



Air Quality Regulations in the Maritime Industry: A Federal Perspective

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Overview



- Maritime Industry and Air Quality in U.S.
- EPA Roles and Responsibilities
- IMO Negotiations
- EPA Strategy on Sustainable Ports
- National Clean Diesel Campaign

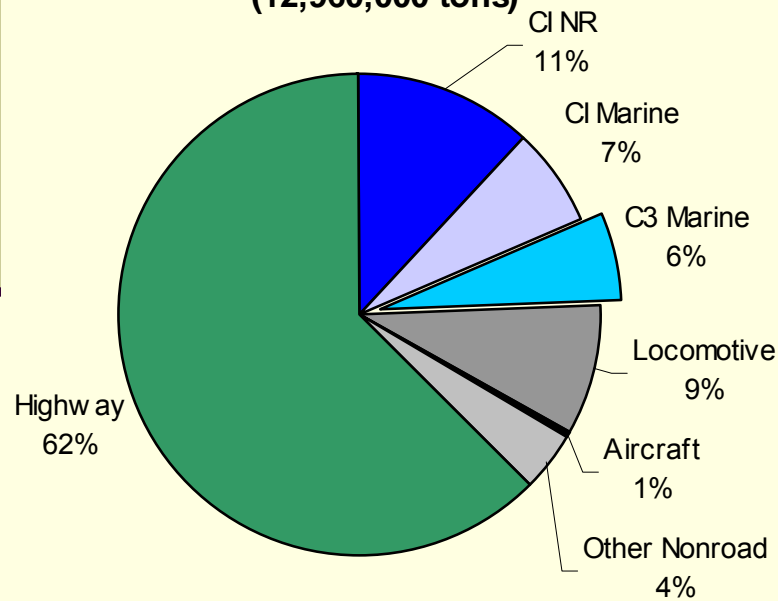
CLEANPORTSUSA
SVC

Inventory Overview of NO_x

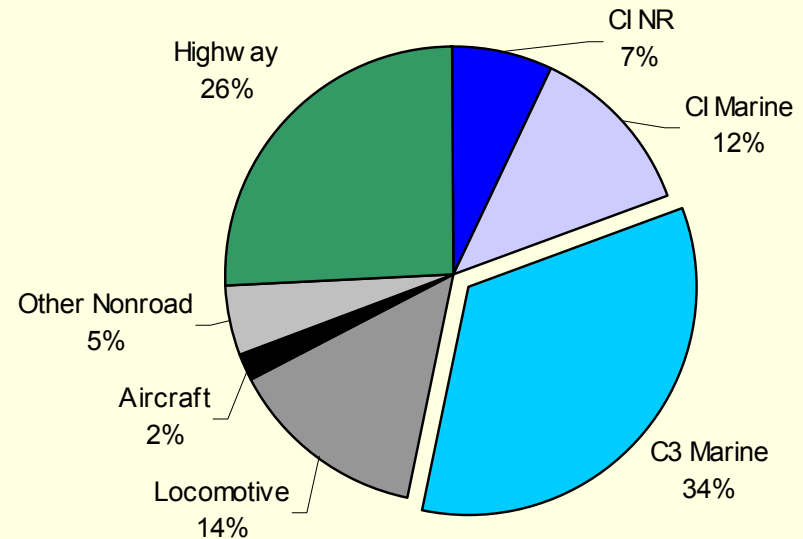


- Marine diesel engines contribute significantly to mobile source air pollution in the United States

**2001 Mobile Source NO_x Inventory
(12,960,000 tons)**



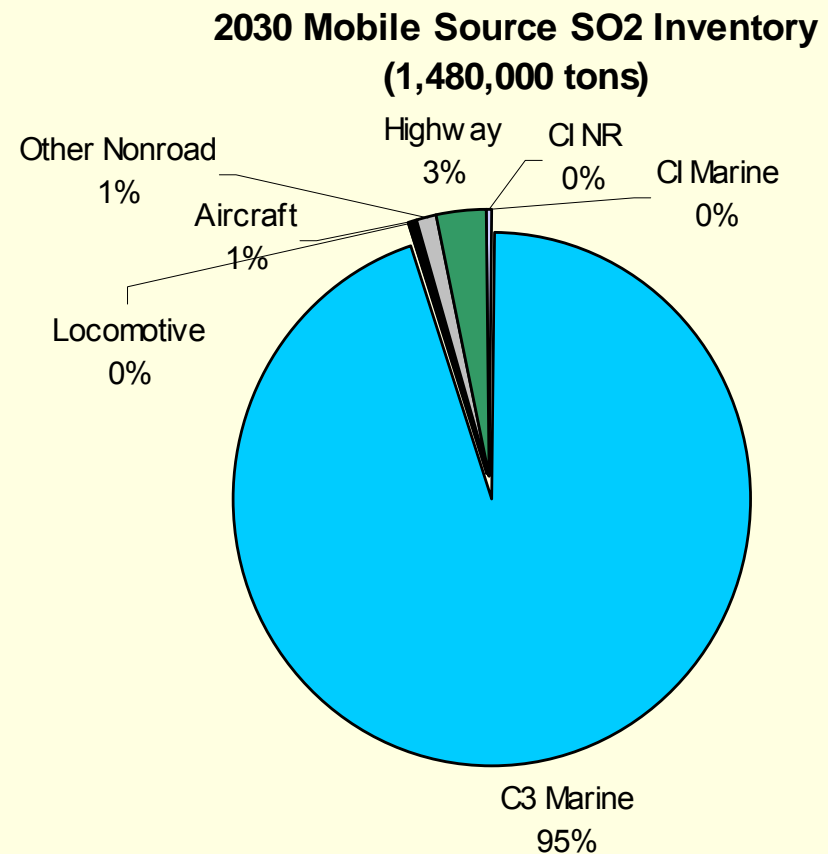
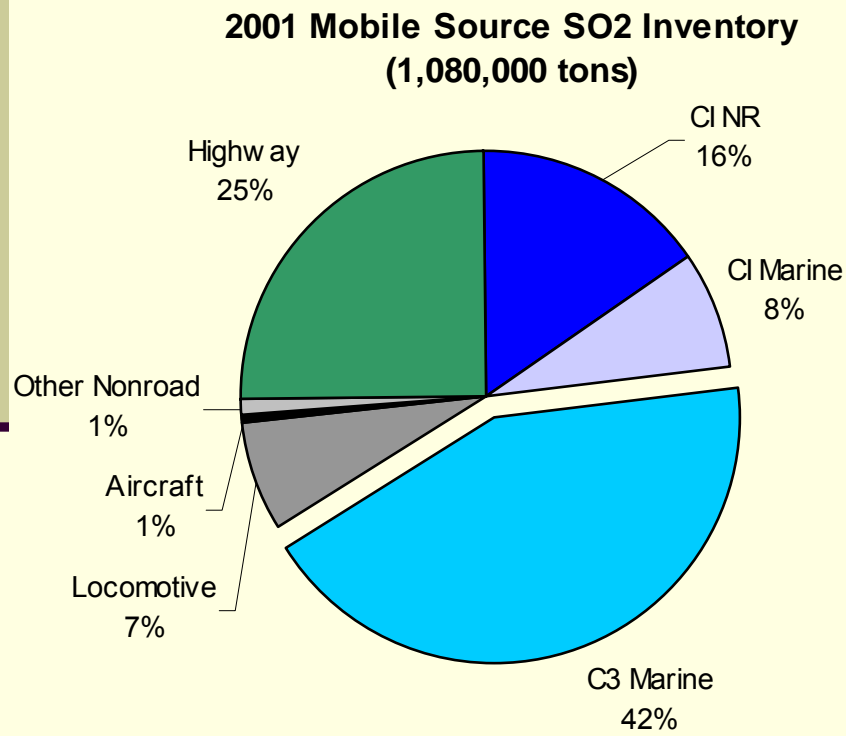
**2030 Mobile Source NO_x Inventory
(6,010,000 tons)**



Inventory Overview of SOx



- SOx emissions are high due to the sulfur content of residual fuel used in C3 engines

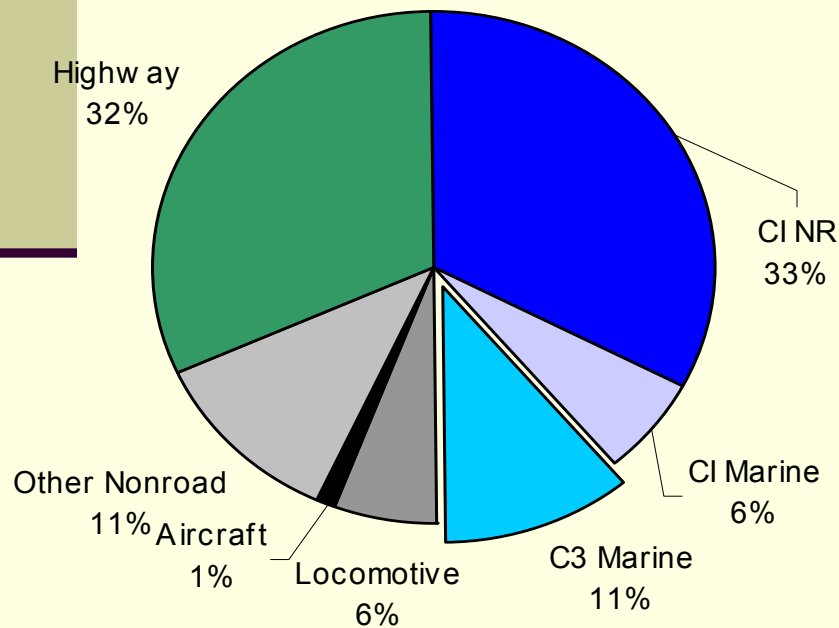


Inventory Overview of PM2.5

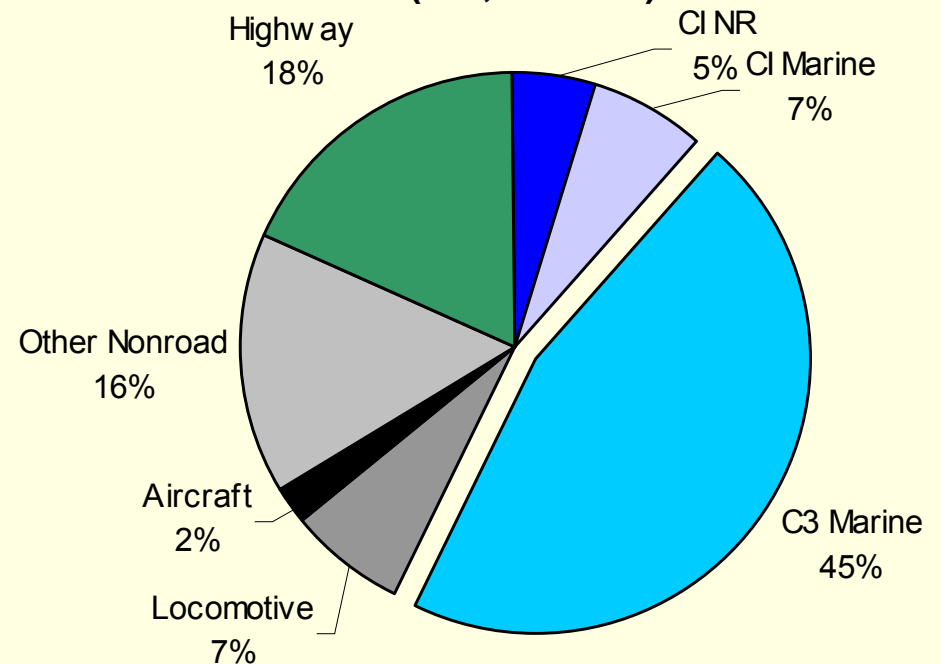


The marine diesel contribution is expected to grow as emissions from other sources decrease

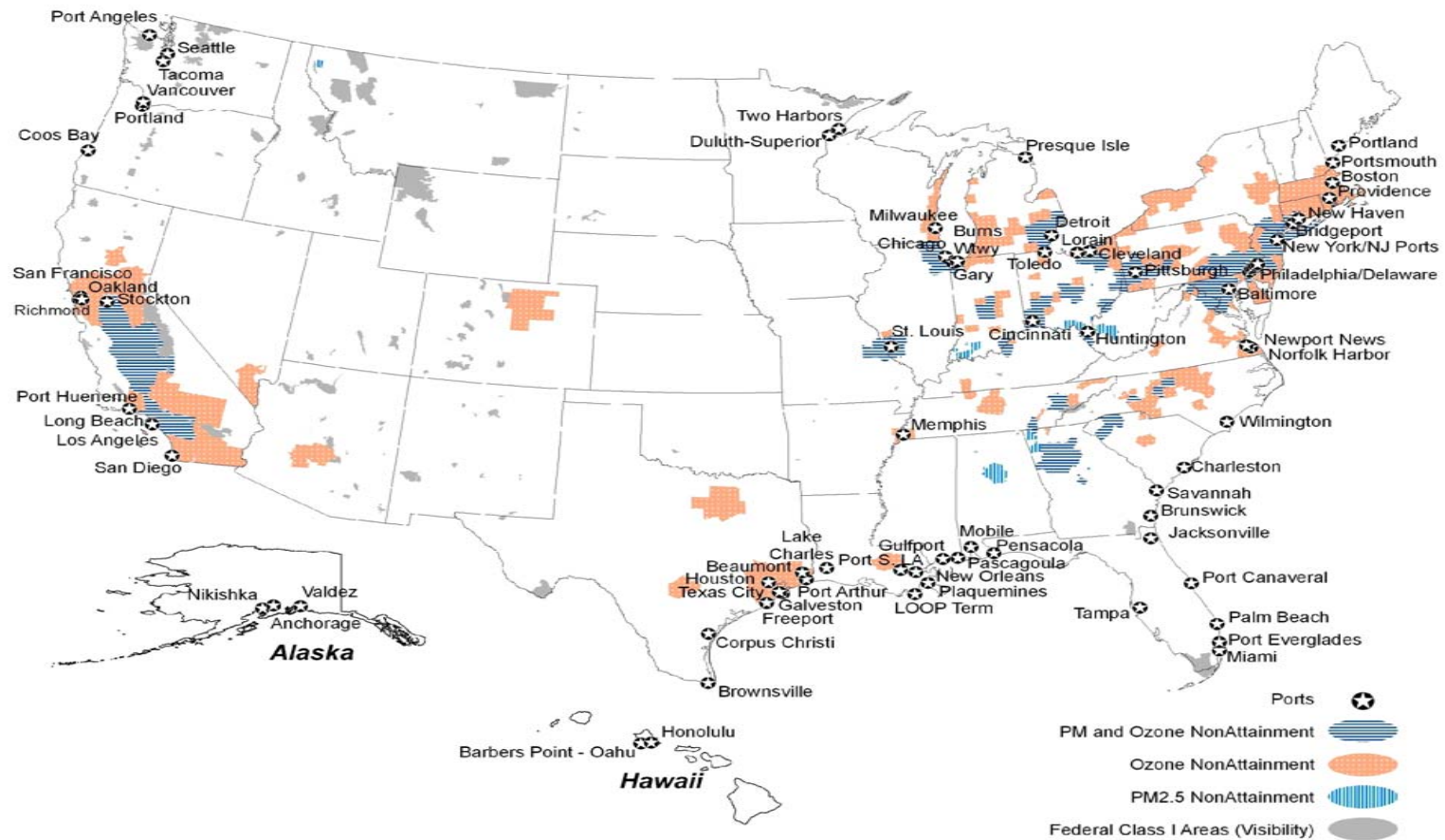
2001 Mobile Source PM2.5 Inventory
(500,400 tons)



2030 Mobile Source PM2.5 Inventory
(366,300 tons)



Ports and Nonattainment Areas in the U.S.



EPA Roles and Tools



- Set Health Based Standards
- Regulatory Tools
- Develop Technology Innovations, Verification, and Transfer Mechanisms
- Support Voluntary Efforts



EPA's Marine Engine Program



- EPA addresses 3 types of marine diesel engines
 - **Category 1:** >37 kW, up to 5 liters per cylinder
 - Similar in size to land-based nonroad engines
 - **Category 2:** 5 to 30 liters per cylinder
 - Similar in size to locomotive engines
 - **Category 3:** at or above 30 liters per cylinder
 - Very large engines for propulsion on ocean-going vessels
- EPA has addressed Small marine diesel engines (< 37 kW) in our Nonroad Engine program

What EPA Rules Cover-- Marine Diesels

<75 hp
<10,000/year



gen sets



sailboats

Recreational
~15,000/year

cruisers



yachts



Category 1 (<5 liter/cylinder)

Commercial



workboats



police boats



fishing vessels

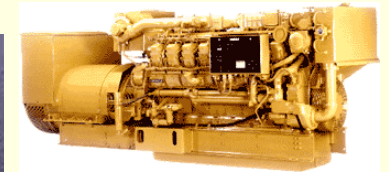
Category 2 (7 to 30 liter/cyl) <300/year



tugboats



ferries



auxiliary power for
ocean-going vessels

**Category 3
(>30 liter/cyl)**



Great Lakes freighters



ocean-going ships

EPA's Current Standards

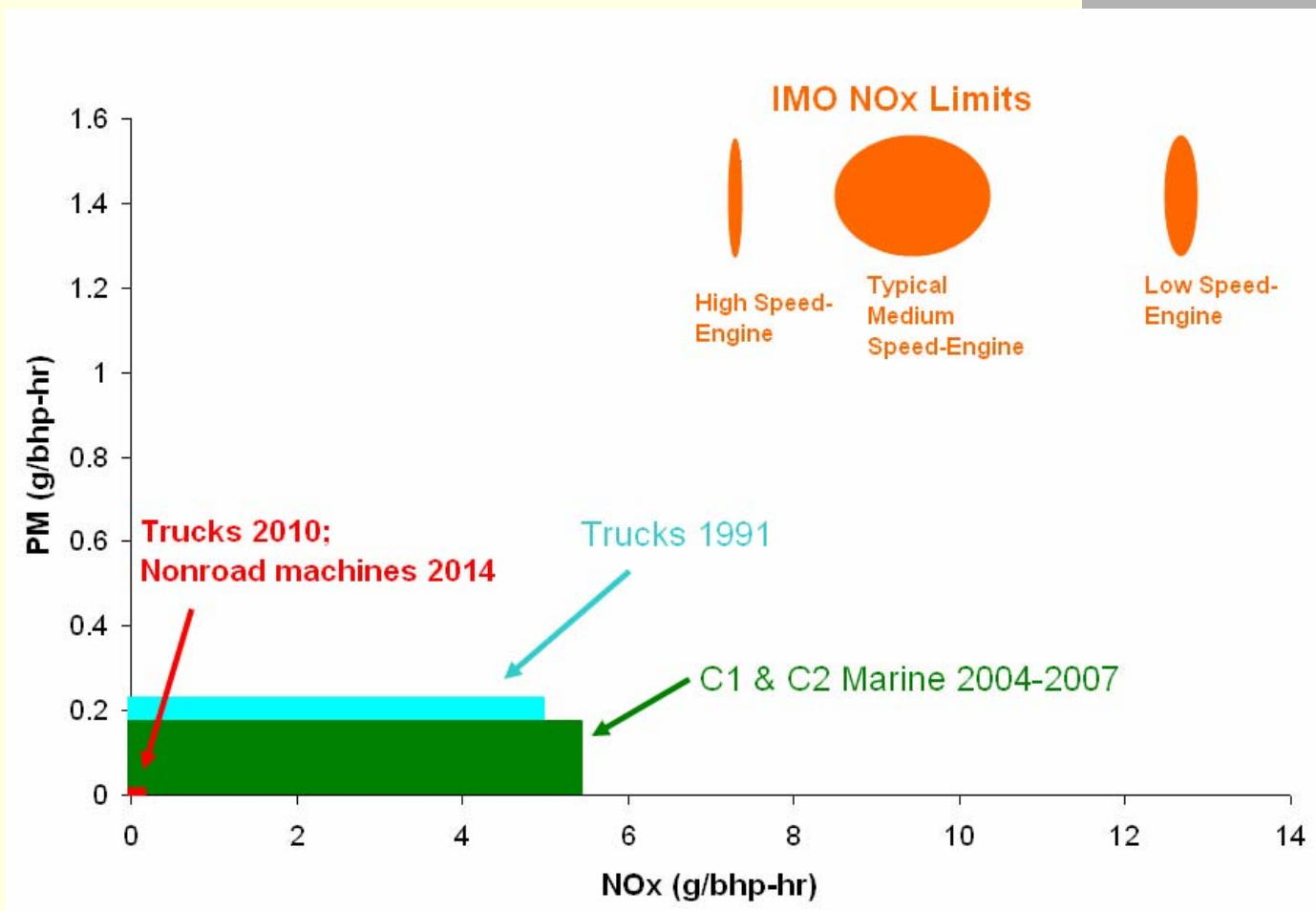


- EPA adopted emission standards for C1, C2, and C3 engines on U.S. vessels

- **C1 & C2:**
 - Engines below 2.5 liters per cylinder: EPA Tier 2 standards beginning 2004
 - Engines at or above 2.5 liters per cylinder:
 - MARPOL NOx limits beginning 2004
 - More stringent Tier 2 standards beginning 2007
 - The standards cover NOx, PM, HC, and CO emissions

- **C3:**
 - Engines at or above 30 liters per cylinder subject to MARPOL NOx limits beginning 2004

EPA's Current Standards



EPA's New Comprehensive 3-Part Program for C1 and C2 Engines



- 1. Tier 3 for newly-built engines
 - Based on internal engine improvements and technologies developed for nonroad Tier 3 and 4 engines
 - 50% PM↓ 20% NOx↓
 - Phases in 2009-2014, depending on engine size

- 2. Tier 4 for newly-built engines
 - Applies to commercial engines >600 kW
 - Based on high-efficiency aftertreatment: PM filters, urea SCR
 - 90% PM↓ 80% NOx↓
 - Phases in 2014-2017, depending on engine size

EPA's New Comprehensive 3-Part Program for C1 and C2 Engines



- 3. Remanufactured marine diesel engine program
 - Existing marine diesels are considered “new” and subject to EPA standards when they are remanufactured (starting ~October 2008)
 - All cylinder liners are replaced, either all at once or over a 5-year period
 - Commercial engines >600 kW manufactured in 1973 through Tier 2
 - At time of remanufacture, engine must be certified to the remanufacture standard if a certified system is available
 - If a remanufacture system has not been certified, there is no requirement
 - Standard: Minimum 25% PM reduction, no NOx increase
 - Expected to be met through “better” versions of parts normally replaced at rebuild

EPA's Ongoing C3 Program



- In our 2003 C3 rule, we made a commitment to issue an additional tier of standards no later than April 2007
 - Additional use and optimization of in-cylinder controls
 - More advanced technologies (i.e., SCR and water injection)

- We did not achieve that deadline
 - Released Final rule in November 2007 to extend the regulatory deadline for C3 marine engines from April 27, 2007 to December 17, 2009



EPA's Ongoing C3 Program



- We issued an Advance Notice of Proposed Rulemaking for C3 marine engines in November 2007
 - Described regulatory program we are considering, based on U.S. Government position paper submitted to IMO for the current round of international negotiations
 - Comments were due March 6, 2008
 - Proposal expected at the end of 2008

- We are very interested in ensuring that the decision reached at MEPC57 is formally adopted by the IMO since this result is generally consistent with what we believe is necessary to address the serious air quality problems we face in many areas of the world.

Outcome of Most Recent IMO Negotiations



- Latest Annex VI negotiations (MEPC 57)
March 31-April 4, 2008, in London

- Outcome is a very aggressive program that addresses emissions from new and existing engines and their fuels
 - Program is largely consistent with US proposal

- Next step: Final Adoption of Annex VI Amendments in October 2008

Outcome of Most Recent IMO Meetings



■ New engines

- Tier 2: 20% reduction from Tier 1 in 2012
- Tier 3: 80% reduction from Tier 1 in 2016
 - Exemption for certain vessels: recreational vessels <24 meters; commercial vessels with total installed power <750 kW
 - Geographic standard – applies in Emission Control Areas (ECAs)

■ Existing engines

- Tier 1 applies to engines above 5,000 kW and 90 l/cyl installed on ships constructed on or after 1/1/90 through 12/31/99, if a certified system is available
- Installation of certified system would occur at the first renewal survey that occurs 12 months after the system is certified

Outcome of Most Recent IMO Meetings



- Fuel Sulfur Limits (to address SO_x and PM)
 - March 2010: 10,000 ppm in ECAs
 - 2012: Global cap falls to 35,000 ppm
 - 2015: ECA cap falls to 1,000 ppm
 - 2020: Global cap falls to 5,000 ppm - subject to a review in 2018; if review indicates fuel will not be available, the date defaults to 2025
 - Program allows alternative measures to be used (e.g. scrubbers) for all of the emission limits

North American ECA



- Emission Control Areas are an important tool to address SO_x, NO_x, and PM, from ocean-going vessels
 - More stringent fuel and engine standards would apply to all ships operating in the designated area regardless of flag

- EPA investigating the feasibility of a North American ECA
 - Contribution of ships: emissions, air quality impacts on land
 - Technological feasibility
 - Air Quality Benefits
 - Economic impacts
 - Collaborative effort: States, Canada, Mexico

Strategy for Sustainable Ports



- EPA has developed a **Strategy for Sustainable Ports** to help guide the agency as it continues to engage public port authorities and other stakeholders in voluntary efforts to reduce the environmental impacts associated with moving goods through the marine transportation system.
- The Strategy supports existing and new EPA programs and projects that will produce measurable results in 2008 and beyond.
- EPA headquarters and regional offices have made commitments to work with others to implement specific actions in the Strategy based on their priorities.

National Clean Diesel Campaign



- **Two components**
 - Regulatory
 - Innovative

- **Technology-driven**
- **Cost-effective**
- **Helping communities achieve public health goals**
- **Appropriation for the first time under Energy Policy Act (\$49.2 million in FY08)**
 - Verified/Certified technologies and engines
 - RFP released end of March





Additional Actions

- Port authority lease agreements
- Eco-speed programs (e.g., Port of Long Beach)
- “Cold ironing” or shore-side electric power (e.g., AMP)
- Freight owners interest in sustainable environmental footprint
- Technologies and cleaner fuel demonstrations

Additional Information



- More information about EPA's marine diesel engine emission control programs:
 - www.epa.gov/otaq/marine.htm
 - www.epa.gov/cleandiesel

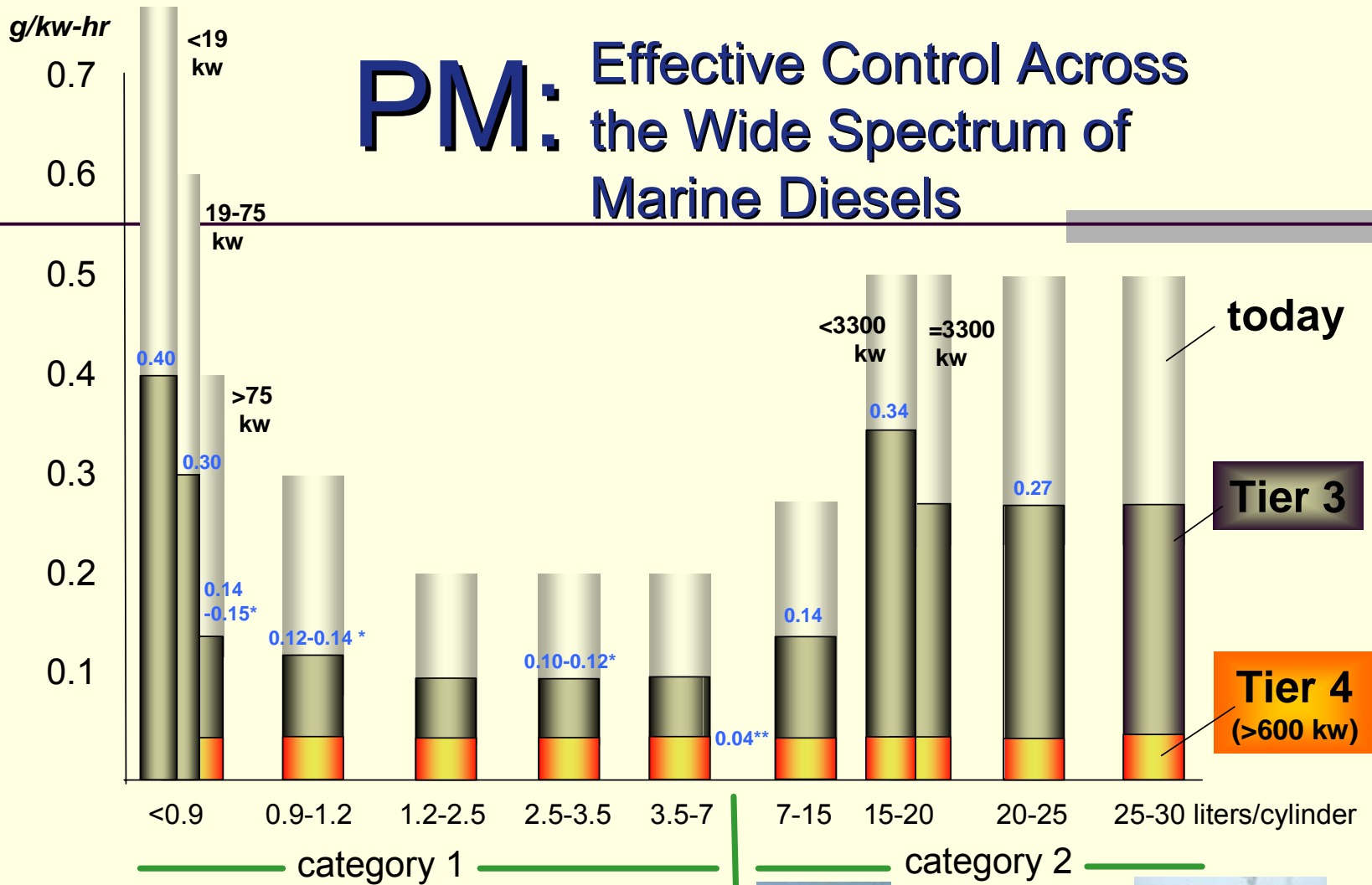
- Contacts:
 - Trish Koman 734-214-4955
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Appendix – EPA's New Tier 3 and Tier 4 Standards

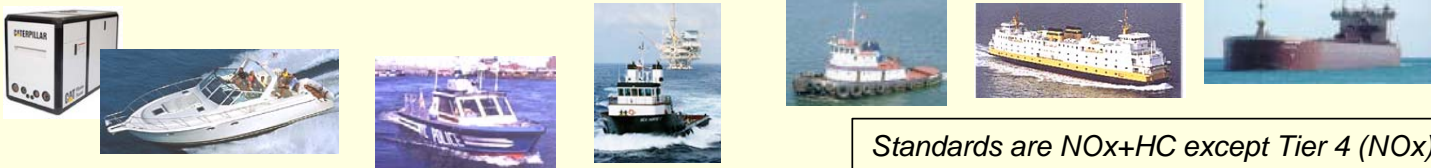
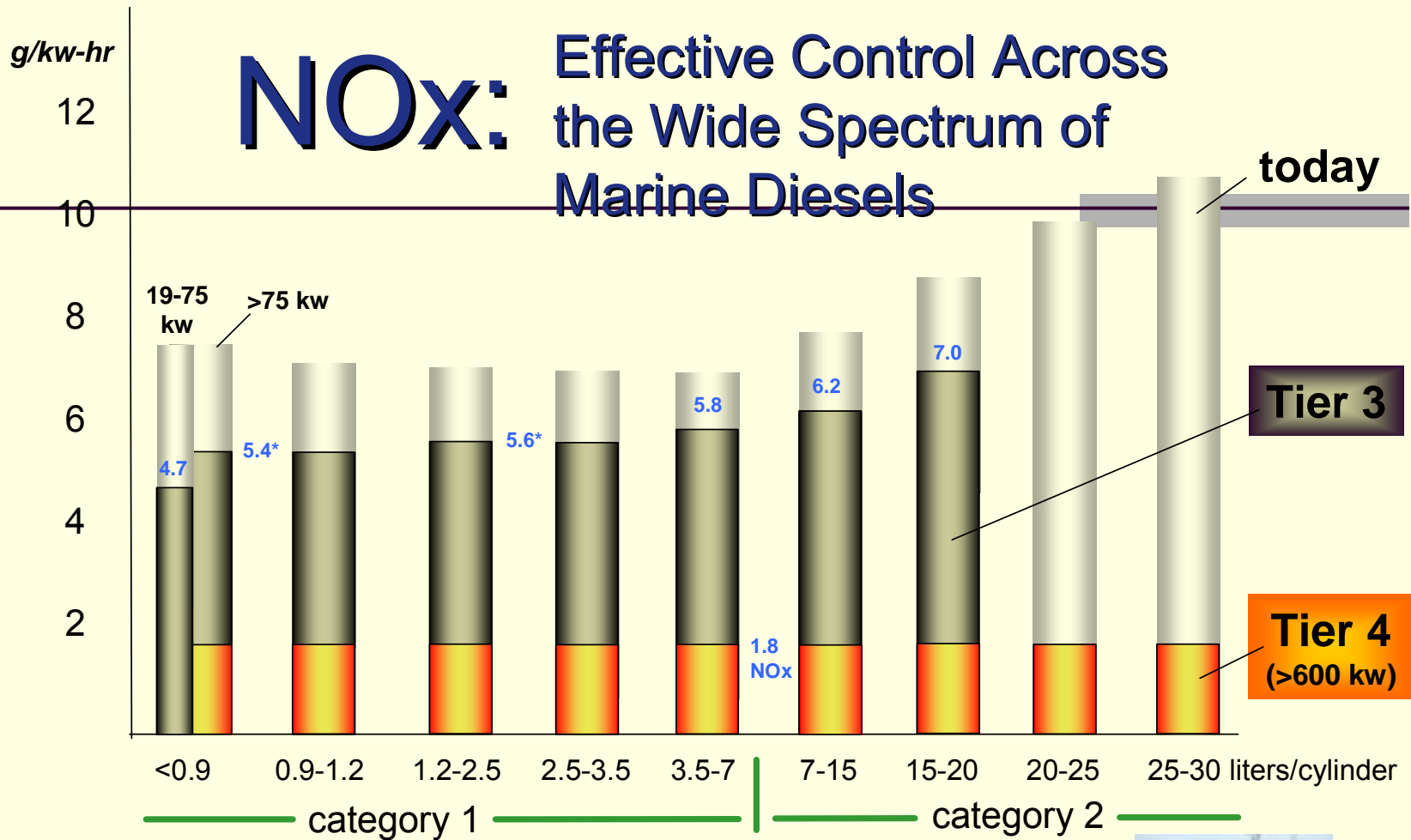


PM: Effective Control Across the Wide Spectrum of Marine Diesels



* higher #s are for hi-power density engines.
 ** 0.06 for the very largest (>3700 kw) engines.

NOx: Effective Control Across the Wide Spectrum of Marine Diesels



Standards are NOx+HC except Tier 4 (NOx).
 Tier 3 NOx replaced by early Tier 4 for >2000 kw.
 * 5.8 for hi-power density engines.