EPA's Locomotive (and Marine Diesel) Proposal

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Railroad Emissions
Technology Symposium
Sacramento June 6, 2007

Reconciling Diesels with the Environment: **EPA's National Clean Diesel Campaign**

Tier 2 Light-Duty
final rule 1999
fully phased in 2009
Diesels held to same stringent standards as gasoline vehicles

Heavy-Duty Highway
sales 800,000 / yr
40B gallons / yr
final rule 2000
fully phased in 2010

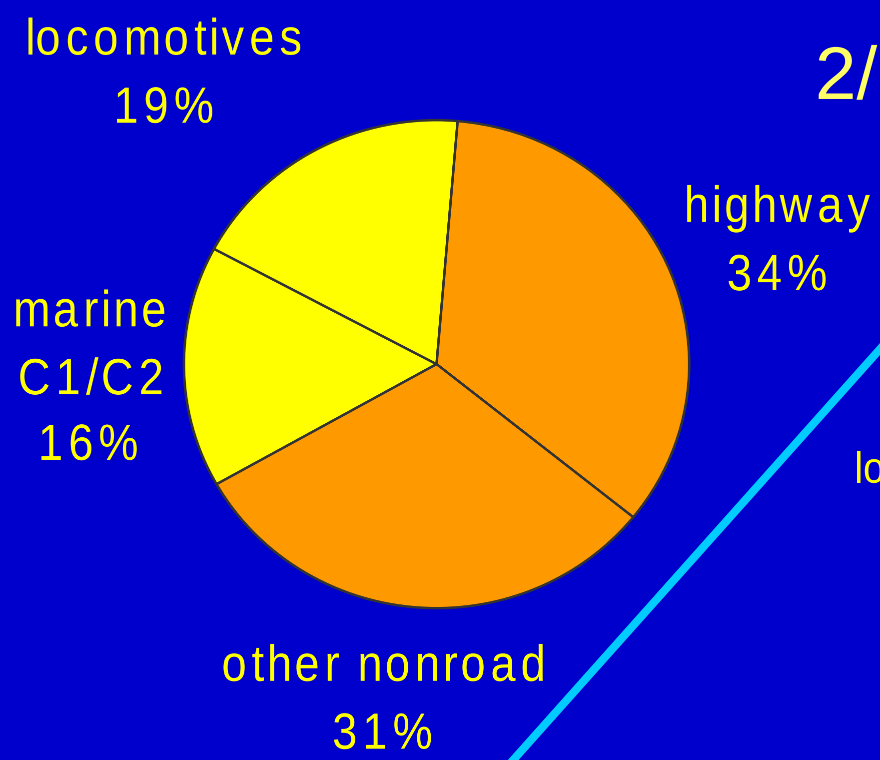
Locomotive / Marine
sales 40,000/yr
(1000 locomotives)
6B gallons / yr
proposal 2007
fully phased in 2017

Nonroad Diesel
sales over 650,000 / yr
12B gallons / yr
final rule 2004
fully phased in 2015

Major Mobile Source -- 1/3 of NOx and 2/3 of diesel PM in 2030

Mobile Source NOx

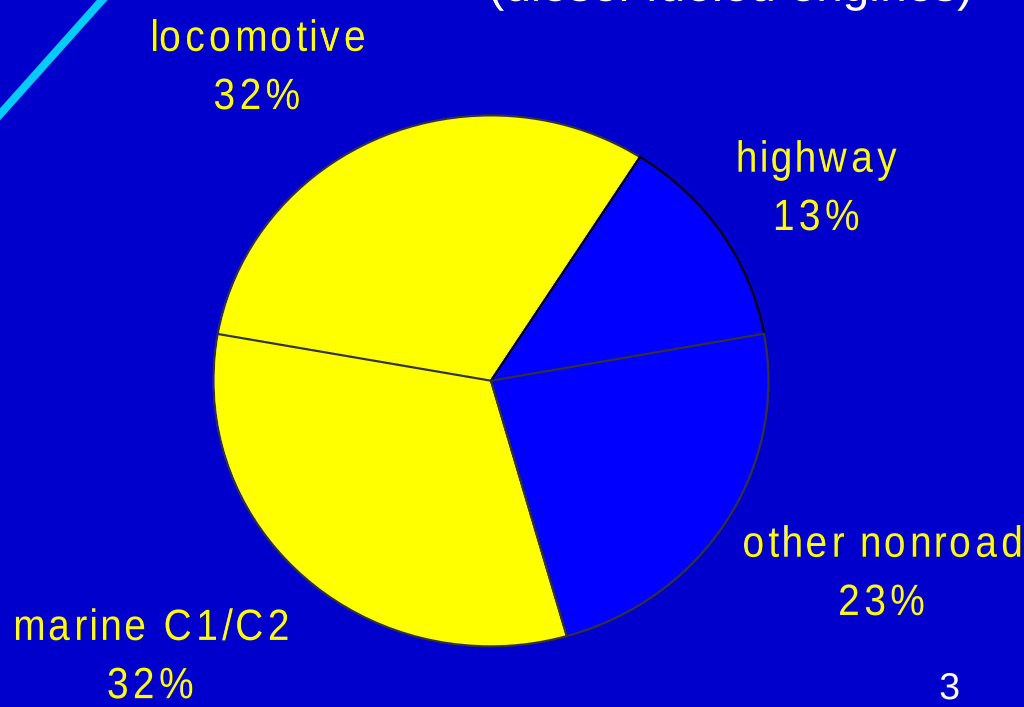
Total=4,500,000 tons/yr



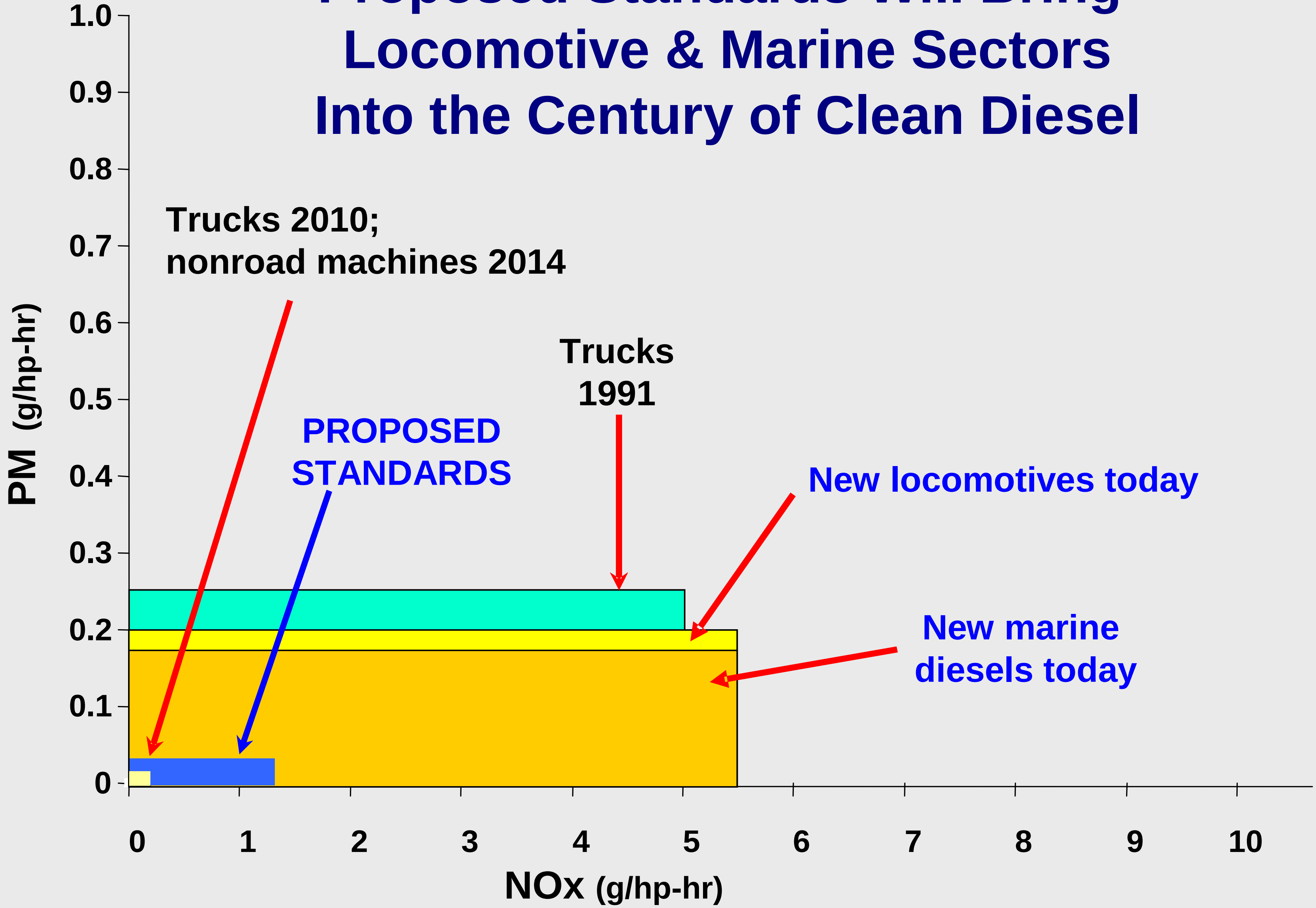
Diesel $PM_{2.5}$

Total=78,000 tons/yr

(diesel-fueled engines)



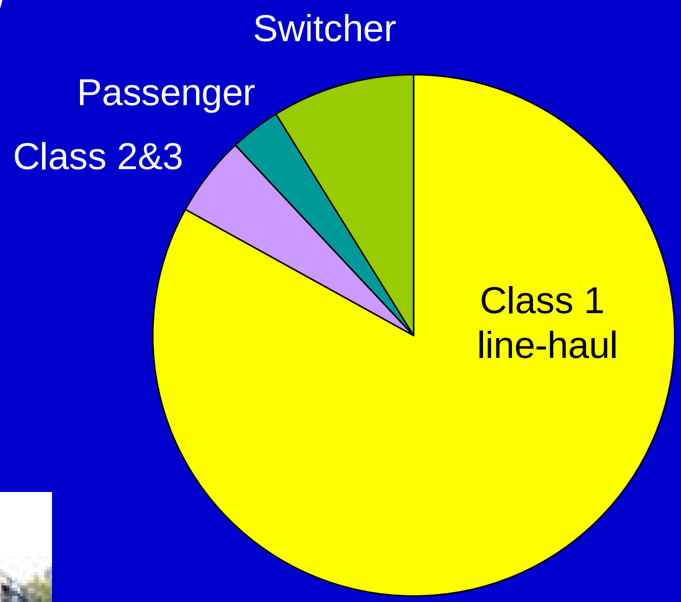
Proposed Standards Will Bring Locomotive & Marine Sectors Into the Century of Clean Diesel



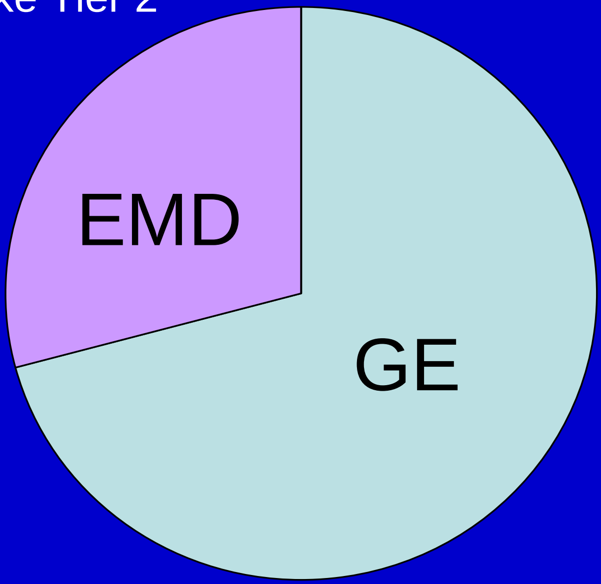
North American Locomotive Market:

2 Major Builders (GE & EMD)

8 Major Customers (Class 1 railroads + Amtrak)



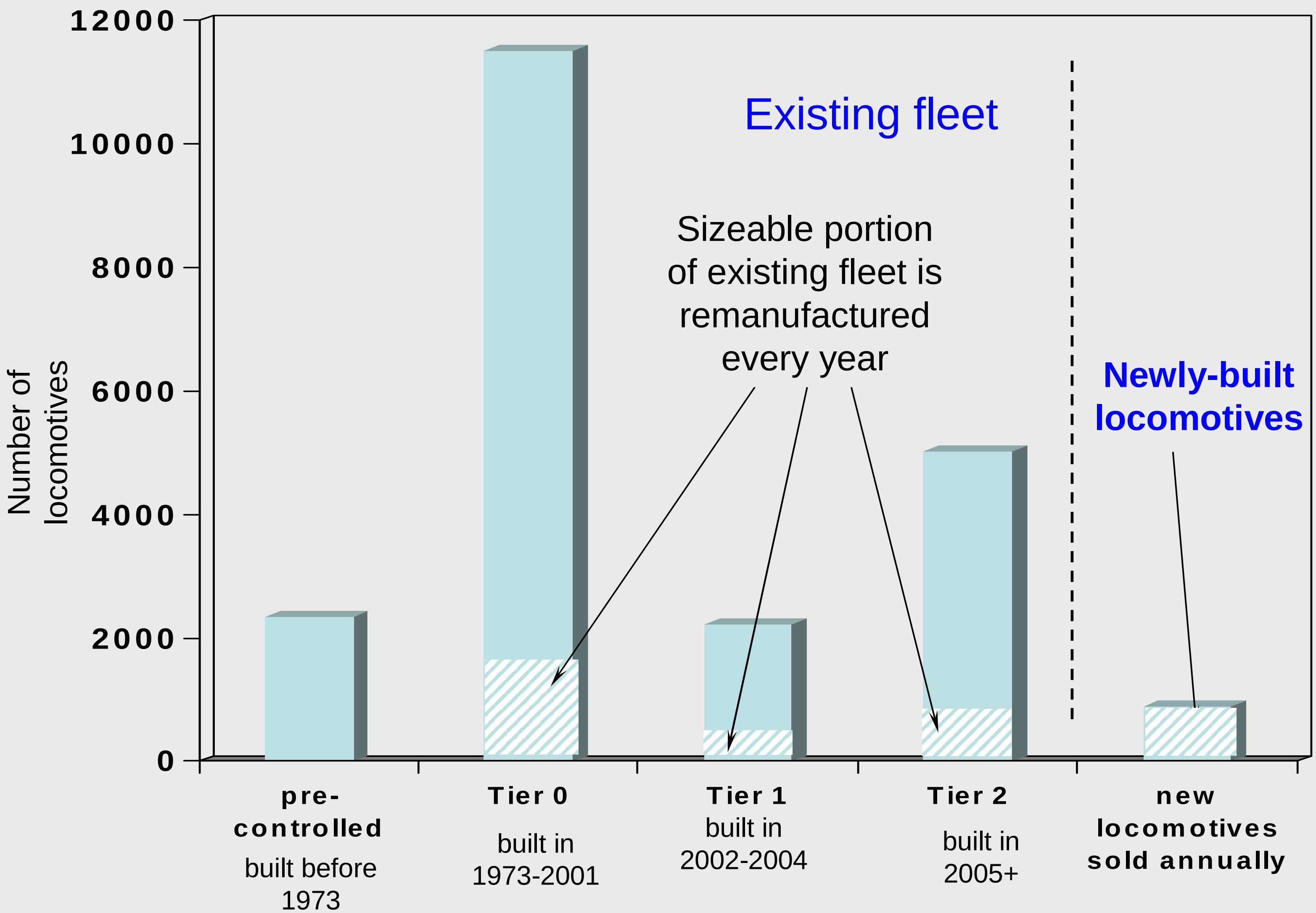
EMD 710 series
2-stroke Tier 2



GE Evolution series
4-stroke Tier 2

- BNSF,
- Union Pacific,
- CSX,
- KC Southern,
- Norfolk Southern,
- Canadian Pacific,
- Canadian National

Addressing Emissions from New and Existing Locomotives



Phase-in of Proposed Standards

Locomotives

- 2008 — **remanufactured Tier 0, 1 & 2--** if certified system available; mandatory in 2010 (Tier 0/1) and 2013 (Tier 2)
- 2009
- 2010
- 2011 — **Tier 3 (switcher)**
- 2012 — **Tier 3 (line-haul)**
- 2013
- 2014
- 2015 — **Tier 4 (switcher)**; **Tier 4 PM (line-haul)**
- 2016
- 2017 — **Tier 4 NOx (line-haul)**

Marine

- Tier 3 (<75 kW) — 2009
- Tier 3 (75-3700 kW) — 2012, 2013, 2014
- Tier 4 (>600 kW) — 2014, 2016, 2017

Proposed Line-Haul Locomotive Standards

locomotive group	date	PM standard (g/hp-hr)	PM reduction %	NO_x standard (g/hp-hr)	NO_x reduction %
Remanufactured Locomotive Standards					
Remanufactured Tier 0 & 1	2008 as available 2010 required	**0.22**	~60%	**7.4 - 8.0**	~20%
Remanufactured Tier 2	2008 as available 2013 required	**0.10**	50%	**5.5**	--
Newly-built Locomotive Standards					
Tier 3	2012	**0.10**	50%	**5.5**	--
Tier 4	PM 2015 NO_x 2017	**0.03**	~90%	**1.3**	80%

If no SLAC

- *2015 & 2016 locomotives must meet Tier 4 NOx at 1st rebuild*
- *Idle reduction required for all Tier 0 – Tier 4*

Switch Locomotive Provisions

New standards equivalent to, or more stringent than, line-haul --

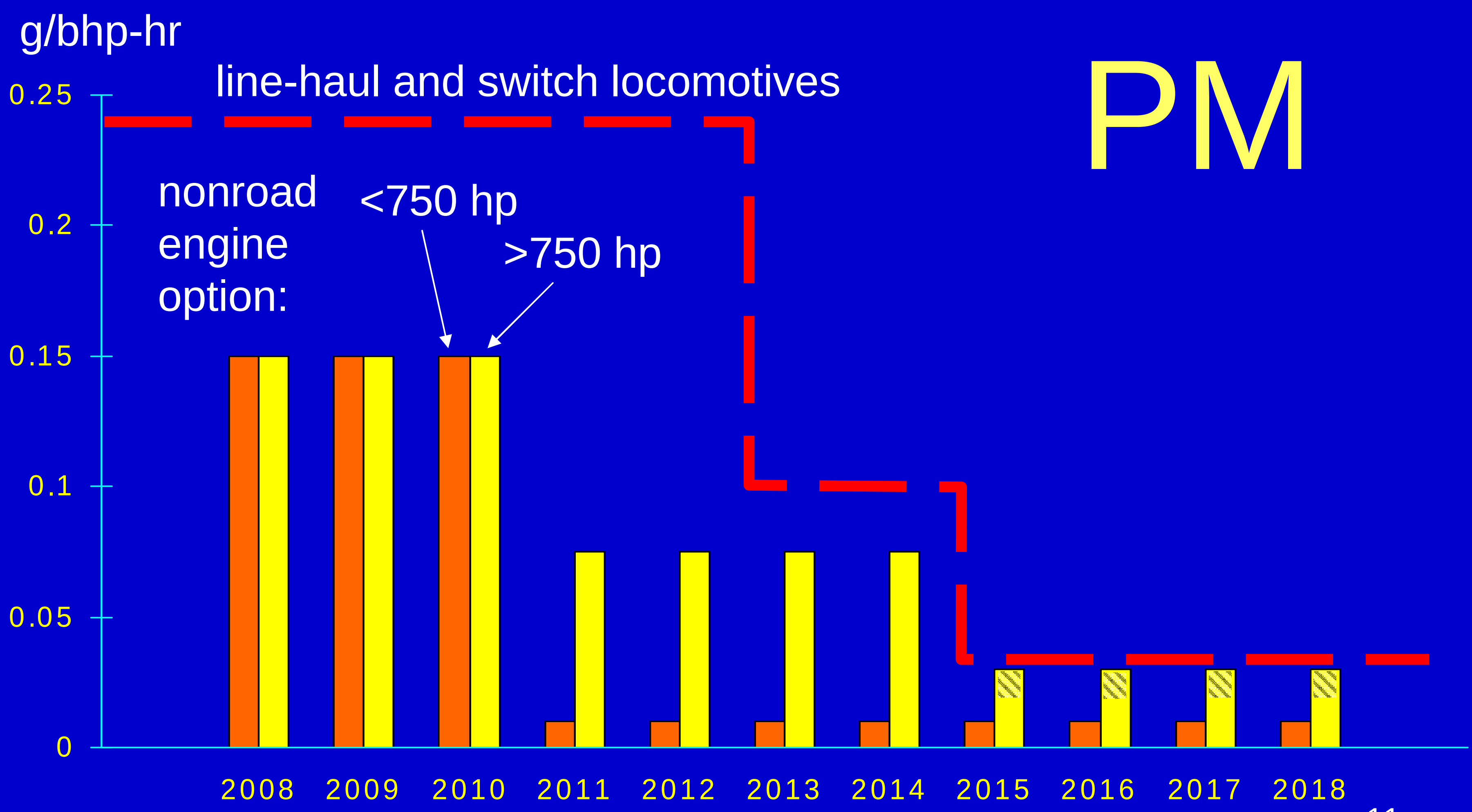
- Tier 3:
  - 1 year earlier (2011) and
  - 10% lower NOx (5.0g)
- Tier 4:
  - Aftertreatment-based NOx 2 years earlier (2015)
  - Provides opportunity to get familiar with urea in controlled (railyard) setting
- Tier 0-2 remanufactured engine standards:
  - proportional to line-haul; same years

More Switch Locomotive Provisions

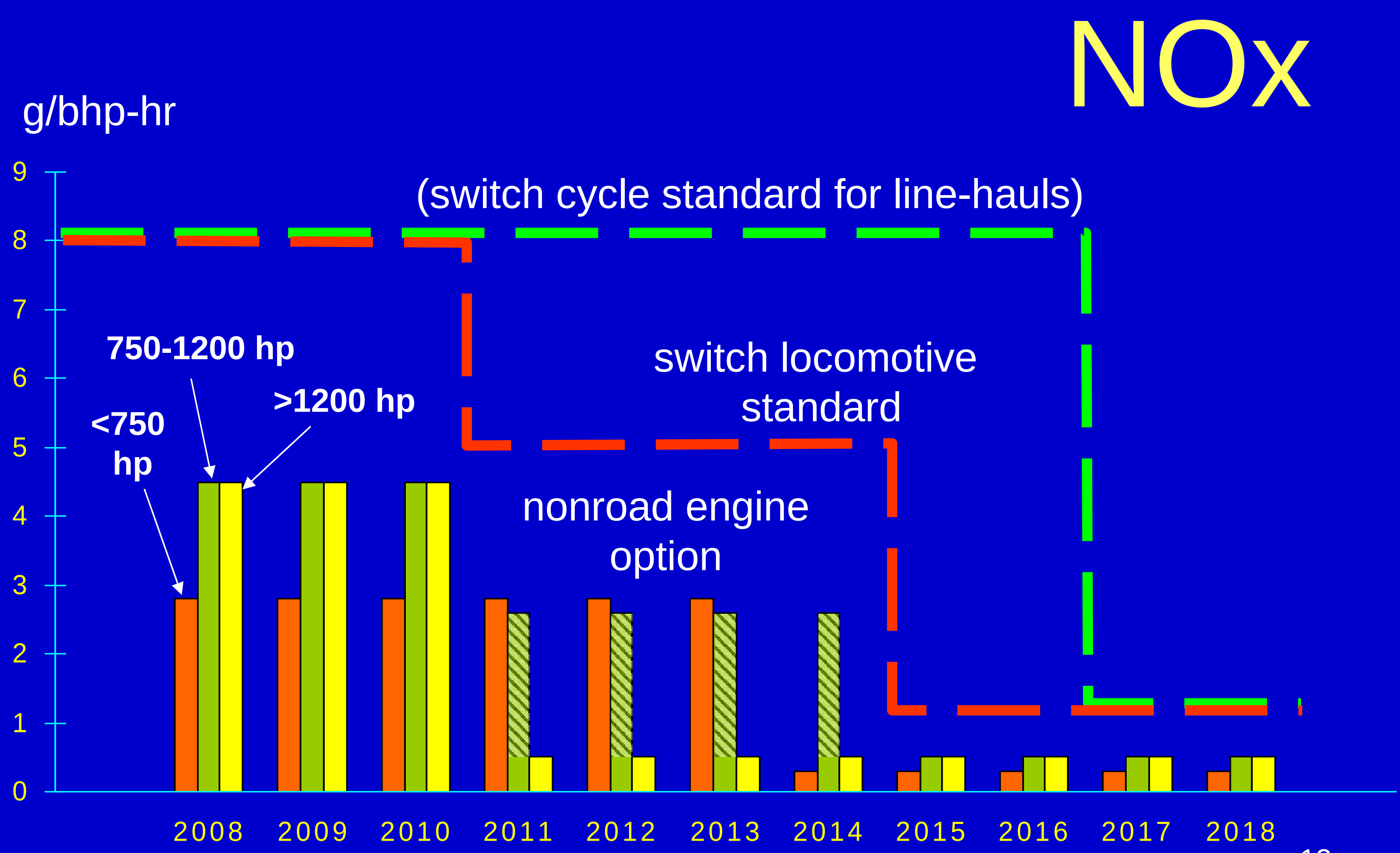
Flexibilities to encourage new clean switchers

- Standards can be met both with high-rpm (nonroad) and traditional medium-rpm engine designs
- Added provision to allow NR-certified engines
  - Allowed for 10 years (thru 2017)– to jumpstart program
  - Encourages smaller innovative manufacturers who do not make engines
    - By 2011: some NR engines will have PM filters, some will have SCR+EGR
- Comment requested on how to encourage scrappage of old switchers

Stringent Standards for Switchers



Stringent Standards for Switchers



Other Locomotive Provisions

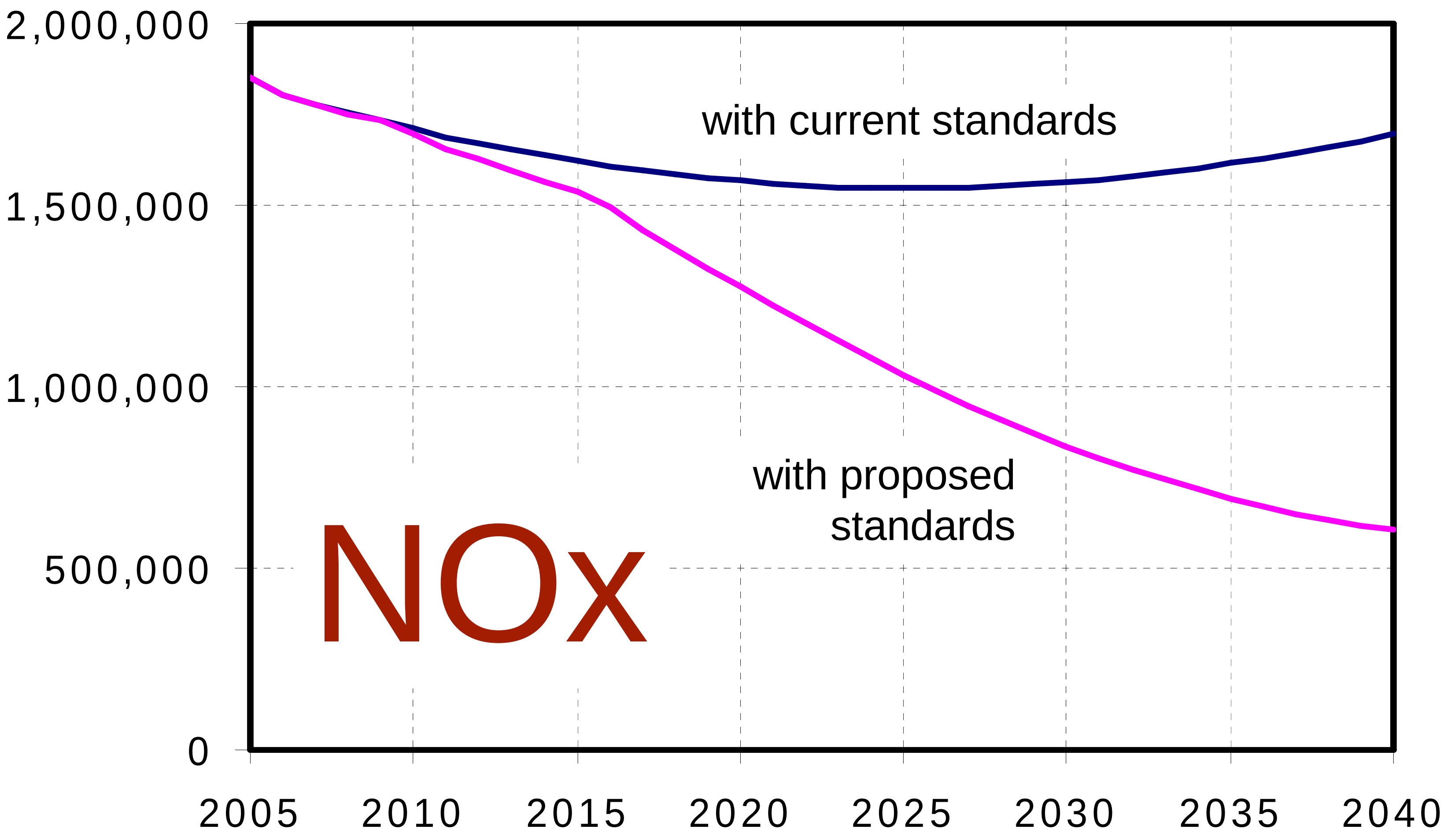
- 0.14 g/hp-hr Tier 4 HC standard
- Flexible averaging, banking, trading credit program
- Drop switch cycle requirement for Tier 4 line-hauls
- Drop smoke standard in Tier 4
- In-use add-ons to Tier 4 standards for 1st 3 model years
- Clarify Mexican/Canadian locomotive exemption
- Small entity flexibilities
- Compliance requirements for maintaining urea levels
- A number of additional test and certification changes

- Comment requested on:
  - Extending carryover recertification to owner/operators
  - Clarifying locomotive selection criteria for in-use railroad testing
  - Requiring engine diagnostic systems in Tier 4
  - Considerations for locomotives designed to operate in a consist

Proposed Marine Diesel Standards
and reductions from previous levels

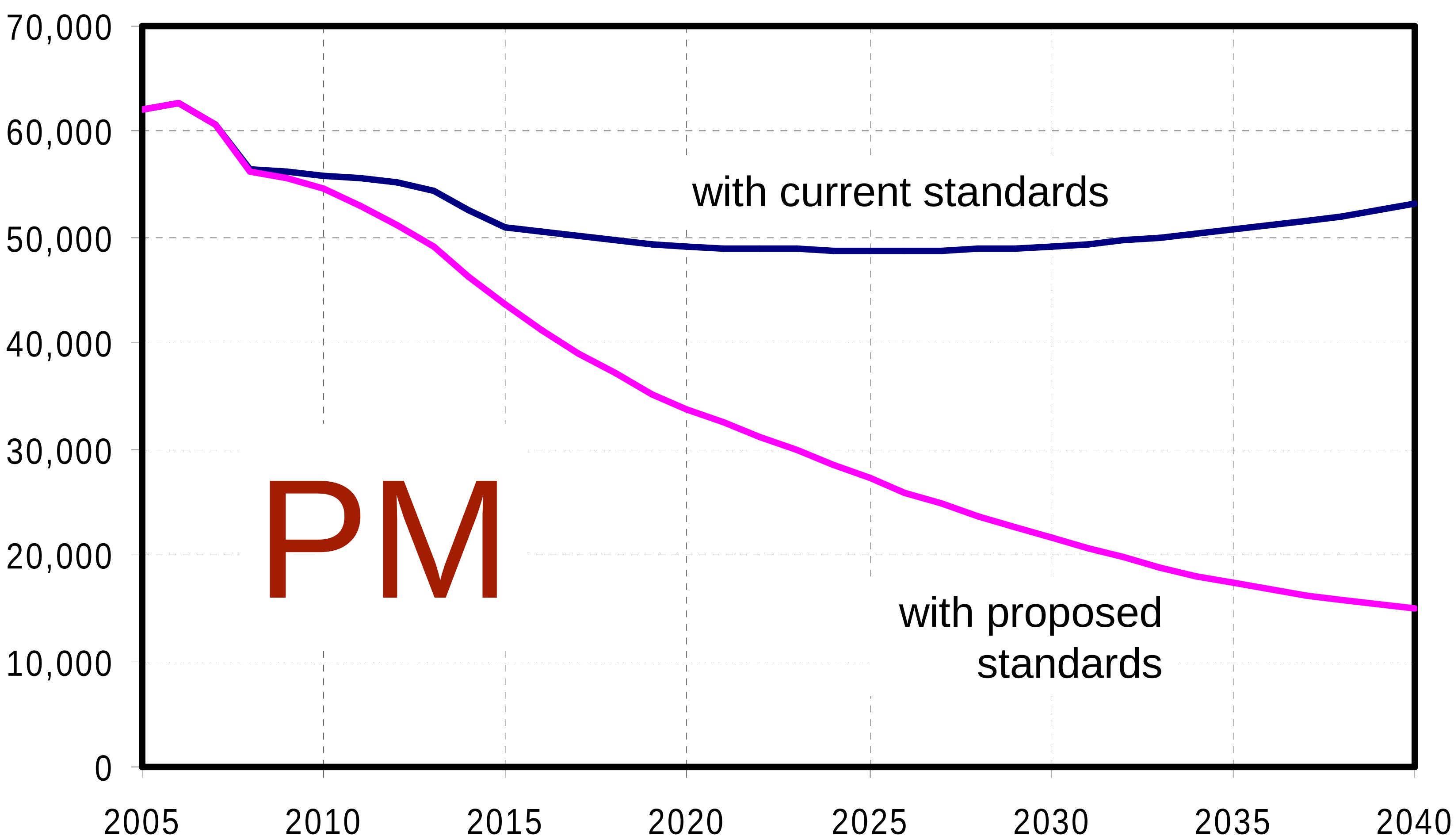
	date	PM		NO_x	
		standard (g/hp-hr)	reduction %	standard (g/hp-hr)	reduction %
New Interim (Tier 3)	2009-2014	**varies by engine size**	~50%	**varies by engine size**	~20%
New Long-Term (Tier 4) Commercial >600kW	2014-2017	**0.03**	~90%	**1.3**	~80%
Existing Marine Engines (requesting comment on remanufacturing stds)	2008	**20-60% reduction**		**0-20% reduction**	

Reductions From Proposal
nationwide annual NOx tons



Reductions From Proposal

nationwide annual $PM_{2.5}$ tons



Proposal Annual Costs and Benefits in 2030

	PM	NO_x
Cost	$159M	$446M
Inventory reduction, tons	28,000	765,000
Cost per ton	$5560	$580
Unit cost as % of typical new locomotive price (similar for marine; varies vessel to vessel)	3%	
Monetized benefits	$12B	
Benefit to cost ratio	20:1	

The Process Toward Completion

- Proposal signed March 1
- Available at EPA's website: http://www.epa.gov/otaq/locomotv.htm#regs
- Hearings in Seattle May 8 and Chicago May 10
- Comment period will close July 2
- Targeting final rule by the end of the year

What Did People Say About the Proposed Locomotive Program at the Hearings?

- Broad general support.
- EPA should work to finalize by end of year.
- State/local governments and environmental groups argued for accelerating reductions, especially NOx.
- Emission control manufacturers were very positive about feasibility of Tier 4 PM and NOx technologies.
- A number of improvements to testing and certification requirements suggested.