

Marine Emissions: *Assessing Local and Global Challenges*



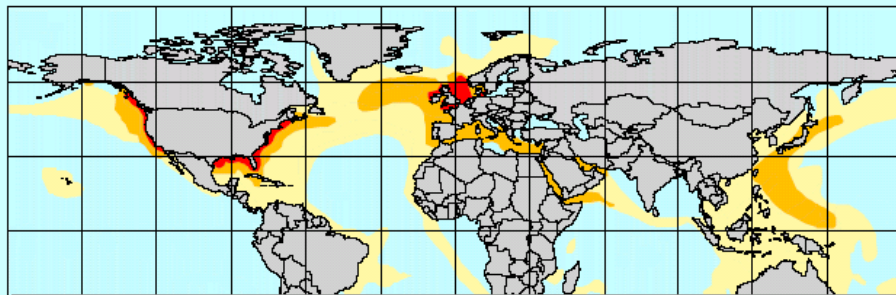
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Coalition for Clean Air

Faster Freight, Cleaner Air
Long Beach, CA
January 31, 2006



Global ship traffic density

Low
Medium
High
Extra high



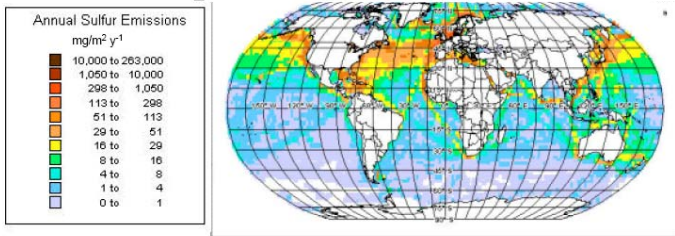
85 percent in Northern Hemisphere
70 percent within 400 km of land

Source: IMO Study on Greenhouse Gas Emissions from Ships, MEPC 45(8), 2000.

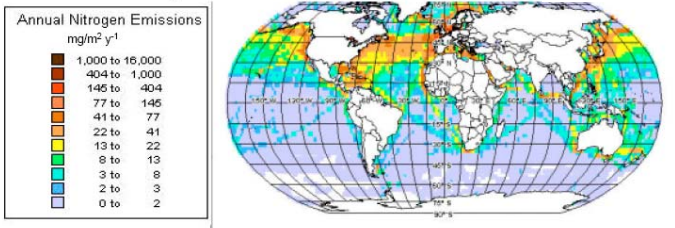
Source: 'Sources of Transport of Air Pollution from Ships: Current Understanding, Implications, and Trends',
Dr. James J. Corbett & Dr. Paul Fischbeck.



Global Ship Sulfur Emissions



Global Ship Nitrogen Emissions

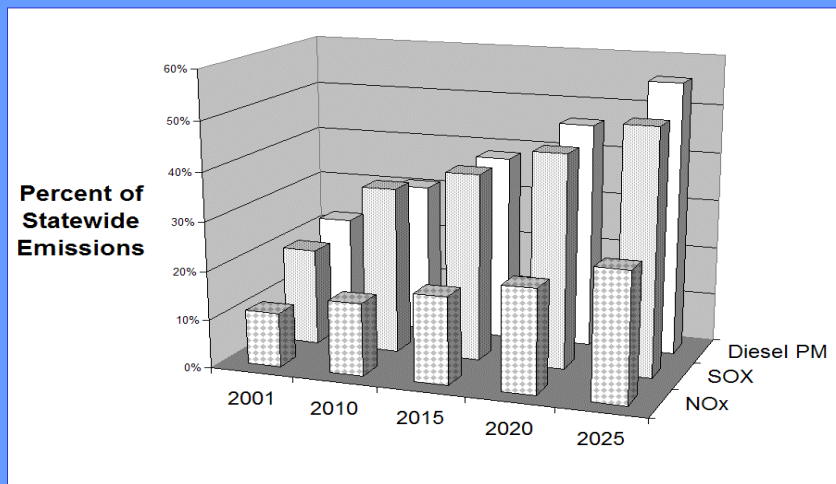


Source: Corbett and Fischbeck, JGR, 1999

Source: 'Sources of Transport of Air Pollution from Ships: Current Understanding, Implications, and Trends',
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Goods Movement Emissions Into Future as a % of Overall California Emissions

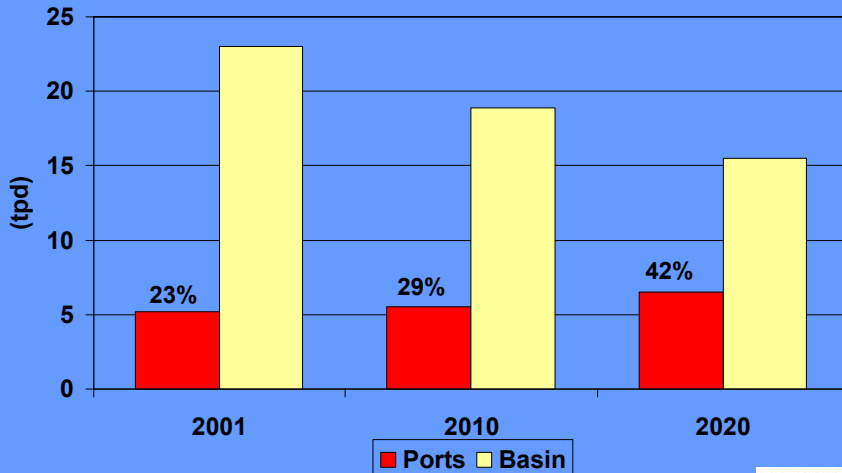


Source: ARB's Draft Goods Movement Emission Reduction Plan, December 2005.

Note: ARB only calculated internationally related goods movement emissions and did not include domestic related contribution from trucks and locomotives.



Contribution of Port-Related Sources to CA's South Coast Basin Diesel PM₁₀*



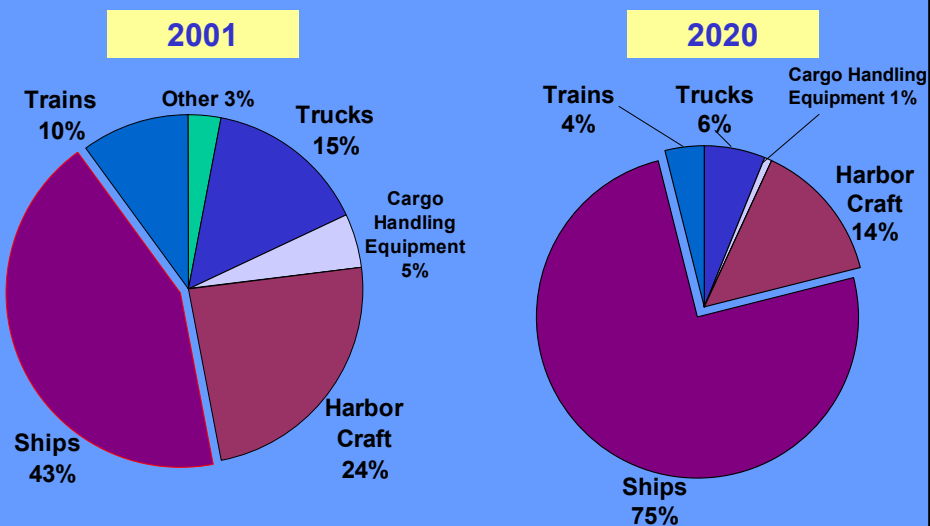
*Assuming ports recent baseline inventories and 2003 AQMP growth and control factors.

Source: Courtesy of the South Coast Air Quality Management District



Goods Movement Emissions in CA

% of Diesel PM Emissions by Source



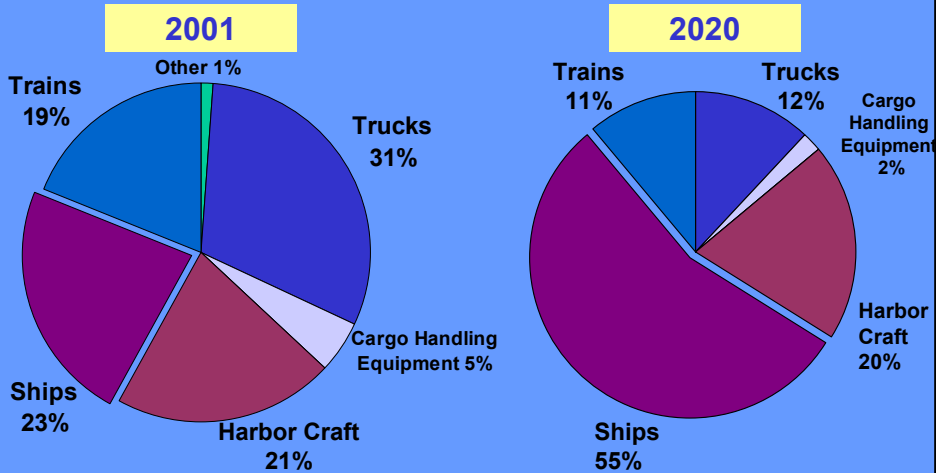
Source: ARB's Draft Goods Movement Emission Reduction Plan, December 2005.

Note: ARB only calculated internationally related goods movement emissions and did not include domestic related contribution from trucks and locomotives.



Goods Movement Emissions in CA

% of NO_x Emissions by Source



Source: ARB's Draft Goods Movement Emission Reduction Plan, December 2005.

Note: ARB only calculated internationally related goods movement emissions and did not include domestic related contribution from trucks and locomotives.



MARINE FUEL

- Large marine vessels typically run on “bunker fuel,” which is extremely polluting
 - USEPA: International avg. 27,000 parts per million sulfur



Photo courtesy of John Barbieri

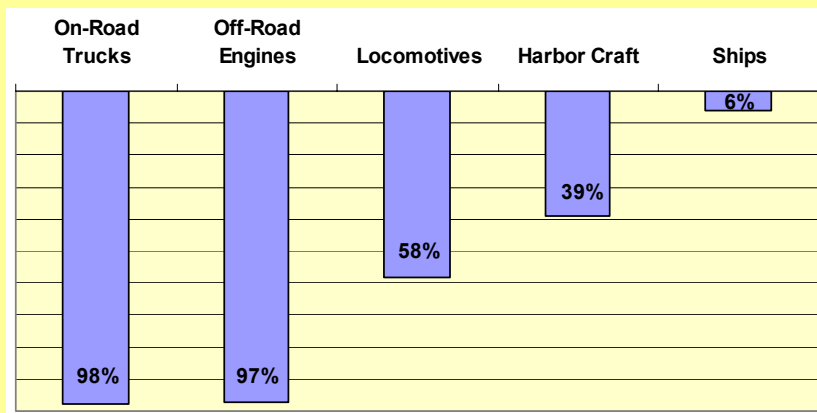
- One ship at berth can generate one ton of NO_x and almost 100 pounds of PM each day
- Pollution released from ships visiting the Ports of LA and LB in a single day is roughly the same as 1,000,000 vehicles

Sources: Final Regulatory Support Document: Control of Emissions from Compression-Ignition Marine Diesel Engines at or Above 30 Liters per Cylinder, January 2003, p. 1-9; Proposed 2003 State and Federal Strategy for the California State Implementation Plan, August 25, 2003, p. II-G-2.



Stringency of Adopted NOx Rules for New Engines

(Percent Reduction Based on Adopted New Engine Standards)



Source: Courtesy of the South Coast Air Quality Management District



Diesel Pollution: Major Public Health Threat

- Diesel exhaust = toxic air contaminant that has serious health effects
- Last year, the # of diesel-related premature deaths estimated to exceed the number of homicides in CA
 - ~3,000 premature deaths
 - ~2,700 cases of chronic bronchitis
 - ~4,400 hospital admissions for cardiovascular and respiratory illnesses



Cost of health impacts = \$21.5 billion per year





International Regulations - MARPOL

- Annex VI entered 'into force' May 19, 2005
- Global cap of 4.5%
- Ozone depleting substances
- NOx limits – most engines complying since 2000
- No PM reductions
- SOx Control Areas (SECA) limited to 1.5% or SOx limits



Other Active Regulatory Venues



European Union	US EPA	CARB
<ul style="list-style-type: none"> ➤ Directive 2005/33/EC <ul style="list-style-type: none"> - SECA for Baltic Sea in 2006 - SECA for North Sea and English Channel in 2007 - 1.5% sulfur for passenger vessels - 0.1% for ships at berth & inland by 2010 	<ul style="list-style-type: none"> ➤ Cat 1 and 2 Engine Rule ➤ Cat 3 Engine Rule <ul style="list-style-type: none"> - only applies to U.S. flagged vessels - similar to IMO NOx requirement ➤ Tier II Cat 3 Rule?? ➤ Pursuing SECA 	<ul style="list-style-type: none"> ➤ Auxiliary Engine Fuel Rule Adopted ➤ Harbor Craft Rule Proposed ➤ Dockside Power Feasibility Study <ul style="list-style-type: none"> - Rulemaking?? ➤ OGV vessel speed reduction ➤ Main engines??



Other Efforts



CA Statewide	Port of LA	SCAQMD
<ul style="list-style-type: none"> ➤ BTH/CalEPA <ul style="list-style-type: none"> - GM ERP (w/ARB) - Health Assessment ➤ Legislation <ul style="list-style-type: none"> - Container fees - Bond proposals ➤ Carl Moyer Program 	<ul style="list-style-type: none"> ➤ NNI Plan <ul style="list-style-type: none"> - Measures include cleaner fuels, dockside power, engine controls ➤ Change in bidding criteria 	<ul style="list-style-type: none"> ➤ Chairman Port Initiative ➤ Technology Advancement ➤ Moyer funds



Marine Vessels - *Mitigation*

- **DOCKSIDE POWER:** Require electrification of piers and at least 70-80% of all ships to plug in at berth

Eliminates a ton of pollution per day for each ship that plugs in.

- **CLEANER FUELS:** Require engines to run on cleaner fuels that contain a sulfur content level no higher than 1,000 or 2,000 ppm while at berth (if not using electric power) and in coastal waters

CARB recently adopted rules that require vessel auxiliary engines to reduce emissions. But use of the “cleanest fuels” (1-2%) is not yet required.

- **EMISSIONS CONTROLS:** Use of selective catalytic reduction (SCR) can reduce NOx emissions by more than 80%



Mitigation for Marine Vessels - *Feasibility*



- **Dockside Power**
 - Ex: POLA, Juneau, Alaska, Sweden
- **Cleaner Marine Fuels**
 - Ex: CARB regulation, NYK Line, USS POSCO, Carnival Cruise Lines, Long Beach/OOCL, EU
- **Cleaner Ships**
 - Ex: > 100 ships w/ SCR in N. Europe, USS POSCO, new builds by Evergreen



Marine Fuel Emission Reductions

(As compared to international average - 27,000 ppm sulfur content)

Sulfur Content (Fuel Type)	NOx	PM	SOx
15,000 ppm (HFO)	0%	18%	44%
5,000 ppm (MGO or MDO)	6%	75%	80%
1,000 ppm (MGO)	6%	83%	96%

Source: Staff Report: Initial Statement of Reasons for Proposed Rulemaking for Auxiliary Diesel Engines and Diesel-Electric Engines, Stationary Source Division-ARB, October 2005.





Barriers & Opportunities

INSUFFICIENT REGULATORY ACTION

- USEPA has not exercised its authority over foreign-flag ships
- USEPA needs to expedite implementation of Tier 2 emission standards for all large marine vessels
- States and/or local authorities should require ships to plug-in to shore-side power while docked; pursue lower sulfur fuels in propulsion engines and emission controls



Barriers & Opportunities

PORTS...

- Ports have not exercised their power to require emissions reductions through leases
- As owners of property and as lease negotiators, Ports have significant power to control emissions w/o violating federal law



... AND THEIR TENANTS

- Ports, tenants and operators must invest money in pollution clean-up programs as part of their ongoing budgets - historically they have not done so
- Positive examples do exist (ex. China Shipping)





CONCLUSION

- Feasible emission reduction strategies exist and must be applied to existing and new sources
- Ports, cities and regulators have the ability and responsibility to require that these technologies be implemented
 - Requirements must be mandated by regulations or required as part of the terminal lease. Voluntary measures have proven insufficient.
- Dedicated funding stream necessary to pay for and incentivize a major shift to clean practices (e.g. container fee)