

Public Hearing to Consider Adoption of a Proposed Regulation for Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels



**Board Hearing
July 24, 2008**

California Environmental Protection Agency



Air Resources Board

Overview

- ◆ Background
- ◆ Proposed Regulation
- ◆ Impacts
- ◆ Comments
- ◆ Proposed 15-Day Changes
- ◆ Future Activities, Summary and Recommendation



Background

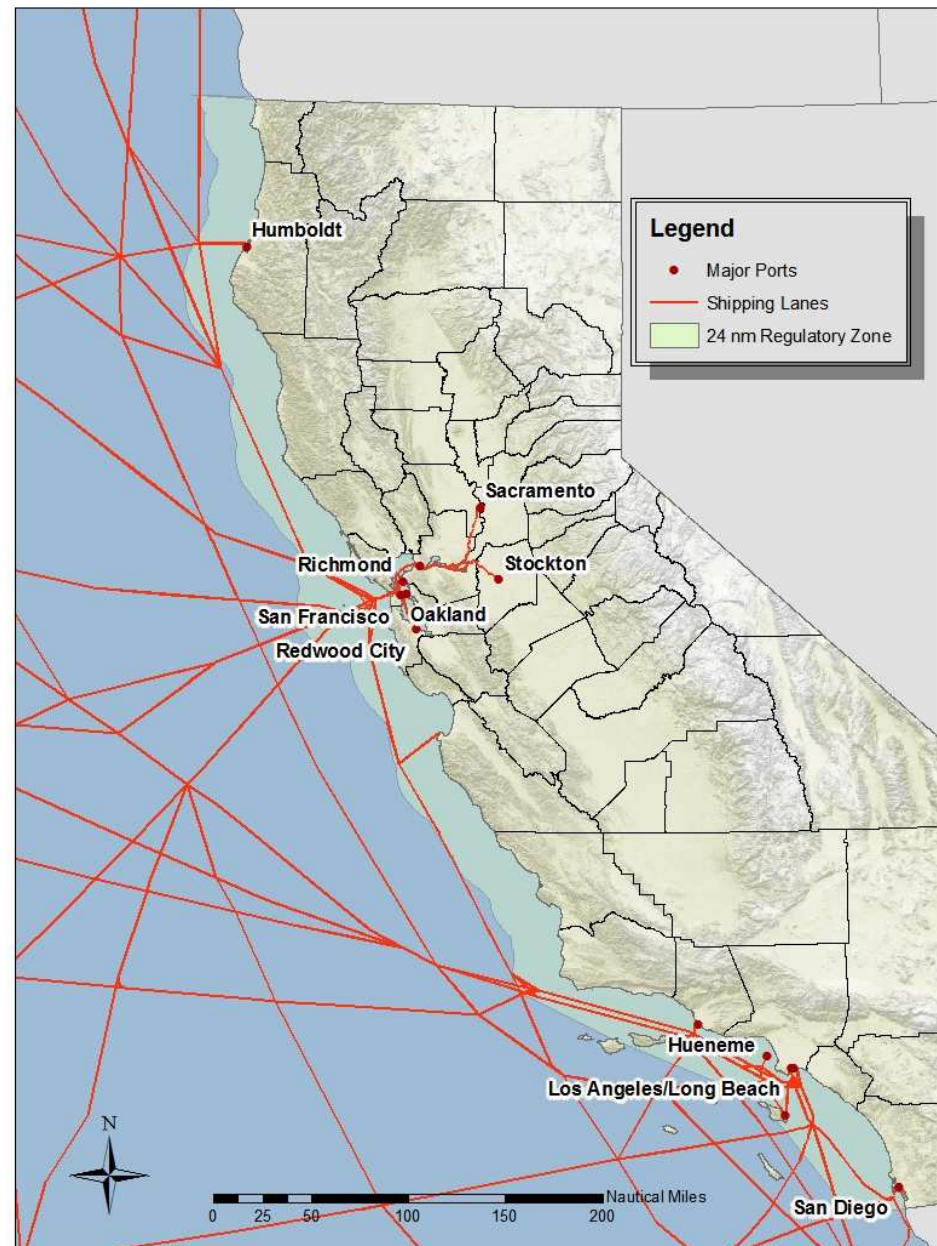


Air Pollution is a Serious Public Health Concern

- ◆ **Numerous studies have confirmed link between air pollution and adverse health impacts**
 - premature death
 - respiratory disease
 - reduced lung function in children
 - cardiovascular disease
 - cancer

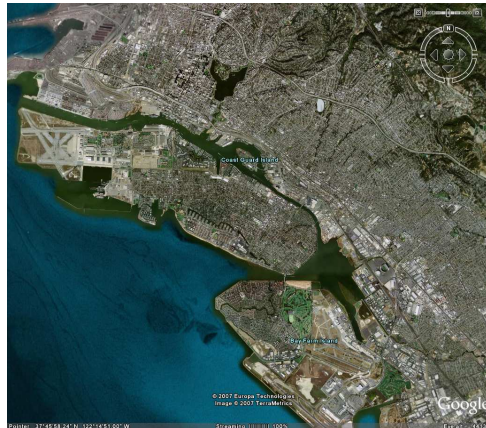


- ♦ **California is major gateway to global trade**
- ♦ **Sixteen ports involved with waterborne commerce**
- ♦ **Over 10,000 ship visits per year**

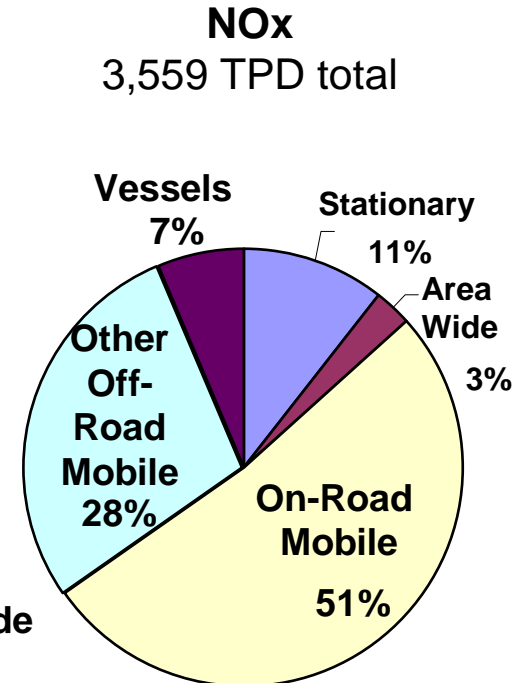
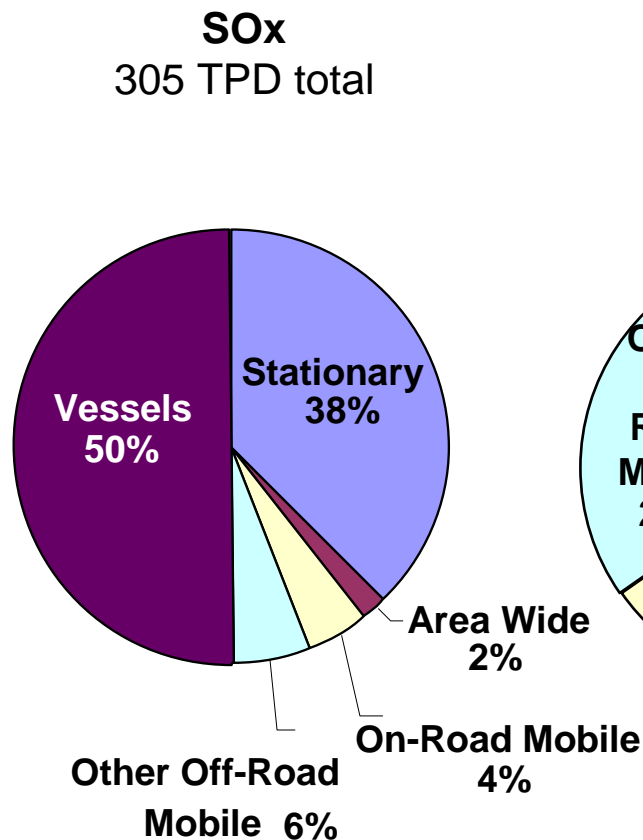
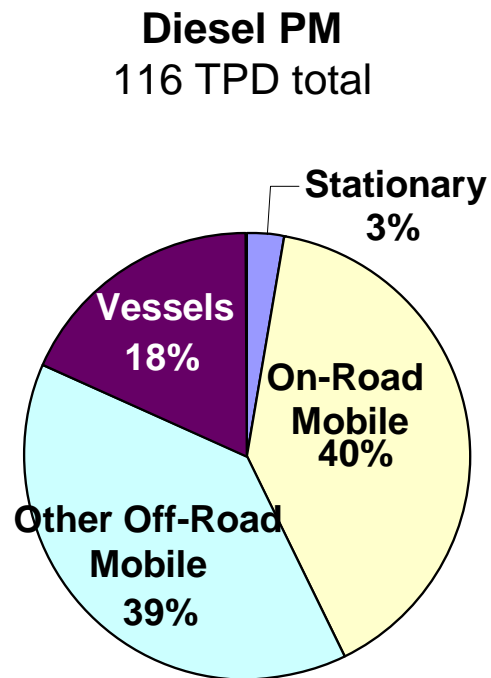


Ocean-Going Vessels Impact Air Quality and Public Health

- ♦ Large and growing source of PM, NO_x, and SO_x emissions
- ♦ Emissions concentrated near population centers
- ♦ Significant localized and regional impacts
- ♦ Contributor to ambient levels of PM and ozone
- ♦ Contributor to cancer risk and PM mortality

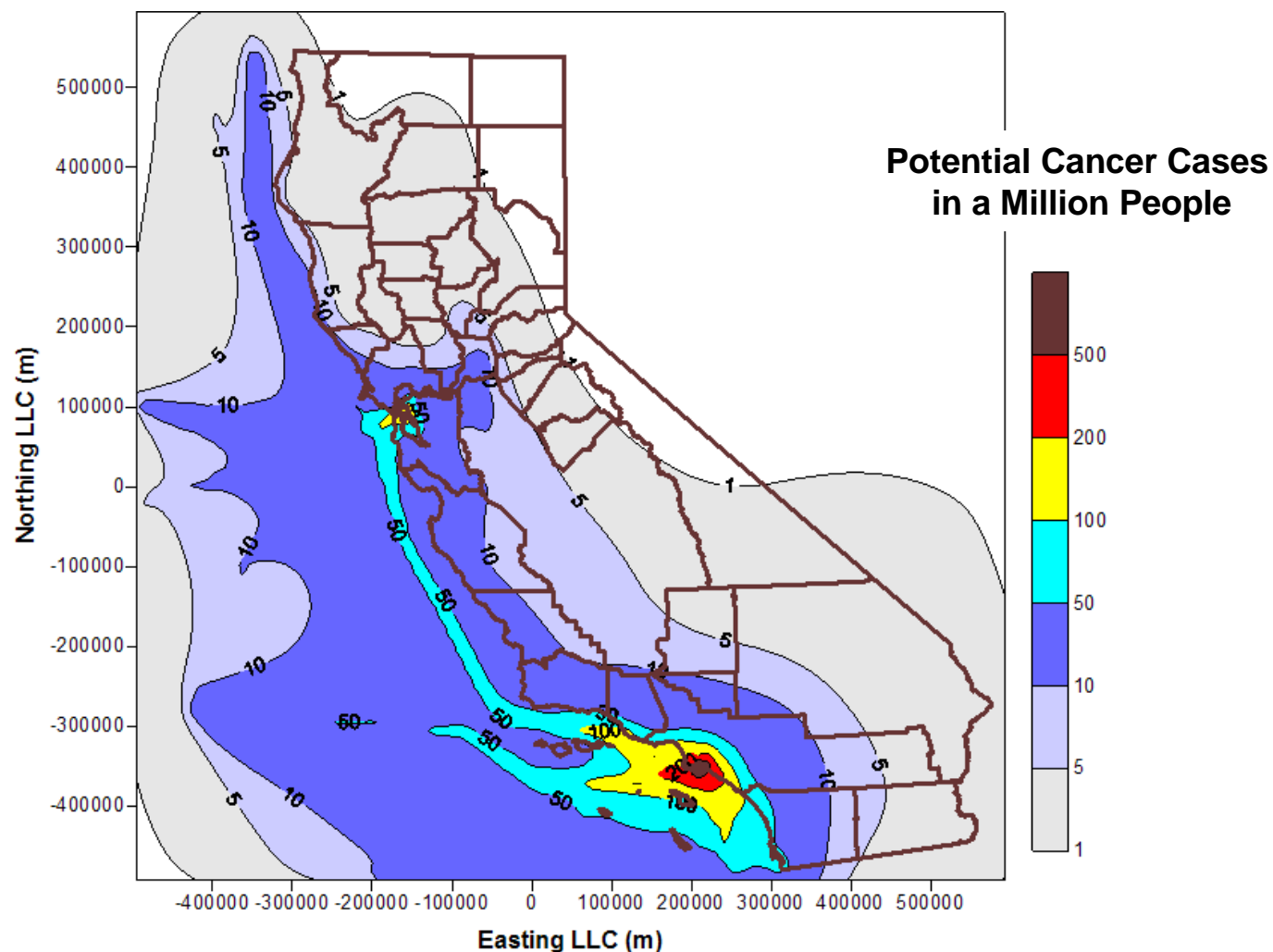


Marine Vessels are a Large Source of Emissions*



* Source: 2006 ARB Emissions Inventory. Does not include benefit of ARB Ship Auxiliary Engine Regulation (Vessel emissions out to 100 NM)

Ocean-Going Vessel Diesel PM Exposures and Cancer Risk*



*2005 ARB Statewide Emissions Inventory

Ocean-Going Vessels Contribute to Public Health Impacts*

- ♦ **1,100 premature deaths per year**
- ♦ **31,000 cases of asthma-related and other lower respiratory symptoms per year**
- ♦ **800 hospital admissions due to respiratory and cardiovascular causes per year**
- ♦ **2,600 cases acute bronchitis per year**
- ♦ **190,000 work loss days per year**
- ♦ **1,100,000 minor restricted activity days per year**

*Estimates are based on air dispersion modeling of direct PM_{2.5} emissions statewide and indirect PM_{2.5} (sulfates and nitrates) in the South Coast for the year 2005.

Proposal Supports Key California Initiatives

- ◆ **State Implementation Plan**
- ◆ **Goods Movement Emission Reduction Plan (2006)**
- ◆ **Diesel Risk Reduction Plan**
- ◆ **Port Specific Plans**



ARB's Auxiliary Engine Fuel Regulation

- ♦ **Use cleaner marine distillate fuels in auxiliary engines**
- ♦ **Successfully implemented over 14 months beginning on January 1, 2007**
- ♦ **Legal challenge resulted in suspension in May 2008**
- ♦ **Court ruled that ARB must seek a waiver from U.S. EPA to implement**

IMO's Actions

- ♦ **Current MARPOL Annex VI limits fuel sulfur to 4.5%**
- ♦ **In October 2008, IMO to consider amendments to international fuel sulfur limits**
 - **mirrors ARB proposal in 2015 timeframe by establishing emission control area (ECA)**
 - **California supports proposal**
- ♦ **California needs to act now to meet air quality needs**

Main Goals

- ♦ **Provide immediate and significant benefits**
 - most vessels currently use high sulfur (2.5%) heavy fuel oil (HFO)
 - control strategy is based on switching to cleaner marine distillate (MGO/MDO)
- ♦ **Establish in-use clean fuel requirements that:**
 - establish uniform fuel requirements for vessels
 - address legal issues
 - provide a “bridge” to possible international requirements in the 2015 timeframe

Proposed Regulation



Regulatory Development Process

- ♦ **5 Public Workshops**
- ♦ **Maritime Working Group Meeting**
- ♦ **Outreach Meetings**
- ♦ **2007 Ship Survey**
- ♦ **Site Visits**
- ♦ **Vessel Emission Testing**
- ♦ **Fuel Property Testing**



Proposal Based on Switch from Heavy Fuel Oil to Cleaner Distillate Fuel

- ♦ **Switch from HFO to distillate provides large reductions**
- ♦ **Cleaner fuels are available and feasible to use**
- ♦ **Result in immediate, major reductions in PM (direct and secondary) and SOx emissions, smaller reductions in NOx**

Proposed Regulation

Applies to Ocean-Going Vessels (OGVs)

- ♦ **US and Foreign-Flagged**
- ♦ **Ocean-going vessels**
 - Auto Carriers
 - Bulk Cargo
 - Container
 - Cruise Ships
 - Refers
 - Ro-ros
 - Tankers

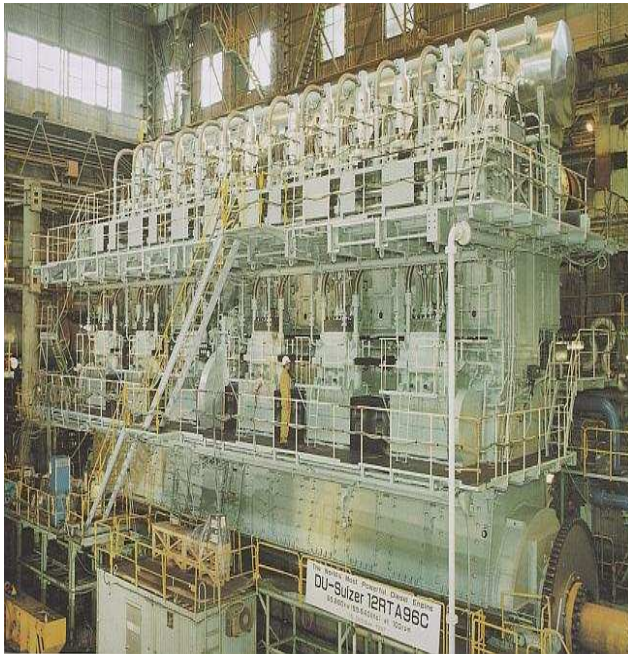


Proposed Regulation

Requires Use of Cleaner Fuels

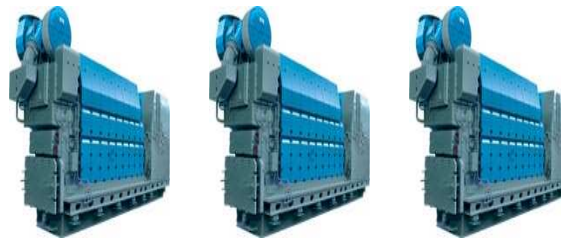
Main Engines

for propulsion



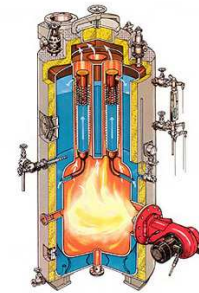
Auxiliary Engines

for electricity and
diesel electric for both
propulsion & electricity



Auxiliary Boilers

for steam, and heating
of heavy fuel oil and
water



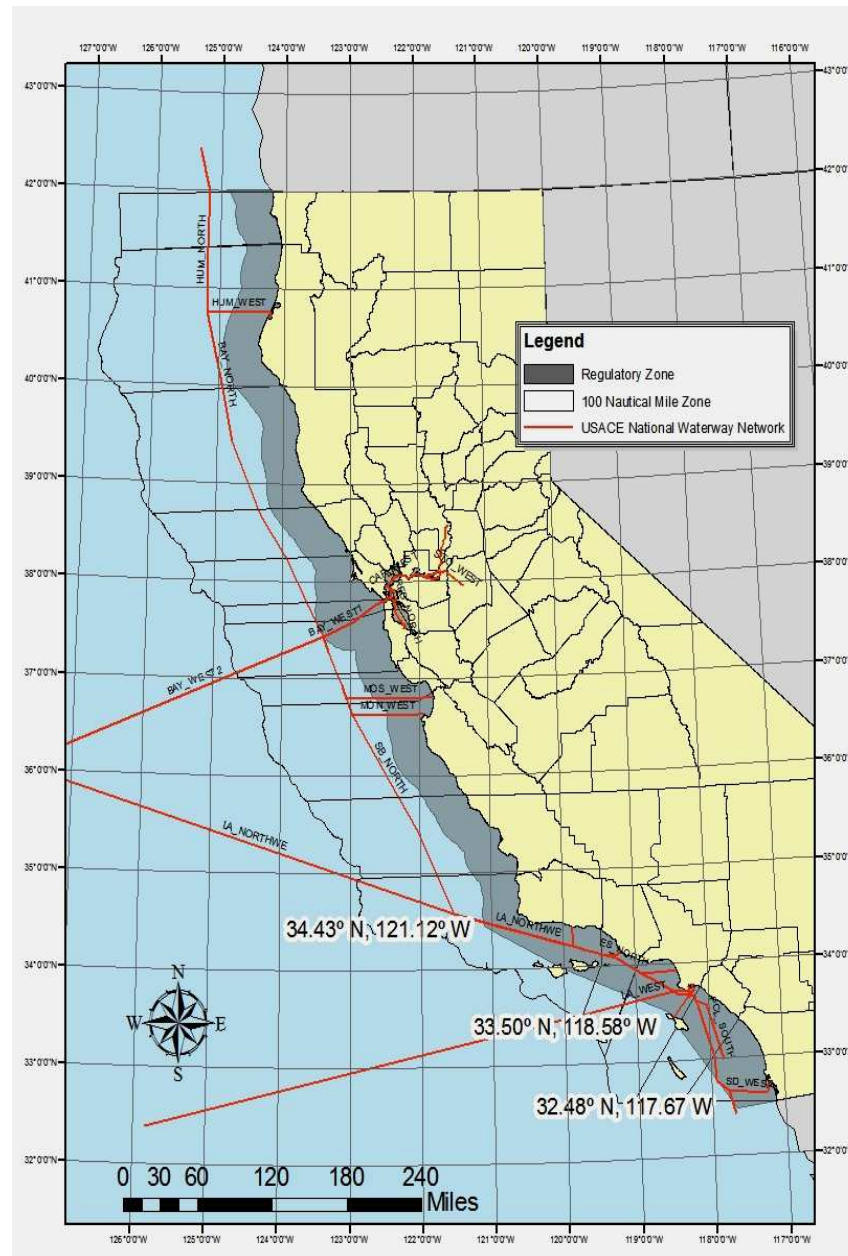
In-use Clean Fuel Requirements

- ♦ **Phase 1 begins July 1, 2009***
 - use marine gas oil (averages 0.3% sulfur), or
 - use marine diesel oil with a 0.5% sulfur limit
- ♦ **Phase 2 begins January 1, 2012**
 - use marine gas oil with a 0.1% sulfur limit, or
 - use marine diesel oil with a 0.1% sulfur limit

***for auxiliary engines, Phase 1 begins upon effective date of regulation**

Proposed Regulation

**Requires Use of
Cleaner Fuels Within
24 Nautical
Mile Zone of the
California Coastline**



Basis for Low-Sulfur Marine Distillate

- ♦ **For most vessels, changing from heavy fuel to distillate is feasible without vessel modifications**
- ♦ **Auxiliary engine rule, main engine pilot programs, and port programs have demonstrated feasibility**
- ♦ **Key challenges that need to be managed:**
 - **changes in fuel properties such as viscosity and lubricity**
 - **crew training/experience with fuel switching**
 - **fuel switching procedures**
 - **managing vessel fuel systems and tankage**

Fuel Availability

- ♦ **Marine distillate for Phase 1 is available**
- ♦ **Marine distillate for Phase 2 (0.1% S) should be available by 2012**
- ♦ **Fuel and fueling infrastructure to support Phase 2 fuel should be in place by 2012**
- ♦ **Rule addresses situation where fuel is not available**

2-Step Implementation is Important

- ♦ **Maximizes reductions that can be achieved immediately**
- ♦ **Provides safer and more successful transition to 0.1% S fuel**
- ♦ **Allows time to identify and address potential operational issues for 0.1% S fuel**
- ♦ **Provides time to make operating procedures and equipment adjustments**
- ♦ **Allows time to address fuel procurement challenges**

Other Provisions

- ◆ **Safety Exemption**
- ◆ **Essential Modification Exemption**
- ◆ **Noncompliance Fee**
 - option to pay a fee under special circumstances
- ◆ **Provision for situations where 0.1% S fuel is not available**
- ◆ **Recordkeeping Requirements**
- ◆ **Sunset Provision**
 - allows ARB to rescind regulation if U.S. EPA/IMO rules adopted

Impacts



Overall Benefits

- ♦ **Reduces diesel PM, PM, SO_x, NO_x, and secondarily formed PM**
- ♦ **Reduces regional and local exposure to diesel PM emissions**
- ♦ **Reduces statewide cancer risk, premature death and other non-cancer health effects**
- ♦ **Improves regional air quality**

Impacts

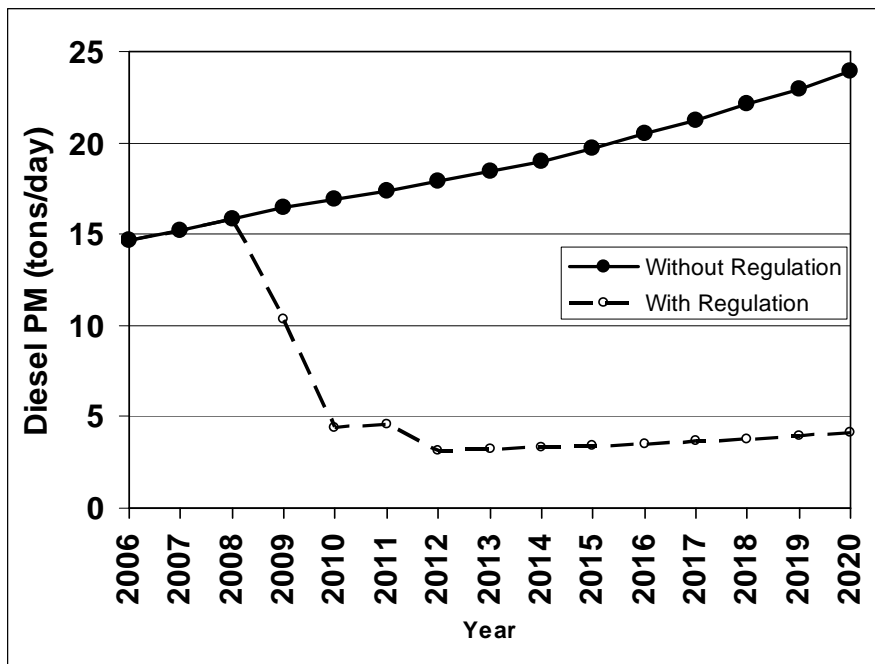
Statewide Emissions Benefits for OGVs

Year	2009	2009 Phase 1	2012	2012 Phase 2
Pollutant	TPD	Overall % Reduction	TPD	Overall % Reduction
PM10	12	74%	15	83%
SOx	106	81%	135	95%
NOx	8	5%	11	6%

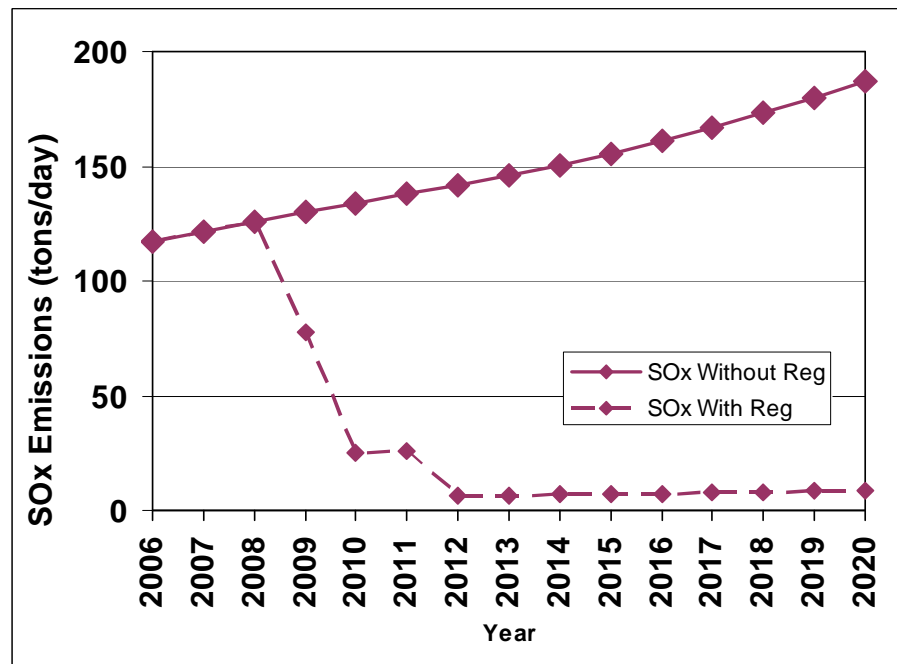
Impacts

Emission Reduction Trends for OGVs

Diesel PM



SOx

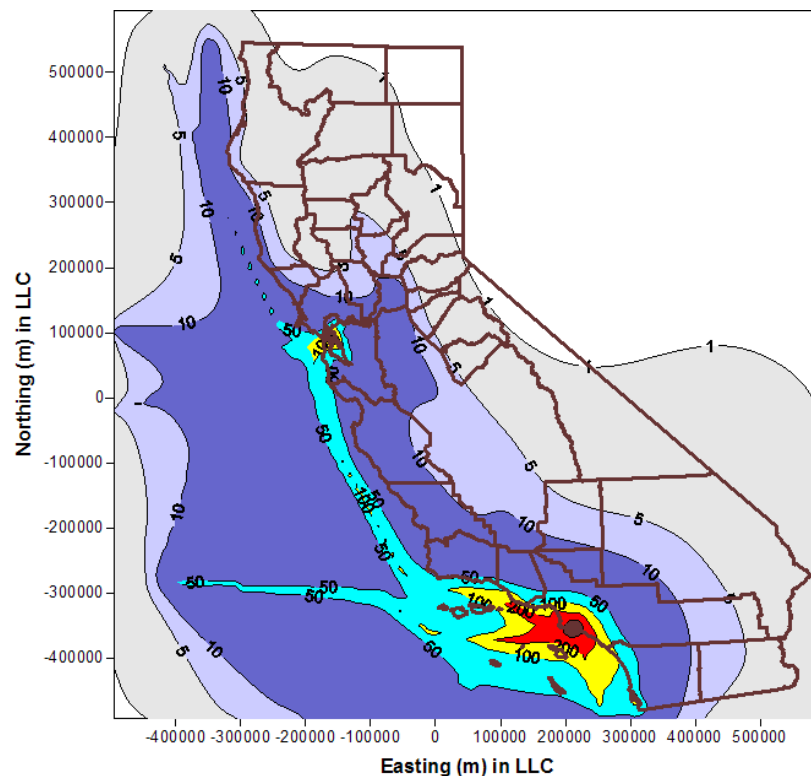


* Vessel emissions out to 24 nautical miles, includes main engines, auxiliary engines and auxiliary boilers

Impacts

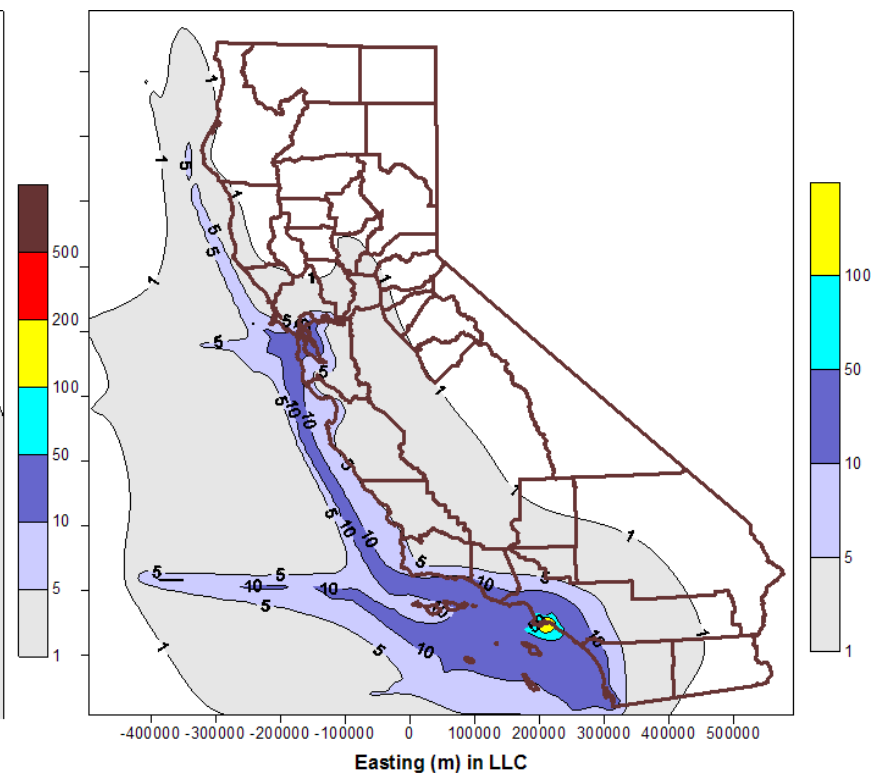
Proposal Results in Over 80% Reduction in Statewide Potential Cancer Risk from OGVs*

Without Proposed Regulation



Isopleth of Diesel PM Potential Cancer Risk in 2012 without Control

With Proposed Regulation



Isopleth of Diesel PM Potential Cancer Risk in 2012 with OGV Regulation

*Based on projected statewide 2012 inventory without control and with control

Impacts

Statewide Reductions in Non-Cancer Health Effects *

Between 2009 and 2015 (cases avoided)

- ♦ **3,600 premature deaths**
- ♦ **60,000 cases of asthma-related and other lower respiratory symptoms**
- ♦ **2,600 hospital admissions due to respiratory and cardiovascular causes**
- ♦ **8,300 cases acute bronchitis**
- ♦ **620,000 work loss days**
- ♦ **3,600,000 minor restricted activity days**

*Estimates are based on air dispersion modeling of direct PM2.5 emissions statewide and indirect PM2.5 (sulfates) in the South Coast.

Greenhouse Gas Analysis

- ♦ **Well-to-Hull analysis estimates net CO₂ changes***
 - resulting from proposal requiring distillate instead of heavy fuel oil in California 24 nautical mile zone
 - only considers volume of fuel required to meet the proposal
 - estimates changes in CO₂ emissions from fuel production and consumption life-cycle
 - feedstock processing - no change
 - fuel refining - increased CO₂ emissions due to added distillate refining (+4%)
 - vessel operation-decreased CO₂ emissions due to higher energy content of distillate (-2%)

*Using Total Energy and Emissions Analysis for Marine Systems (TEAMS) Model

Greenhouse Gas Impacts

- ♦ GHG decrease from ship emissions
- ♦ GHG increase during fuel refining
- ♦ Net small increase in CO₂ (1-2%) per gallon of fuel switched
- ♦ Overall increase for a typical voyage is very small (0.04%)
- ♦ Reductions in GHG are possible from other actions
 - speed reduction
 - hull cleaning, engine efficiency, and propeller design
 - refining efficiency or controls
- ♦ Health and environmental benefits outweigh the potential small increase in CO₂

Economic Impacts

- ◆ **Total annual cost to industry**
 - \$140-\$360 million per year
- ◆ **Added fuel costs for typical cargo ship visit of about \$30,000**
 - less than 1% (\$6.00) added to the shipping cost per container from Asia to California
 - adds 0.1¢ to a pair of tennis shoes
- ◆ **Value of health benefits (non-cancer)**
 - \$6 billion annually

Impacts

Proposal is Cost-Effective

Regulation	Diesel PM* \$/pound
Ocean-going Vessel Proposal	\$32
In-Use Off-Road Diesel Vehicles Regulation	\$74-\$86
Cargo Handling Equipment Regulation	\$41
On-Road Drayage Trucks	\$57-\$77

*Attributes all costs to reductions in diesel PM

Comments



Comments

Move the 2012 Fuel 0.1% S Limit for Auxiliary Engines to 2010

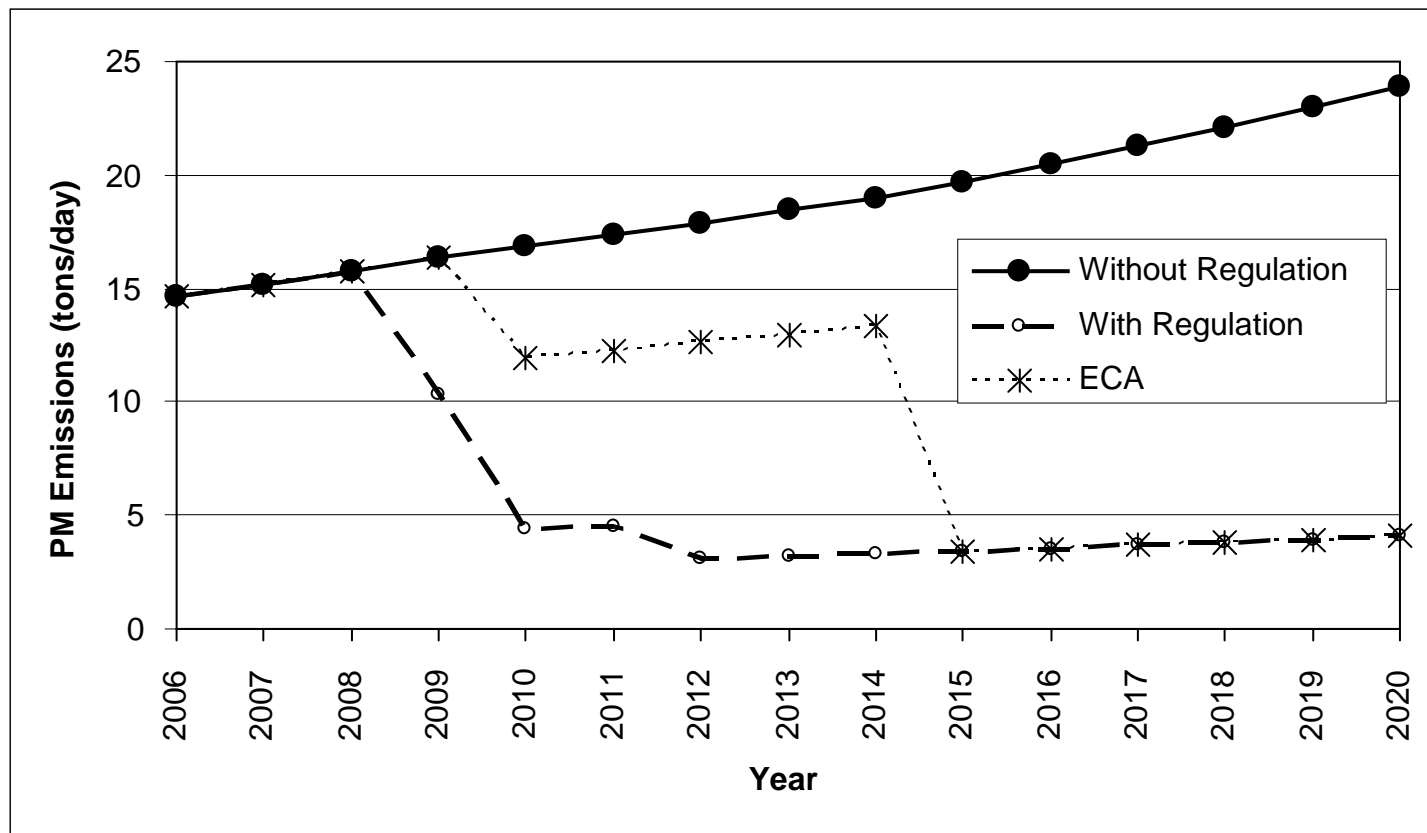
- ♦ **Greatest benefit by requiring immediate use of marine distillate in mid-2009**
- ♦ **Critical to have uniform fuel requirements for main, auxiliary engines and auxiliary boilers**
- ♦ **0.1% S distillate fuel and infrastructure not in place at key ports**
- ♦ **Operators need phase-in period to address technical and operational challenges**
- ♦ **Proposed regulation achieves 3 to 4 times higher reductions between 2009-2012 than suspended auxiliary engine regulation**

Defer to International Controls

- ♦ **Some in shipping industry prefer international action**
 - if current IMO proposal approved, U.S. could apply for an Emission Control Area (ECA)
 - 1% sulfur fuels in 2010 and 0.1% sulfur fuels in 2015 is possible
 - California can't wait, needs near term reductions
- ♦ **ARB Proposal would achieve significantly more emission reductions in 2009-2015 timeframe**
- ♦ **ARB Proposal contains provision to sunset rule if equivalent benefits are achieved**

Comments

Comparison of Proposed Regulation and Potential IMO Emission Control Area (ECA) Benefits*



*Assumes earliest possible ECA implementation

Comments

Use Alternative Routes to Avoid Requirements

- ♦ **U.S. Navy concerned that more ships will travel through the missile test range**
 - **test range occupies vast overwater region off Southern California**
 - **U.S. Navy believes weapons testing and training activities impacted if large number of vessels travel through test range**
 - **ARB staff committed to working with U.S. Navy and other stakeholders to address concerns**

Proposed 15-Day Changes



Proposed 15-Day Changes

- ◆ Define essential modifications
- ◆ Remove sunset date for essential modifications exemption provision



Future Activities, Summary and Recommendation



Future Activities

- ◆ **Conduct outreach to vessel operators and enforce regulation**
- ◆ **Monitor fuel availability**
- ◆ **Conduct studies to investigate impacts of fuel-switching on marine engines and associated components**
- ◆ **Work with U.S. Navy concerning possible impact on Navy test range**
- ◆ **Work with U.S. EPA**
 - to establish a West Coast emission control area
 - to continue evaluating offshore impacts



Summary

♦ Proposed regulation

- establishes uniform in-use fuel requirements
- achieves immediate and significant emissions reductions and reduces health risks
- meets or exceeds SIP, GMERP and Diesel Risk Reduction commitments
- is feasible and cost-effective
- provides bridge to possible international requirements
- addresses lawsuit issues

Recommendation

- ◆ **Staff recommends the Board adopt the proposed regulation with suggested 15-day changes**

