

EPA's New Program for Clean Nonroad Diesel Engines & Fuel



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U.S. EPA

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EPA's New Program to Clean Up Nonroad Diesels

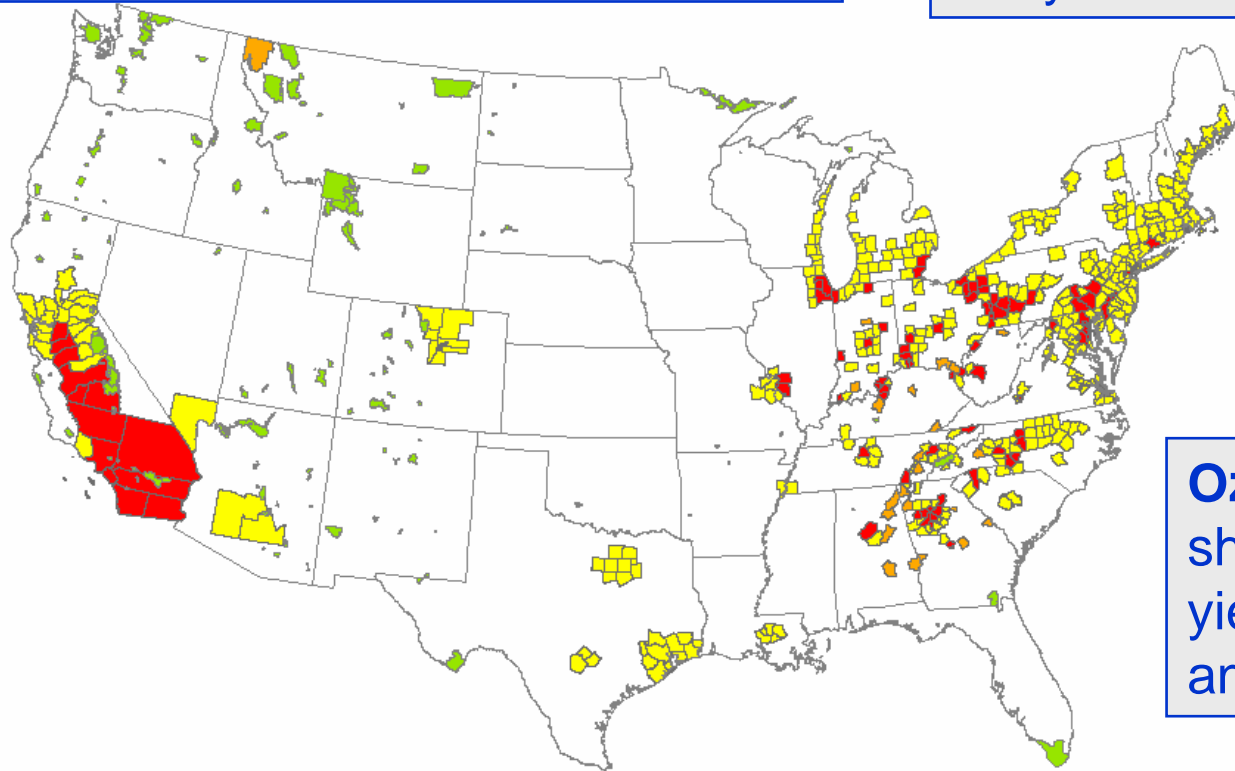
- Nonroad diesels and air quality
- A challenging sector
- A systems solution
- The fuel program
- The engine program
- The costs
- The benefits



Widespread Need for Air Pollution Reductions

65 million people live in areas that violate the fine PM air quality standard; **159 million** people live in areas that are not in attainment for ozone

Fine particles from diesel exhaust can remain in the atmosphere for weeks, and carry over hundreds of miles



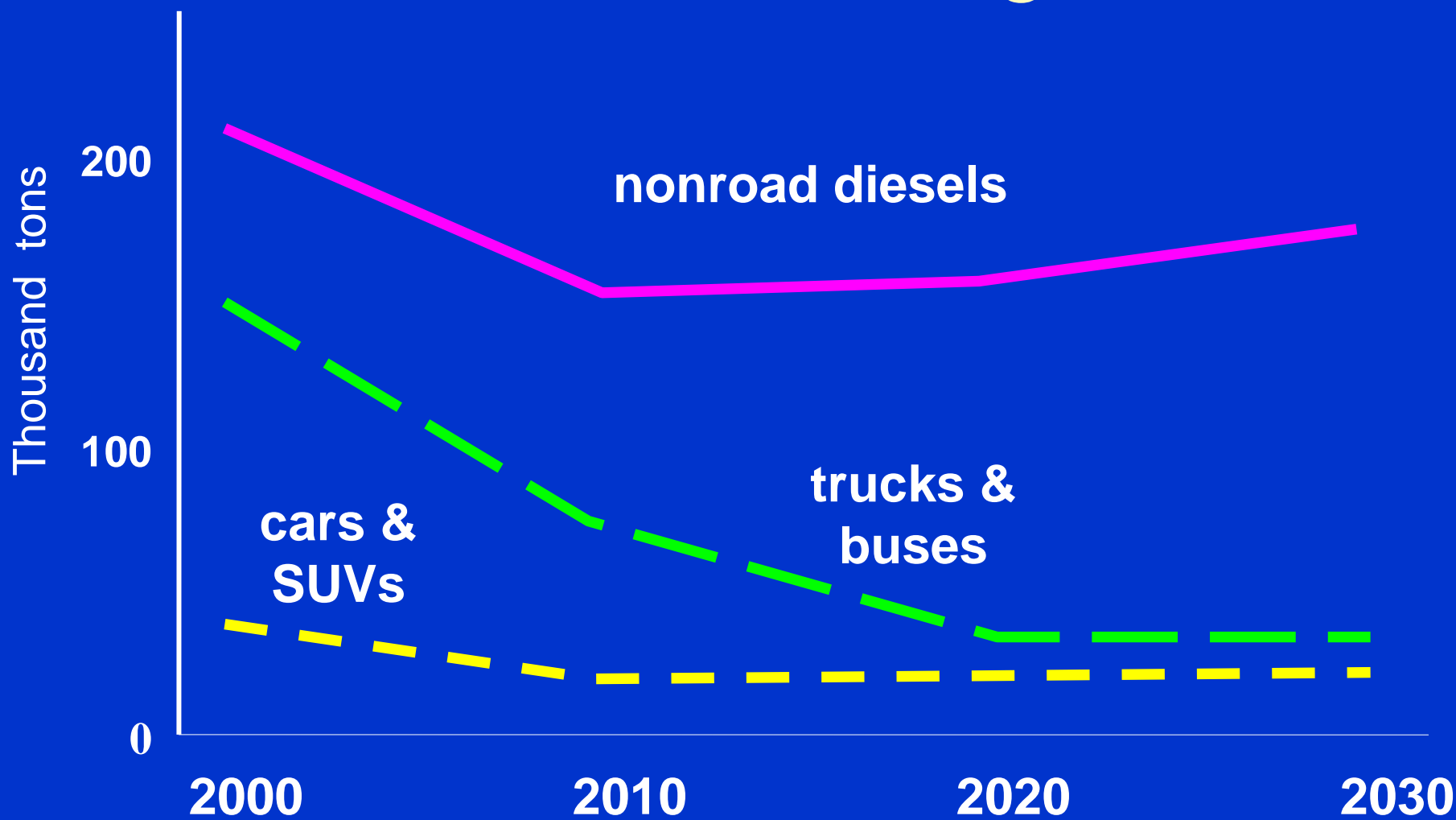
Diesel exhaust is **likely to be carcinogenic** to humans

Ozone has been shown to reduce yields of vegetables and field crops

- 8 Hour Ozone Nonattainment Areas
- Counties Exceeding PM_{2.5} NAAQS
- 8 Hour Ozone Nonattainment AND PM_{2.5} NAAQS Exceedances
- Federal Class I Areas (Visibility)

Clean Air Act requires EPA to take steps to remedy regional haze in **156 pristine “Class I”** areas

Mobile Source PM Projections Without This Program



Controlling Nonroad Diesel Emissions Presents Some Challenges

- Engines vary from 3 to 3000 hp
- Used in thousands of machine models
- High hurdles for emissions controls--
 - Users demand rugged machines
 - Must work in extreme conditions
- Nonroad diesel fuel is currently unregulated
 - Has ~3000 ppm sulfur (10 x more than highway fuel)
 - Harms sulfur-sensitive control technologies

skid steer loader 80 hp



genset 20 hp

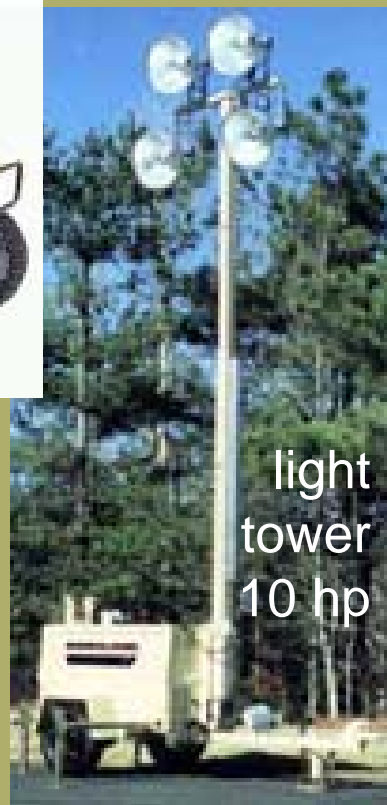


backhoe loader 80 hp

2WD tractor 130 hp



utility vehicle 18 hp



light tower 10 hp



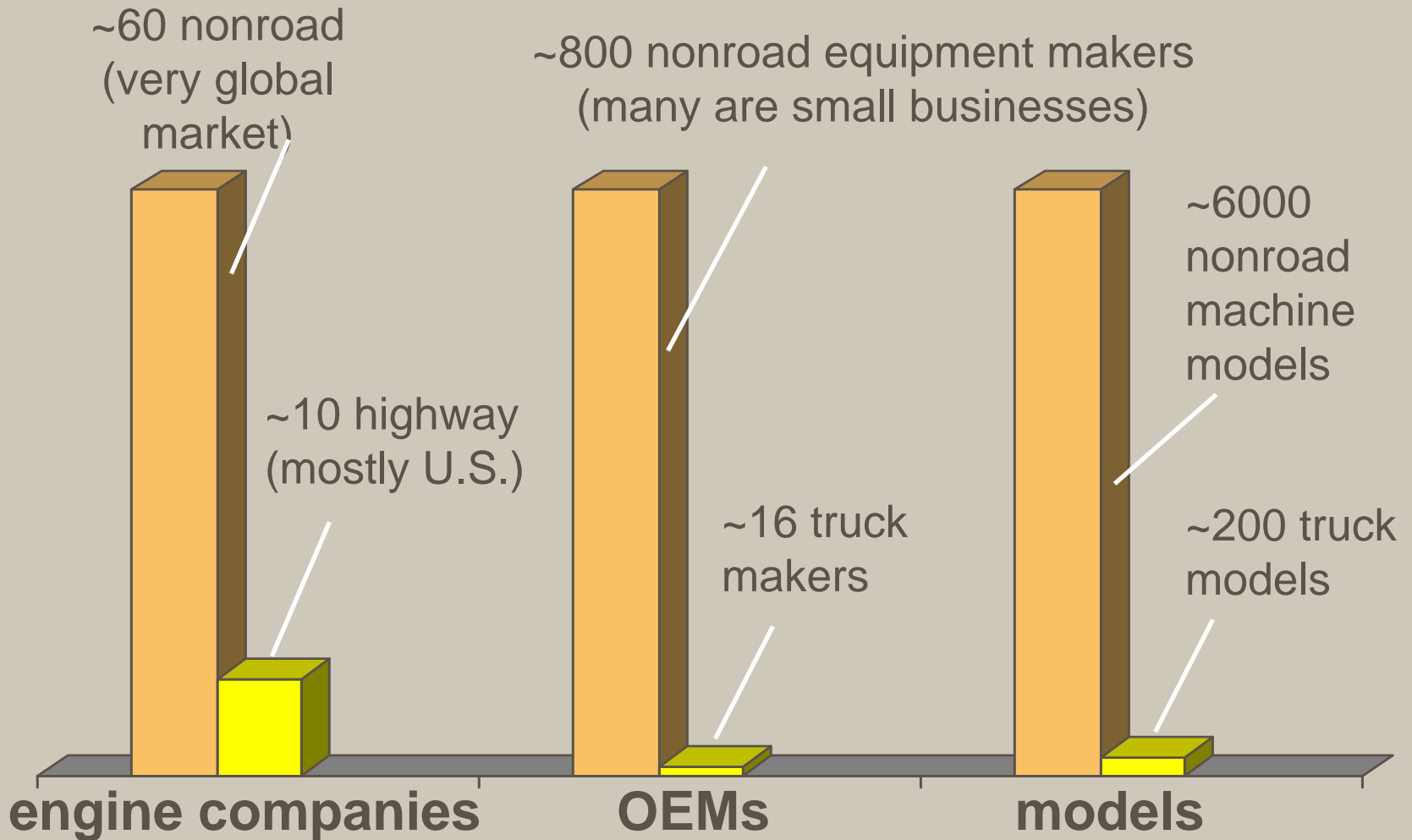
combine 285 hp

Wide Range of Diesel Machines



off-highway truck 1000 hp

Nonroad Diesel Industry Is Very Diverse



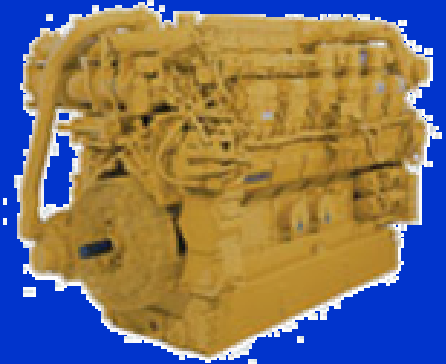
Program Considerations

- Treat the diesel fuel and engine as a system.
- Transfer advanced technology from 2007 highway program to nonroad applications.
- Get timely, large emission reductions to help States' attainment and maintenance plans.
- Provide 6-10 years lead time to deal with technical challenges and diversity of industries & products covered.
- Include flexibility provisions to minimize costs.
- Align with implementation of 2007 highway diesel program (put in place by EPA in 2001).

Collaboration

- Program success keyed to extensive outreach done by EPA with all stakeholder groups
 - Engine and equipment manufacturers
 - Oil industry
 - State and local governments/environmental and public health organizations
- Final rule has received widespread support

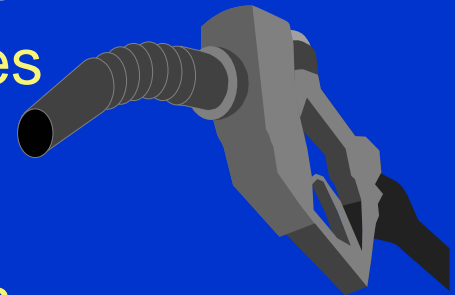
A Systems Approach-- Fuel & Engines



Patterned after the 2007 highway diesel rule:

- **Diesel aftertreatment**
 - Stringent new standards for NO_x and PM
 - Also new test requirements to ensure control in use

- **Fuel sulfur reduced to 15 ppm in 2 steps**
 - Enables the aftertreatment technologies
 - AND gets large immediate sulfate PM reductions from existing fleet
 - AND lowers engine maintenance costs
 - sulfur acidifies oil, shortens engine life
 - benefits owners of new *and old* equipment



Program Overview

2007: Nonroad, locomotive and marine diesel fuel sulfur limited to 500 ppm

- Large immediate reductions in sulfate PM & SO_x from existing fleet

2008: Initial Tier 4 PM standards for engines <75 hp

- Achieves early Tier 4 PM reductions

2010: Sulfur limit drops to 15 ppm

- Enables advanced-technology nonroad engine standards
- Applies to locomotive & marine fuel starting in 2012

2011-15: Phase-in of advanced-technology Tier 4 standards

- Reductions of >95% PM, ~90% NO_x
- Also new test requirements to ensure control in use

Distillate Fuels



home heating, etc 15%
not covered



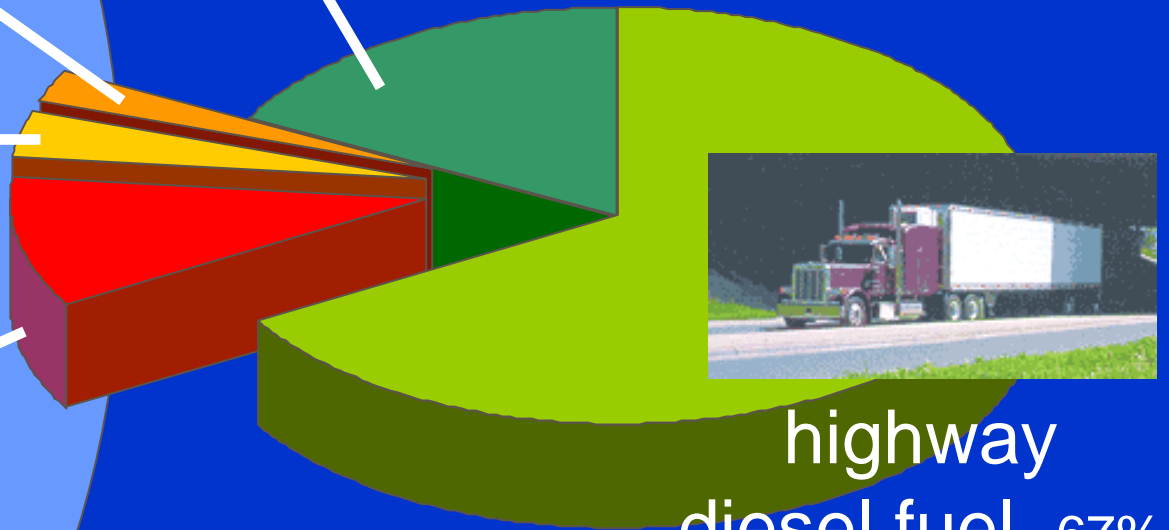
marine 2.6%



locomotive 3.2%



nonroad equipment
12%



highway diesel fuel 67%
regulated since 1993

covered by the new program

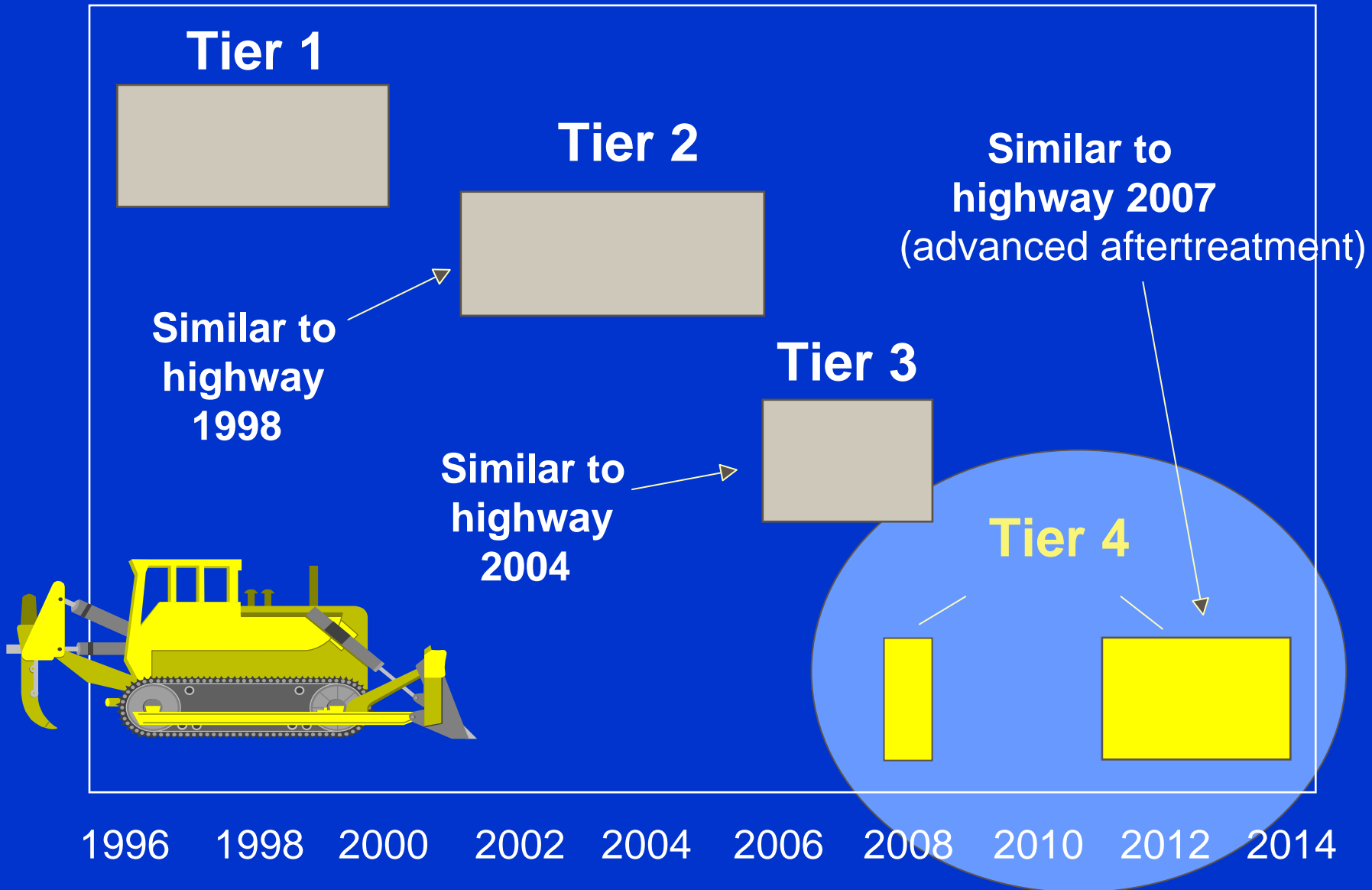
Nonroad, Locomotive and Marine Fuel Standards

(parts per million sulfur)

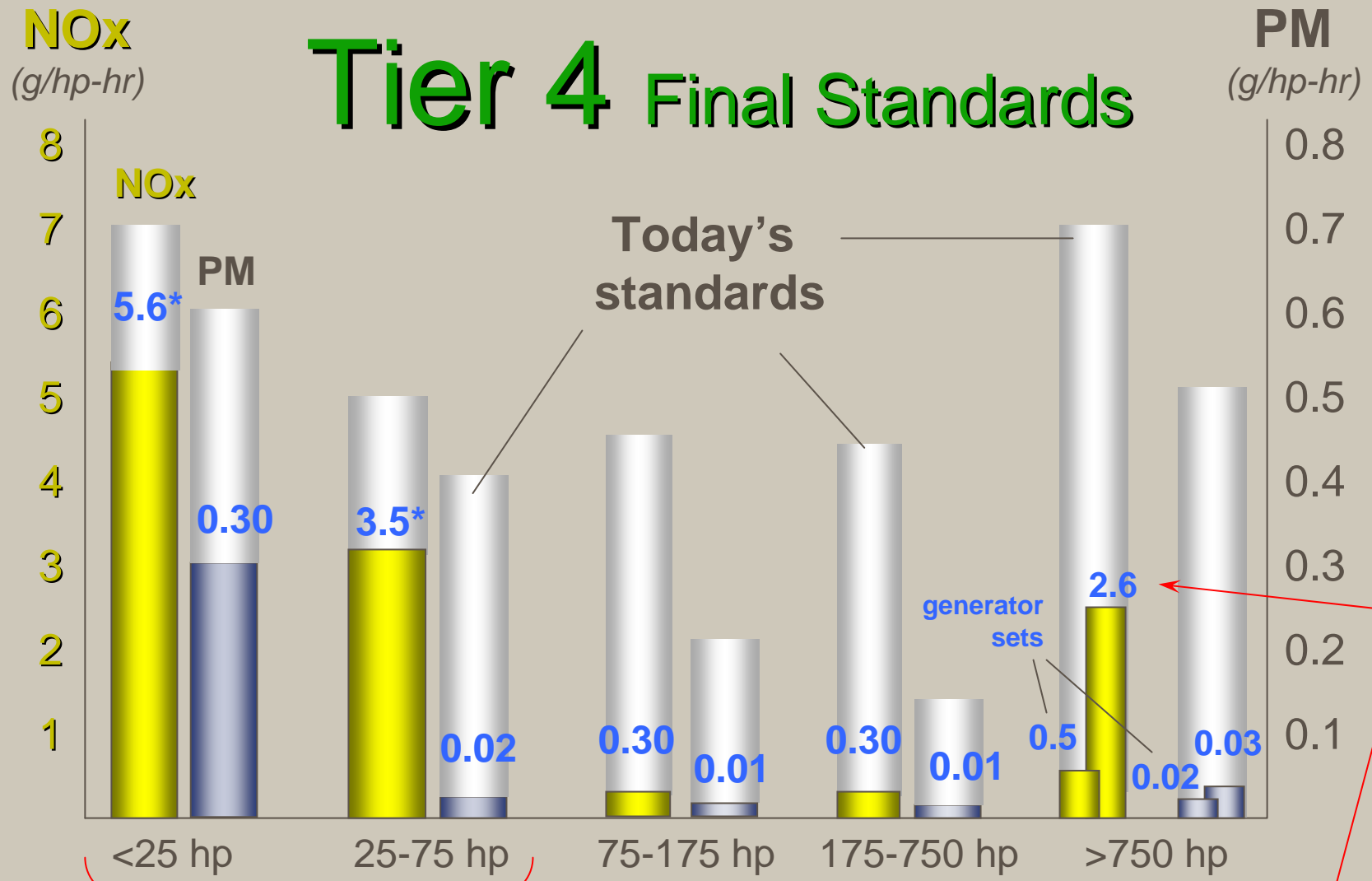
Who	What	2007	2008	2009	2010	2011	2012	2013	2014
Large Refiner & Importer	Nonroad	500	500	500	15	15	15	15	15
Large Refiner & Importer	Locomotive/ Marine	500	500	500	500	500	15	15	15
	With Credits (Not in NE or AK)	HS	HS	HS	500	500	500	500	15
Small Refiner	(Not in NE) (w/ approval in AK)	HS	HS	HS	500	500	500	500	15
Transmix Processor & In-use	Nonroad (Not in NE or AK)	HS	HS	HS	500	500	500	500	15
Transmix Processor & In-use	Locomotive/ Marine (Not in NE or AK)	HS	HS	HS	500	500	500	500	500

Note: Dates are June 1 at refinery, Aug 1 at terminal, Oct 1 at retailer and Dec 1 for in-use
 HS= high sulfur (unregulated)

Phase-In of Nonroad Diesel Engine Programs



Tier 4 Final Standards



will be reassessed in 2007
technology review

will be reassessed in
future action

* This is a combined NOx + hydrocarbon standard

**NVFEL Relative PM Emissions
- Diesel PM Filter Enabled Reductions -**



A vivid demonstration of what this is all about

- Typical test filter – current standards
- Test filter – Tier 4 PM standards
- Unused test filter

Provisions to Reduce Economic Impacts

- **2-step fuel sulfur reduction** -- 2007 and 2010
 - also final standard for locomotive/marine fuel not until 2012.
- **Gradual, coordinated phase-in of Tier 4 engine standards to:**
 - maximize technology transfer from 2007 highway program
 - address redesign workload for diesel engines and machines.
- **Additional lead time** for small refiners and manufacturers.
- **Credit incentives** to encourage early compliance.
- **Averaging, Banking, & Trading** provisions for engine companies.
- **Up to 7 years additional lead time** given to equipment manufacturers for models with small sales volumes.
- **Companies may petition EPA for relief** on the basis of economic hardship or (for equipment manufacturers) technical problems.

Cost Impacts

Vary with Engine Size and Equipment Application



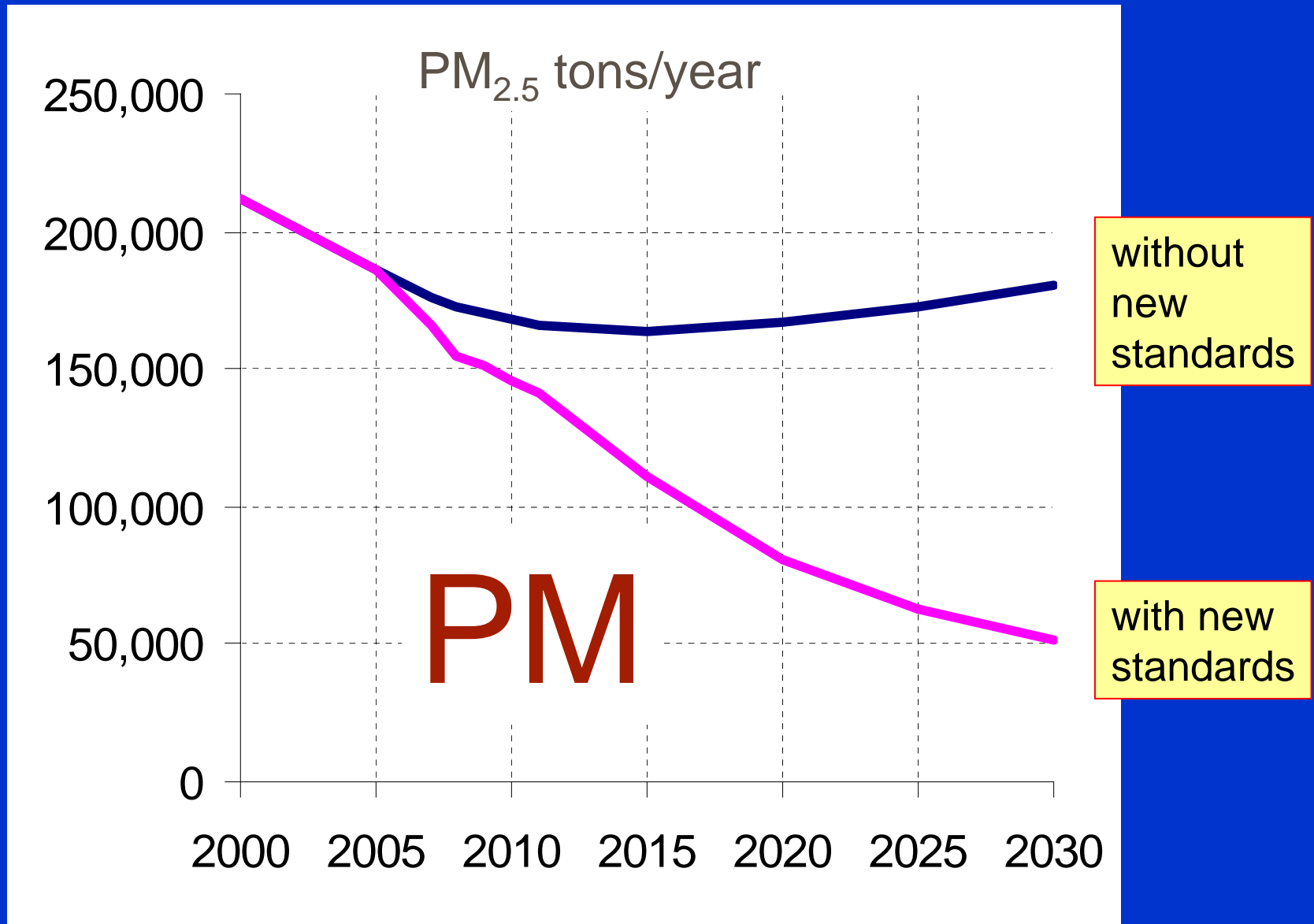
	Skid Steer Loader 33 hp	Backhoe 76 hp	Dozer 175 hp	Off-Highway Truck 1000 hp
Long-term cost of meeting new standards	\$790	\$1200	\$2560	\$4670
Typical retail price of this equipment	\$20,000	\$49,000	\$238,000	\$840,000

Diesel Fuel Refiner, Distributor, & User Impacts

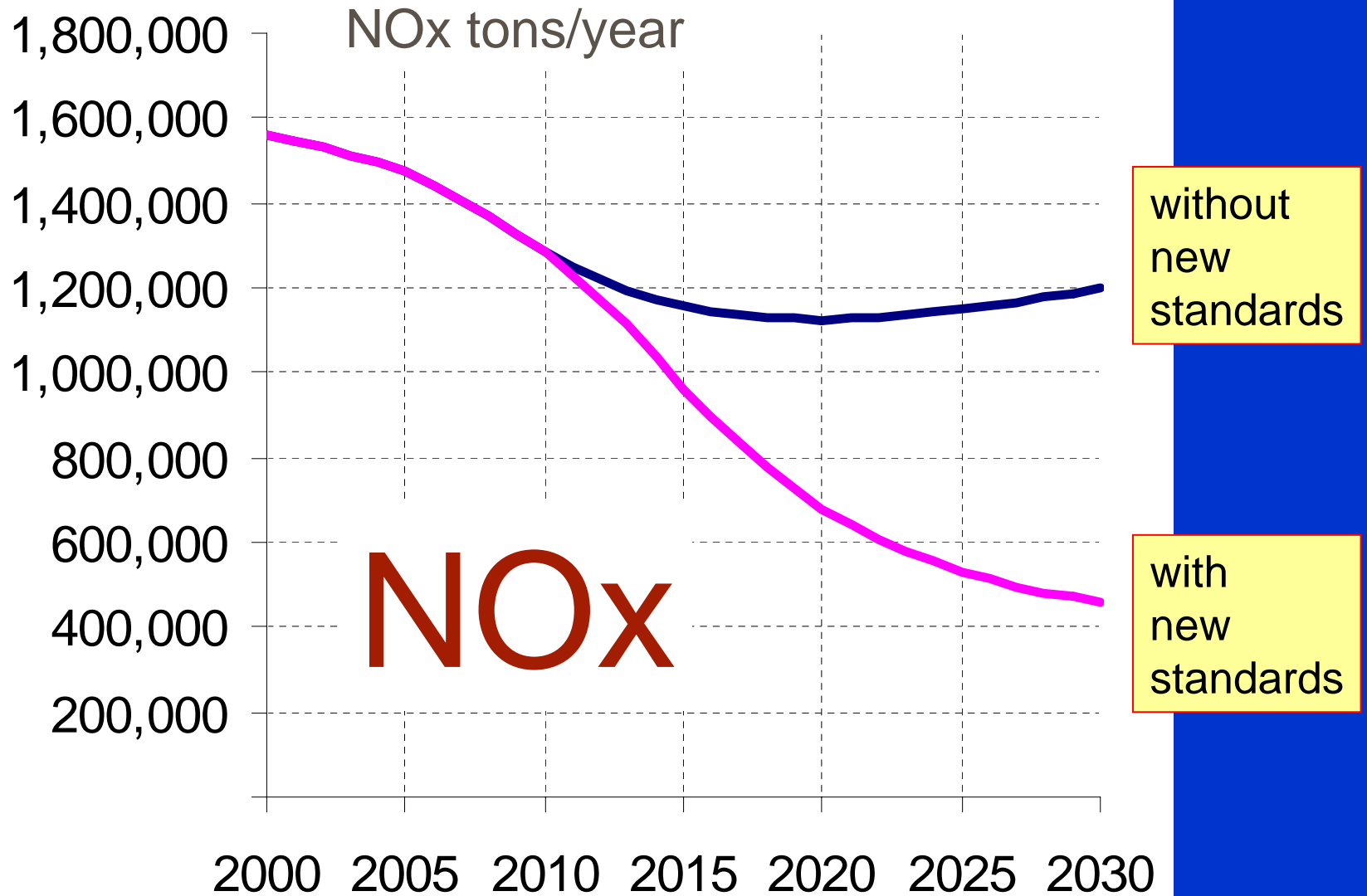


- Average fuel cost (refining & distribution): 6-7 ¢/gal
- Maintenance savings to nonroad equipment owner from cleaner fuel: ~3 ¢/gal
- Net consumer cost of fuel change: 3-4 ¢/gal

Nationwide PM Reductions From Nonroad Diesels



Nationwide NOx Reductions From Nonroad Diesels



Health Benefits



premature deaths

12,000

nonfatal heart attacks

15,000

ER visits by kids with asthma

6,000

hospital admissions

8,900

lost work days

1 million

0

10,000

20,000

prevented annually (in 2030)

Benefits



- Health benefits are comparable to benefits of 2007 heavy-duty highway program
- Will also help improve visibility (\$1.7 billion/year benefit in 2030)
- Overall, on a dollar basis: approximately \$80 billion/year (*in 2030*)
 - Outweighs the \$2 billion/year program cost by 40:1
 - These figures include only PM control benefits; there are additional non-quantified benefits from ozone and toxics reductions

- Also issued an Advanced Notice of Proposed Rulemaking for potential engine standards for locomotive and marine engines
 - Proposal targeted for May, 2005
- The final rule and supporting documents are available at:

www.epa.gov/nonroad/

Locomotive & Marine Diesels

Advance Notice of Proposed Rulemaking

Locomotive & Marine Diesels

Current Situation

- Current standards require application of 1990-era highway technologies
- Locomotive standards started taking effect in 2000:
 - Engine-out emission reductions in 2005+ engines
 - Also modest NOx reductions via retrofit of 1973-2004 engines at time of rebuild
- Marine diesel standards taking effect over 1999-2009
 - Ocean-going (C3) ships are on a separate track
 - international in nature; recently regulated

Diesel Marine Applications

<37 kW



gen sets



sailboats

Recreational



cruisers



yachts

Category 1 Commercial



workboats



police boats



fishing vessels

Category 2



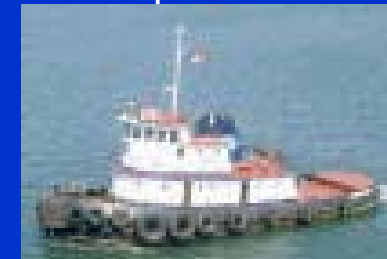
ferries



auxiliary power for
ocean-going



Great Lakes freighters



tugboats

Locomotive Types



Line-Haul



Switch

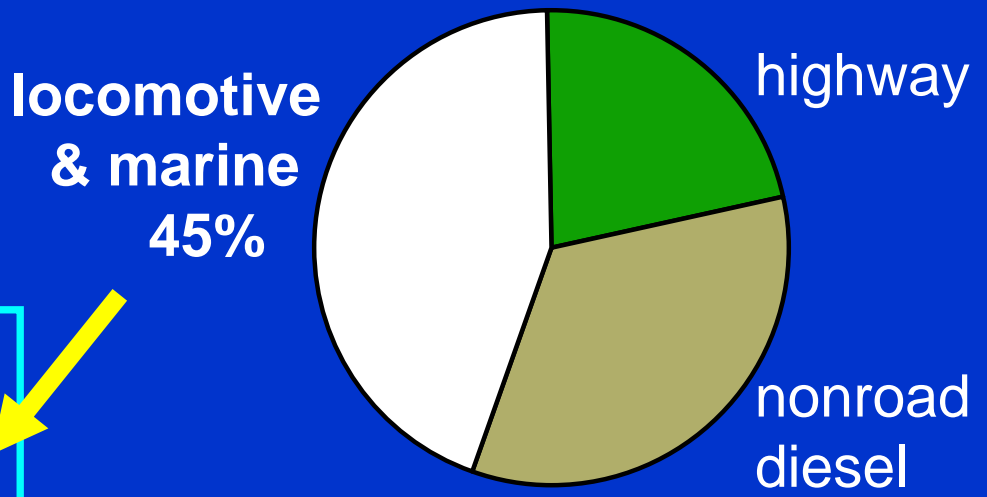


Passenger

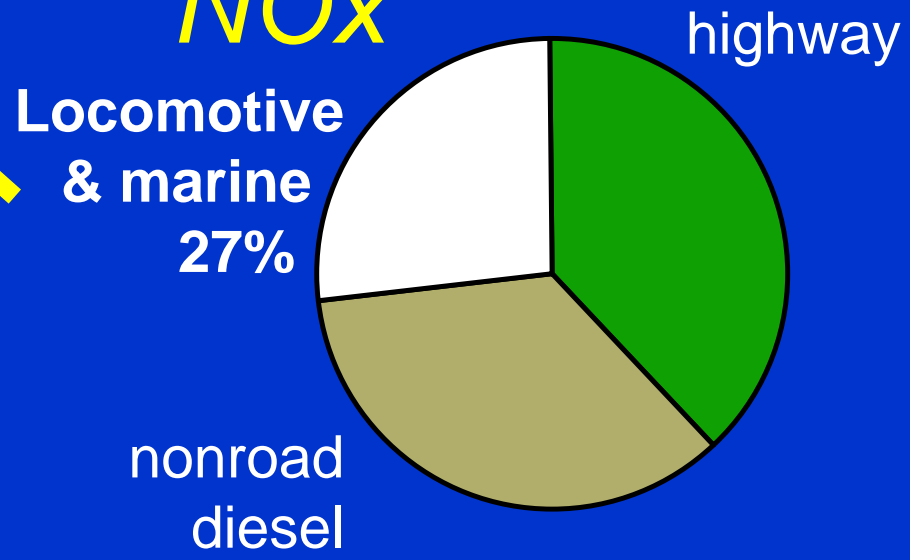
Mobile Source Inventories in 2030

- Potential reductions on the order of:
 - ~25,000 tons/yr of PM
 - ~900,000 tons/yr of NOx
- Compares to nonroad rule reductions of:
 - ~129,000 tons/yr of PM
 - 738,000 tons/yr of NOx

Diesel PM_{2.5}



NOx



Locomotive & Marine Diesels Advance Notice

- Signed by Administrator Leavitt May 11th
- Targets high-efficiency (sulfur-sensitive) aftertreatment
 - Patterned after highway and nonroad programs
 - L&M fuel will be at 500 ppm in 2007, 15 ppm in 2012
 - Large pool of 15 ppm fuel (highway/nonroad) earlier
- Considering new standards as early as 2011
 - With phase-in consistent with the nonroad diesel rule
 - Opportunity for comprehensive strategy (retrofits, ...)
- Different challenges than nonroad: marine environment, packaging constraints, exhaust temperatures

Locomotive & Marine Diesels

Next Steps

- Comment period open for 60 days after ANPRM publication
- Starting to engage stakeholders in discussions
- NPRM planned for mid-2005
- FRM mid-2006

The ANPRM is available at:
www.epa.gov/otaq/locomotv.htm#ANPRM