Regulation to Reduce Hotelling Emissions from Ships in California Ports
(Adopted 12/6/07)

AAPA Cruise Seminar
February 6, 2008
BACKGROUND
Emissions from At-Berth Ships

♦ Auxiliary engines provide power for ship’s electrical power needs

♦ Power requirements are specific to ship type and cargo
Health Impacts Due to Hotelling Emissions

- Diesel particulate matter (PM)
  - 70 percent of inhalable cancer risk in CA
- Elevated cancer risk near ports
  - POLA/POLB health risk assessment indicates potential cancer risk from hotelling emissions (2006) affects:
    - 2,000,000 with risk greater than 10 in a million
    - 340,000 with risk greater than 100 in a million
    - 87,500 with risk greater than 200 in a million
Health Impacts Due to Hotelling Emissions (Continued)

♦ Non-cancer annual impacts (2006)

- 60 premature deaths
- 1,800 respiratory impacts
- 11,000 work loss days
- 61,000 minor restricted activity days
Ship Activity to California Ports (2006)

- 2,000 ships
- 10,500 visits
- Majority visiting ports of Long Beach, Los Angeles, and Oakland
Ship Types

- Container ships
- Passenger ships
- Refrigerated cargo ships
- Tankers
- General cargo ships
- Bulk ships
- Vehicle carriers
Visits by Ship Category (2006)

- Container (45%)
- Bulk
- Auto
- General
- Reefer (3%)
- Passenger (7%)
- Tanker
Hotelling NOx Emissions by Ship Category (2006)

- Container: 65%
- Passenger: 13%
- Bulk: (4%)
- Reefer: (4%)
- Tanker: (13%)
- Auto: (13%)
- General: (13%)

Pie chart showing the distribution of NOx emissions by ship category in 2006.
Shore Power Candidates

- Frequent Visitors
- Long Hotelling Times
- Significant Power Needs
Shore Power Candidates (Cont.)

♦ Most Cost-Effective for Container Ships, Passenger Ships, and Refrigerated Cargo Ships

♦ Prime Candidate Ports: Los Angeles, Long Beach, Oakland, San Diego, San Francisco, and Hueneme

♦ Two-Thirds Of Capital Costs & Benefits at Los Angeles/Long Beach
Container Ships

- 45 percent of total ship visits (2006)
- 65 percent of emissions
- Frequent visitors: 60% of ships make 80% of visits
- Power needs: 1 to 7 MW
- Average berthing times:
  - 50 hrs/visit (POLA/POLB)
  - 21 hrs/visit (Oakland)
Passenger Ships

- 7 percent of total ship visits (2006)
- 13 percent of emissions
- Frequent visitors: 40% of ships make 85% of visits
- Power needs: 5 to 15 MW
- Average berthing times: 10 hours/visit
Reefer Ships

- 3 percent of total ship visits (2006)
- 4 percent of emissions
- Frequent visitors: 30% of ships make 75% of visits
- Power needs: 2 to 5 MW
- Berthing times: 20-60 hours/visit
Other Vessel Categories

♦ Continue to evaluate other ship categories
♦ Proposed requirements for Board consideration within a year
REGULATION
Key Elements

♦ Targeted ship categories most suitable for shore power

♦ Provided flexibility by allowing alternative technologies that achieve emission reductions
  – Can be implemented expeditiously
  – Achieves equally effective reductions

♦ Design schedule to obtain reductions as soon as practicable
Grid-Based Shore Power

- Requires capital-intensive improvements to terminals and ships
- Proven technology
  - U.S. Navy
  - Passenger ships on West Coast
  - Container ships in California
Other Potentially Viable Emission Control Techniques

- Proposal allows other control technologies to achieve required emission reductions
## Implementation Schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Reduced Onboard Power Option (Grid)</th>
<th>Emission Reduction Option</th>
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<tbody>
<tr>
<td>January 1, 2010</td>
<td>Ships must use shore power if available</td>
<td>10% reduction</td>
</tr>
<tr>
<td>January 1, 2012</td>
<td>Ships must use shore power if available</td>
<td>25% reduction</td>
</tr>
<tr>
<td>January 1, 2014</td>
<td>50% visits and power demand</td>
<td>50% reduction</td>
</tr>
<tr>
<td>January 1, 2017</td>
<td>70% visits and power demand</td>
<td>70% reduction</td>
</tr>
<tr>
<td>January 1, 2020</td>
<td>80% visits and power demand</td>
<td>80% reduction</td>
</tr>
</tbody>
</table>
Who Does What

- Vessel fleets are subject to emission reduction requirements
- Terminals must accommodate the vessel fleets
  - Plan document due in 2009 indicating how requirement is satisfied
  - Follow-up reports
Regulatory Impact

♦ Shoreside
  – six ports
  – 31 terminals
  – 76 berths

♦ Ships
  – 1450 ships
Affected Terminals

- 31 Terminals at Six Ports

- Hueneme: 1 reefer terminal
- Long Beach: 8 container and 1 passenger terminal
- Los Angeles: 7 container and 1 passenger terminal
- Oakland: 10 container terminals
- San Diego: 1 reefer and 1 passenger terminal
- San Francisco: 1 passenger terminal
AIR QUALITY BENEFITS
NOx Emissions

[Graph showing NOx emissions from 2006 to 2020 with a trend line indicating an increase over time.]
NOx Reductions

- Auxiliary Engine Fuel Regulation
- Plus Shore Power

Graph showing TPD (Tons per Day) from 2006 to 2020.
PM Emissions

PM Reductions

- Auxiliary Engine Fuel Regulation
- Auxiliary Engine Fuel Regulation Plus Shore Power

Graph shows TPY from 2006 to 2020.
CO₂ Emissions for Ship Power Sources

- Ship engine
- DG (PUC/CEC)
- Grid Marginal Generation
- Future Grid?

Combined Cycle Power Plant
Cumulative Health Benefits

♦ Health benefits (2009-2020)
  – Significant reduction in near-source cancer risk: > 25-in-a-million risk eliminated
  – Premature deaths avoided: 280
  – Respiratory impacts avoided: 8,200
  – Work loss days avoided: 49,000
  – Minor restricted activity days avoided: 280,000
ESTIMATED COSTS
Estimated Costs

- Overall costs of $1.8 billion dollars (2006 dollars)—assuming grid power is used
  - 65 percent for ship modifications
  - 20 percent for shore modifications
  - 15 percent operating costs
Potential State Funding to Incent Early Reductions

- Proposition 1B Bond Funding (Goods Movement)
  - Staff bringing recommended guidelines to the Board this month
  - Funding potentially available for early grid-based shore power and clean DG

- Carl Moyer Funding (Ships)
  - Staff bringing proposed revisions to the Board this year
  - Revisions will explicitly address shore power
Summary

♦ Hotelling emissions affect public health
  – cancer risks
  – noncancer risks
  – climate change
♦ Container ships, passenger ships, and refrigerated cargo ships are attractive candidates for shore power
♦ CARB regulation allows alternative technologies
♦ CARB requirements are cost-effective
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- **Webpage:**
  [Shore Power](http://www.arb.ca.gov/ports/shorepower/shorepower.htm)