

# California's Heavy-Duty Diesel In-Use Compliance Regulation



Public Hearing  
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Sacramento, California

California Environmental Protection Agency  
 Air Resources Board

# Today's Presentation

- Background
- Staff Proposal
- Costs and Benefits
- Remaining Issues
- Staff Recommendation

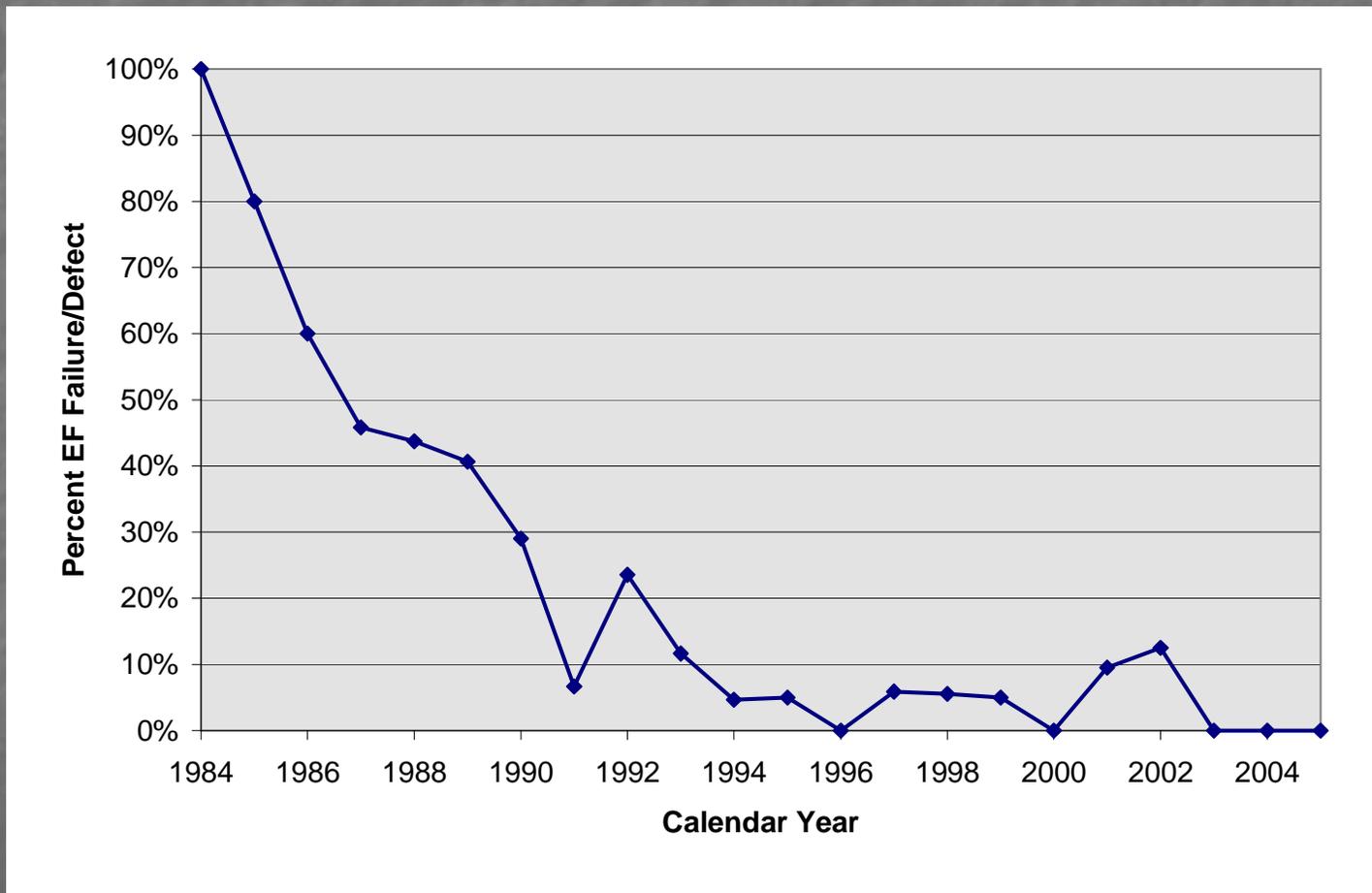
# Background

- Heavy-duty diesel engine (HDDE):
  - Play vital role in the transportation of goods and services
  - Offer better performance, fuel economy, and durability
  - Are a significant source of mobile source NO<sub>x</sub> and toxic PM emissions
- Adoption of 2007/2010 HDDE Standards
  - 90% reduction of NO<sub>x</sub> and PM from 2004 standards
  - Results in new aftertreatment systems for NO<sub>x</sub> and PM control

# Importance of In-use Compliance

- New standards, new emission control devices (aftertreatment) for HDDEs begin in 2007
- In-use compliance testing will:
  - Ensure emission standards are met
  - Encourage manufacturers to properly design engines and durable emission control systems

# In-Use Testing Improves Compliance Light Duty Vehicle Experience



# Existing Compliance Procedures

- Originally developed to cover all motor vehicles and engines
- Emphasis, however, was on cars and light trucks
- A minimum of 10 vehicles must be tested to determine engine family compliance

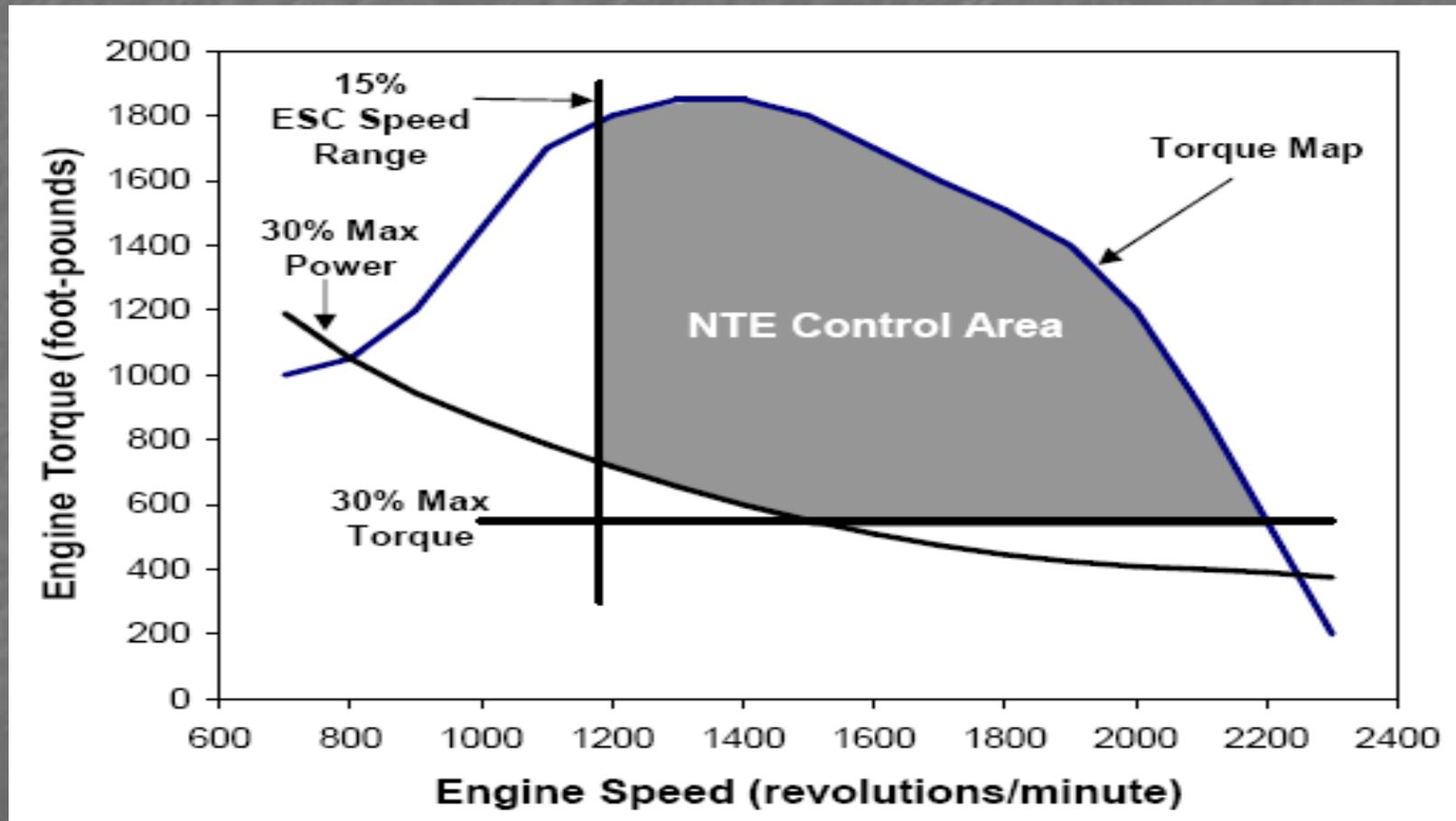
# Existing Compliance Procedures (cont'd)

- Compliance procedures problematic for heavy-duty vehicles
  - Requires removal of the engine
  - Time consuming
  - Very costly
- More practical/efficient compliance procedures needed for heavy-duty vehicles
  - Now possible with adopted Not-to-Exceed (NTE) requirements and portable, on-truck emission measurement systems (PEMS)

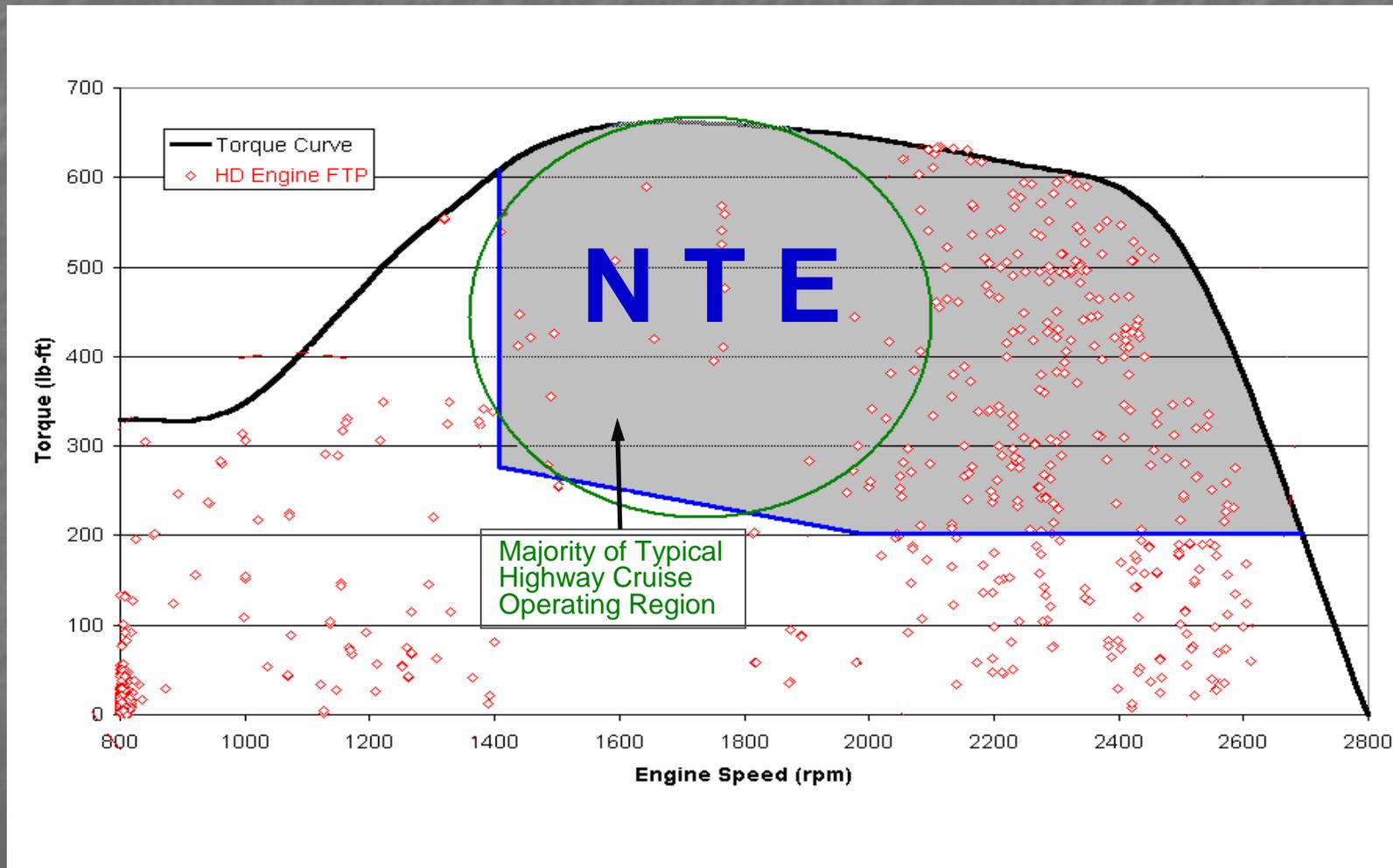
# What is NTE ?

- Alleged Violations
  - Engines were high emitters when operated outside of standard emission test cycle
  - Settlement Agreement established Not-to-Exceed (NTE) emission limits at nearly all operational modes
  - Began with 1998 model engines
- Not a cycle but a region of engine operation
  - Applies to 30 second snippets of operation
  - Applies to real-world conditions

# NTE Control Area

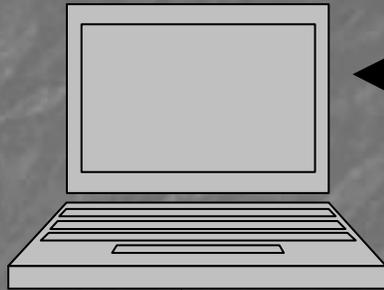


# FTP PLUS NTE COVERS VIRTUALLY ALL HDDE OPERATION



# What is PEMS ?

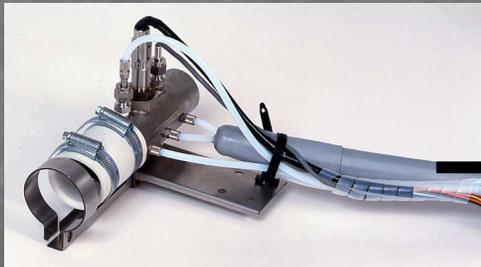
Notebook-PC



ECU

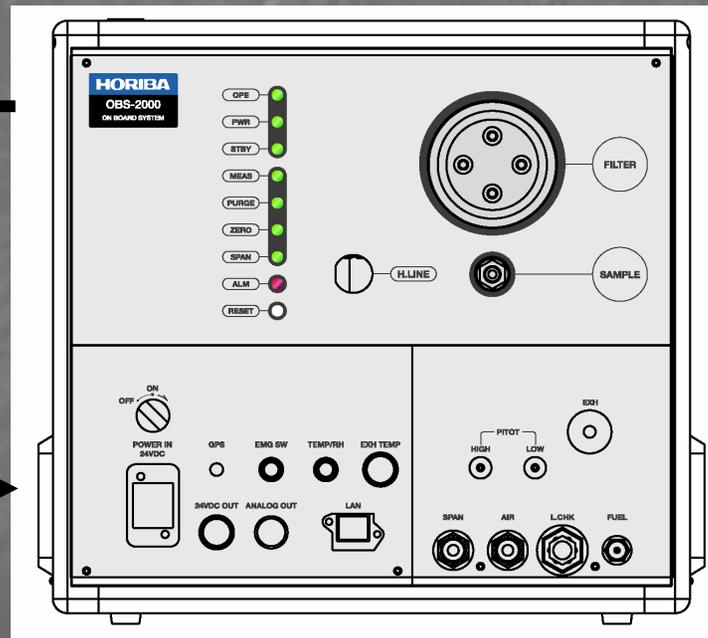
LAN

Attachment



Exhaust flow meter

PEMS



GPS

Temp/Humid.

Batteries

DC 20-30V  
700 watts

CO, CO<sub>2</sub>, NOx, THC analyzer

# Utilizing PEMS to Assess NTE Compliance

- Allows for over-the-road, real time in-use testing
  - Analyzers in PEMS use same technology as laboratory analyzers
  - PEMS easily installed and testing performed without interrupting normal truck operation
  - Automated collection and analysis of test data
  - Removal of the engine is no longer necessary

# Development of Proposed Regulation

- 5 year collaborative effort with U.S. EPA and Industry
- Modeled after light-duty program “CAP 2000”
- U.S. EPA adoption in June 2005
- Staff’s proposal is essentially identical to the U.S. EPA’s adopted regulation

# Summary of Proposal

- Manufacturer-run in-use compliance test program
- Manufacturer responsible for procuring and testing trucks
- Over-the-road emission testing of heavy-duty diesel engines using PEMS
- Determine NTE compliance

# Summary of Proposal (cont'd)

- Pilot program to gain experience with NTE testing using PEMS
  - Gaseous emissions 2005-2006
  - PM emissions 2006-2007
- Enforcement program starts in 2007 (for gaseous) and 2008 (for PM)
- Accuracy margin being developed for PEMS
  - Testing in progress at Southwest Research Inst.
- Adoption satisfies 2003 SIP measure ON-RD HVY-DTY-3

# Manufacturer-Run In-Use Compliance Program

- ARB/U.S. EPA make engine family (EF) selection
- Up to 25% of EFs tested annually
- Testing for NO<sub>x</sub>, NMHC, CO, and PM for NTE compliance
- Test results compared with NTE threshold emission limit for each pollutant
- Program conducted in two phases

# Phase 1 Testing

- General screening of engine family (EF)
  - No specific test conditions required
  - Testing of trucks in normal service
- 5 to 10 trucks tested for each EF
- Specific pass/fail criteria must be met
- Depending on performance, Phase 2 testing may be necessary

# Phase 2 Testing

- Testing specific to failing conditions observed in Phase 1 testing
  - Ambient temperature & pressure
  - Engine operating conditions (e.g. HP, speed etc.)
  - Geographical location, time of year
- 10 trucks tested
- Data from Phase 1 & 2 used to determine compliance and possible remedial action

# Program Costs

- 13 medium- and heavy-duty manufacturers will be affected
- Cumulative average annual cost (13 manufacturers) is \$1.6 to \$2.1 million

# Emission Benefits

- Ensure emission benefits claimed through adoption of 2007 HDDE standards
- Emission compliance throughout the useful life of the engine
- Majority of engine families tested over a four year period

# Other Benefits

- The program would encourage manufacturers to:
  - Design robust engines to meet emission requirements throughout their useful life
  - Design better emission control systems
  - Develop real world deterioration factors
- In-use, real-world emission test data would give ARB the ability to:
  - Develop better emission factors for heavy-duty diesel vehicle modeling
  - Improve heavy-duty diesel vehicle emission inventory

# Remaining Issues

- Accuracy margin development at Southwest Research Institute
  - Gaseous Emissions: Accuracy margin and final report by January 2007 for the enforcement program to begin by December 2007
  - Particulate Matter: Accuracy margin and final report by early 2008 for the enforcement program to begin by December 2008

# Staff Recommendation

- Compliance testing using PEMS would reduce time and cost
- California and federal program alignment would reduce manufacturer cost for compliance
- Manufacturers would be encouraged to improve engine and emission control system designs
- ARB can use test data for developing in-use emission factors and for air quality modeling
- Staff recommends that the Board adopt the proposed manufacturer-run in-use compliance regulation