HD 2007 Rule Overview

Clean Diesel Engine Implementation Workshop

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US EPA Office of Transportation and Air Quality
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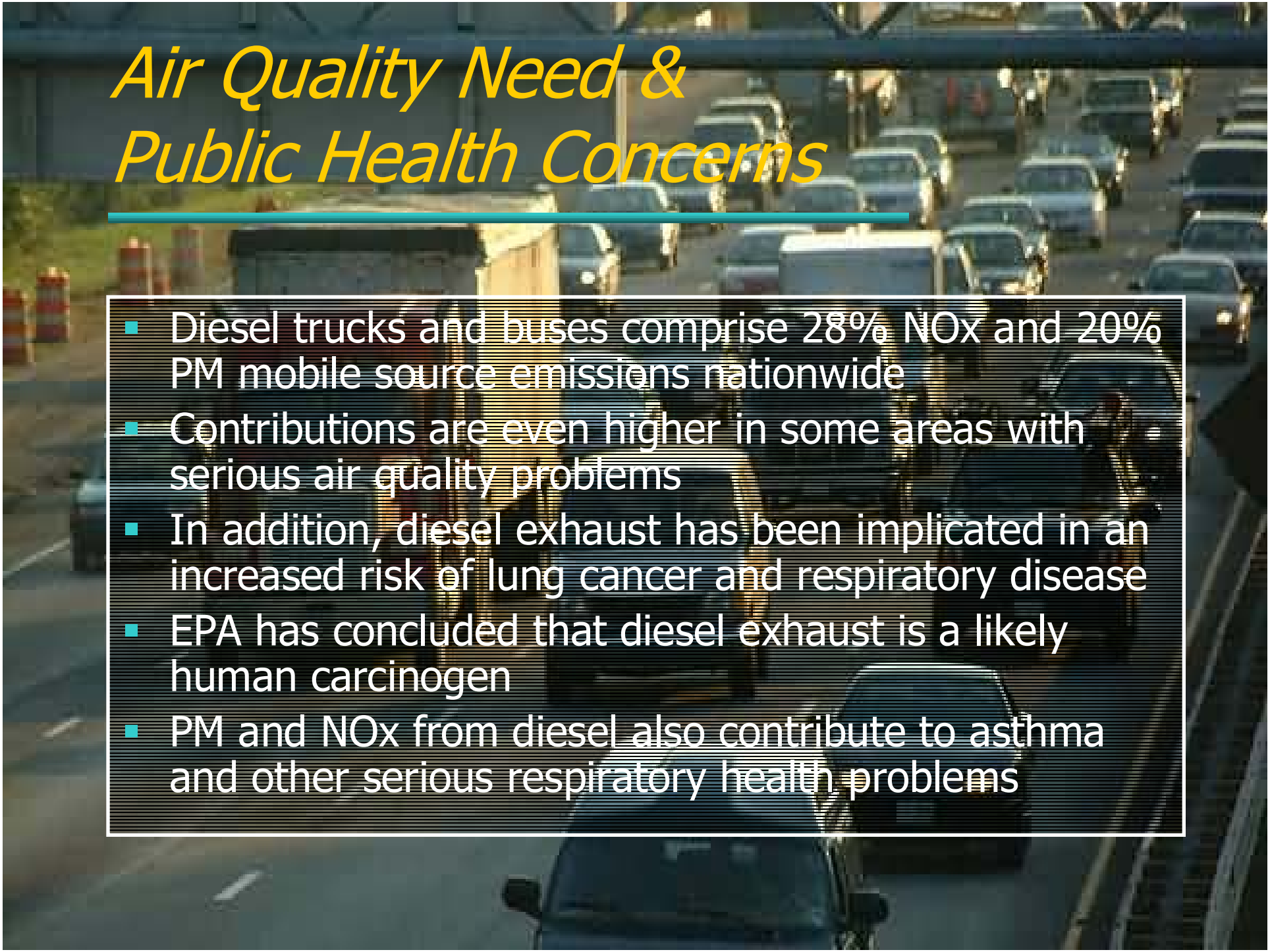
Presentation Overview

- Diesels and Air Quality
- Key Elements of the Program
  - Engine Standards
  - Fuel Provisions
- Health Benefits of the Program
- HD2007 Progress – What's Happening Now?



Air Quality Need & Public Health Concerns

- Diesel trucks and buses comprise 28% NOx and 20% PM mobile source emissions nationwide
- Contributions are even higher in some areas with serious air quality problems
- In addition, diesel exhaust has been implicated in an increased risk of lung cancer and respiratory disease
- EPA has concluded that diesel exhaust is a likely human carcinogen
- PM and NOx from diesel also contribute to asthma and other serious respiratory health problems

Key Elements of the Engine & Vehicle Program

- Applies new NOx and PM standards to heavy-duty engines and vehicles
  - 90%+ emission reductions—gasoline-like levels
  - Based on high efficiency emission control devices (like passenger vehicle catalysts)
  - Phase-in of NOx standards 2007-2010
  - Incentives for early technology introduction

Key Elements of the Fuel Program

- Reduces diesel fuel sulfur levels nationwide
  - Enables use of advanced emission control technology
  - Highway diesel fuel sulfur cap of 15 ppm
    - 80% by 2006
    - 100% by 2010
  - Flexibility for small and Western refiners

Basic Program Requirements

	2006	2007	2008	2009	2010	2011	2012
PM		**100%** at **0.01** g/hp-hr					
NOx			**50%** at **0.20** g/hp-hr			**100%** at **0.20** g/hp-hr	
Fuel		**80%** at **15 ppm maximum sulfur** (under temporary compliance option)				**100%** at **15 ppm**	

Other Engine Provisions

Early Incentive Program

- Provided to diesel engines that meet the program's final standards
- A diesel engine meeting the new standards early (sold before 2007) counts as 1.5 such diesel engines later
- Predicated on the assurance that the engines will use 15 ppm diesel fuel

Averaging, Banking, and Trading

- Engine families certified below the standard (credit generation) can offset engine families certified above the standard (credit use)
- Credits can be banked for later use or traded to other manufacturers
- Credits can also be transferred across averaging sets, with some restrictions
- Family Emission Limit (FEL) Caps
  - NOx: 2.0 g/bhp-hr (2007-09)
  - NOx: 0.50 g/bhp-hr (2010+)
  - PM: 0.02 g/bhp-hr (2007+)

Other Engine Provisions

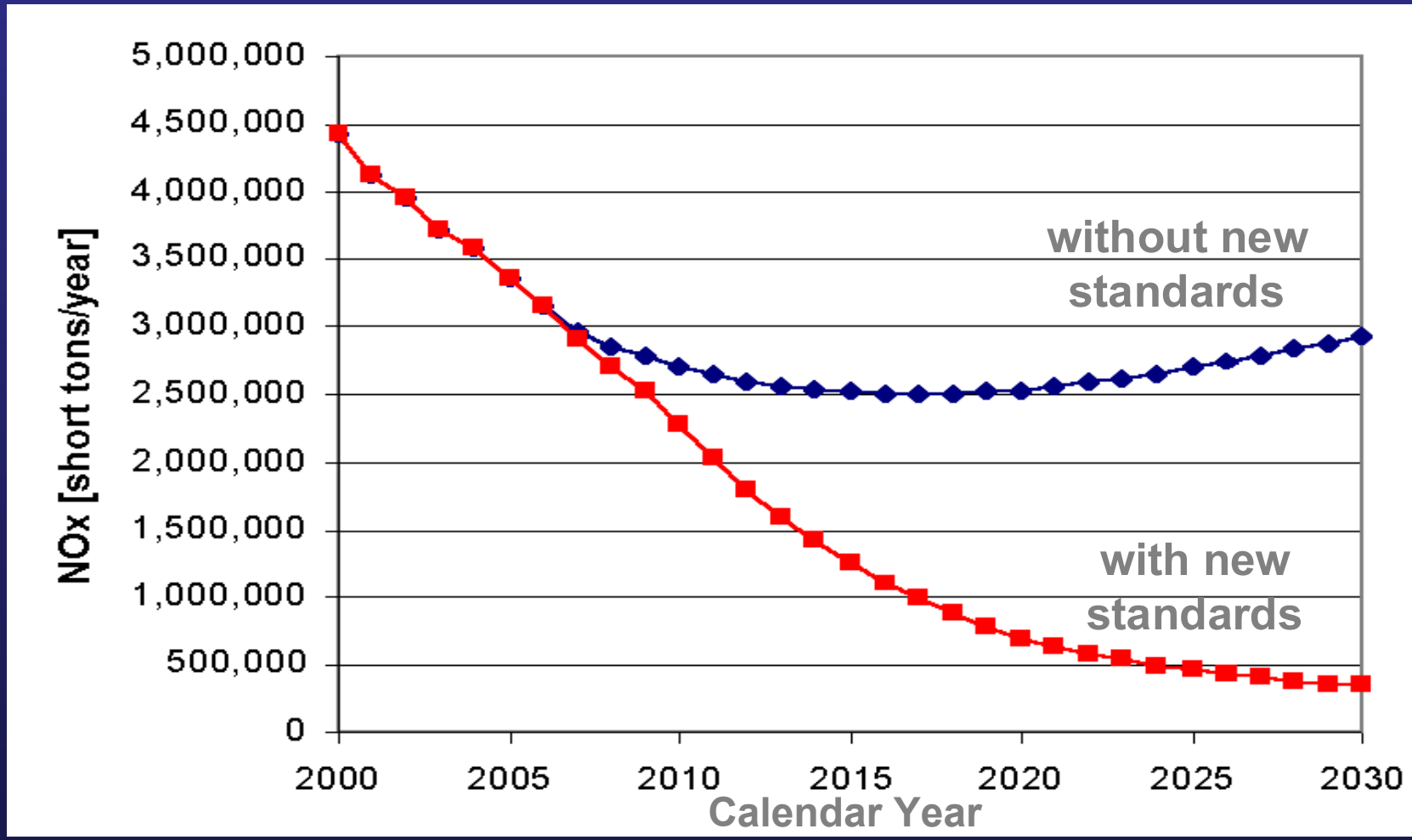
Test Procedure Improvements

- Changes to laboratory PM and gaseous measurement requirements
- Ensures accurate measurement of low-level emissions from 2010 technology engines
- Includes new provisions to allow manufacturers to use alternative measurement techniques

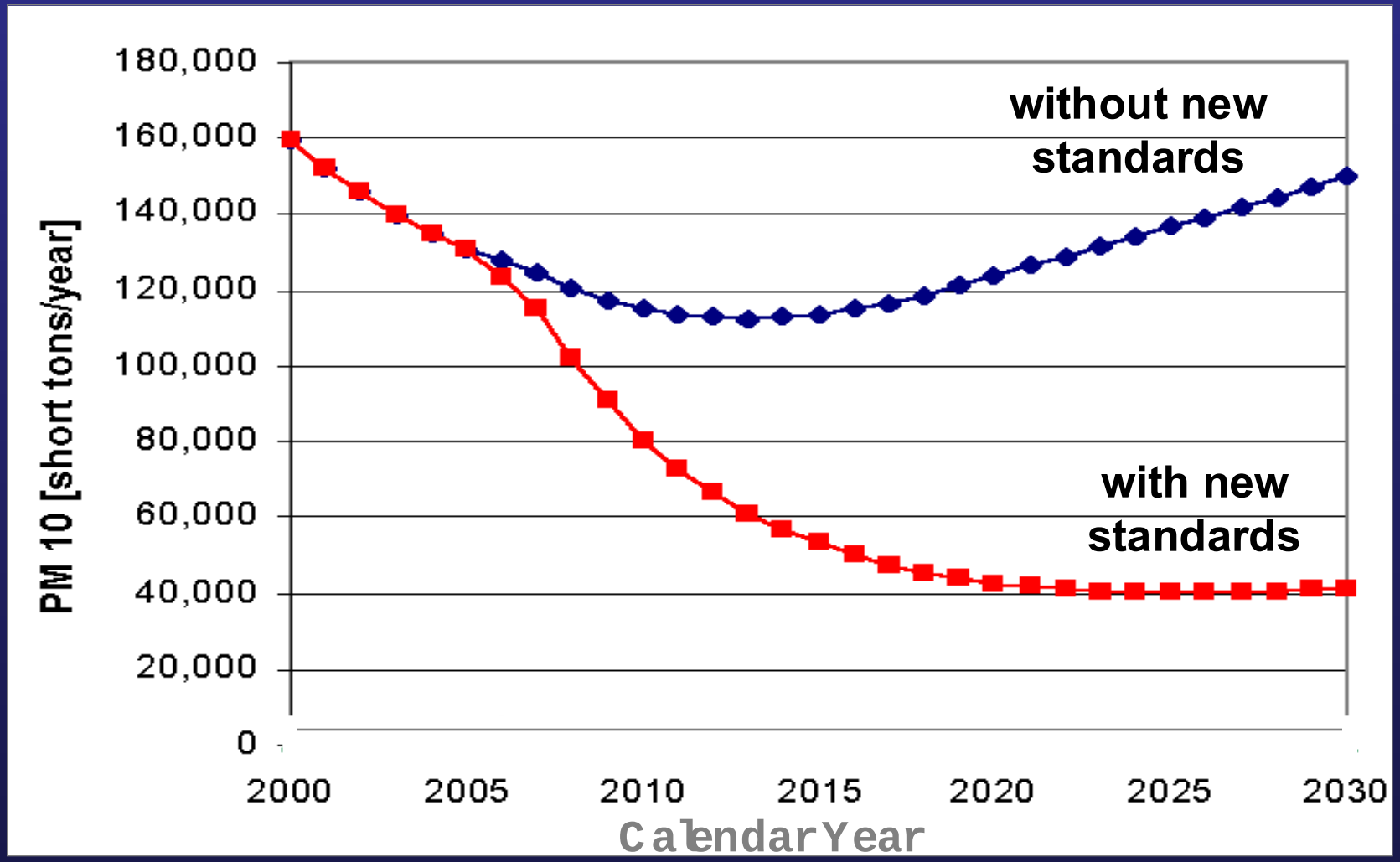
NOx Phase-in Provisions

- NOx standard is phased-in at 50% of production from 2007-10
- ABT provisions can be combined with the phase-in to allow engines to certify to a NOx value roughly half-way between 2.5 g/bhp-hr and 0.2 g/bhp-hr through 2009

Nationwide Heavy-Duty NOx Emissions



Nationwide Heavy-Duty PM Emissions



Costs and Benefits

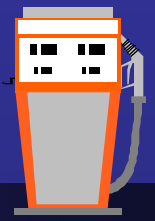
- Compliance costs
  - Estimated at $1200-1900 per engine
  - 4-5 cents per gallon fuel, partially off-set by maintenance savings of ~ 1 cent per gallon
  - Total costs are $4.3 billion/year
- Health benefits

The program will prevent annually

  - Over 8,300 premature deaths
  - Over 750,000 respiratory illnesses
  - 1.5 million lost work days
  - 2.6 million tons of NOx, 110,000 tons of PM, and 17,000 tons of toxic pollutants
- Monetized benefits: $70.3 billion/year

HD2007 Progress - What's Happening Now?

Progress Toward 2007



- Clean Diesel Independent Review Panel
- Technology progress reviews
- Engine technology test program
- Refiners/Importers pre-compliance reports
- Implementation workshops and pre-certification meetings

Progress Toward 2007:
Clean Diesel Independent Review Panel

Independent review conducted in 2002

- Open, public process following FACA requirements
- Panels Findings:

Panels Findings

Engine Emission Control Technology

- Very encouraging rate of progress to date.
- No insurmountable issues at this time.
- Key technical challenge remaining is NOx adsorber durability.

15ppm Desulfurization Technology

- No technological impediments to going forward.
- In general, refiners are where they are expected to be.
- Some are proceeding ahead of schedule, others are evaluating compliance options
- New technologies have been introduced which could lower costs to produce 15 ppm S fuel.

Progress Toward 2007:
EPA Technology Progress Reviews: Engines

- 2002 EPA Progress Review report - progress made on all fronts:
  - PM filter in production in U.S. on HD applications
  - NOx aftertreatment improvements in all key areas (durability, wider temperature range, desulfation)
  - Technical issues remain, but industry is focused on resolving remaining issues
- 2003 Status
  - EPA has continued progress updated meetings with engine and aftertreatment companies
  - Thus far, we have met with all the majority of the HD diesel companies
  - Progress meetings will be completed in Fall 2003
  - EPA 2nd Progress Review report in early 2004

Progress Toward 2007:
EPA Technology Progress Reviews: Engines

- 2002 → 2003
  - Technology focus has shifted from R&D programs to product development
- Engine companies have reached or are approaching technology down-select
  - Most companies have multiple technology paths capable of achieving 2007 standards
    - NOx control options being considered include engine-out, NOx adsorber, urea-SCR
  - Senior engineers preparing for formal company gate reviews to choose final 2007 package
    - Most companies will make decision in 4th quarter 2003 or 1st quarter 2004

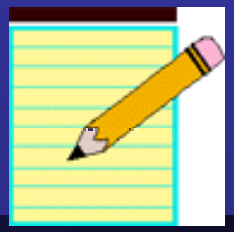
Progress Toward 2007:
EPA Engine Technology Test Program

- EPA began NOx adsorber test programs in 1999 - with key support from MECA companies
- Results thus far include;
  - Demonstrated 2010 standards, SAE papers 2001-01-1351, 2001-01-3619
  - New NOx adsorber desulfation techniques, SAE paper 2002-01-2871
  - Thermal aging investigations, SAE paper 2003-01-0042
  - Novel vehicle packaging investigation, SAE paper 2003-01-2305
- Future work looking at long term durability

Progress Toward 2007:
EPA Technology Progress Reviews: Fuel

- 2002 EPA Progress Review Report
  - Progress made on all fronts
    - Desulfurization technology for producing 15 ppmS diesel fuel was well understood
    - Technology options for refiners were increasing resulting in better economic feasibility—vendors were making progress in the areas of catalyst, substrate, and coating development
    - Technical issues remained, but industry was focused on resolving remaining issues
    - Industry was where we expected it to be
- 2003 Status
  - EPA has continued discussions with refiners, fuel distributors, and fuel marketers
  - Pre-compliance report results released later this year

Progress Toward 2007:
Refiner/Importer Pre-Compliance Reports



- Annual pre-compliance reports due June 1, 2003-05
- All refiners and importers are required to submit reports, including the following information:
  - Projected volumes of 15 ppm and 500 ppm S diesel fuel
  - Estimates of credits to be generated/used
  - Engineering plans and capital commitments
  - Permit status and construction progress
- The purpose of the reports is to help facilitate the market for credit trading under the TCO
- EPA will summarize the reports
  - Presenting generalized data on a PADD basis in annual reports
  - Maintaining confidentiality of data

Progress Toward 2007:
Industry is On Target

- Results are consistent with the expectations in the final rule and EPA's 2002 Highway Diesel Progress Review
  - However, results are preliminary
  - Plans could still change, prompting different results next year
- Most companies are in the planning stage now and expect to make final decisions by 1Q 2004
- Flexibilities will be used (small refiner options, GPA option, hardship)

Progress Toward 2007:
15 ppmS Diesel Fuel will be Available

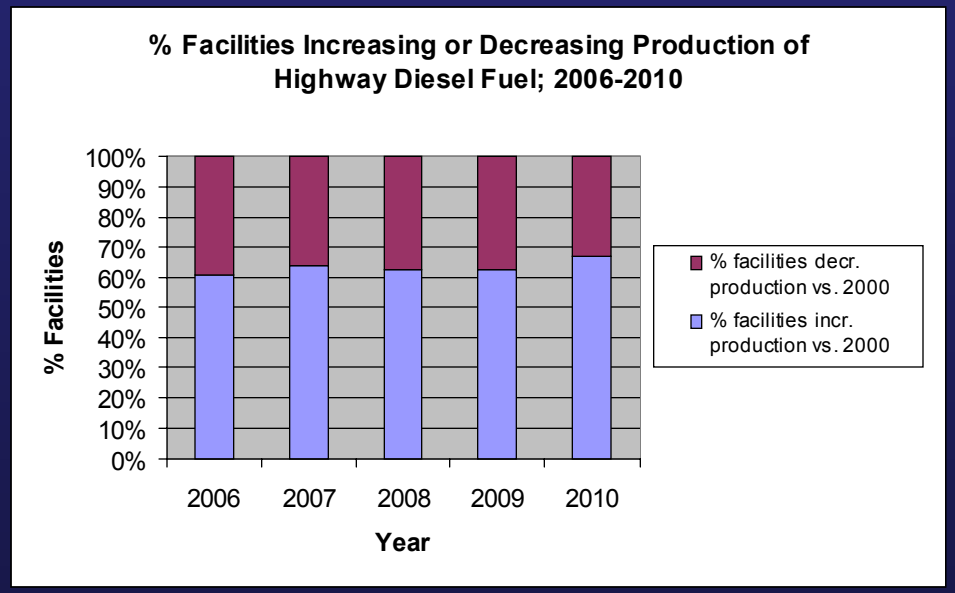
- 15 ppm fuel will be widely available —
  - On a volume basis, over 95% of highway diesel fuel produced in 2006 is projected to meet the 15 ppm sulfur standard
  - On a facility basis, over 90% of refineries/importers have stated that they plan to produce some 15 ppm diesel fuel
- A large credit volume is expected
  - Accommodates off-spec material
  - Provides a supply "safety valve"
  - Allows for an additional volume of 500 ppm highway diesel fuel without violating the 80/20 TCO requirement

Progress Toward 2007:
Highway Diesel Fuel Supply will be Sufficient

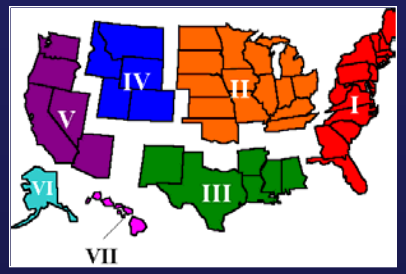
- Refiners/Importers plans are in line with projected demand — highway diesel fuel supply will be sufficient
  - 2.9 million bbls/day hwy diesel production for 2006
  - In comparison, the FRM projected a hwy diesel fuel consumption of 2.6 million bbls/day for 2006, based on EIA's AEO 2000
  - Refiners appear to be planning for increased growth which is consistent with more recent data — projected fuel consumption using AEO 2003 is around 3 million bbls/day

Progress Toward 2007:
Highway Diesel Fuel Supply will be Sufficient

- While some refineries are planning to decrease highway diesel fuel production, this will be more than offset by those that are planning to increase production



- On a PADD basis, the reports project:
  - A slight volume decrease in PADD 1
  - Volume increases in PADDs 2, 3,and 5 from 2006-10
  - Fairly constant volumes for PADD 4 from 2006-09 with some growth in 2010.



Progress Toward 2007: Implementation Workshops and pre-Certification Meetings

- Implementation workshops
  - A forum for stakeholders to discuss and address implementation issues questions
  - Clean Diesel Fuel Workshop held in Nov. 2002
  - Today's Clean Diesel Engine Workshop
- EPA pre-certification engine meetings
  - A normal part of new program implementation
  - Allows companies to discuss specific questions and product plans with EPA on a one-on-one basis
  - We encourage all companies to come and speak with us early regarding any certification concerns