

Ocean-going Ships Main Engine Workshop



March 20, 2007
Port of Long Beach



Overview

- ◆ Background
- ◆ Emissions Inventory
- ◆ Current Efforts
- ◆ Proposed Regulatory Concepts
- ◆ Questions to Consider
- ◆ Next Steps

Background



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Air Pollution is a Serious Public Health Concern

- ◆ Diesel PM identified as a Toxic Air Contaminant (1998)
- ◆ Non-Cancer Health Impacts of Diesel PM, SO_x, Ozone
 - Premature death
 - Respiratory disease
 - Cardiovascular disease
 - Activity restriction

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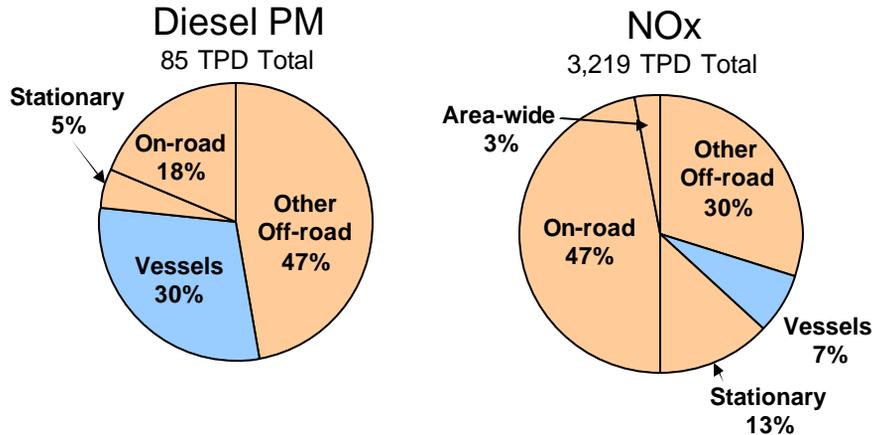
Emissions from Ships Impact Public Health and Air Quality

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



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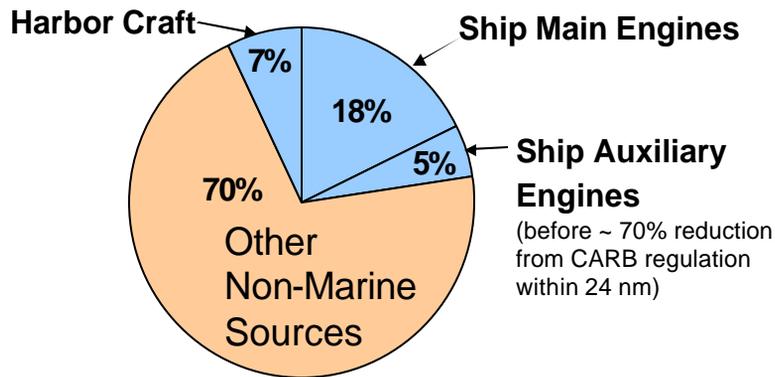
Marine Vessels are a Large Source of California's NO_x & Diesel PM Emissions*



* Source: 2005 ARB Emissions Inventory. Does not include benefit of ARB Ship Auxiliary Engine Regulation

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Marine Vessel Diesel PM Emissions Breakdown*



* Sources: 2003 ARB Emissions Inventory and 2005 Ship ISOR

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Significant Contribution to Community Health Risk

- ◆ POLA and POLB Assessment Study found ship transiting and maneuvering emissions were significant contributors to high near source risk levels

OGV Transiting and Maneuvering	Percent of Total Port Emissions	Cancer Risk Levels (Chances/million)	Square Miles Impacted	Population Affected
942 Tons/year (2002)	53%	Risk > 10	163,435	1,977,760
		Risk > 100	227	1,810

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Emission Reductions from Ships Are Necessary to Meet Air Quality Goals

- ◆ Diesel Risk Reduction Plan (2000)
 - Reduce diesel PM by 85% in 2020
- ◆ Goods Movement Emission Reduction Plan (2006)
 - Reduce emissions to 2001 levels by 2010
 - Attain Air Quality Standards
 - Reduce diesel-related health risks by 85% by 2020
 - Ensure risk reduction in local communities

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Strategies to Reduce Emissions From Ships

- ◆ Auxiliary Engine Fuel Rule (2005)
 - Jan. 1, 2007: MGO or MDO (0.5% S limit)
 - Jan. 1, 2010: MGO (0.1% S limit)
- ◆ Rule prohibiting incineration for cruise ships and OGV (2005/2006)
- ◆ Green Ships Program
- ◆ Port and Industry Environmental Programs
- ◆ Vessel Speed Reduction Rule (scheduled mid-2007)
- ◆ Shore-Power Rule (scheduled late 2007)
- ◆ **Main Engine Fuel Rule (scheduled late 2007)**

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Emissions Inventory



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Ship Main Engine Emissions

- ◆ Heavy Fuel Oil
 - Except for Some Passenger & 4 Diesel Electric Tankers
- ◆ Modes of Operation:
 - Transit
 - Maneuvering
- ◆ Growth:
 - Installed Power
 - Large

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Ship Main Engine Emissions

Pollutant	Operating Mode	2006 (tpd)	2010 (tpd)	2020 (tpd)
Diesel PM	Transit	15.4	18.4	28.6
Diesel PM	Maneuvering	0.06	0.08	0.12
Total dPM		15.5	19.2	28.7
NOx	Transit	191.1	228.5	355.2
NOx	Maneuvering	1.9	2.4	3.7
Total NOx		193.1	230.9	358.9
SOx	Transit	112.8	134.8	209.5
SOx	Maneuvering	0.5	0.6	0.9
Total SOx		113.2	135.4	210.4

Source: Current CARB inventory, no controls applied; 100 nm from shore 13

Statewide Ship Contribution

- ◆ SO_x Emissions:
 - Largest source category
 - 45% in 2006; 65% in 2020
- ◆ NO_x Emissions:
 - 4th largest in 2006; largest in 2020
 - 5% in 2006; 15% in 2020
- ◆ Diesel PM Emissions:
 - 3rd largest in 2006 and 2020
 - 13% in 2006; 15% in 2020

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Next Steps – Revised Emissions Model

- ◆ Activity:
 - Corbett-Wang STEEM Network
 - AIS Data
 - Wharfinger Data
- ◆ Population:
 - Lands Commission/Army Corps
 - Lloyds/Internet
- ◆ Compatible:
 - POLA/LB Revision
 - Current CARB SIP and GMERP
 - Port of Oakland
 - SECA
- ◆ Summer 2007

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Current Efforts



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Emission Test Programs – Completed and Underway

- ◆ Maersk (Main and Aux)
- ◆ APL (Baseline, Slide Valves and Emulsification)
- ◆ Industry/CE-CERT (Chevron Shipping Company)
- ◆ Holland-America cruise ship (seawater scrubber)
- ◆ Additional ME Test Funding Committed

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2007 Ship Survey

- ◆ For ships that visited CA ports in 2006
- ◆ Ship and engine information
- ◆ Fuel usage
- ◆ Costs/Modifications for Using Cleaner Fuels



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2007 Ship Survey Data Will Support Regulatory Decision Making

- ◆ Update the emissions inventory
- ◆ Collect information to improve understanding of regulatory impacts
 - modifications needed to use cleaner fuels in main engine
 - potential costs for modifications
 - actual costs/modifications for compliance with auxiliary engine rule
 - power requirements while dockside
- ◆ Robust survey response = solid technical foundation for regulatory decisions

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2007 Ship Survey

- ◆ Return Date: March 31, 2007
 - Part I: Contact/Company Information
 - Part II: Ship and Engine Information

- ◆ Questions? Contact Kathleen or Bonnie

<http://www.arb.ca.gov/msprog/offroad/marinevess/survey.htm>

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Proposed Regulatory Concepts



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Objectives

- ◆ Reduce emissions from the operation of the main engine
- ◆ Align to extent feasible with the auxiliary engine rule
 - Identify and address considerations unique to main engines

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Emissions Benefits Estimates of MGO Use in Main Engines

Emission reductions from switching from HFO to 0.1%S MGO

- ◆ Diesel PM: 83%
- ◆ SOx: 96%
- ◆ NOx: 6%

Assumptions:

- ◆ average sulfur content of HFO=2.5%
- ◆ based on 2005 CARB Ship inventory

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Proposed Regulatory Concepts Main Engine - Applicability

- ◆ All ocean-going vessels (U.S. and Foreign-flagged)
 - = 400 feet in length overall (LOA);
 - = 10,000 gross tons; or
 - Engine per-cylinder displacement of = 30 liters
- ◆ Diesel main propulsion engines

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Proposed Regulatory Concepts Main Engine - Exemptions

- ◆ Incorporate/consider similar exemptions to those in auxiliary engine fuel rule
 - “Innocent Passage”
 - Auxiliary diesel engines
 - Emergency generators
 - Military vessels
 - Alternative fuels
 - Safety Exemption

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Proposed Regulatory Concepts Main Engine - Definitions

- ◆ Similar to Auxiliary Engine Fuel Rule

Potential Additional Definitions:

- ◆ Alternative Fuel
- ◆ Emergency Generator
- ◆ Ocean-going Vessel
- ◆ Port Visit
- ◆ Others?

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Proposed Regulatory Concepts Main Engine - Requirement

- ◆ Require the use of low sulfur distillate fuel
 - Dependent on outcome of fuel availability and cost study
 - Align with Auxiliary Engine Fuel Rule

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Proposed Regulatory Concepts Main Engine - Implementation

- ◆ Dependent on fuel availability and cost study
- ◆ Possibly Jan. 1, 2010 to align timing with Auxiliary Engine Fuel Rule



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Proposed Regulatory Concepts Main Engine - Boundary

- ◆ At least 24 NM from the California Baseline
- ◆ Consider further offshore
- ◆ Dependent on emissions impact, fuel availability, cost analysis, consistency with other regulations

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Proposed Regulatory Concepts Main Engine – Other Provisions

- ◆ Noncompliance Fee Provision
- ◆ Alternative Control of Emissions
- ◆ Recordkeeping and Reporting Requirements

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Questions to Consider

- What modifications are necessary to allow the use of distillate fuel in the main engine? What are the costs associated with any modifications?
- Are there any unique ship configurations where switching fuels is more feasible? Infeasible?
- Is there sufficient fuel available worldwide to support the use of the cleaner fuel?
- Are there reliability issues associated with switching fuels?
- What procedures should be followed when switching fuels?
- Are there any safety issues associated with fuel switching to a distillate fuel?
- What about fuel compatibility?
- Are there lubricity concerns?

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Next Steps



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Next Steps

- ◆ Collect and analyze data from survey
- ◆ Update emissions inventory
- ◆ Fuel availability and cost study with POLA/POLB
- ◆ Complete Port of Oakland Health Risk Assessment
- ◆ Address Key Questions
- ◆ Additional public workshops
- ◆ Board Consideration – December 2007

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