. These ports include Los Angeles, Long Beach, Oakland, San Diego, San Francisco, and Hueneme. For purposes of complying with the proposed regulation, the ports of Los Angeles and Long Beach are considered as one port.

The regulation applies to both U.S.-flagged vessels and foreign-flagged vessels. Foreign-flagged vessels are vessels registered under the flag of a country other than the United States.

Exemptions

The proposed regulations contain general and specific exemptions. Under the general exemptions, vessels in “innocent passage;” vessels owned or operated by local, state, federal or foreign governments in government non-commercial

service; steamships; and auxiliary engines using natural gas are exempt from the regulations in their entirety. A steamship is an ocean-going vessel whose primary propulsion and electrical power are provided by steam boilers. In addition, there are particular exemptions from specified portions of the regulations for emergency events and delays caused by federal agency inspections.

Options to Reduce Emissions

Limited Engine Use Option

The proposed regulation allows for two options to reduce hotelling emissions: (1) ship operators can either shut down their auxiliary engines while in port (except for three or five permissible hours of operation per visit), or (2) they can reduce the at-berth emissions from those auxiliary engines by specified percentages while docked.

The "limited engine use" option in the proposed regulation requires that the operators of container ships, passenger ships, and reefers that visit California ports shut down their auxiliary engines for most of their stay while hotelling. Specifically, these auxiliary engines must be shut down for 50 percent of a fleet's total visits to a California port in 2014 and 80 percent of the fleet's total visits to a port in 2020. While auxiliary engines are shut down, the ship's onboard electrical needs must be satisfied by some other source of power. The source of electrical power used instead of the auxiliary engines must be provided either by the grid or by another power source that meets specified emission standards.

Fleets that do not make a minimum number of annual visits to a California port are exempt from the auxiliary engine limitations for that port. The specified threshold for applying the engine shutdown requirement is less than 25 total annual visits by a container vessel fleet or reefer vessel fleet to a port. For passenger vessel fleets, this threshold is less than five visits. However, these minimum thresholds notwithstanding, the regulation requires a vessel to use shore power if it is equipped to do so, and it visits a berth equipped to provide compatible shore power.

As noted, to provide for sufficient time to connect and disconnect electrical lines for shore power, the proposed regulation allows the auxiliary engines to operate for up to three hours during a visit, or five hours during a visit for vessels that lose power during the process of switching power from the vessel's auxiliary engines to shore power. This time period may be extended due to circumstances beyond the control of the vessel operators, such as emergency events or delays resulting from obligations imposed by federal agencies (for example, the U.S. Coast Guard or some other branch of the Department of Homeland Security).

Emission Reduction Option

An alternative to the “limited engine use” approach is the “emissions reduction option.” Operators choosing this option are required to reduce their auxiliary engine emissions at a port by specific percentages and by specific dates. The compliance dates vary based on the types of emission reduction techniques applied to the fleets.

The emission reduction techniques that could be applied to a fleet include: 1) using selected vessels for grid-supplied power based on potential auxiliary engine emission reductions rather than fleet visit percentages; 2) using distributed generation equipment to provide power to a vessel; 3) using alternative emission controls onboard a vessel or located adjacent to the vessel; and 4) using a combination of these techniques.

For option 1, the emission reduction targets are aligned with the limited engine use approach: the NOx and PM emissions from the fleet’s auxiliary engines at a port must be reduced by 50 percent from the baseline fleet emissions by 2014 and by 80 percent by 2020. For options 2 and 3, in which alternative control technologies are implemented, the NOx and PM emissions from the fleet’s auxiliary engines at a port must be reduced by 20 percent from the baseline fleet emissions by 2010, 40 percent by 2012, 60 percent by 2014, and 80 percent by 2016. For option 4, in which a combination of approaches is implemented, NOx and PM emissions must be reduced by 20 percent from the baseline fleet emissions by 2012, 50 percent by 2014, and 80 percent by 2020.

Staff is proposing earlier compliance dates (2010 and 2012) for vessel operators choosing alternative emission controls to reduce their fleet’s hotelling emissions rather than using grid supplied shore power, because of the significant lead time required to design and install a grid-based shore power application, which can be up to several years. If alternative controls or alternative shore power are available much earlier than 2014 and a vessel operator chooses the emission reductions option, then staff expects to begin achieving emission reductions from these options soon after the regulation is effective in late 2008.

The proposal provides default values for making the emission reduction calculation, including default values for emission factors and power requirements, in lieu of more specific values. In addition, the proposal provides procedures for determining control factors and applicable emission testing procedures.

Sources of electrical power, other than the grid, that are used to comply with the emission reduction option would be required to satisfy additional requirements. Before January 1, 2014, distributed generation equipment must satisfy the emission standards applicable to a newly manufactured spark-ignited off-road engine. As of January 1, 2014, all distributed generation would be subject to a

more stringent emission standard that is equivalent to a spark-ignited engine using Best Available Control Technology (BACT). Finally, the source of electrical power must emit no more CO_2 (a greenhouse gas) emissions than a combined-cycle gas turbine—the emissions level that the California Public Utilities Commission recommended for unspecified sources of power.

Recordkeeping and Reporting Requirements

The proposed regulation has reporting and recordkeeping requirements affecting the vessel owners and operators, terminals, and ports.

The reporting and recordkeeping requirements for vessel owners or operators depend upon the compliance option selected by the vessel owner or operator and terminal. The proposed regulation requires a vessel fleet plan to be submitted to the Executive Officer of the ARB in the years prior to the fleet's regulatory compliance dates.

In addition to the vessel fleet plans, the proposal requires an annual statement of compliance to be submitted to the Executive Officer of the ARB certifying compliance with the regulatory requirements for the previous calendar year. As with the vessel fleet plans, the dates for the initial submittals depend upon the compliance option selected by the vessel owner or operator.

The recordkeeping and reporting requirements are simpler for the limited engine use option because the vessel owner or operator choosing that option must track only those vessels that will comply with the 2014 and 2020 shore power requirements. The recordkeeping and reporting requirements for the emission reduction option are more significant because the vessel owner or operator choosing that option must track the emissions of each vessel in the fleet.

A terminal that receives more than 50 vessel visits in 2008 is required to submit a plan to the Executive Officer of the Air Resources Board by July 1, 2009. This plan is required to identify how the terminal will be upgraded to allow vessels to satisfy either the limited engine use option or the emissions reduction option. The terminal is also required to submit plan updates at a frequency that depends on the control strategy selected by the vessel fleet owner or operator and the terminal.

The port is required to submit wharfinger data annually to ARB's Executive Officer. The port's written submittal must document when each vessel visits the port, the berth that the vessel visited, and the dates and times that the vessel was initially tied to the berth and subsequently released from the berth. In addition, the terminal operator is required to keep records of electricity usage for shore power and equipment breakdowns that affect a vessel's ability to comply with the limited engine use option or the emission reduction option.

Violations and Severability

The proposal includes a violations provision that provides, among other things, that any violation of any part of the regulation would constitute a single, separate violation for each hour that the violation occurs. The exception to this would be for violations of the recordkeeping and reporting requirements; a violation of those provisions would constitute a single, separate violation for each day that the violation occurs.

The proposed regulation states that if any part of the regulation is held to be invalid, the remainder of the regulation shall continue to be effective.

6. EMISSION REDUCTIONS

As mentioned earlier, staff assumes that the challenge to the auxiliary engine fuel regulation will ultimately be upheld and that the fuel regulation will provide significant emission reductions from auxiliary engines on ocean-going vessels. The proposed at-berth ocean-going vessel regulation is expected to provide additional significant emission reduction benefits. Staff projects that the proposed regulation would reduce hotelling diesel PM and NOx emissions from container ships, passenger ships, and refrigerated cargo ships by 50 percent and 75 percent relative to levels expected to be emitted in 2014 and 2020, respectively. These emission reductions will occur in areas at and near ports where environmental justice concerns are especially prevalent.

In addition, hotelling CO_2 emissions are expected to be reduced by 122,000 to 242,000 metric tons in 2020. These estimated CO_2 reductions take into account the CO_2 emissions associated with the generation of electricity for shore power. The CO_2 benefits from this regulation—which will assist the State with meeting the AB 32 targets for greenhouse gas reductions—are discussed in more detail later in this staff report.

Figures 1 and 2 show the projected diesel PM and NOx hotelling emissions for container ships, passenger ships, and reefer ships, with and without implementation of the proposed regulation.

Figure 1: Projected Diesel PM Emissions with and without the Proposed Regulation

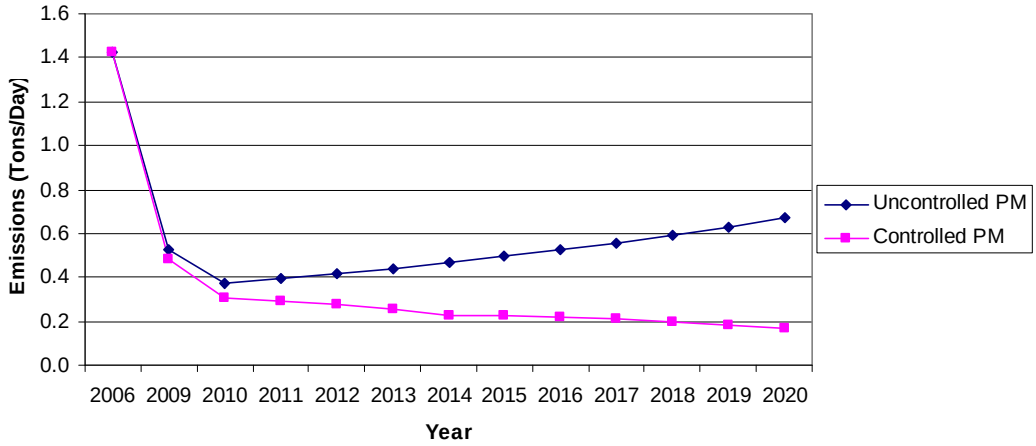
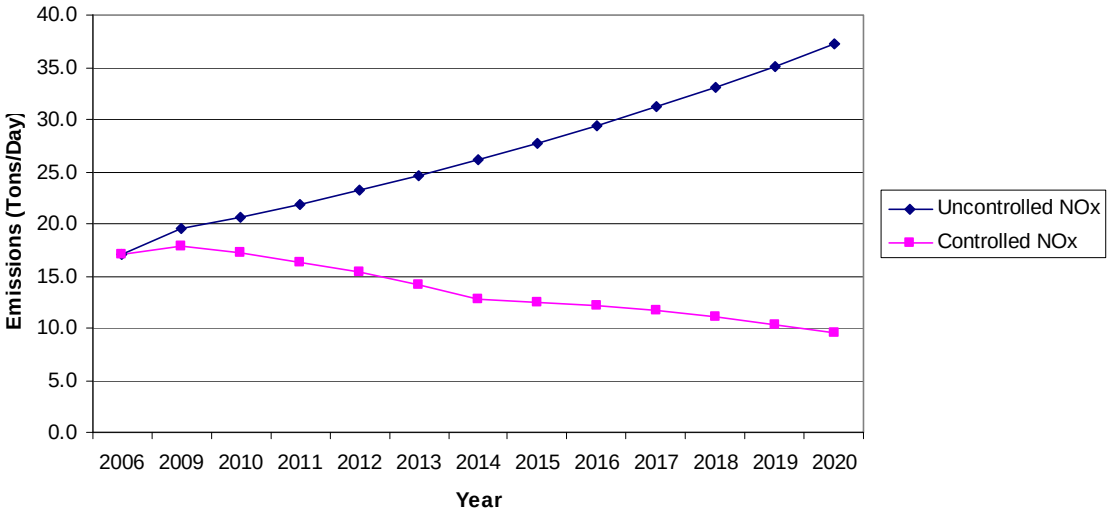


Figure 2: Projected NOx Emissions with and without the Proposed Regulation



As summarized in Table 4 below, staff estimates that approximately 1,100 tons of diesel PM and 61,700 tons of NO_x will be removed from California's air between 2006 and 2020 due to the implementation of the proposed regulation.

Table 4: Emission Benefits from Implementation of the Proposed Regulation

	PM	NO_x
Total Emission Reductions 2006 to 2020 (Tons)	1,100*	61,700*
Annual Average Reductions (Tons per Year)	85	4,700

*For the container-ship category, the regulatory period is 2009 – 2030 to account for ship turnover. Total emissions reductions to 2030 are 2,600 tons of diesel PM and 140,000 tons of NOx.

7. RISK REDUCTION

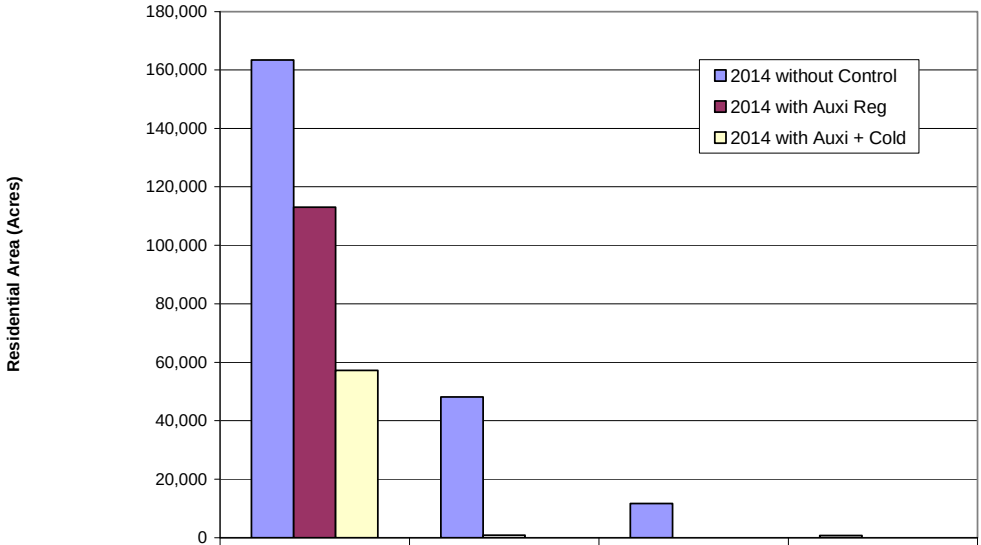
A. Cancer Risk

The emission reductions obtained from the proposed regulation would result in lower ambient PM levels and reductions in exposure to diesel PM. These reductions would result in a corresponding reduction in potential cancer risk. Because ARB's auxiliary engine fuel regulation would significantly reduce diesel PM hotelling emissions from auxiliary engines[1], the potential cancer risks from exposures to the projected 2014 and 2020 emissions levels after implementation of the proposed regulation were estimated and compared to those of 2014 and 2020 emission levels from implementation of the auxiliary engine fuel regulation to determine how the potential risks will change.

As shown in Figures 3 through 6, we expect a significant decline in the number of people exposed to elevated risk levels from hotelling emissions and the acres impacted as the auxiliary engine fuel regulation is implemented. In addition to this reduction, the proposed At-Berth Ocean-Going Vessel regulation will reduce the number of residential acres and population exposed to diesel PM concentrations greater than 10 per million by an additional 50 percent by 2014 and 70 percent by 2020. More importantly, all higher risk levels of greater than 100 in a million are eliminated due to implementation of the proposed regulation.

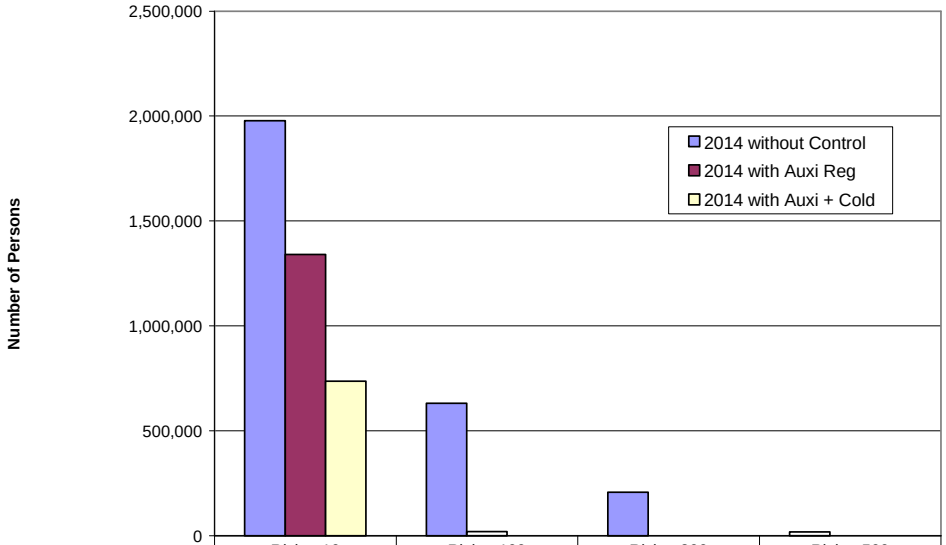
[1] See title 13 CCR § 2299.1 and title 17 CCR § 93118. At the time this ISOR was published, those regulations had been challenged in federal district court and undergoing appeal at the Ninth Circuit Court of Appeals. Pacific Merchant Shipping Ass'n v. Cackette, (E.D.Cal. Oct 05, 2007) 2007 WL 2914961 (No. Civ. S-06-2791-WBS-KJM). The analysis presented in this portion of the ISOR assumes those auxiliary engine regulations will ultimately be upheld on appeal.

Figure 3: Projected Residential Areas Impacted by Hotelling Emissions at POLA/POLB by 2014



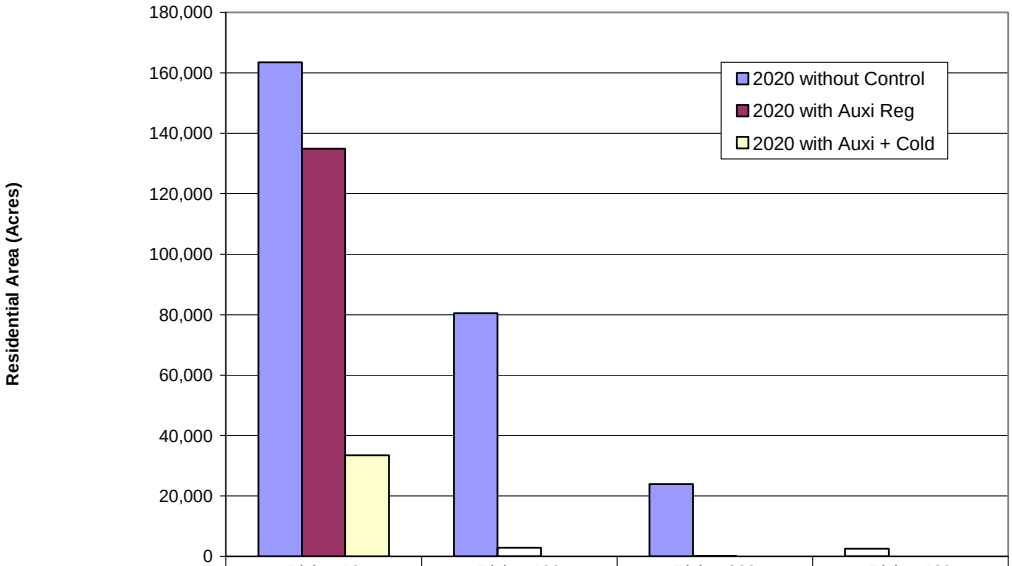
	Risk > 10	Risk > 100	Risk > 200	Risk > 500
2014 without Control	163,435	48,146	11,653	761
2014 with Auxi Reg	113,016	939	0	0
2014 with Auxi + Cold	57,269	0	0	0

Figure 4: Projected Numbers of Population Affected by Hotelling Emissions at POLA/POLB by 2014



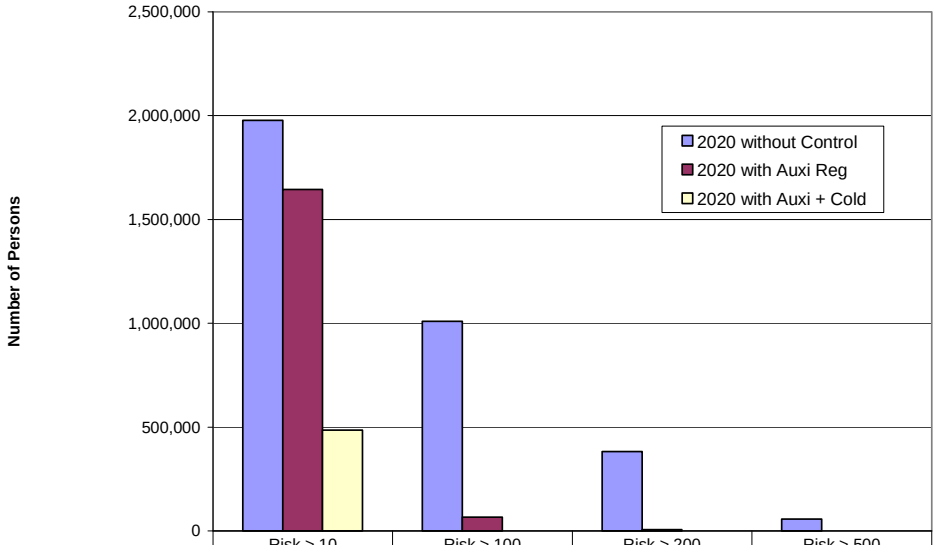
	Risk > 10	Risk > 100	Risk > 200	Risk > 500
2014 without Control	1,977,764	631,799	206,577	17,917
2014 with Auxi Reg	1,339,600	20,800	0	0
2014 with Auxi + Cold	736,000	0	0	0

Figure 5: Projected Residential Areas Impacted by Hotelling Emissions at POLA/POLB by 2020



	Risk > 10	Risk > 100	Risk > 200	Risk > 500
2020 without Control	163,435	80,457	23,979	2,540
2020 with Auxi Reg	134,820	2,955	119	0
2020 with Auxi + Cold	33,517	0	0	0

Figure 6: Projected Numbers of Population Affected by Hotelling Emissions at POLA/POLB by 2020



	Risk > 10	Risk > 100	Risk > 200	Risk > 500
2020 without Control	1,977,765	1,009,250	381,870	57,600
2020 with Auxi Reg	1,644,856	65,856	6,180	0
2020 with Auxi + Cold	485,000	0	0	0

B. Non-Cancer Risk

The emission reductions obtained from this regulation will result in lower ambient PM levels and reduced exposure to diesel PM. Staff estimates that approximately 280 premature deaths (78 – 480, 95 percent confidence interval (95% CI)) statewide will be avoided by the year 2020 from the implementation of the proposed regulation. Estimates of other health effects avoided statewide include:

- 60 hospital admissions due to respiratory causes (38 – 83, 95% CI)
- 110 hospital admissions due to cardiovascular causes (70 – 170, 95% CI)
- 8,200 cases of asthma-related and other lower respiratory symptoms (3,200 – 13,000, 95% CI)
- 680 cases of acute bronchitis (0 – 1,400, 95% CI)
- 49,000 work loss days (42,000 – 57,000, 95% CI)
- 280,000 minor restricted activity days (230,000 – 330,000, 95% CI)

8. ENVIRONMENTAL IMPACT

No significant adverse environmental impacts are expected to occur from adoption of, and compliance with, the proposed requirements for ocean-going vessels at berth. Implementation of the proposal would reduce directly emitted and secondarily formed PM levels, provide both near source and regional risk reduction, and contribute to the overall effort of reducing PM mortality, hospital admissions, and lost work days.

9. IMPACT ON GLOBAL WARMING

As noted, the Board will consider, at its October 2007 meeting, reclassifying shore power (now referred to as Green Ports) from an early action measure to a discrete early action measure pursuant to AB 32. The proposed regulation for ocean-going vessels at-berth would result in significant CO_2 reductions and its adoption would fulfill the Board's commitment to pursue shore power as an early action measure, assuming the Board accepts the staff's recommendation in October to include the measure as an early action item.

The proposal's primary emission reduction strategy is to allow a ship to utilize grid-based shore power instead of onboard electrical generation from diesel-fueled auxiliary engines. The CO_2 emissions from California's utility grid are much cleaner than diesel-fueled auxiliary engines on ships. In addition, new state mandates (SB 1368[2] and AB 32) will result in CO_2 emissions from the grid declining between now and 2020. Consequently, CO_2 emissions from

[2] SB 1368 (Stats. 2006, ch. 598).

ocean-going vessels at-berth are expected to be reduced by 122,000 to 242,000 metric tons in 2020.

The proposed regulation will allow the use of alternative technologies to achieve required emission reductions. These alternatives may include ship-side technologies, such as post-combustion devices, alternative fuels, or cleaner engines, or shore-side technologies, including distributed generation or emission-capture-and-treatment devices (so-called "bonnet" systems). These technologies—although attractive for early deployment for NOx and diesel PM reductions—will most likely be less effective in reducing GHG emissions when compared to grid-based shore power, but they are permitted as specified in the proposal.

For sources of electricity other than the grid for providing shore power to the ships, the proposed regulation limits the CO_2 emissions to 500 grams per kilowatt-hour (1,100 lbs CO_2/MW-hr). This emission standard will prohibit the use of electrical generation technologies that emit much higher levels of CO_2, such as diesel engines and less efficient spark-ignited engines.

The post-combustion technologies—selective catalytic reduction (SCR), diesel particulate filters (DPFs), and diesel oxidation catalysts (DOCs)—tend to increase CO_2 emissions due to increased fuel use. However, the DPFs and DOCs remove black carbon, a component of diesel PM and a likely contributor to global warming.

For the emission-capture-and-treatment devices (e.g., Advanced Cleanup Technologies' "bonnet" system), there would be a much larger CO_2 penalty because there is an auxiliary burner on the treatment unit for reheating the stack gases so that the SCR operates effectively. In addition, a vessel would use a bonnet system to allow the continued operation of the onboard auxiliary engines. Thus, the auxiliary engines aboard the ships would still be operating, along with the treatment unit's burner. On the other hand, this alternative technology would capture and treat the NOx and PM emissions from the boilers on the ships—something that shore power would not do—so the increase in CO_2 emissions would need to be balanced against the additional NOx and PM emission reductions.

Most of these technologies are at the proof-of-concept stage, and ARB staff cannot at this time predict with certainty the extent of their deployment in the future. Therefore, we are unable to project the impact of such alternatives on overall CO_2 emission reductions under this program.

10. ECONOMIC IMPACTS

Staff assumes that the most widely deployed technique for meeting the requirements of the proposed regulation will be grid-based shore power. This approach satisfies the "limited engine use" option and will probably be the

technique of choice for the emissions reduction option. Consequently, staff's economic analysis addressed the use of grid-based shore power only.

Staff estimates the total statewide costs for affected businesses and port authorities to comply with the proposed regulation to be approximately $1.8 billion, in 2006 dollars. This includes costs directly resulting from compliance with the proposed regulation (e.g., shutting down engines, recordkeeping, reporting), as well as those costs that are not directly required by the regulation, but are expected, as terminals and ports prepare to accommodate vessels that shut down their engines at berth (e.g., installation of shore power capabilities). Annually, the costs are expected to vary from $30 million to $137 million. The low end of the range represents a year when the only major capital expenditures are for retrofitting container ships due to repositioning, and the high end of the range represents a year when capital expenditures are being made for shoreside infrastructure and for retrofitting a considerable number of ships to meet the 2020 milestone. The total statewide annual costs to private business include recovery of capital expenditures, both aboard the ships and at the ports, and operating costs, which are labor costs and net energy costs.

Since 25 of the 35 vessel fleets affected by the proposed regulation are container-ship fleets, for the purposes of this proposed regulation, the typical ship company refers to a company operating container ships. The total costs to a typical ship company complying with the proposed regulation, including capital and ongoing costs are estimated to be about $34 million. This cost would be distributed over the years 2009 to 2020 for passenger ship companies and reefer ship companies and to 2030 for container ship companies. About 40 percent of the cost is associated with modifying additional ships to replace ships that have been re-deployed away from California ports. Annual costs would vary between $600,000 and $3 million per year, with the average cost of $1.5 million per year over this time period. The low end of the range represents a year when no major capital expenditures are made, and the high end of the range represents a year where capital expenditures are made for both new ships as well as replacement ships that are rerouted.

For the other passenger ship and reefer categories, the total costs for a typical ship company to comply with the proposed regulation, including capital and ongoing costs, are estimated to be about $3.2 million. This cost would be distributed over a 12-year period, from 2009 to 2020. Annual costs would vary between $150,000 and $500,000 per year, with the average cost of $260,000 per year over this time period.

Similarly, the total costs to a typical terminal operator complying with the proposed regulation, including capital and ongoing costs, are estimated to be about $11 million. About 20 percent of the cost is attributed to labor costs and the other 80 percent for capital costs. This cost would be distributed over a

12-year period, from 2009 to 2020. Annual costs would vary between $500,000 and $1.1 million per year, with the average cost of $1 million per year over this time period. The low end of the range represents a year where no major capital expenditures are made, and the high end of the range represents a year where capital expenditures are made for shore-side improvements. With 31 terminals and 35 vessel fleets affected by the proposed regulation, the cost to a typical business would be $26 million.

Vessel owners or operators, terminals, and ports would have additional recurring costs associated with recordkeeping and reporting. Reporting requirements begin July 1, 2009, and recordkeeping requirements begin January 1, 2010. For the vessel owner or operator, the costs associated with reporting and recordkeeping will vary between $600 and $12,000 annually. The higher end of this range applies when the ship company chooses to comply with the emission reduction option of the proposed regulation, and the lower end of the range represents the costs for ship companies that comply with the limited engine use requirement. For the terminal operators and ports, the costs associated with reporting and recordkeeping are about $800 annually.

Staff does not anticipate any small businesses being affected by the proposed regulation due to the large capital and operating costs associated with ocean-going vessel operations.

The proposed regulation achieves these reductions automatically as a co-benefit of the diesel PM and NOx emission reductions. Because the proposed regulation is primarily a diesel PM and NOx control measure, and it will not mandate any additional requirements in order to reduce CO_2 emissions, there will be effectively zero costs involved in achieving these CO_2 emission reductions. Therefore, the cost-effectiveness for reducing CO_2 as a co-benefit of achieving the primary reductions in diesel PM and NOx emissions is essentially zero dollars per pound of CO_2 reduced.

11. COST TO LOCAL AGENCIES

The governmental agencies affected by the proposed regulation are the port authorities, which are branches of the local city governments. The ports affected by the proposed regulation are the Ports of Hueneme, Long Beach, Los Angeles, Oakland, San Diego, and San Francisco. Additionally, the cruise terminal at the Port of Long Beach is owned by the City of Long Beach

The costs to be expended by the port authorities to add shore-power equipment to their facilities ranges from $4 million to $86 million. Staff does not expect ports to have a fiscal impact—defined as the costs incurred to the local agencies in the three fiscal years starting with the 2007/2008 fiscal year—until the second year. At this time, staff anticipates that the port authorities would begin to make

payments during fiscal years 2008/2009 and 2009/2010 for the necessary shore-power equipment to satisfy the 2014 milestone. The estimated fiscal costs for the ports range from $600,000 to $7.4 million for the fiscal years 2007/2008 and 2009/2010.

Staff assumes that the landlord ports will work with their tenants, the terminal lessees, to provide the shoreside infrastructure necessary to meet the requirements of the proposed regulation. Furthermore, staff assumes that the landlord ports will eventually recover their capital costs through modifications to terminal leases, while the non-landlord ports will recover their capital costs through fees collected from the carriers.

12. COST-EFFECTIVENESS

Cost-effectiveness is expressed in terms of regulatory compliance costs (dollars) per unit of air pollutant reduced (ton). Except for container ships, the cost-effectiveness for the proposed regulation was determined by dividing the total cost of the proposed regulation by the total tons of air pollutants reduced from 2009 to 2020. For container ships, the emission reductions out to 2030 were included in the calculation to account for that category's ship turnover rate.

Staff estimates the overall cost-effectiveness of the proposed regulation, in terms of dollars per ton of NOx emission reduction, to be about $12,800 per ton, if the total cost is attributed solely to the NOx emission reductions. Staff estimates the overall cost-effectiveness of the proposed regulation, in terms of dollars per ton of PM emission reduction, to be is about $690,000 per ton if the total annualized cost is attributed solely to the PM reduction. Because the proposed regulation reduces significant amounts of both NOx and PM, staff also evaluated cost-effectiveness by attributing half the total annualized cost to the PM emission reductions and half to the NOx emission reductions. The resulting cost-effectiveness values using that method are $6,400 per ton of NOx reduced and $345,000 per ton of PM reduced.

For perspective, the cost-effectiveness values of the proposed regulation are compared to that for other regulations recently adopted by the Board. For example, the *Heavy Duty Urban Bus Engines and Fleet Rule for Transit Agencies*, approved by the Board in September 2005, estimated a cost-effectiveness of nearly $68,000 per ton of NOx reduced, assuming all of the costs are attributed to NOx emissions reductions. The average cost-effectiveness of the proposed regulation is below the urban bus regulation's value, as are the calculations for the individual terminals, with the exception of one terminal at Oakland, which is slightly above this cost-effectiveness level.

The highest cost-effective values for regulations adopted by the Board to reduce PM emissions was about $320,000 per ton of PM reduced for the *Diesel*

Particulate Control Measure for On-Road Heavy-Duty Diesel-Fueled Vehicles Owned or Operated by Public Agencies and Utilities. If the total costs of the proposed regulation are split between NOx emissions reductions and diesel PM reductions, then about half of the terminals are below this cost-effectiveness threshold. Again, the auxiliary engine fuel regulation already has reduced hotelling diesel PM emissions by 70 percent.

The cost-effectiveness was calculated for each affected ship terminal in California. Table 5 shows the cost-effectiveness estimate for the proposed regulation expressed in three ways for each type of affected ship category. All costs are in equivalent 2006 expenditure dollars.

Table 5: Summary of Cost-Effectiveness for Shore-Power

	All Costs for NOx Only	All Costs for PM Only	Half Costs for NOx	Half Costs for PM
(Dollars per Ton of Pollutant Reduced)				
Container Ships— POLA/POLB	$11,000 to $32,000	$400,000 to $1.1 million	$5,500 to $16,000	$200,000 to $550,000
Container Ships-- Oakland	$11,500 to $71,000	$400,000 to $2.5 million	$5,800 to $36,000	$200,000 to $1.2 million
Passenger Ships	$13,000 to $47,000	$440,000 to $1.6 million	$6,400 to $23,000	$220,000 to $810,000
Reefer Ships	$16,000 to $30,000	$600,000 to $1 million	$7,900 to $15,000	$300,000 to $510,000

13. FEASIBILITY OF PROPOSED REGULATION

The proposed regulation allows for two options to reduce hotelling emissions: 1) ship operators can either shut down their auxiliary engines while in port (except for three or five permissible hours of operation per visit), or 2) they can reduce the at-berth emissions from those auxiliary engines by specified percentages while docked.

Staff expects most ship operators to comply with the limited engine use option and to use shore power provided by the grid. However, some ship operators may decide to reduce their fleet hotelling emissions by applying a number of other techniques to their fleet, including using alternative sources of power at the berth (e.g. distributed generation equipment), and using onboard or shore-based engine emission control technologies.

A. Grid Supplied Shore Power

Grid-supplied shore power has been proven and is technologically feasible. Shore power is already being used or will soon be used for passenger ships, container ships, bulk ships and oil tankers at California ports. POLA and POLB have committed to adding shore power to their passenger ship terminals and to several of their container ship terminals. Ships will soon be utilizing shore power at two additional container terminals at POLA and at a tanker terminal at POLB. Several passenger ships that visit California ports have been retrofitted to connect to shore power, and some container-ship owners have committed to adding shore power equipment to their new-builds and retrofitting some of their existing fleet with shore-power capabilities.

Although this is a proven technology, there are challenges to implementing shore power as an emission reduction measure. Modifications would be needed to both terminals and ships to utilize grid-based shore power as a method for reducing hotelling emissions. The modifications that would be necessary to install and utilize shore power are discussed in more detail in Chapter VII of the Technical Support Document.

B. Alternative Emission Reduction Measures

An alternative to the limited engine use compliance approach is the "emissions reduction option," in which the fleets reduce their auxiliary engine emissions at a port by specified percentages and dates. The emission reduction techniques that could be applied to a fleet include: 1) using select vessels for grid-supplied power based on potential auxiliary engine emission reductions rather than fleet visit percentages; 2) using alternative sources of power (distributed generation equipment) to provide power to a vessel; 3) using alternative emission controls onboard a vessel or located adjacent to the vessel; and 4) using a combination of these techniques.

Alternative emission control technologies for auxiliary engines could include alternative fuels and post-combustion control measures. Emission control equipment for auxiliary engines could be placed at the berth or onboard the ships. While many control technologies have been proven to reduce emissions of PM and NOx from land-based diesel-fueled engines, there is limited experience in applying these technologies to marine vessel engines. In addition, there are currently no emission control strategies verified by the ARB for marine applications. Some of these technologies have been applied to harbor craft engines, but those applications were on much smaller engines than the auxiliary engines on ocean-going vessels.

A few demonstration projects have been conducted on auxiliary ocean-going vessel engines. These involved the use of portable distributed generation, a

seawater scrubber, biodiesel fuel, an on-demand water/fuel emulsion system, and selective catalytic reduction. However, because these technology demonstrations are still at an early stage, ARB staff cannot predict at this time the future deployment or feasibility of these alternative technologies as effective emission control measures for auxiliary engines on ships at berth.

14. ALTERNATIVES CONSIDERED

Staff considered two regulatory alternatives: 1) targeting the highest-emitting ships to obtain the necessary reductions, or 2) using best available control technology (BACT) on auxiliary engines while the ship is hotelling.

Alternative 1 would target the ships that make the most visits to specific ports and make them use shore power or an equivalent control technology to reduce hotelling emissions. For example, a requirement under this regulatory alternative might state “container ships making more than four visits to a California port in 2014 must turn off their engines or use an alternative control technology.”

Staff estimated that this regulatory alternative would be as effective as the proposed regulation; however, staff did not pursue this alternative because of the complexity and difficulty of tracking the ships that were required to reduce emissions. Many of these ships would be repositioned elsewhere, while other ships would replace them in California service, creating excessive recordkeeping requirements and practical enforcement challenges.

Alternative 2 requires vessel operators to install BACT on their auxiliary engines. Currently, few emission-control technologies that have been used successfully on land-based engine applications have been demonstrated on marine engines. Nevertheless, for the purpose of determining a potential cost-effectiveness of this alternative, staff selected selective catalytic reduction (SCR) for NOx emissions reductions and diesel oxidation catalyst (DOC) for diesel PM emissions reductions.

Installing this equipment on the same ships affected by the proposed regulation would cost less than the overall cost of the proposed regulation. However, the reduction of PM emissions would be considerably less with this BACT alternative because DOCs achieve only about 25 percent PM emission reductions. Furthermore, the varying load of the auxiliary engines during transiting, maneuvering, and hotelling would compromise the performance of the SCR, achieving less than 80 percent emissions reduction.

Considering the unproven application of these technologies for marine engines, fewer total emissions reductions, and much higher cost-effective values for diesel PM emissions reductions, staff did not pursue this alternative regulatory alternative.

15. OUTREACH

ARB's outreach efforts for the proposed regulation began during the development of its draft cold-ironing feasibility report (Evaluation Report). ARB staff first discussed a plan for analyzing the cost-effectiveness of cold-ironing ocean-going vessels at a public consultation meeting on November 9, 2004.

During the Evaluation Report's development, staff visited four ports in California: Los Angeles, Long Beach, Oakland, and San Diego. Staff also visited three cold-ironing applications in the State. Staff also held conference calls or met with shipping companies, utility companies, environmental groups, and other organizations interested in cold-ironing applications.

ARB staff solicited public input on the Evaluation Report when it was released in March 2006 and considered the comments received when they began developing draft concepts for a shore power regulation.

Staff also coordinated with the Ports of Los Angeles and Long Beach in the development of the San Pedro Bay Ports Clean Air Action Plan (CAAP), which was released in November 2006. The CAAP identifies shore power as a measure to control hotelling emissions and identifies specific terminals and berths that will be equipped with shore power capability and the expected completion dates for these projects. ARB staff considered the CAAP's shore power requirements as we began our development of the proposed regulation with a goal of developing a proposed measure that would be consistent with the CAAP and complementary to the ports' ongoing emissions reduction efforts.

ARB staff and interested parties formed a workgroup in early 2007 to assist staff with developing a shore power regulation. Many of the stakeholders that assisted ARB staff with developing the Evaluation Report were also members of the workgroup.

Five shore power workgroup meetings were held between January and August 2007. At the end of that process, ARB staff decided that it was appropriate to transition from the workgroup process to a more formal rulemaking process. Subsequently, staff held four public workshops in September 2007 to discuss the draft proposed regulation. Two of these workshops were evening meetings held in community centers near ports, where staff could seek input from those communities most impacted by hotelling emissions.

ARB staff created a shore power electronic list serve and webpage to notify interested parties of the workgroups and to post drafts of the regulation before they were discussed at the meetings. Over 2000 individuals and companies have subscribed to the shore power list serve.

In addition to the workgroup and workshop meetings, staff's outreach efforts also included hundreds of personal contacts via telephone and electronic mail; numerous individual meetings with interested parties, including port representatives, environmental groups, utility representatives, and shipping representatives; and informational visits to ports. Staff visited the Port of Hueneme in early 2007, where staff had the opportunity to observe refrigerated cargo ships carrying break-bulk products and discuss regulation development with port staff. ARB staff also toured a containerized refrigerated cargo ship at the Port of San Diego. At the Port of Oakland, ARB staff toured a container ship that was equipped with shore power capability and observed a demonstration of a portable distributed generation power source for powering container ships while in port.

16. ENVIRONMENTAL JUSTICE

A public process that involves all parties affected by the proposed regulation is an important component of ARB rulemaking activities. The proposal is consistent with the ARB's environmental justice policy to reduce health risks from toxic air contaminants in all communities, including low-income and minority communities. The proposed regulation would reduce diesel PM and other emissions from ocean-going vessels at berth in communities surrounding the six major ports of California. The majority of these reductions will occur at the Los Angeles-Long Beach and Bay Area ports, which are surrounded by densely populated areas, including some in low-income and minority communities. Therefore, the proposal will help address environmental justice concerns by reducing emissions and health risks in the areas where hotelling emissions have the greatest impacts.

17. IMPLEMENTATION AND ENFORCEMENT

We believe that ARB staff needs to take the following actions to efficiently and effectively implement the proposed regulation:

- develop an outreach program to inform the 35 ship companies, 31 terminals and six ports affected by the proposed regulation of the regulation's requirements, as well as provide information about incentive programs such as the existing Carl Moyer program and the upcoming Proposition 1B air quality mitigation funds;
- develop recordkeeping and reporting guidance; and,
- provide implementation guidance and assistance as needed.

18. RECOMMENDATION

We recommend the Board approve the proposed regulation for ocean-going vessels at berth presented in Appendix A of the Staff Report. The proposal would provide substantial benefits by requiring diesel-fueled auxiliary engines on

ocean-going vessels to be shut down while in port, or reducing an equivalent amount of emissions by using alternative control methods. These benefits include reducing diesel PM, NOx, and other air pollutant emissions from these engines which, in turn, would reduce human exposure to such pollutants and the concomitant health risk across California, particularly in communities adjacent to the ports. ARB staff believes the proposed regulation and its recordkeeping and reporting requirements are technologically feasible, cost-effective, and necessary to carry out the Board's responsibilities under State law and implement provisions of the Emission Reduction Plan for Ports and Goods Movement approved by the Board in April 2006.

REFERENCES:

California Air Resources Board. *Evaluation of Cold-Ironing Ocean-Going Vessels at California Ports*; March 2006. http://www.arb.ca.gov/ports/shorepower/report.pdf

California Air Resources Board. *Expanded List of Early Action Measures to Reduce Greenhouse Gas Emissions in California Recommended for Board Consideration*, October 2007.

California Air Resources Board. *Proposed Amendments to the Exhaust Emission Standards for 2007-2009 Model-Year Heavy Duty Urban Bus Engines and the Fleet Rule for Transit Agencies*; September 2005. (ARB, 2005c)

California Air Resources Board. *Proposed Diesel Particulate Matter Control Measure for On-Road Heavy-Duty Diesel-Fueled Vehicles Owned or Operated by Public Agencies and Utilities*; October 2005. (ARB, 2005b)

California Air Resources Board. *Proposed Early Actions to Mitigate Climate Change in California*, April 2007.

California Air Resources Board. *Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles*; October 2000. http://www.arb.ca.gov/diesel/documents/rrpapp.htm

Port of Los Angeles and Port of Long Beach. *San Pedro Bay Ports Clean Air Action Plan*; November 2006. http://www.portoflosangeles.org/DOC/CAAP_Tech_Report_Final.pdf and/or http://www.polb.com/civica/filebank/blobdload.asp?BlobID=3451

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Appendix

Proposed Regulations for At-Berth Ocean-Going Vessels

PROPOSED REGULATION ORDER

OPERATIONAL HOUR LIMITS AND OTHER REQUIREMENTS FOR AUXILIARY DIESEL ENGINES OPERATED ON OCEAN-GOING VESSELS AT-BERTH IN A CALIFORNIA PORT

Adopt new section 2299.3, title 13, chapter 5.1, California Code of Regulations (CCR), to read as follows:

(Note: The entire text of section 2299.3 is new language.):

Section 2299.3. Operational Hour Limits and Other Requirements for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At-Berth in a California Port.

(a) *Purpose*.

The purpose of this section is to reduce oxides of nitrogen (NOx) and diesel particulate matter (PM) emissions from the operation of auxiliary engines on container ships, passenger ships, and refrigerated cargo ships while these vessels are docked at berth at a California port. This section reduces emissions by limiting the time during which auxiliary diesel engines are operated on the regulated vessels while such vessels are docked at-berth in a California port, as well as by applying other requirements. This section implements provisions of the Goods Movement Emission Reduction Plan, adopted by the Air Resources Board (ARB) in April 2006, to reduce emissions and health risk from ports and the movement of goods in California. This section also helps achieve the goals specified in the California Global Warming Solutions Act of 2006, established under California law by Assembly Bill 32 (Stats. 2006, ch. 488) and set forth in Health and Safety Code § 38500 et seq.

(b) *Applicability and General Exemptions.*

(1) Except as provided in this subsection (b), this section applies to any person who owns, operates, charters, rents, or leases any U.S. or foreign-flagged container ship, passenger ship, or refrigerated cargo ship that visits a California port. In addition, this section also applies to any person who owns or operates a port or terminal located at a port where container, passenger, or refrigerated cargo vessels visit.

(2) Nothing in this section shall be construed to amend, repeal, modify, or change in any way any applicable U.S. Coast Guard requirements. Any person subject to this section shall be responsible for ensuring compliance with both U.S. Coast Guard regulations and the

requirements of this section, including but not limited to, obtaining any necessary approvals, exemptions, or orders from the U.S. Coast Guard.

(3) The requirements of this section do not apply to:

(A) Ocean-going vessel voyages that are comprised of continuous and expeditious navigation through any of the Regulated California Waters for the purpose of traversing such bodies of water without entering California internal or estuarine waters or calling at a port, roadstead, or terminal facility. "Continuous and expeditious navigation" includes stopping and anchoring only to the extent such stopping and anchoring are required by the U.S. Coast Guard; rendered necessary by force majeure or distress; or made for the purpose of rendering assistance to persons, ships, or aircraft in danger or distress. This exemption does not apply to the passage of an ocean-going vessel that engages in any of the prejudicial activities specified in United Nations Convention on the Law of the Seas (UNCLOS) 1982, Article 19, subpart 2. Further, notwithstanding any Coast Guard mandated stops or stops due to force majeure or the rendering of assistance, this exemption does not apply to a vessel that was otherwise scheduled or intended to enter California internal or estuarine waters or call at a port, roadstead or terminal facility.

(B) Auxiliary engines on-board ocean-going vessels owned or operated by any branch of local, state, federal government, or by a foreign government, when such vessels are operated on government non-commercial service. However, such vessels are encouraged to act in a manner consistent, so far as is reasonable and practicable, with this section.

(C) Steamships while berthed at a California port.

(D) Auxiliary engines while such engines are operating primarily on liquefied natural gas or compressed natural gas.

(c) *Definitions.*

For purposes of this section, the definitions in Health and Safety Code sections 39010 through 39060 shall apply except as otherwise specified in this section:

(1) "Alternative Control Technologies" means technologies, techniques, or measures that reduce the emissions of NOx and PM from an auxiliary diesel engine other than shutting down the engine.

(2) “Auxiliary Engine” means an engine on an ocean-going vessel designed primarily to provide power for uses other than propulsion, except that all diesel-electric engines shall be considered “auxiliary diesel engines” for purposes of this section.

(3) “Baseline Fleet Emissions” means the total emissions from all vessels in a fleet during all berthing times in a calendar year or other specified time period. For purposes of calculating the baseline fleet emissions, the auxiliary engines on the vessels in the fleet shall be assumed to use marine diesel fuel while at berth.

(4) “Berthing Time” means the time period that begins when the vessel is first tied to the berth and ends when the vessel is untied from the berth.

(5) “California Ports” means:

(A) The Port of Hueneme, the Port of Los Angeles (POLA) and Port of Long Beach (POLB), the Port of Oakland, the Port of San Diego, and the Port of San Francisco;

(B) For purposes of this section, POLA and POLB are treated as one port.

(6) “Container Vessel” means a self-propelled ocean-going vessel constructed or adapted primarily to carry uniform-sized ocean freight containers.

(7) “Diesel Engine” means an internal combustion, compression-ignition (CI) engine with operating characteristics significantly similar to the theoretical diesel combustion cycle. The regulation of power by controlling fuel supply in lieu of a throttle is indicative of a compression ignition engine.

(8) “Diesel-Electric Engine” means a diesel engine connected to a generator that is used as a source of electricity for propulsion or other uses.

(9) “Diesel Particulate Matter” means the particles found in the exhaust of diesel engines, which may agglomerate and adsorb other species to form structures of complex physical and chemical properties.

(10) “Distributed Generation” shall have the same meaning as that term is defined in title 17, CCR, section 94202.

(11) “Docked at the Berth” means the state of being tied to a berth.

(12) “Emergency Event” means the period of time during which any of the following events occurs; the emergency event begins when such an event begins and ends when the event is over:

(A) Any situation arising from a sudden and reasonably unforeseen event beyond the control of the master that threatens the safety of the vessel;

(B) The utility serving the port states that electrical power will be temporarily unavailable as a result of equipment failure; or

(C) The electrical system at the terminal cannot provide electrical power as a result of equipment failure; or

(13) “Executive Officer” means the executive officer of the Air Resources Board (ARB), or his or her designee.

(14) “Fleet” means all container, passenger, and refrigerated cargo (reefer) vessels, visiting a specific California port, which are owned or operated under the direct control of the same person. Direct control includes, but is not limited to, vessels that are operated under a contract, lease, or other arrangement with a third-party for the third-party to operate the vessel. For the purposes of this section, a person shall be deemed to have separate fleets for each California port visited. For example, if a person owns or operates vessels that visit both the Port of Los Angeles and Port of Oakland, that person is deemed to have two fleets, one a “POLA-based fleet” and the other a “Port of Oakland-based fleet.”

(15) “IMO” means the International Maritime Organization.

(16) “Landlord Port” means a California port that leases the port’s real property to a person(s).

(17) “Master” means the person who operates an ocean-going vessel or is otherwise in charge of the vessel’s operations.

(18) “Ocean-Going Vessel” means a commercial, government, or military vessel meeting any one of the following criteria:

(A) A vessel greater than or equal to 400 feet in length overall (LOA) as defined in 50 CFR § 679.2, as adopted June 19, 1996;

(B) A vessel greater than or equal to 10,000 gross tons (GT ITC) pursuant to the convention measurement (international system) as defined in 46 CFR § 69.51-.61, as adopted September 12, 1989; or

(C) A vessel propelled by a marine compression ignition engine with a per-cylinder displacement of greater than or equal to 30 liters.

For the purposes of this section, “ocean-going vessel” will be used interchangeably with the term “vessel.”

(19) “Operate” means steering or otherwise running the vessel or its functions while the vessel is underway, moored, anchored, or at berth.

(20) “Operate an Auxiliary Diesel Engine” means running or idling an auxiliary diesel engine such that it is producing mechanical work or electricity or is otherwise consuming fuel.

(21) “Own” means having all the incidents of ownership, including the legal title, of a vessel whether or not that person leads, rents, or pledges the vessel; having or being entitled to the possession of a vessel as the purchaser under a conditional sale contract; or being the mortgagor of a vessel.

(22) “Oxides of Nitrogen” means compounds of nitric oxide (NO), nitrogen dioxide (NO_2), and other oxides of nitrogen, which are typically created during combustion processes and are major contributors to smog formation and acid deposition.

(23) “Particulate Matter” means any airborne finely divided material, except uncombined water, which exists as a liquid or solid at standard conditions (e.g., dust, smoke, mist, fumes, or smog).

(24) “Passenger Vessel” means a self-propelled vessel constructed or adapted primarily to carry people.

(25) “Person” includes all of the following:

(A) Any person, firm, association, organization, partnership, business trust, corporation, limited liability company, or company;

(B) Any state or local governmental agency or public district, or any officer or employee thereof;

(C) The United States or its agencies, to the extent authorized by federal law.

(26) “Post-Baseline Fleet Emissions” means the total emissions from all vessels in a fleet after the application of alternative control technologies during all berthing times in a calendar year or other specified time period. For purposes of calculating the baseline fleet emissions, the auxiliary engines on the vessels in the fleet shall be assumed to use marine diesel fuel while at berth.

(27) “Refrigerated Cargo (or Reefer) Vessel” means a self-propelled vessel constructed or adapted primarily to carry refrigerated cargo. Reefer vessels include vessels where the cargo may be stored in large refrigerated rooms within the vessel or vessels that carry exclusively refrigerated cargo containers.

(28) “Responsible Official” means the individual(s) with the authority to certify that all vessels in a fleet comply with applicable requirements of this regulation.

(29) “Shore power” refers to electrical power being provided by either the local utility or by distributed generation.

(30) “Steamship” means a self-propelled vessel in which the primary propulsion and electrical power are provided by steam boilers.

(31) “Synchronous Power Transfer” means the synchronized switchover in vessel-based power to shore-based power without a loss in power during such transfer.

(32) “Terminal” means a facility consisting of wharves, piers, docks and other berthing locations and adjacent storage, which are used primarily for loading and unloading of cargo or material from vessels or the temporary storage of this cargo or material on-site.

(33) “Terminal Operator” means a person that leases terminal property from a port for the purpose of loading and unloading of cargo or material from vessels or the temporary storage of this cargo or material on-site.

(34) “Utility” shall have the same meaning and be used interchangeably with the term “Electric Utility” as defined in Public Resources Code section 28105.

(35) “Verified Emission Control Strategy” means an emission control strategy that has been verified pursuant to the “Verification Procedure

for In-Use Strategies to Control Emissions from Diesel Engines" in title 13, California Code of Regulations, commencing with section 2700, which is incorporated herein by reference.

(36) "Visit" means the time period that begins when an ocean-going vessel initially ties to a berth (the beginning of the visit) and ends when it casts off the lines (the end of the visit) at a berth in a California port. Separate and sequential visits shall collectively be deemed a single visit when a vessel ties to two or more berths at the same California port and the time interval between leaving one berth and tying to another berth in the same port is less than two hours.

(d) Vessel In-Use Operational Requirements.

(1) Limits on Hours and Other Aspects of Operation for Auxiliary Diesel Engines on Container, Passenger, and Refrigerated Cargo (Reefer) Vessels.

(A) Except as provided in subsection (d)(2), beginning January 1, 2014, no less than 50 percent of a fleet's visits to a California port in a calendar quarter, rounded to the nearest whole visit, shall meet the following limits on the number of hours auxiliary diesel engines on such vessels may be operated at berth:

1. Three hours total per visit, provided the visiting vessel uses a synchronous power transfer process to change from vessel-based power to shore-based power; or

2. Five hours total per visit, provided the visiting vessel does not use a synchronous power transfer process to change from vessel-based power to shore-based power.

For example, if a person's fleet makes 10 visits to a California port in a calendar quarter, the auxiliary diesel engines on vessels in at least 5 of those visits shall be operated no more than a combined 3 or 5 hours total, depending on whether a synchronous power transfer is used. The 3- and 5-hour limit applies to the combined operating time for all auxiliary diesel engines used in a vessel visit, rather than on a per-engine basis.

(B) Except as provided in subsection (d)(2), beginning January 1, 2020, no less than 80 percent of a fleet's visits to a California port in a calendar quarter, rounded to the nearest whole visit, shall meet the following limits on the number of hours auxiliary diesel engines on such vessels may be operated at berth:

1. Three hours total per visit, provided the visiting vessel uses a synchronous power transfer process to change from vessel-based power to shore-based power; or

2. Five hours total per visit, provided the visiting vessel does not use a synchronous power transfer process to change from vessel-based power to shore-based power.

For example, if a person's fleet makes 10 visits to a California port in a calendar quarter, the auxiliary diesel engines on vessels in at least 5 of those visits shall be operated no more than a combined 3 or 5 hours total, depending on whether a synchronous power transfer is used. The 3- and 5-hour limit applies to the combined operating time for all auxiliary diesel engines used in a vessel visit, rather than on a per-engine basis.

(C) Compliance with the requirements in subsection (d)(1)(A) and (d)(1)(B) shall be determined quarterly for the periods specified as follows:

1. January 1 through March 31, inclusive;

2. April 1 through June 30, inclusive;

3. July 1 through September 30, inclusive; and

4. October 1 through December 31, inclusive.

(D) Except as otherwise specified in subsection (d)(1)(F), the requirements of subsection (d)(1)(A) and (d)(1)(B) do not apply to:

1. A fleet comprised solely of container or reefer vessels that visits a California port fewer than 25 times total in a calendar year; and

2. A fleet comprised solely of passenger vessels that visits a California port fewer than 5 times total in a calendar year.

(E) No person shall sell, supply, offer to supply, or purchase electrical power for use on a vessel during a visit in lieu of using the on-board auxiliary diesel engines, unless such electrical power is either supplied by the local utility or is otherwise generated by equipment that meet the following emission standards:

1. NOx emissions no greater than 0.03 gram per kilowatt-hour (g/kW-hr);

2. PM emissions equivalent to the combustion of natural gas with a fuel sulfur content of no more than one grain per 100 standard cubic foot;

3. CO_2 emissions shall be no greater than 500 g/kW-hr; and

4. Ammonia emissions no greater than five parts per million on a dry volume basis (ppmdv), if selective catalytic reduction is used.

(F) Notwithstanding the requirements specified in subsection (d)(1)(A) and (d)(1)(B), any ocean-going vessel equipped to receive shore power that visits a berth equipped to provide compatible shore power shall utilize the shore power during every visit to that berth. This requirement shall not apply under the following circumstances:

1. The master of the vessel reasonably and actually determines that an emergency event, as defined in subsection (c)(12)(A), is in effect and the use of shore power during the emergency event would endanger the vessel's safety. Shore power shall be used for the remainder of the visit once the master determines that the emergency event no longer exists;

2. An emergency event, as defined in subsection (c)(12)(B) or (c)(12)(C), is in effect. Shore power shall be used for the remainder of the visit once the emergency event is no longer in effect; or

3. The California Independent System Operator (CAISO) has declared a Stage 3 emergency and the utility providing electrical power to the port is requesting the terminal where the vessel is located to reduce the use of grid-based electrical power. Shore power shall be used for the remainder of the visit once CAISO declares the Stage 3 emergency is over.

(2) *Emissions Reduction Option.*

The purpose of this provision is to allow any person the option of complying with the requirements of this subsection (d)(2) in lieu of meeting the requirements of subsection (d)(1).

Requirements.

(A) For fleets visiting terminals that are providing electrical power from the utility's electrical grid, the owner or operator of the fleets shall comply with the following schedule:

1. For the quarter beginning on January 1, 2014, and each subsequent quarter through December 31, 2019, inclusive, the NOx and PM emissions at berth from the fleet's auxiliary engines must be reduced by 50 percent from the baseline fleet emissions.

2. For the quarter beginning on January 1, 2020, and each subsequent quarter thereafter, the NOx and PM emissions at berth from the fleet's auxiliary engines must be reduced by 80 percent from the baseline fleet emissions.

(B) For fleets visiting terminals that are providing electrical power from sources that are not part of an utility's electrical grid, or alternative control technologies are used to reduce the emissions of the fleet, the owner or operator of the fleet shall comply with the following schedule:

1. For the quarter beginning on January 1, 2010, and each subsequent quarter through December 31, 2011, inclusive, the NOx and PM emissions at berth from the fleet's auxiliary engines must be reduced by 20 percent from the baseline fleet emissions.

2. For the quarter beginning on January 1, 2012, and each subsequent quarter through December 31, 2013, inclusive, the NOx and PM emissions at berth from the fleet's auxiliary engines must be reduced by 40 percent from the baseline fleet emissions.

3. For the quarter beginning on January 1, 2014, and each subsequent quarter through December 31, 2015, inclusive, the NOx and PM emissions at berth from the fleet's auxiliary engines must be reduced by 60 percent from the baseline fleet emissions.

4. For the quarter beginning on January 1, 2016, and each subsequent quarter thereafter, the NOx and PM emissions from the fleet's auxiliary engines must be reduced by 80 percent from the baseline fleet emissions.

(C) For fleets visiting terminals that are using a combination of electrical power from the utility grid and electrical power from sources that are not part of an utility's electrical grid, or alternative control technologies, the following schedule applies:

1. For the quarter beginning on January 1, 2012, and each subsequent quarter through December 31, 2013, inclusive, the NOx and PM emissions at berth from the fleet's auxiliary engines must be reduced by 20 percent from the baseline fleet emissions.

2. For the quarter beginning on January 1, 2014, and each subsequent quarter through December 31, 2019, inclusive, the NOx and PM emissions from the fleet's auxiliary engines must be reduced by 50 percent from the baseline fleet emissions.

3. For the quarter beginning on January 1, 2020, and each subsequent quarter thereafter, the NOx and PM emissions from the fleet's auxiliary engines must be reduced by 80 percent from the baseline fleet emissions.

(D) Compliance with the requirements of subsection (d)(2)(A), (d)(2)(B), and (d)(2)(C) shall be determined quarterly for the periods specified as follows:

1. January 1 through March 31, inclusive;

2. April 1 through June 30, inclusive;

3. July 1 through September 30, inclusive; and

4. October 1 through December 31, inclusive.

(E) No person shall sell, supply, offer to supply, or purchase electrical power for use on a vessel during a visit in lieu of using the on-board auxiliary diesel engines, unless such electrical power is either be supplied by the local utility or is otherwise generated by equipment that meet the following emission:

1. NOx Emissions.

   a. Up to and including December 31, 2013, the NOx emissions shall be no greater than 2 g/kW-hr at any time; and

b. Beginning January 1, 2014, the NOx emissions shall be no greater than 0.2 g/kW-hr at any time;

2. PM emissions shall be no greater than the PM emissions from combustion of natural gas with a fuel sulfur content of no more than one grain per 100 standard cubic foot;

3. CO_2 emissions shall be no greater than 500 g/kW-hr; and

4. Ammonia emissions shall be no greater than five ppmdv if selective catalytic reduction is used.

(e) Exemptions to the Three-Hour or Five-Hour Limited Auxiliary Engine Operation Requirement in Subsection (d)(1)(A)(1), (d)(1)(A)(2), (d)(1)(B)(1) and (d)(1)(B)(2).

(1) Emergency Event.

All of the following requirements apply to claimed exemptions based on emergency events:

(A) If the master of the vessel reasonably and actually determines that an emergency event, as defined subsection (c)(12), occurs during the vessel's visit to a California port, the master of the vessel may operate the vessel's auxiliary engines during the emergency event;

(B) The master shall not operate the vessel's auxiliary engines for more than one hour beyond the time when the master receives notification that the emergency event is over, determines that the emergency event is over, or should have known the emergency event is over; and

(C) The provisions of paragraph (B) above notwithstanding, the master may continue to operate the auxiliary engines for no more than five hours if the master receives notification that the emergency event is over, determines that the emergency event is over, or should have known the emergency event is over and the vessel is scheduled to leave port within five hours.

(2) Delays Caused By U.S. Coast Guard or Department of Homeland Security Inspections.

The Executive Officer may extend the three-hour/five-hour operational requirement in subsection (d)(1)(A) and (d)(1)(B) if the following criteria are met:

(A) The initial inspection and clearance of the vessel by the Department of Homeland Security exceeds one hour. The time extension granted shall be commensurate with the excess time necessary for inspection and clearance; or

(B) After the auxiliary engines have been put back into service pending departure from the berth, the scheduled departure of the vessel has been delayed by the United States (U.S.) Coast Guard or the Department of Homeland Security.

(f) *Calculations for Emissions Reduction Option in Subsection (d)(2).*

(1) For the purposes of subsection (d)(2)(A), (d)(2)(B), and (d)(2)(C), the percent emission reduction shall be calculated as follows:

Percent Reduction = (BFE – PBFE) / BFE

Where,

The baseline fleet and post-baseline fleet emissions are calculated as follows:

(A) Baseline Fleet Emissions (BFE).

The baseline fleet emissions of NOx and PM shall be calculated using the following formula:

Baseline Fleet Emissions = $\sum$ (emission rate x average berthing time x power requirement x visits)

Where:

“Emission rate” for each auxiliary engine is determined pursuant to subsection (f)(2);

“Average berthing time” for each vessel is determined for the applicable period specified in subsection (d)(2)(D);

“Power requirements” means the electrical power requirement for each vessel as determined pursuant to subsection (f)(3);

"Visits" means the total number of visits by the vessel during the applicable period specified in subsection (d)(2)(D); and

"$\sum$" means the summation over the entire fleet subject to the emission reduction option.

(B) Post-Baseline Fleet Emissions (PBFE).

The post-baseline fleet emissions of NOx and PM shall be calculated using the following formula:

Post-Baseline Fleet Emissions = $\sum$ (emission rate x average berthing time x power requirement x visits x control factor)

Where:

"Emission rate" for each auxiliary engine is determined pursuant to subsection (f)(2);

"Average berthing time" for each vessel is determined for the applicable period specified in subsection (d)(2)(D);

"Power requirements" means the electrical power requirement for each vessel as determined pursuant to subsection (f)(3);

"Visits" means the total number of visits by the vessel during the applicable period specified in subsection (d)(2)(D);

"Control factor" means the applicable control factor specified in subsection (f)(4); and

"$\sum$" means the summation over the entire fleet subject to the emission reduction option.

(2) A person complying with the requirements of subsection (d)(2) may choose any of the following emissions rates for use in the calculations specified in subsection (f)(1)(A) and (f)(1)(B):

(A) Results from emission measurements for similar auxiliary diesel engines that are used to satisfy a marine engine standard, including U.S. Environmental Protection Agency (EPA) emission standards for marine engines (40 CFR Part 94), and the International Convention for the Prevention of Pollution from

Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78), both of which are incorporated herein by reference;

(B) Emission measurements approved by the Executive Officer and using the test methods specified in subsection (f)(4)(B)(3); or

(C) In lieu of test data measured pursuant to paragraph (A) or (B) above, the following emission rates may be used as default values:

1. 13.9 g/kW-hr for NOx.

2. 0.38 g/kW-hr for PM if 0.11 to 0.5 percent sulfur marine gas oil is used as a fuel.

3. 0.25 g/kW-hr for PM if 0.10 or less sulfur content marine gas oil is used as a fuel.

(3) Power Requirements.

(A) The following values in Table 1 may be used as default values for power requirements:

Table 1.

Ship Category	Ship Size / Type	Default Power Requirement (kW)
Container Vessel	<1000 TEU	1,000
	1,000-1,999 TEU	1,300
	2,000-2,999 TEU	1,600
	3,000-3,999 TEU	1,900
	4,000-4,999 TEU	2,200
	5,000-5,999 TEU	2,300
	6,000-6,999 TEU	2,500
	7,000-7,999 TEU	2,900
	8,000-9,999 TEU	3,300
	10,000-12,000 TEU	3,700
Passenger Vessel		No Default Value – Use Actual Load
Reefer	Break Bulk	1,300
	Fully Containerized	3,300

TEU = twenty-foot equivalent unit.
kW = kilowatt

(B) In lieu of the default values above, the fleet operator may, with adequate supporting documentation, use the following:

1. The actual shore power usage, on a monthly basis, rounded to the nearest whole kW-hrs, of the vessels in the fleet utilizing shore power, or

2. The actual on-board power usage, on a monthly basis, rounded to the nearest whole kW-hrs, of the vessels in the fleet utilizing alternative control technologies.

(4) Control Factors.

(A) The emissions from vessels using grid power in lieu of the vessel's auxiliary engines when the vessels are at berth are presumed to be reduced by 90 percent.

(B) No control efficiencies for alternative control technologies shall be used to comply with the requirements of this provision unless the control efficiencies are calculated or measured as follows:

1. The control efficiencies shall be based on an emission test protocol that is approved by the Executive Officer prior to conducting the emission measurements;

2. The results of the emission measurements conducted pursuant to paragraph 1 above are approved by the Executive Officer; and

3. Emission measurements are conducted using the following test methods:

a. NOx and CO_2 shall be measured using California Air Resources Board (CARB) Test Method 100, dated July 1997, which is incorporated herein by reference, or equivalent district-approved test method;

b. Diesel PM shall be measured using ISO 8178 Test Procedures: ISO 8178-1: 1996(E) ("ISO 8178 Part 1"); ISO 8178-2:1996(E) ("ISO 8178 Part 2"); and ISO 8178-4: 1996(E) ("ISO 8178 Part 4"), all of which are incorporated herein by reference; and

c. Ammonia slip shall be measured using the Bay Area Air Quality Management District Source Test Procedure

ST-1B, Ammonia Integrated Sampling, dated January 1982, which is incorporated herein by reference, or other equivalent district approved test method.

d. The sulfur content of fuels shall be determined pursuant to International Standard ISO 8754 (as adopted in 2003), which is incorporated herein by reference.

(C) Results from emission measurements from a verified emission control strategy may be used in conjunction with engine emission information.

(D) The Executive Officer may request periodic emission testing or other types of monitoring to verify the proper operation of alternative control technologies or to verify the emission rate of an auxiliary engine.

1. At a minimum, emission control technologies shall be tested as follows and the results of such testing provided to the Executive Officer within 30 days of the testing:

a. Shore-based systems shall be tested annually to demonstrate the overall percentage of emission reduction being achieved.

b. Catalyst based air pollution control systems installed on vessels shall be tested after every 1,000 hours of operation to determine the overall percentage of emission reduction being achieved.

c. If Selective Catalytic Reduction (SCR) is used as a control technology, the emissions of ammonia shall also be measured at the same time the NOx emissions are being measured.

2. The Executive Officer may modify the testing frequency as he/she deems appropriate.

(g) *Terminal Plan Requirements.*

(1) A terminal that receives more than 50 vessel visits in 2008 shall submit a plan for the Executive Officer's approval that discusses how the terminal will accommodate the vessels that will visit the terminal who are subject to subsection (d)(1) and (d)(2). The terminal shall submit the plan and subsequent updates to the plan according to the schedule below (Table 2). The plan updates shall address any contingencies

that may be necessary for the vessels to meet the requirements of subsection (d)(1)and (d)(2) by the applicable dates.

Table 2.

Vessel Compliance Option	Initial Terminal Plan Due Date	Subsequent Terminal Plan Updates
Grid-Based Shore Power: (d)(1) and (d)(2)(A)	July 1, 2009	July 1, 2013 July 1, 2019
Alternative Control Technologies to Grid-Based Shore Power: (d)(2)(B)	July 1, 2009	July 1, 2011 July 1, 2013 July 1, 2015
Combination of Grid-Based Shore Power and Alternative Control Technologies: (d)(2)(C)	July 1, 2009	July 1, 2011 July 1, 2013 July 1, 2015 July 1, 2019

(2) Plan Requirements for Grid-Based Shore Power.

(A) Specify the schedule for implementing infrastructure modifications, including the following:

1. Utility infrastructure improvements, if any, outside the port boundary;

2. Improvements to port infrastructure; and

3. Major infrastructure improvements to terminal.

(B) Identification of existing berths to be modified or new berths to be constructed that will satisfy the requirements of subsection (d)(1).

(3) Plan Requirements for Alternative Control Technologies.

(A) Description of the approach that will be used to reduce in-berth vessel emissions, including whether the approach is a vessel-based approach or shore-based approach;

(B) Identification and description of equipment;

(C) Berth(s) where the equipment will be used;

(D) Specific vessels affected by the technology; and

(E) Estimate of the expected reductions in NOx and PM emissions from vessels using the technology, including documentation supporting the anticipated reductions.

(4) Plan Requirements for a Combination of Grid-Based Shore Power and Alternative Control Technologies.

(A) Identification of which berths will implement grid-based shore power and which berths will implement alternative control technologies

(B) For berths implementing shore-based grid power, the plan must contain the information specified in subsection (g)(2).

(C) For berths implementing alternative control technologies, the plan shall contain the information specified in subsection (g)(3).

(5) A port may submit terminal plans required under subsection (g)(1) on behalf of the terminals located at that port.

(h) *Reporting and Recordkeeping Requirements*.

(1) Reporting and Recordkeeping Requirements for Persons that Comply with Subsection (d)(1).

(A) The Responsible Official shall provide the following reports to the Executive Officer:

1. A vessel fleet plan, due to the Executive Officer by July 1, 2013, and an updated plan by July 1, 2019, which includes a listing of the vessels that would be affected by the requirements specified in subsection (d)(1) and the description of the ability of each vessel to use shore power.

   The vessel fleet plan shall list the vessels that are able to shut down the vessel's auxiliary engines and use shore power, along with the related information as follows:

   a. Name of the vessel, Lloyd's number for the vessel, and vessel category (container, passenger, or reefer); and

   b. The port(s) each vessel(s) is expected to visit.

2. An annual statement of compliance pursuant to subsection (d)(1) and (d)(2).

    a. The initial annual statement of compliance is due to the Executive Officer by March 1, 2015. This statement is for the 2014 calendar year. Thereafter, the annual statement is due to the Executive Officer by March 1 of each year, certifying compliance with the requirements for the previous calendar year.

    b. The annual statement of compliance shall include the following:

        i. A statement signed by the Responsible Official that the requirements specified in subsection (d)(1) or (d)(2) have been met.

        ii. Visit-related information for all vessels within a fleet that visited a California port. The list shall include the following information for each vessel:

            I. Current name of the vessel;
            II. Lloyd's number for the vessel;
            III. Vessel type (cargo, passenger, reefer); and
            IV. Visits, by port and terminal, where the auxiliary engines were shut down;

        iii. The information submitted pursuant to paragraph 2.b.ii above shall be reported for the following periods:

            I. January 1 through March 31, inclusive;
            II. April 1 through June 30, inclusive;
            III. July 1 through September 30, inclusive; and
            IV. October 1 through December 31, inclusive.

(B) Recordkeeping.

1. The following records shall be kept at a central location by the vessel operator. This information shall be supplied to the Executive Officer within 30 days of a request from ARB inspectors or staff.

    a. A logbook that records, for each visit, the dates, times, and other information as specified below:

i. When the vessel initially tied to the berth and when the vessel cast-off the tie lines;

ii. When the Department of Homeland Security released the vessel;

iii. When the auxiliary engines were initially shut down and subsequently restarted;

iv. Whether departure from the berth was delayed by the U.S. Coast Guard or other federal agency and identification of the agency that caused the delay;

v. If an emergency event occurred, a description of that emergency event;

vi. If the vessel could not use shore power as a result of the CAISO declaring a stage 3 emergency, and

vii. If a vessel could not use shore power as a result of equipment failure aboard the vessel

b. Copies of all current U.S. Department of Homeland Security Bureau of Customs and Border Protection "Vessel Entrance or Clearance Statement" documents (CBP Form 1300, version 02/02), which is incorporated herein by reference, if the vessel operator or owner is claiming an exemption pursuant to subsection (e)(2)(A) or (e)(2)(B).

2. All records required pursuant to this provision shall be retained for a minimum of five years.

(2) Reporting and Recordkeeping Requirements for Persons Opting to Comply with the Emissions Reduction Option in Subsection (d)(2).

(A) The Responsible Official shall provide the following reports to the Executive Officer:

1. A vessel fleet plan, due to the Executive Officer by the dates shown in Table 3 below:

Table 3.

Compliance Option	Initial Vessel Fleet Plan	Subsequent Submittal Due Dates
Grid-Based Shore Power: (d)(2)(A)	July 1, 2013	July 1, 2019
Alternative Control Technologies to Grid-Based Shore Power: (d)(2)(B)	July 1, 2009	July 1, 2011 July 1, 2013 July 1, 2015
Combination of Grid-Based Shore Power and Alternative Control Technologies: (d)(2)(C)	July 1, 2011	July 1, 2013 July 1, 2019

The vessel fleet plan shall include the following items:

a. List of the vessels included in the company's fleet; Lloyd's number for each vessel, vessel category (cargo, passenger, reefer), average number of reefer containers carried by the vessel over the calendar year (container vessels only), and power requirement for each vessel (passenger and reefer vessels); and

b. Identify the potential alternative control techniques that may be used to achieve the requirements specified in subsection (d)(2). For each control technique, specify the following:

   i. The vessels that would be affected by the technique;

   ii. The status of implementation of the alternative control technique; and

   iii. The basis used in determining the expected emission reduction, including submittal of any emission testing or other documentation.

2. An annual statement of compliance.

   a. The initial annual statement of compliance is due to the Executive Officer by the dates in Table 4 below:

Table 4.

Compliance Option	Initial Submittal of Annual Statement of Compliance
Grid-Based Shore Power: (d)(2)(A)	March 1, 2015
Alternative Control Technologies to Grid-Based Shore Power: (d)(2)(B)	March 1, 2011
Combination of Grid-Based Shore Power and Alternative Control technologies: (d)(2)(C)	March 1, 2013

Thereafter, the annual compliance statement is due to the Executive Officer by March 1 of each year, certifying compliance with the requirements for the previous year.

b. The following items, applicable to the calendar year in question, should be included with the statement of compliance:

i. A statement signed by the Responsible Official indicating that the NOx and PM emission reductions specified by (d)(2) have been achieved;

ii. The calculated NOx and PM baseline and post-baseline emissions for each fleet, on a quarterly basis, as specified in (d)(2)(D). Include each vessel's contribution to the fleet's baseline and post-baseline emissions; and

iii. Description of the technique(s) used, including alternative controls technology (or technologies), achievable emission reductions, and supporting documentation (e.g., source test results or verification documentation). For subsequent statements of compliance, the supporting documents can be referenced.

(B) Recordkeeping.

1. The following records shall be kept at a central location by the master and the fleet vessel operator. This information shall be

supplied to the Executive Officer within 30 days of a request from ARB staff.

For each calendar year of vessel activity, a quarterly summary of emissions that demonstrates compliance with the applicable emission reduction (2010, 2012, 2014, or 2016), which includes the following:

a. The fleet's baseline and post-baseline levels for NOx and PM emissions; and

b. Each vessel's contribution to fleet's baseline and post-baseline NOx and PM emissions, including the following information:

    i. Name of each vessel;

    ii. Lloyd's number for each vessel;

    iii. Fuel type and average sulfur content of fuel for each vessel;

    iv. NOx and PM emissions for each vessel;

    v. Average hotelling time for each vessel;

    vi. Power requirements for each vessel while at berth;

    vii. For container vessels, the number of reefer containers imported and exported for each container vessel;

    viii. Total visits to each California port made by the vessel;

    ix. Technology used to reduce emissions and associated control factor used; and

    x. Any equipment failure aboard a vessel that prevented the vessel from using the emissions reduction technology

2. Records made pursuant to paragraph (2)(B) above shall be kept for a minimum of five years.

(3) Reporting and Recordkeeping Requirements for Ports and Terminals.

(A) Affected ports shall provide wharfinger information to the Executive Officer annually, beginning with the wharfinger information for calendar year 2010.

1. This information shall be provided to the Executive Officer no later than April 1 of the following year.

2. At a minimum, the wharfinger information shall include for each vessel visiting the port:

a. Name of the vessel;

b. Vessel type;

c. Company operating the vessel;

d. Lloyd's number for each vessel;

e. Berth used by the vessel; and

f. Date(s) and time the vessel was initially tied to the berth and subsequently released from the berth.

(B) The terminal operator shall keep the following records. These records shall be supplied to the Executive Officer within 30 days of a request from ARB staff:

1. Electricity usage for shore power:

a. Monthly utility billing statements that separately identify electricity supplied for shore power;

b. Episodes of electrical service interruption by local utility company, as confirmed and documented by local utility company; and

c. For distributed generation, monthly records that contain the following:

i. Names of vessels serviced;
ii. Location of vessels serviced, by berth;
iii. Date and time of use; and
iv. Power, in megawatts, supplied to the vessels.

2. Date, time, and description of equipment failure that affected the ability of vessels to turn off their auxiliary engines or use alternative control technologies to reduce emissions pursuant to (d)(2).

3. Record of each vessel that did not operate its auxiliary engines while the vessel was docked at the terminal:

   a. Name of vessel; and

   b. Date and time each vessel was initially tied to the terminal.

4. Records made pursuant to paragraph (3)(B) above shall be kept for five years.

(4) Electronic submittals of records and other information required under this section may be approved by the Executive Officer upon request, provided such electronic submittals use digital signatures that meet the requirements specified in Government Code section 16.5. Notwithstanding the approved submittal of electronic records, the Executive Officer may request the submittal of a hard copy of any electronic submittal.

(i) *Violations.*

(1) Except as otherwise specified in this subsection, any person who is subject to this section and commits a violation of any provision, prohibition, limit, standard, criteria, or requirement in this section is subject to the penalties, injunctive relief, and other remedies specified in Health and Safety Code section 42400 et seq., other applicable sections in the Health and Safety Code; and other applicable provisions as provided under California law for each violation. Nothing in this section shall be construed to limit or otherwise affect any applicable penalties or other remedies available under federal law.

(2) Except as otherwise specified in this subsection, any failure to meet any provision, prohibition, limit, standard, criteria, or requirement in this section, including but not limited to the applicable emission limits for supplied shore power and hours of engine operation limits, shall constitute a single, separate violation of this section for each hour that a person operates the auxiliary diesel engine until such provision, prohibition, limit, standard, criteria, or requirement has been met.

(3) A violation of the recordkeeping and reporting requirements in this section shall constitute a single, separate violation of this section for

each day that the applicable recordkeeping or reporting requirement has not been met.

(j) *Severability.*

If any subsection, paragraph, subparagraph, sentence, clause, phrase, or portion of this regulation is, for any reason, held invalid, unconstitutional, or unenforceable by any court of competent jurisdiction, such portion shall be deemed as a separate, distinct, and independent provision, and such holding shall not affect the validity of the remaining portions of the regulation.

NOTE: Authority cited: Sections 38560, 38560.5, 39600, 39601, 41511, 43013, and 43018, Health and Safety Code. Reference: Sections 38560, 38560.5, 39000, 39001, 39515, 39516, 41510, 41511, 43013, and 43018, Health and Safety Code; and *Western Oil and Gas Ass'n v. Orange Country Air Pollution Control District*, (1975) 14 Cal.3d 411, 121 Cal.Rptr. 249.

PROPOSED REGULATION ORDER

AIRBORNE TOXIC CONTROL MEASURE FOR AUXILIARY DIESEL ENGINES OPERATED ON OCEAN-GOING VESSELS AT-BERTH IN A CALIFORNIA PORT

Adopt new section 93118.3, title 17, chapter 1, subchapter 7.5, California Code of Regulations (CCR), to read as follows:

(Note: The entire text of section 93118.3 is new language.):

Section 93118.3. Airborne Toxic Control Measure for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At-Berth in a California Port.

(a) *Purpose*.

The purpose of this section is to reduce oxides of nitrogen (NOx) and diesel particulate matter (PM) emissions from the operation of auxiliary engines on container ships, passenger ships, and refrigerated cargo ships while these vessels are docked at berth at a California port. This section reduces emissions by limiting the time during which auxiliary diesel engines are operated on the regulated vessels while such vessels are docked at-berth in a California port, as well as by applying other requirements. This section implements provisions of the Goods Movement Emission Reduction Plan, adopted by the Air Resources Board (ARB) in April 2006, to reduce emissions and health risk from ports and the movement of goods in California. This section also helps achieve the goals specified in the California Global Warming Solutions Act of 2006, established under California law by Assembly Bill 32 (Stats. 2006, ch. 488) and set forth in Health and Safety Code § 38500 et seq.

(b) Applicability and General Exemptions.

(1) Except as provided in this subsection (b), this section applies to any person who owns, operates, charters, rents, or leases any U.S. or foreign-flagged container ship, passenger ship, or refrigerated cargo ship that visits a California port. In addition, this section also applies to any person who owns or operates a port or terminal located at a port where container, passenger, or refrigerated cargo vessels visit.

(2) Nothing in this section shall be construed to amend, repeal, modify, or change in any way any applicable U.S. Coast Guard requirements. Any person subject to this section shall be responsible for ensuring compliance with both U.S. Coast Guard regulations and the

requirements of this section, including but not limited to, obtaining any necessary approvals, exemptions, or orders from the U.S. Coast Guard.

(3) The requirements of this section do not apply to:

(A) Ocean-going vessel voyages that are comprised of continuous and expeditious navigation through any of the Regulated California Waters for the purpose of traversing such bodies of water without entering California internal or estuarine waters or calling at a port, roadstead, or terminal facility. "Continuous and expeditious navigation" includes stopping and anchoring only to the extent such stopping and anchoring are required by the U.S. Coast Guard; rendered necessary by force majeure or distress; or made for the purpose of rendering assistance to persons, ships, or aircraft in danger or distress. This exemption does not apply to the passage of an ocean-going vessel that engages in any of the prejudicial activities specified in United Nations Convention on the Law of the Seas (UNCLOS) 1982, Article 19, subpart 2. Further, notwithstanding any Coast Guard mandated stops or stops due to force majeure or the rendering of assistance, this exemption does not apply to a vessel that was otherwise scheduled or intended to enter California internal or estuarine waters or call at a port, roadstead or terminal facility.

(B) Auxiliary engines on-board ocean-going vessels owned or operated by any branch of local, state, federal government, or by a foreign government, when such vessels are operated on government non-commercial service. However, such vessels are encouraged to act in a manner consistent, so far as is reasonable and practicable, with this section.

(C) Steamships while berthed at a California port.

(D) Auxiliary engines while such engines are operating primarily on liquefied natural gas or compressed natural gas.

(c) *Definitions.*

For purposes of this section, the definitions in Health and Safety Code sections 39010 through 39060 shall apply except as otherwise specified in this section:

(1) "Alternative Control Technologies" means technologies, techniques, or measures that reduce the emissions of NOx and PM from an auxiliary diesel engine other than shutting down the engine.

(2) “Auxiliary Engine” means an engine on an ocean-going vessel designed primarily to provide power for uses other than propulsion, except that all diesel-electric engines shall be considered “auxiliary diesel engines” for purposes of this section.

(3) “Baseline Fleet Emissions” means the total emissions from all vessels in a fleet during all berthing times in a calendar year or other specified time period. For purposes of calculating the baseline fleet emissions, the auxiliary engines on the vessels in the fleet shall be assumed to use marine diesel fuel while at berth.

(4) “Berthing Time” means the time period that begins when the vessel is first tied to the berth and ends when the vessel is untied from the berth.

(5) “California Ports” means:

(A) The Port of Hueneme, the Port of Los Angeles (POLA) and Port of Long Beach (POLB), the Port of Oakland, the Port of San Diego, and the Port of San Francisco;

(B) For purposes of this section, POLA and POLB are treated as one port.

(6) “Container Vessel” means a self-propelled ocean-going vessel constructed or adapted primarily to carry uniform-sized ocean freight containers.

(7) “Diesel Engine” means an internal combustion, compression-ignition (CI) engine with operating characteristics significantly similar to the theoretical diesel combustion cycle. The regulation of power by controlling fuel supply in lieu of a throttle is indicative of a compression ignition engine.

(8) “Diesel-Electric Engine” means a diesel engine connected to a generator that is used as a source of electricity for propulsion or other uses.

(9) “Diesel Particulate Matter” means the particles found in the exhaust of diesel engines, which may agglomerate and adsorb other species to form structures of complex physical and chemical properties.

(10) “Distributed Generation” shall have the same meaning as that term is defined in title 17, CCR, section 94202.

(11) “Docked at the Berth” means the state of being tied to a berth.

(12) “Emergency Event” means the period of time during which any of the following events occurs; the emergency event begins when such an event begins and ends when the event is over:

(A) Any situation arising from a sudden and reasonably unforeseen event beyond the control of the master that threatens the safety of the vessel;

(B) The utility serving the port states that electrical power will be temporarily unavailable as a result of equipment failure; or

(C) The electrical system at the terminal cannot provide electrical power as a result of equipment failure; or

(13) “Executive Officer” means the executive officer of the Air Resources Board (ARB), or his or her designee.

(14) “Fleet” means all container, passenger, and refrigerated cargo (reefer) vessels, visiting a specific California port, which are owned or operated under the direct control of the same person. Direct control includes, but is not limited to, vessels that are operated under a contract, lease, or other arrangement with a third-party for the third-party to operate the vessel. For the purposes of this section, a person shall be deemed to have separate fleets for each California port visited. For example, if a person owns or operates vessels that visit both the Port of Los Angeles and Port of Oakland, that person is deemed to have two fleets, one a “POLA-based fleet” and the other a “Port of Oakland-based fleet.”

(15) “IMO” means the International Maritime Organization.

(16) “Landlord Port” means a California port that leases the port’s real property to a person(s).

(17) “Master” means the person who operates an ocean-going vessel or is otherwise in charge of the vessel’s operations.

(18) “Ocean-Going Vessel” means a commercial, government, or military vessel meeting any one of the following criteria:

(A) A vessel greater than or equal to 400 feet in length overall (LOA) as defined in 50 CFR § 679.2, as adopted June 19, 1996;

(B) A vessel greater than or equal to 10,000 gross tons (GT ITC) pursuant to the convention measurement (international system) as defined in 46 CFR § 69.51-.61, as adopted September 12, 1989; or

(C) A vessel propelled by a marine compression ignition engine with a per-cylinder displacement of greater than or equal to 30 liters.

For the purposes of this section, “ocean-going vessel” will be used interchangeably with the term “vessel.”

(19) “Operate” means steering or otherwise running the vessel or its functions while the vessel is underway, moored, anchored, or at berth.

(20) “Operate an Auxiliary Diesel Engine” means running or idling an auxiliary diesel engine such that it is producing mechanical work or electricity or is otherwise consuming fuel.

(21) “Own” means having all the incidents of ownership, including the legal title, of a vessel whether or not that person leads, rents, or pledges the vessel; having or being entitled to the possession of a vessel as the purchaser under a conditional sale contract; or being the mortgagor of a vessel.

(22) “Oxides of Nitrogen” means compounds of nitric oxide (NO), nitrogen dioxide (NO_2), and other oxides of nitrogen, which are typically created during combustion processes and are major contributors to smog formation and acid deposition.

(23) “Particulate Matter” means any airborne finely divided material, except uncombined water, which exists as a liquid or solid at standard conditions (e.g., dust, smoke, mist, fumes, or smog).

(24) “Passenger Vessel” means a self-propelled vessel constructed or adapted primarily to carry people.

(25) “Person” includes all of the following:

(A) Any person, firm, association, organization, partnership, business trust, corporation, limited liability company, or company;

(B) Any state or local governmental agency or public district, or any officer or employee thereof;

(C) The United States or its agencies, to the extent authorized by federal law.

(26) “Post-Baseline Fleet Emissions” means the total emissions from all vessels in a fleet after the application of alternative control technologies during all berthing times in a calendar year or other specified time period. For purposes of calculating the baseline fleet emissions, the auxiliary engines on the vessels in the fleet shall be assumed to use marine diesel fuel while at berth.

(27) “Refrigerated Cargo (or Reefer) Vessel” means a self-propelled vessel constructed or adapted primarily to carry refrigerated cargo. Reefer vessels include vessels where the cargo may be stored in large refrigerated rooms within the vessel or vessels that carry exclusively refrigerated cargo containers.

(28) “Responsible Official” means the individual(s) with the authority to certify that all vessels in a fleet comply with applicable requirements of this regulation.

(29) “Shore power” refers to electrical power being provided by either the local utility or by distributed generation.

(30) “Steamship” means a self-propelled vessel in which the primary propulsion and electrical power are provided by steam boilers.

(31) “Synchronous Power Transfer” means the synchronized switchover in vessel-based power to shore-based power without a loss in power during such transfer.

(32) “Terminal” means a facility consisting of wharves, piers, docks and other berthing locations and adjacent storage, which are used primarily for loading and unloading of cargo or material from vessels or the temporary storage of this cargo or material on-site.

(33) “Terminal Operator” means a person that leases terminal property from a port for the purpose of loading and unloading of cargo or material from vessels or the temporary storage of this cargo or material on-site.

(34) “Utility” shall have the same meaning and be used interchangeably with the term “Electric Utility” as defined in Public Resources Code section 28105.

(35) “Verified Emission Control Strategy” means an emission control strategy that has been verified pursuant to the “Verification Procedure

for In-Use Strategies to Control Emissions from Diesel Engines" in title 13, California Code of Regulations, commencing with section 2700, which is incorporated herein by reference.

(36) "Visit" means the time period that begins when an ocean-going vessel initially ties to a berth (the beginning of the visit) and ends when it casts off the lines (the end of the visit) at a berth in a California port. Separate and sequential visits shall collectively be deemed a single visit when a vessel ties to two or more berths at the same California port and the time interval between leaving one berth and tying to another berth in the same port is less than two hours.

(d) Vessel In-Use Operational Requirements.

(1) Limits on Hours and Other Aspects of Operation for Auxiliary Diesel Engines on Container, Passenger, and Refrigerated Cargo (Reefer) Vessels.

(A) Except as provided in subsection (d)(2), beginning January 1, 2014, no less than 50 percent of a fleet's visits to a California port in a calendar quarter, rounded to the nearest whole visit, shall meet the following limits on the number of hours auxiliary diesel engines on such vessels may be operated at berth:

1. Three hours total per visit, provided the visiting vessel uses a synchronous power transfer process to change from vessel-based power to shore-based power; or

2. Five hours total per visit, provided the visiting vessel does not use a synchronous power transfer process to change from vessel-based power to shore-based power.

For example, if a person's fleet makes 10 visits to a California port in a calendar quarter, the auxiliary diesel engines on vessels in at least 5 of those visits shall be operated no more than a combined 3 or 5 hours total, depending on whether a synchronous power transfer is used. The 3- and 5-hour limit applies to the combined operating time for all auxiliary diesel engines used in a vessel visit, rather than on a per-engine basis.

(B) Except as provided in subsection (d)(2), beginning January 1, 2020, no less than 80 percent of a fleet's visits to a California port in a calendar quarter, rounded to the nearest whole visit, shall meet the following limits on the number of hours auxiliary diesel engines on such vessels may be operated at berth:

1. Three hours total per visit, provided the visiting vessel uses a synchronous power transfer process to change from vessel-based power to shore-based power; or

2. Five hours total per visit, provided the visiting vessel does not use a synchronous power transfer process to change from vessel-based power to shore-based power.

For example, if a person's fleet makes 10 visits to a California port in a calendar quarter, the auxiliary diesel engines on vessels in at least 5 of those visits shall be operated no more than a combined 3 or 5 hours total, depending on whether a synchronous power transfer is used. The 3- and 5-hour limit applies to the combined operating time for all auxiliary diesel engines used in a vessel visit, rather than on a per-engine basis.

(C) Compliance with the requirements in subsection (d)(1)(A) and (d)(1)(B) shall be determined quarterly for the periods specified as follows:

1. January 1 through March 31, inclusive;

2. April 1 through June 30, inclusive;

3. July 1 through September 30, inclusive; and

4. October 1 through December 31, inclusive.

(D) Except as otherwise specified in subsection (d)(1)(F), the requirements of subsection (d)(1)(A) and (d)(1)(B) do not apply to:

1. A fleet comprised solely of container or reefer vesselsthat visits a California port fewer than 25 times total in a calendar year; and

2. A fleet comprised solely of passenger vessels that visits a California port fewer than 5 times total in a calendar year.

(E) No person shall sell, supply, offer to supply, or purchase electrical power for use on a vessel during a visit in lieu of using the on-board auxiliary diesel engines, unless such electrical power is either supplied by the local utility or is otherwise generated by equipment that meet the following emission standards:

1. NOx emissions no greater than 0.03 gram per kilowatt-hour (g/kW-hr);

2. PM emissions equivalent to the combustion of natural gas with a fuel sulfur content of no more than one grain per 100 standard cubic foot;

3. CO_2 emissions shall be no greater than 500 g/kW-hr; and

4. Ammonia emissions no greater than five parts per million on a dry volume basis (ppmdv), if selective catalytic reduction is used.

(F) Notwithstanding the requirements specified in subsection (d)(1)(A) and (d)(1)(B), any ocean-going vessel equipped to receive shore power that visits a berth equipped to provide compatible shore power shall utilize the shore power during every visit to that berth. This requirement shall not apply under the following circumstances:

1. The master of the vessel reasonably and actually determines that an emergency event, as defined in subsection (c)(12)(A), is in effect and the use of shore power during the emergency event would endanger the vessel's safety. Shore power shall be used for the remainder of the visit once the master determines that the emergency event no longer exists;

2. An emergency event, as defined in subsection (c)(12)(B) or (c)(12)(C), is in effect. Shore power shall be used for the remainder of the visit once the emergency event is no longer in effect; or

3. The California Independent System Operator (CAISO) has declared a Stage 3 emergency and the utility providing electrical power to the port is requesting the terminal where the vessel is located to reduce the use of grid-based electrical power. Shore power shall be used for the remainder of the visit once CAISO declares the Stage 3 emergency is over.

(2) Emissions Reduction Option.

The purpose of this provision is to allow any person the option of complying with the requirements of this subsection (d)(2) in lieu of meeting the requirements of subsection (d)(1).

Requirements.

(A) For fleets visiting terminals that are providing electrical power from the utility's electrical grid, the owner or operator of the fleets shall comply with the following schedule:

1. For the quarter beginning on January 1, 2014, and each subsequent quarter through December 31, 2019, inclusive, the NOx and PM emissions at berth from the fleet's auxiliary engines must be reduced by 50 percent from the baseline fleet emissions.

2. For the quarter beginning on January 1, 2020, and each subsequent quarter thereafter, the NOx and PM emissions at berth from the fleet's auxiliary engines must be reduced by 80 percent from the baseline fleet emissions.

(B) For fleets visiting terminals that are providing electrical power from sources that are not part of an utility's electrical grid, or alternative control technologies are used to reduce the emissions of the fleet, the owner or operator of the fleet shall comply with the following schedule:

1. For the quarter beginning on January 1, 2010, and each subsequent quarter through December 31, 2011, inclusive, the NOx and PM emissions at berth from the fleet's auxiliary engines must be reduced by 20 percent from the baseline fleet emissions.

2. For the quarter beginning on January 1, 2012, and each subsequent quarter through December 31, 2013, inclusive, the NOx and PM emissions at berth from the fleet's auxiliary engines must be reduced by 40 percent from the baseline fleet emissions.

3. For the quarter beginning on January 1, 2014, and each subsequent quarter through December 31, 2015, inclusive, the NOx and PM emissions at berth from the fleet's auxiliary engines must be reduced by 60 percent from the baseline fleet emissions.

4. For the quarter beginning on January 1, 2016, and each subsequent quarter thereafter, the NOx and PM emissions from the fleet's auxiliary engines must be reduced by 80 percent from the baseline fleet emissions.

(C) For fleets visiting terminals that are using a combination of electrical power from the utility grid and electrical power from sources that are not part of an utility's electrical grid, or alternative control technologies, the following schedule applies:

1. For the quarter beginning on January 1, 2012, and each subsequent quarter through December 31, 2013, inclusive, the NOx and PM emissions at berth from the fleet's auxiliary engines must be reduced by 20 percent from the baseline fleet emissions.

2. For the quarter beginning on January 1, 2014, and each subsequent quarter through December 31, 2019, inclusive, the NOx and PM emissions from the fleet's auxiliary engines must be reduced by 50 percent from the baseline fleet emissions.

3. For the quarter beginning on January 1, 2020, and each subsequent quarter thereafter, the NOx and PM emissions from the fleet's auxiliary engines must be reduced by 80 percent from the baseline fleet emissions.

(D) Compliance with the requirements of subsection (d)(2)(A), (d)(2)(B), and (d)(2)(C) shall be determined quarterly for the periods specified as follows:

1. January 1 through March 31, inclusive;

2. April 1 through June 30, inclusive;

3. July 1 through September 30, inclusive; and

4. October 1 through December 31, inclusive.

(E) No person shall sell, supply, offer to supply, or purchase electrical power for use on a vessel during a visit in lieu of using the on-board auxiliary diesel engines, unless such electrical power is either be supplied by the local utility or is otherwise generated by equipment that meet the following emission:

1. NOx Emissions.

a. Up to and including December 31, 2013, the NOx emissions shall be no greater than 2 g/kW-hr at any time; and

b. Beginning January 1, 2014, the NOx emissions shall be no greater than 0.2 g/kW-hr at any time;

2. PM emissions shall be no greater than the PM emissions from combustion of natural gas with a fuel sulfur content of no more than one grain per 100 standard cubic foot;

3. CO_2 emissions shall be no greater than 500 g/kW-hr; and

4. Ammonia emissions shall be no greater than five ppmdv if selective catalytic reduction is used.

(e) Exemptions to the Three-Hour or Five-Hour Limited Auxiliary Engine Operation Requirement in Subsection (d)(1)(A)(1), (d)(1)(A)(2), (d)(1)(B)(1) and (d)(1)(B)(2).

(1) Emergency Event.

All of the following requirements apply to claimed exemptions based on emergency events:

(A) If the master of the vessel reasonably and actually determines that an emergency event, as defined subsection (c)(12), occurs during the vessel's visit to a California port, the master of the vessel may operate the vessel's auxiliary engines during the emergency event;

(B) The master shall not operate the vessel's auxiliary engines for more than one hour beyond the time when the master receives notification that the emergency event is over, determines that the emergency event is over, or should have known the emergency event is over; and

(C) The provisions of paragraph (B) above notwithstanding, the master may continue to operate the auxiliary engines for no more than five hours if the master receives notification that the emergency event is over, determines that the emergency event is over, or should have known the emergency event is over and the vessel is scheduled to leave port within five hours.

(2) Delays Caused By U.S. Coast Guard or Department of Homeland Security Inspections.

The Executive Officer may extend the three-hour/five-hour operational requirement in subsection (d)(1)(A) and (d)(1)(B) if the following criteria are met:

(A) The initial inspection and clearance of the vessel by the Department of Homeland Security exceeds one hour. The time extension granted shall be commensurate with the excess time necessary for inspection and clearance; or

(B) After the auxiliary engines have been put back into service pending departure from the berth, the scheduled departure of the vessel has been delayed by the United States (U.S.) Coast Guard or the Department of Homeland Security.

(f) Calculations for Emissions Reduction Option in Subsection (d)(2).

(1) For the purposes of subsection (d)(2)(A), (d)(2)(B), and (d)(2)(C), the percent emission reduction shall be calculated as follows:

Percent Reduction = (BFE – PBFE) / BFE

Where,

The baseline fleet and post-baseline fleet emissions are calculated as follows:

(A) Baseline Fleet Emissions (BFE).

The baseline fleet emissions of NOx and PM shall be calculated using the following formula:

Baseline Fleet Emissions = $\sum$ (emission rate x average berthing time x power requirement x visits)

Where:

“Emission rate” for each auxiliary engine is determined pursuant to subsection (f)(2);
“Average berthing time” for each vessel is determined for the applicable period specified in subsection (d)(2)(D);

“Power requirements” means the electrical power requirement for each vessel as determined pursuant to subsection (f)(3);

"Visits" means the total number of visits by the vessel during the applicable period specified in subsection (d)(2)(D); and

"∑" means the summation over the entire fleet subject to the emission reduction option.

(B) Post-Baseline Fleet Emissions (PBFE).

The post-baseline fleet emissions of NOx and PM shall be calculated using the following formula:

Post-Baseline Fleet Emissions = ∑ (emission rate x average berthing time x power requirement x visits x control factor)

Where:

"Emission rate" for each auxiliary engine is determined pursuant to subsection (f)(2);

"Average berthing time" for each vessel is determined for the applicable period specified in subsection (d)(2)(D);

"Power requirements" means the electrical power requirement for each vessel as determined pursuant to subsection (f)(3);

"Visits" means the total number of visits by the vessel during the applicable period specified in subsection (d)(2)(D);

"Control factor" means the applicable control factor specified in subsection (f)(4); and

"∑" means the summation over the entire fleet subject to the emission reduction option.

(2) A person complying with the requirements of subsection (d)(2) may choose any of the following emissions rates for use in the calculations specified in subsection (f)(1)(A) and (f)(1)(B):

(A) Results from emission measurements for similar auxiliary diesel engines that are used to satisfy a marine engine standard, including U.S. Environmental Protection Agency (EPA) emission standards for marine engines (40 CFR Part 94), and the International Convention for the Prevention of Pollution from

Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78), both of which are incorporated herein by reference;

(B) Emission measurements approved by the Executive Officer and using the test methods specified in subsection (f)(4)(B)(3); or

(C) In lieu of test data measured pursuant to paragraph (A) or (B) above, the following emission rates may be used as default values:

1. 13.9 g/kW-hr for NOx.

2. 0.38 g/kW-hr for PM if 0.11 to 0.5 percent sulfur marine gas oil is used as a fuel.

3. 0.25 g/kW-hr for PM if 0.10 or less sulfur content marine gas oil is used as a fuel.

(3) Power Requirements.

(A) The following values in Table 1 may be used as default values for power requirements:

Table 1.

Ship Category	Ship Size / Type	Default Power Requirement (kW)
Container Vessel	<1000 TEU	1,000
	1,000-1,999 TEU	1,300
	2,000-2,999 TEU	1,600
	3,000-3,999 TEU	1,900
	4,000-4,999 TEU	2,200
	5,000-5,999 TEU	2,300
	6,000-6,999 TEU	2,500
	7,000-7,999 TEU	2,900
	8,000-9,999 TEU	3,300
	10,000-12,000 TEU	3,700
Passenger Vessel		No Default Value – Use Actual Load
Reefer	Break Bulk	1,300
	Fully Containerized	3,300

TEU = twenty-foot equivalent unit.
kW = kilowatt

(B) In lieu of the default values above, the fleet operator may, with adequate supporting documentation, use the following:

1. The actual shore power usage, on a monthly basis, rounded to the nearest whole kW-hrs, of the vessels in the fleet utilizing shore power, or

2. The actual on-board power usage, on a monthly basis, rounded to the nearest whole kW-hrs, of the vessels in the fleet utilizing alternative control technologies.

(4) Control Factors.

(A) The emissions from vessels using grid power in lieu of the vessel's auxiliary engines when the vessels are at berth are presumed to be reduced by 90 percent.

(B) No control efficiencies for alternative control technologies shall be used to comply with the requirements of this provision unless the control efficiencies are calculated or measured as follows:

1. The control efficiencies shall be based on an emission test protocol that is approved by the Executive Officer prior to conducting the emission measurements;

2. The results of the emission measurements conducted pursuant to paragraph 1 above are approved by the Executive Officer; and

3. Emission measurements are conducted using the following test methods:

a. NOx and CO_2 shall be measured using California Air Resources Board (CARB) Test Method 100, dated July 1997, which is incorporated herein by reference, or equivalent district-approved test method;

b. Diesel PM shall be measured using ISO 8178 Test Procedures: ISO 8178-1: 1996(E) ("ISO 8178 Part 1"); ISO 8178-2:1996(E) ("ISO 8178 Part 2"); and ISO 8178-4: 1996(E) ("ISO 8178 Part 4"), all of which are incorporated herein by reference; and

c. Ammonia slip shall be measured using the Bay Area Air Quality Management District Source Test Procedure ST-1B, Ammonia Integrated Sampling, dated

January 1982, which is incorporated herein by reference, or other equivalent district approved test method.

d. The sulfur content of fuels shall be determined pursuant to International Standard ISO 8754 (as adopted in 2003), which is incorporated herein by reference.

(C) Results from emission measurements from a verified emission control strategy may be used in conjunction with engine emission information.

(D) The Executive Officer may request periodic emission testing or other types of monitoring to verify the proper operation of alternative control technologies or to verify the emission rate of an auxiliary engine.

1. At a minimum, emission control technologies shall be tested as follows and the results of such testing provided to the Executive Officer within 30 days of the testing:

a. Shore-based systems shall be tested annually to demonstrate the overall percentage of emission reduction being achieved.

b. Catalyst based air pollution control systems installed on vessels shall be tested after every 1,000 hours of operation to determine the overall percentage of emission reduction being achieved.

c. If Selective Catalytic Reduction (SCR) is used as a control technology, the emissions of ammonia shall also be measured at the same time the NOx emissions are being measured.

2. The Executive Officer may modify the testing frequency as he/she deems appropriate.

(g) *Terminal Plan Requirements.*

(1) A terminal that receives more than 50 vessel visits in 2008 shall submit a plan for the Executive Officer's approval that discusses how the terminal will accommodate the vessels that will visit the terminal who are subject to subsection (d)(1) and (d)(2). The terminal shall submit the plan and subsequent updates to the plan according to the schedule below (Table 2). The plan updates shall address any contingencies

that may be necessary for the vessels to meet the requirements of subsection (d)(1)and (d)(2) by the applicable dates.

Table 2.

Vessel Compliance Option	Initial Terminal Plan Due Date	Subsequent Terminal Plan Updates
Grid-Based Shore Power: (d)(1) and (d)(2)(A)	July 1, 2009	July 1, 2013 July 1, 2019
Alternative Control Technologies to Grid-Based Shore Power: (d)(2)(B)	July 1, 2009	July 1, 2011 July 1, 2013 July 1, 2015
Combination of Grid-Based Shore Power and Alternative Control Technologies: (d)(2)(C)	July 1, 2009	July 1, 2011 July 1, 2013 July 1, 2015 July 1, 2019

(2) Plan Requirements for Grid-Based Shore Power.

(A) Specify the schedule for implementing infrastructure modifications, including the following:

1. Utility infrastructure improvements, if any, outside the port boundary;

2. Improvements to port infrastructure; and

3. Major infrastructure improvements to terminal.

(B) Identification of existing berths to be modified or new berths to be constructed that will satisfy the requirements of subsection (d)(1).

(3) Plan Requirements for Alternative Control Technologies.

(A) Description of the approach that will be used to reduce in-berth vessel emissions, including whether the approach is a vessel-based approach or shore-based approach;

(B) Identification and description of equipment;

(C) Berth(s) where the equipment will be used;

(D) Specific vessels affected by the technology; and

(E) Estimate of the expected reductions in NOx and PM emissions from vessels using the technology, including documentation supporting the anticipated reductions.

(4) Plan Requirements for a Combination of Grid-Based Shore Power and Alternative Control Technologies.

(A) Identification of which berths will implement grid-based shore power and which berths will implement alternative control technologies

(B) For berths implementing shore-based grid power, the plan must contain the information specified in subsection (g)(2).

(C) For berths implementing alternative control technologies, the plan shall contain the information specified in subsection (g)(3).

(5) A port may submit terminal plans required under subsection (g)(1) on behalf of the terminals located at that port.

(h) *Reporting and Recordkeeping Requirements*.

(1) Reporting and Recordkeeping Requirements for Persons that Comply with Subsection (d)(1).

(A) The Responsible Official shall provide the following reports to the Executive Officer:

1. A vessel fleet plan, due to the Executive Officer by July 1, 2013, and an updated plan by July 1, 2019, which includes a listing of the vessels that would be affected by the requirements specified in subsection (d)(1) and the description of the ability of each vessel to use shore power.

The vessel fleet plan shall list the vessels that are able to shut down the vessel's auxiliary engines and use shore power, along with the related information as follows:

a. Name of the vessel, Lloyd's number for the vessel, and vessel category (container, passenger, or reefer); and

b. The port(s) each vessel(s) is expected to visit.

2. An annual statement of compliance pursuant to subsection (d)(1) and (d)(2).

a. The initial annual statement of compliance is due to the Executive Officer by March 1, 2015. This statement is for the 2014 calendar year. Thereafter, the annual statement is due to the Executive Officer by March 1 of each year, certifying compliance with the requirements for the previous calendar year.

b. The annual statement of compliance shall include the following:

i. A statement signed by the Responsible Official that the requirements specified in subsection (d)(1) or (d)(2) have been met.

ii. Visit-related information for all vessels within a fleet that visited a California port. The list shall include the following information for each vessel:

I. Current name of the vessel;
II. Lloyd's number for the vessel;
III. Vessel type (cargo, passenger, reefer); and
IV. Visits, by port and terminal, where the auxiliary engines were shut down;

iii. The information submitted pursuant to paragraph 2.b.ii above shall be reported for the following periods:

I. January 1 through March 31, inclusive;
II. April 1 through June 30, inclusive;
III. July 1 through September 30, inclusive; and
IV. October 1 through December 31, inclusive.

(B) Recordkeeping.

1. The following records shall be kept at a central location by the vessel operator. This information shall be supplied to the Executive Officer within 30 days of a request from ARB inspectors or staff.

a. A logbook that records, for each visit, the dates, times, and other information as specified below:

i. When the vessel initially tied to the berth and when the vessel cast-off the tie lines;

ii. When the Department of Homeland Security released the vessel;

iii. When the auxiliary engines were initially shut down and subsequently restarted;

iv. Whether departure from the berth was delayed by the U.S. Coast Guard or other federal agency and identification of the agency that caused the delay;

v. If an emergency event occurred, a description of that emergency event;

vi. If the vessel could not use shore power as a result of the CAISO declaring a stage 3 emergency, and

vii. If a vessel could not use shore power as a result of equipment failure aboard the vessel.

b. Copies of all current U.S. Department of Homeland Security Bureau of Customs and Border Protection "Vessel Entrance or Clearance Statement" documents (CBP Form 1300, version 02/02), which is incorporated herein by reference, if the vessel operator or owner is claiming an exemption pursuant to subsection (e)(2)(A) or (e)(2)(B).

2. All records required pursuant to this provision shall be retained for a minimum of five years.

(2) Reporting and Recordkeeping Requirements for Persons Opting to Comply with the Emissions Reduction Option in Subsection (d)(2).

(A) The Responsible Official shall provide the following reports to the Executive Officer:

1. A vessel fleet plan, due to the Executive Officer by the dates shown in Table 3 below:

Table 3.

Compliance Option	Initial Vessel Fleet Plan	Subsequent Submittal Due Dates
Grid-Based Shore Power: (d)(2)(A)	July 1, 2013	July 1, 2019
Alternative Control Technologies to Grid-Based Shore Power: (d)(2)(B)	July 1, 2009	July 1, 2011 July 1, 2013 July 1, 2015
Combination of Grid-Based Shore Power and Alternative Control Technologies: (d)(2)(C)	July 1, 2011	July 1, 2013 July 1, 2019

The vessel fleet plan shall include the following items:

a. List of the vessels included in the company's fleet; Lloyd's number for each vessel, vessel category (cargo, passenger, reefer), average number of reefer containers carried by the vessel over the calendar year (container vessels only), and power requirement for each vessel (passenger and reefer vessels); and

b. Identify the potential alternative control techniques that may be used to achieve the requirements specified in subsection (d)(2). For each control technique, specify the following:

i. The vessels that would be affected by the technique;

ii. The status of implementation of the alternative control technique; and

iii. The basis used in determining the expected emission reduction, including submittal of any emission testing or other documentation.

2. An annual statement of compliance.

a. The initial annual statement of compliance is due to the Executive Officer by the dates in Table 4 below:

Table 4.

Compliance Option	Initial Submittal of Annual Statement of Compliance
Grid-Based Shore Power: (d)(2)(A)	March 1, 2015
Alternative Control Technologies to Grid-Based Shore Power: (d)(2)(B)	March 1, 2011
Combination of Grid-Based Shore Power and Alternative Control technologies: (d)(2)(C)	March 1, 2013

Thereafter, the annual compliance statement is due to the Executive Officer by March 1 of each year, certifying compliance with the requirements for the previous year.

b. The following items, applicable to the calendar year in question, should be included with the statement of compliance:

i. A statement signed by the Responsible Official indicating that the NOx and PM emission reductions specified by (d)(2) have been achieved;

ii. The calculated NOx and PM baseline and post-baseline emissions for each fleet, on a quarterly basis, as specified in (d)(2)(D). Include each vessel's contribution to the fleet's baseline and post-baseline emissions; and

iii. Description of the technique(s) used, including alternative controls technology (or technologies), achievable emission reductions, and supporting documentation (e.g., source test results or verification documentation). For subsequent statements of compliance, the supporting documents can be referenced.

(B) Recordkeeping.

1. The following records shall be kept at a central location by the master and the fleet vessel operator. This information

shall be supplied to the Executive Officer within 30 days of a request from ARB staff.

For each calendar year of vessel activity, a quarterly summary of emissions that demonstrates compliance with the applicable emission reduction (2010, 2012, 2014, or 2016), which includes the following:

a. The fleet's baseline and post-baseline levels for NOx and PM emissions; and

b. Each vessel's contribution to fleet's baseline and post-baseline NOx and PM emissions, including the following information:

i. Name of each vessel;

ii. Lloyd's number for each vessel;

iii. Fuel type and average sulfur content of fuel for each vessel;

iv. NOx and PM emissions for each vessel;

v. Average hotelling time for each vessel;

vi. Power requirements for each vessel while at berth;

vii. For container vessels, the number of reefer containers imported and exported for each container vessel;

viii. Total visits to each California port made by the vessel;

ix. Technology used to reduce emissions and associated control factor used, and

x. Any equipment failure aboard a vessel that prevented the vessel from using the emissions reduction technology

2. Records made pursuant to paragraph (2)(B) above shall be kept for a minimum of five years.

(3) Reporting and Recordkeeping Requirements for Ports and Terminals.

(A) Affected ports shall provide wharfinger information to the Executive Officer annually, beginning with the wharfinger information for calendar year 2010.

1. This information shall be provided to the Executive Officer no later than April 1 of the following year.

2. At a minimum, the wharfinger information shall include for each vessel visiting the port:

a. Name of the vessel;

b. Vessel type;

c. Company operating the vessel;

d. Lloyd's number for each vessel;

e. Berth used by the vessel; and

f. Date(s) and time the vessel was initially tied to the berth and subsequently released from the berth.

(B) The terminal operator shall keep the following records. These records shall be supplied to the Executive Officer within 30 days of a request from ARB staff:

1. Electricity usage for shore power:

a. Monthly utility billing statements that separately identify electricity supplied for shore power;

b. Episodes of electrical service interruption by local utility company, as confirmed and documented by local utility company; and

c. For distributed generation, monthly records that contain the following:

i. Names of vessels serviced;
ii. Location of vessels serviced, by berth;
iii. Date and time of use; and
iv. Power, in megawatts, supplied to the vessels.

2. Date, time, and description of equipment failure that affected the ability of vessels to turn off their auxiliary engines or use alternative control technologies to reduce emissions pursuant to (d)(2).;

3. Record of each vessel that did not operate its auxiliary engines while the vessel was docked at the terminal:

   a. Name of vessel; and

   b. Date and time each vessel was initially tied to the terminal.

4. Records made pursuant to paragraph (3)(B) above shall be kept for five years.

(4) Electronic submittals of records and other information required under this section may be approved by the Executive Officer upon request, provided such electronic submittals use digital signatures that meet the requirements specified in Government Code section 16.5. Notwithstanding the approved submittal of electronic records, the Executive Officer may request the submittal of a hard copy of any electronic submittal.

(i) *Violations.*

(1) Except as otherwise specified in this subsection, any person who is subject to this section and commits a violation of any provision, prohibition, limit, standard, criteria, or requirement in this section is subject to the penalties, injunctive relief, and other remedies specified in Health and Safety Code section 42400 et seq., other applicable sections in the Health and Safety Code; and other applicable provisions as provided under California law for each violation. Nothing in this section shall be construed to limit or otherwise affect any applicable penalties or other remedies available under federal law.

(2) Except as otherwise specified in this subsection, any failure to meet any provision, prohibition, limit, standard, criteria, or requirement in this section, including but not limited to the applicable emission limits for supplied shore power and hours of engine operation limits, shall constitute a single, separate violation of this section for each hour that a person operates the auxiliary diesel engine until such provision, prohibition, limit, standard, criteria, or requirement has been met.

(3) A violation of the recordkeeping and reporting requirements in this section shall constitute a single, separate violation of this section for

each day that the applicable recordkeeping or reporting requirement has not been met.

(j) *Severability.*

If any subsection, paragraph, subparagraph, sentence, clause, phrase, or portion of this regulation is, for any reason, held invalid, unconstitutional, or unenforceable by any court of competent jurisdiction, such portion shall be deemed as a separate, distinct, and independent provision, and such holding shall not affect the validity of the remaining portions of the regulation.

NOTE: Authority cited: Sections 39600, 39601, 39650, 39658, 39659, 39666 and 41511, Health and Safety Code. Reference: Sections 39650, 39658, 39659, 39666, 41510, and 41511, Health and Safety Code.