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
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, NOx, and SOx 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*

Potential Cancer Cases in a Million People

*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 PM2.5 emissions statewide and indirect PM2.5 (sulfates and nitrates) in the South Coast for the year 2005.
Proposal Supports Key California Initiatives

- State Implementation Plan
- Diesel Risk Reduction Plan
- Port Specific Plans
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
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
Proposed Regulation

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
Proposed Regulation

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, SOx, NOx, 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

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>2009</th>
<th>2009 Phase 1</th>
<th>2012</th>
<th>2012 Phase 2</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Year</td>
<td>TPD</td>
<td>Overall % Reduction</td>
<td>TPD</td>
</tr>
<tr>
<td>PM10</td>
<td>2009</td>
<td>12</td>
<td>74%</td>
<td>15</td>
</tr>
<tr>
<td>SOx</td>
<td>2009</td>
<td>106</td>
<td>81%</td>
<td>135</td>
</tr>
<tr>
<td>NOx</td>
<td>2009</td>
<td>8</td>
<td>5%</td>
<td>11</td>
</tr>
</tbody>
</table>
**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

With Proposed 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
Impacts

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
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

<table>
<thead>
<tr>
<th>Regulation</th>
<th>Diesel PM* $/pound</th>
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<tbody>
<tr>
<td>Ocean-going Vessel Proposal</td>
<td>$32</td>
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<tr>
<td>In-Use Off-Road Diesel Vehicles Regulation</td>
<td>$74-$86</td>
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<tr>
<td>Cargo Handling Equipment Regulation</td>
<td>$41</td>
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<tr>
<td>On-Road Drayage Trucks</td>
<td>$57-$77</td>
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*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
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
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