Maritime Air Quality Technical Working Group

Proposal to Reduce Emissions from Oceangoing Ship Auxiliary Engines

April 8, 2004
Sacramento, California

California Environmental Protection Agency

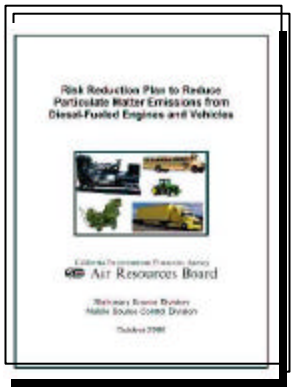
Air Resources Board

Overview

- Background
- Oceangoing ship auxiliary engine emissions and potential control strategies
- Proposed regulatory concepts
- Next steps

Background

Framework For Continuing Improvement

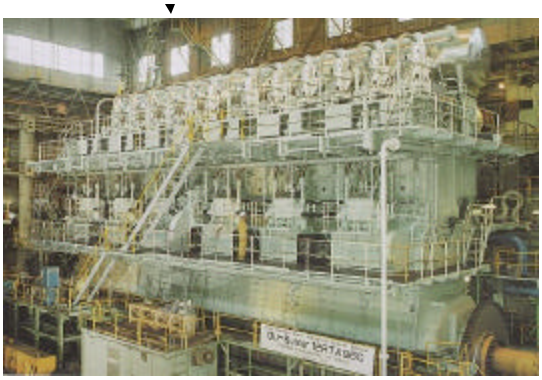


Governor's Action Plan

California State Implementation Plan Measure to Reduce Emissions From Existing Oceangoing Ships

- Evaluate variety of emission reduction options
  - Cleaner fuels, Operational controls, Incentive programs, Opacity limits, Retrofits, Cold ironing
- Adopt statewide programs 2004-2005, implement 2005-2010
- Emission Reduction Goals
  - 10% 2005, 25-40% 2010
- Cooperative effort

Strategies Necessary for Main & Auxiliary Engines

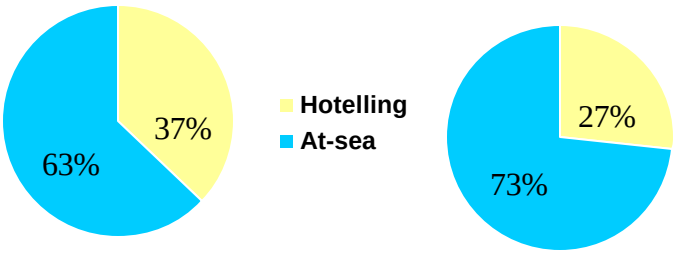


Oceangoing Ship Auxiliary Engine Emissions and Potential Control Strategies

Option 1

Auxiliary Engine Hotelling Emissions are Significant

2000 Ship Emissions in the SCAQMD



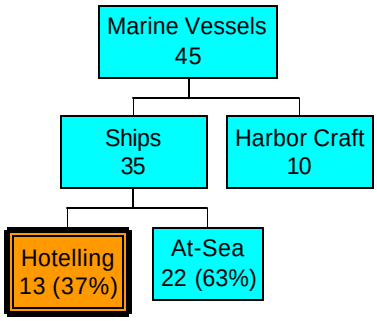
NOx 35 TPD

PM 3 TPD

Option 2

Auxiliary Engine Hotelling NOx Emissions are Significant

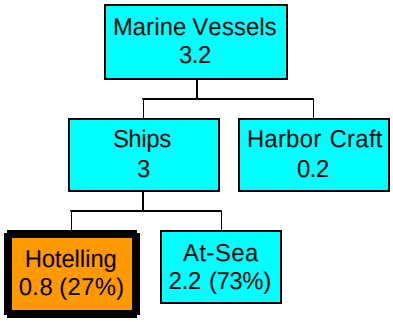
NOx Emissions in SCAQMD in TPD and (%)



Option 2

Auxiliary Engine Hotelling PM Emissions are Significant

PM Emissions in SCAQMD in TPD and (%)



Key Emission Control Options for Auxiliary Engines

Shore-side Power
Almost 100% Reductions in NOx, PM, SOx

Marine Distillate:
~60% PM Reduction
- ***~6-10% NOx Redn.***
- ***~90% SOx Reduction***
- ***assumes HFO to MGO switch***

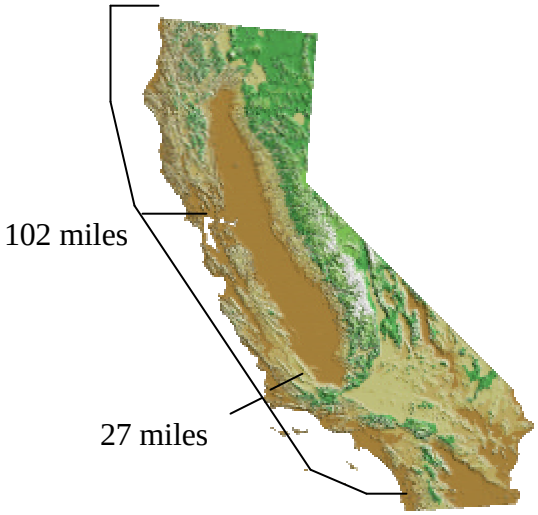
Add-on Controls:
Reductions vary

Control of Emissions from Auxiliary Engines is Crucial

- Auxiliary engines are a significant proportion of overall ship emissions
- Majority of auxiliary engine emissions released at dockside during hotelling
- More control options available for auxiliary engines

Proposed Regulatory Concepts

California Coastal Waters



Proposed Concepts for Reducing Auxiliary Engine Emissions

- Use of cleaner fuels
- Additional controls for frequent visitors
- Provisions providing flexibility

Cleaner Fuel Concept

- Oceangoing ships use marine gas oil (MGO) in auxiliary engines at dockside and in California Coastal Waters
  - fuel with 0.2% sulfur MGO initially
  - sulfur cap lowered to 0.1% in 2008 consistent with the current European Union proposal
- Includes cruise ship diesel-electric engines

Auxiliary Engines Use MGO

Issues for Investigation

- **Cost impacts**
- **Fuel switching procedures**
- **Additional tanks and piping needed**
- **Engine compatibility**
- **Availability of cleaner fuels**
- **Safety issues/flash point**
- **Port impacts**
- **Enforcement mechanism**

Cost Impacts

- Distillate diesel fuel is more expensive than heavy fuel oil (HFO)
- Cost effectiveness is within range of other measures adopted by the Board due to significant emission reductions
  - preliminary estimates of $1,700/ton of NOx/SOx/PM combined, or 26,000/ton NOx only

Fuel Switching Necessary

- Technically feasible
- Currently necessary prior to certain engine maintenance operations
- Fuel switching common practice in the past for main engines
- Another option is engine/s with dedicated distillate diesel tanks

Additional Tanks & Piping

- Many ships will need to add additional tanks and piping (mono-fueled ships)
- Existing tanks can be partitioned where space is not available

Engine Compatibility

- We have not identified specific auxiliary engines that cannot use MGO
- Some manufacturers reported that use of MGO can result in lower maintenance costs

Availability of Cleaner Fuel

- MGO is widely available worldwide
- Investigating availability of 0.2% and 0.1% maximum sulfur content MGO

Safety Issues

- Concerns relate to improperly handled fuel transitions, and leaks due to less viscous fuel
- Ships already switch fuels for maintenance --should be capable of handling both fuels

Port Impacts

- Concerns relate to port competitiveness
- Cooperative efforts with other states and Canada underway to try to implement maritime strategies on a West Coast basis

Enforcement Mechanism

- Verifying compliance offshore may require coordination with other governmental agencies

Ships Making Frequent Visits to California

- Should “frequent” visitors achieve additional emission reductions?
- Options for frequent visitors may include:
  - cold-ironing
  - emulsified fuels
  - engine retrofit controls

Provisions Providing Flexibility Needed

- Alternative compliance plans
  - Achieve equivalent emission reductions through alternative control mechanisms
- Averaging provisions
  - Shipping Company
  - Ports
  - Other

Next Steps

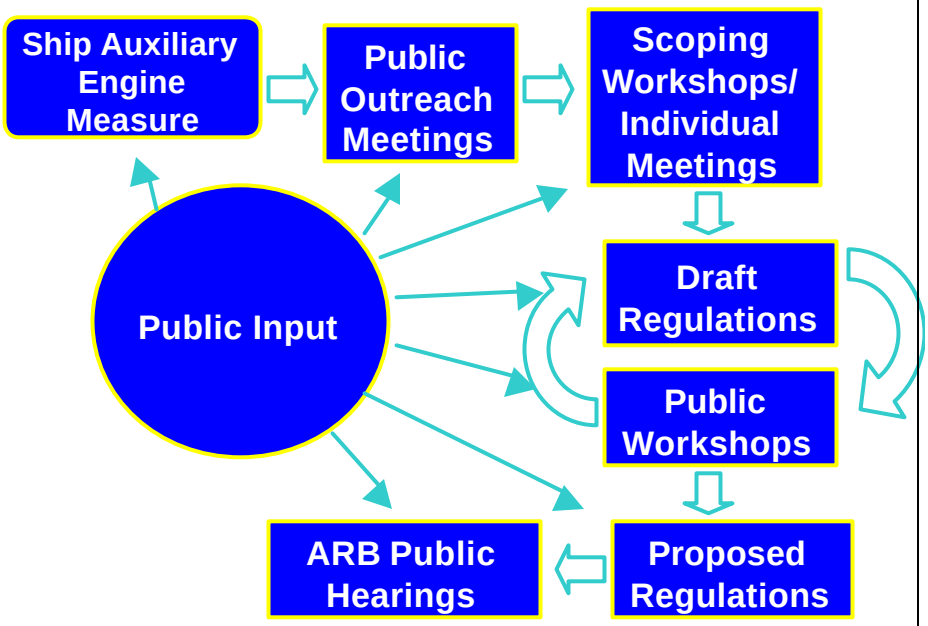
Potential Survey of Ship Operators

- California port visits by vessel
- Main and auxiliary engine information
- Fuels types used
- Voltage of ship electrical power supply
- Comments and suggestions on draft survey welcome

Supporting Activities

- Ship Demonstration Project
  - Evaluate control technologies on ships
- In-use emission testing
- Cold-ironing and auxiliary engine control evaluations in 2004

Public Process



Summary

- Auxiliary engines are key to meeting emission reduction targets
- Regulatory proposal in this presentation is a starting point for discussions
- Open to alternatives that meet goals
- Extensive public process will be followed