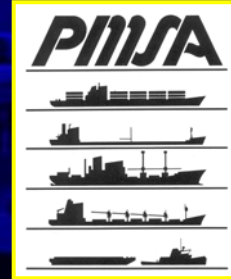


Ocean Carriers and Terminal Operators:

*Industry Perspective
Plenary Session
May 16, 2007*



**T.L. Garrett
Vice President
Pacific Merchant Shipping Association**

Ships



Cargo Handling Equipment

Yard Tractor



Top Pick



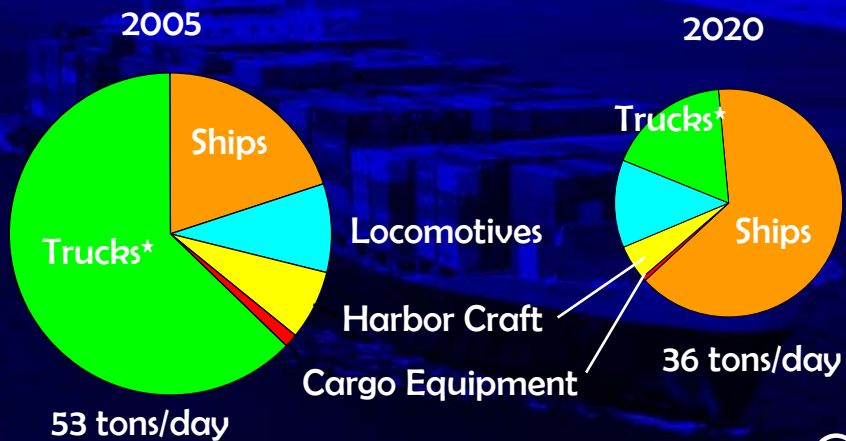
Transtainer



Cranes



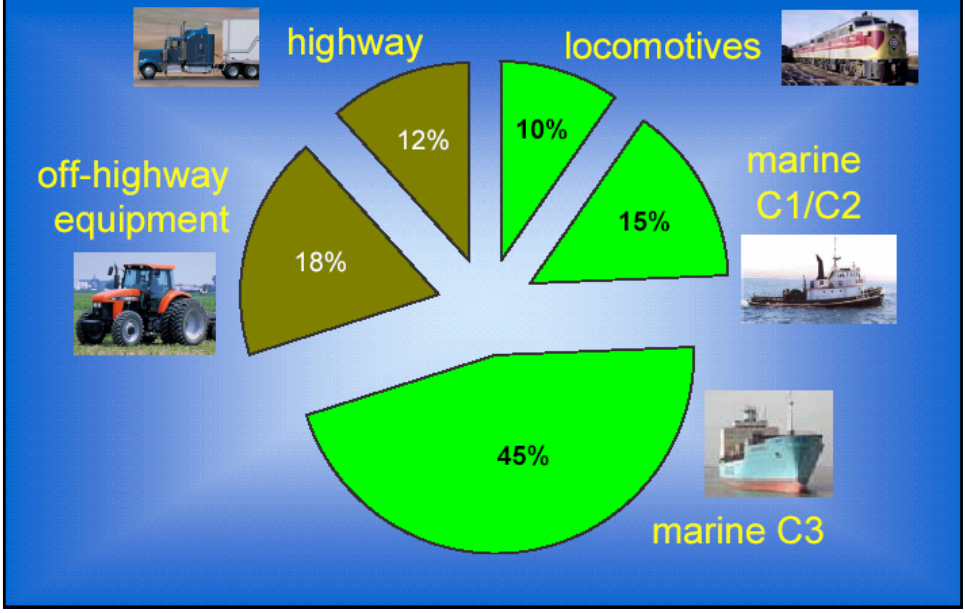
Diesel PM from Goods Movement



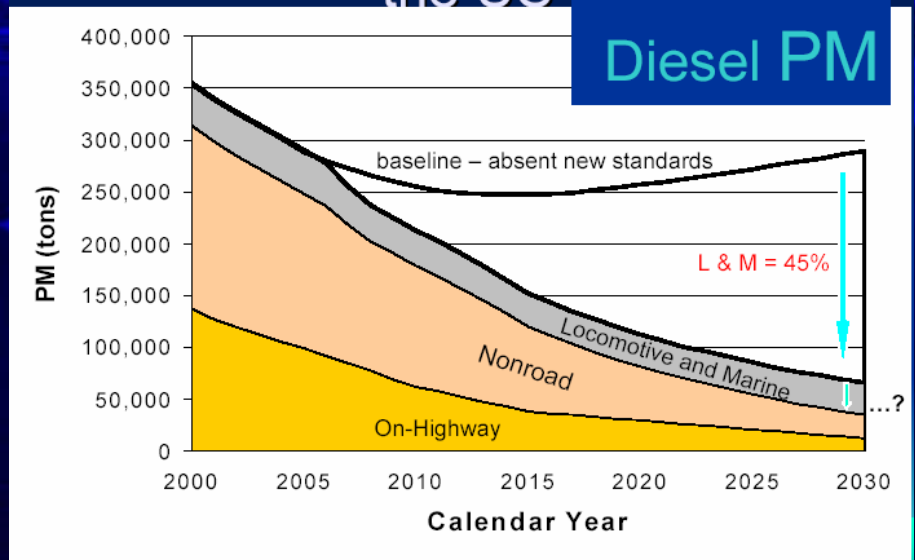
* Includes TRUs



PM_{2.5} from Diesel Engines in 2030



Long-Term Emissions Trends in the US



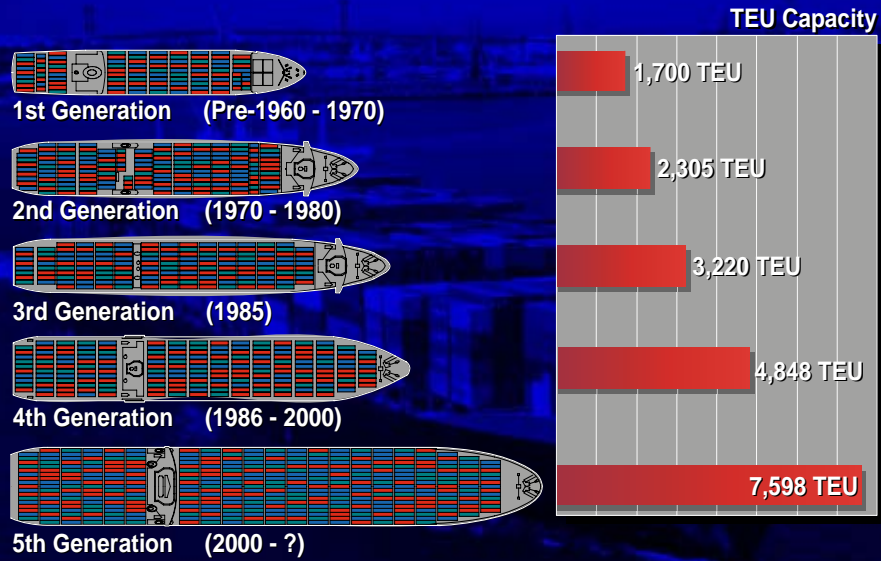
Where Is the Maritime Industry

- Ship emissions ARE an international issue
- Much has already been accomplished
- Many Technologies under development and some are ready for deployment
- Uniform international regulations are preferred but patience is running thin
- There is a need for demonstration projects

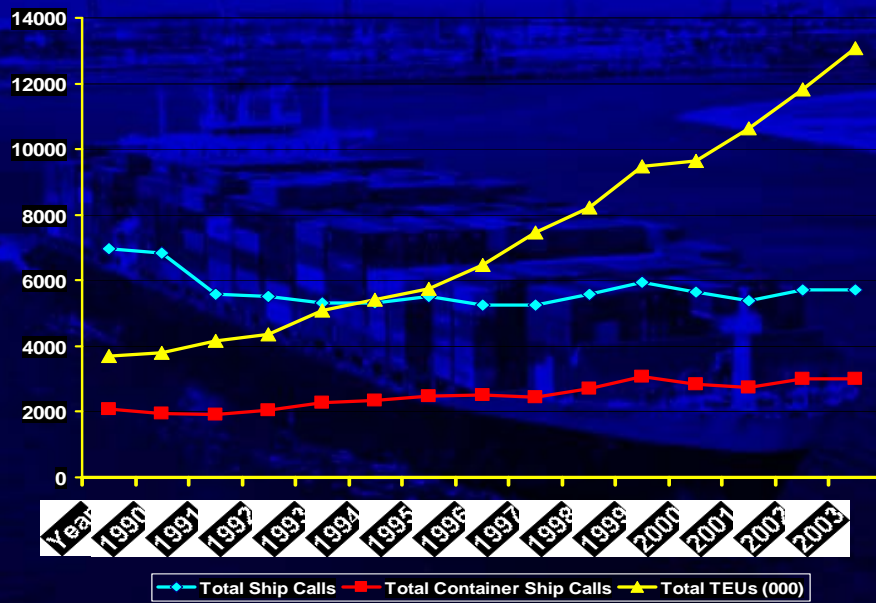
What the Maritime Industry Supports

- Industry prefers a performance standard not a technology
 - Tell us the goal and we will find a solution
- There is a need for good science, especially for ship emission factors
 - We can't manage what we can't measure
- There has to be uniform and consistent regulations
 - Preferably at the international level

Container Ship Evolution



Ship Calls & TEUs



Ship Emission Control

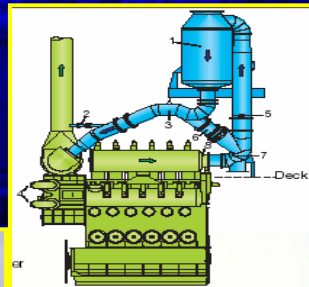


- IMO & U.S. Engine Stds.
- Vessel Speed Reduction
- Cleaner Fuels
- Engine Technology
- Retrofits

Ship Strategies

- Efficiency
- Speed Reduction – $V=E^3$
- Sea Water Scrubbers
- Selective Catalytic Reduction (SCR)
- Shore-side Power

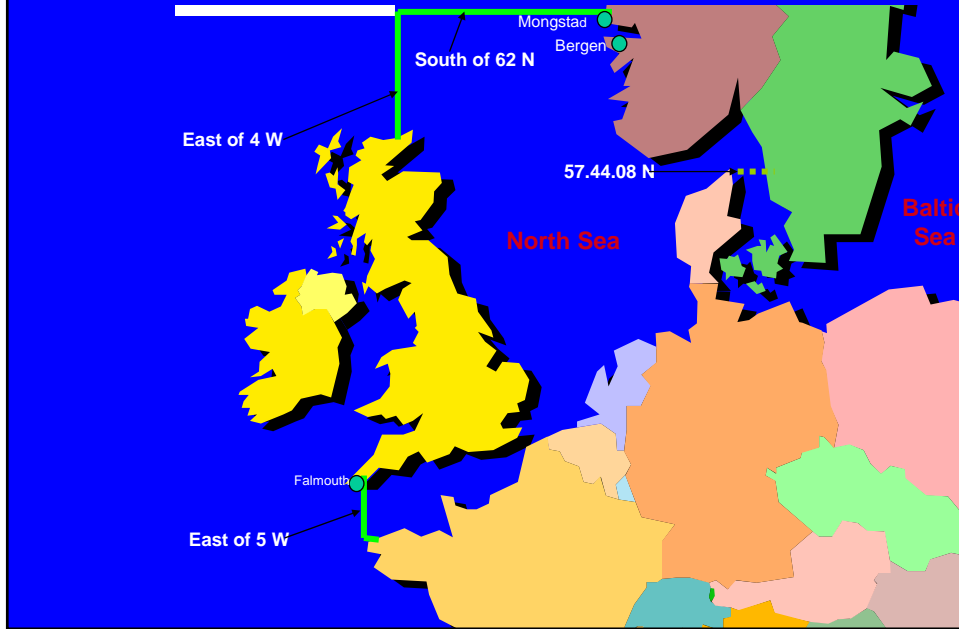
SCR



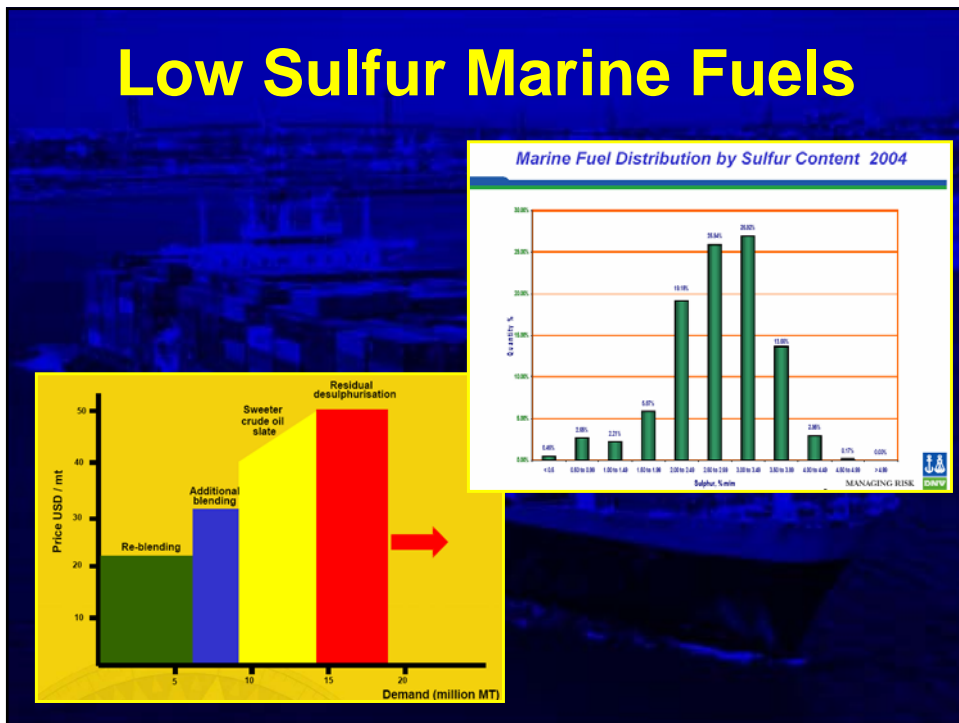
Barge Mount



The Baltic and North Sea SECA Boundaries

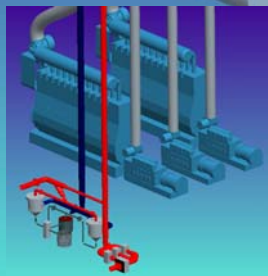


Low Sulfur Marine Fuels



Sea Water Scrubbing (SO_x & PM)

Sea water is pumped to the scrubber
CaCO₃ absorbs the SO_x from the exhaust
Produces CaSO₄ in discharge



Scrubber also removes most of the particulates
PM is removed from the discharge and disposed at dock

MAN Diesel Engine Technology (NO_x)*



Electronic Controls	-30%
Slide Valves	-30%
Water Emulsification	-30%
Scavenge Air Moisting	-50%
Selective Catalytic Red.	-98%

Voluntary Vessel Speed Reduction Program/Reg?



$$V=E^3$$

- Initiated May 2001
- Green Flag Program + 80% compliance



COLD IRONING



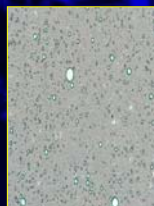
- CARB Regulation?
- 20% by 2010
 - 60% by 2015
 - 80% by 2020

“Cold Ironing” Limitations

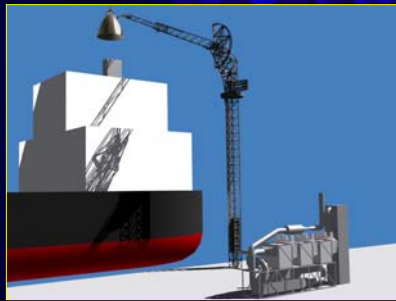
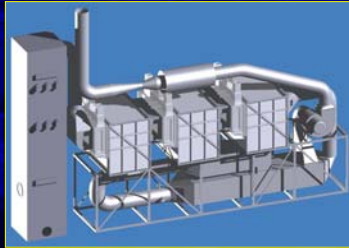
- Existing Fleet – Retrofits
- Need for International Standards
 - Cold Ironing Connections
 - Ship Building Requirement
- Complex, Incremental, Expensive
- Limited Scope
- Physical Connection Required

Water In Fuel Emulsification

- Water typically represents 10-20% of the total volume in the water-diesel blends manufactured & tested.
- NOx reduction equals water content i.e. 10-20% water=10-20% less NOx
- PM reduction is 2-3 times % of water i.e. 10-20% water=30-60% less PM



Advanced Maritime Emissions Control System (AMECS)



Cargo Handling Equipment

Yard Tractor



Transtainer



Emulsified Fuel

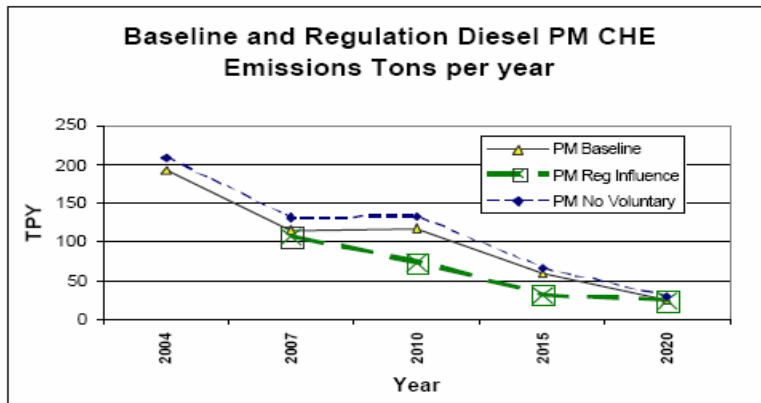


DOC



CARB CHE Regulation

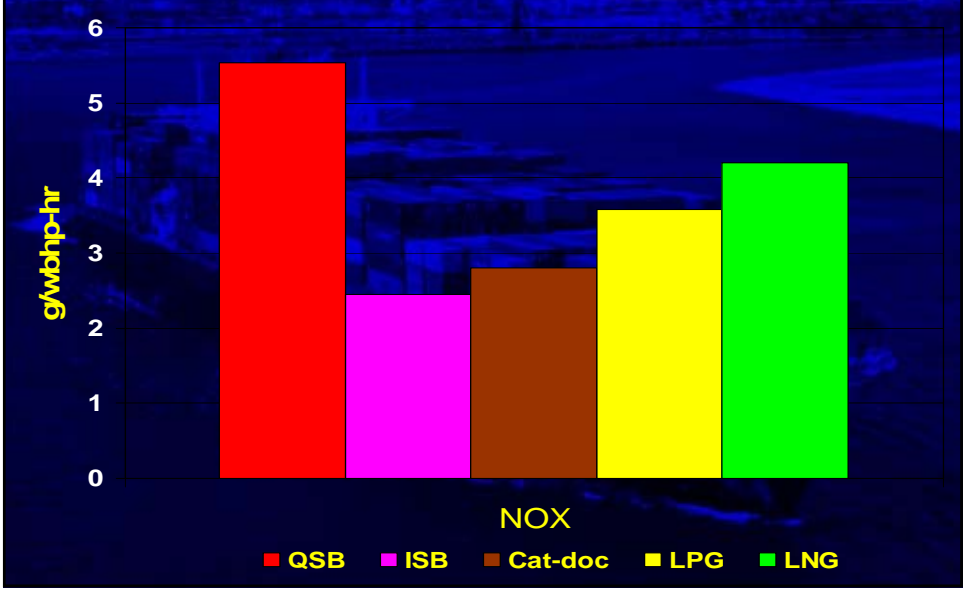
Preliminary Estimated Emission Reductions (Diesel PM)



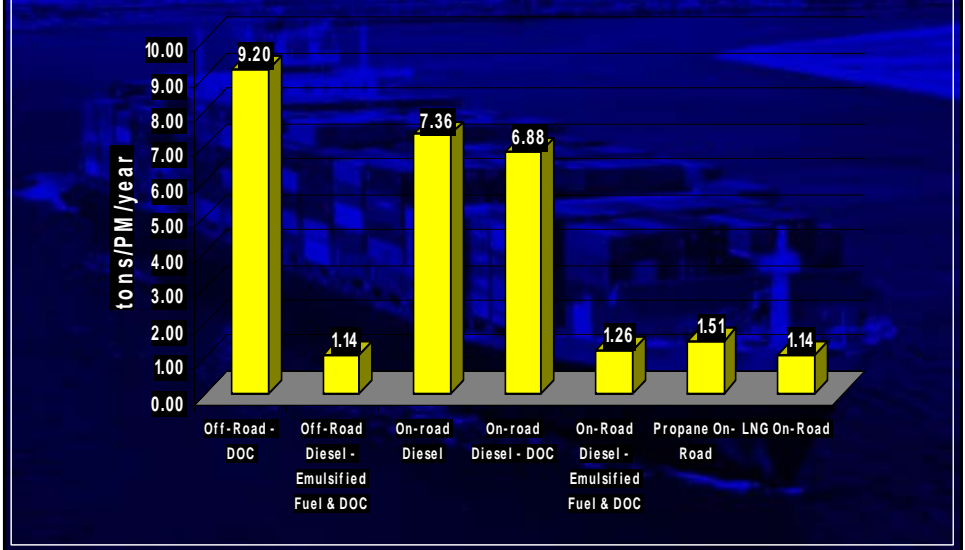
UCR Yard Tractor Emission Tests



Yard Tractor Emission Testing



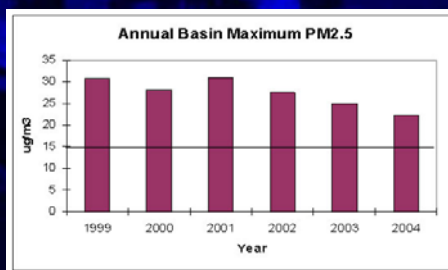
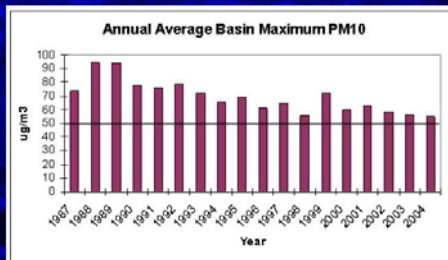
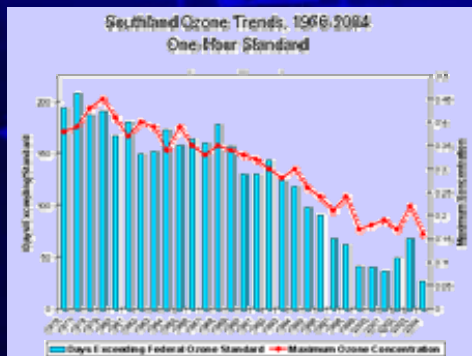
Particulate Emissions Reduced per Million Dollars



Next Steps

- **Good Science is Necessary**
 - Better Emissions Estimates
 - Ability to Measure Improvements
 - Cost Effectiveness **MUST** be a Consideration
- **Demonstrations are Needed to Prove New Technologies in Actual Use**
- **Funding is Needed until Regulations Catch Up**
 - Support Development of New Technologies
 - Support Voluntary & Incentive Programs

The Air is Getting Cleaner



**Thank you!
Questions?**



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