

EPA's Nonroad Regulatory Effort



U.S. EPA

Clean Air Act Advisory Committee

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Alexandria, VA

Overview



- Background on Nonroad CI
- Current Standards for Nonroad
- Inventory Impacts
- On-going Efforts
- Issues to be addressed

Background of Nonroad Regulations

- **1991:** EPA study found that nonroad diesels (tractors, bulldozers, ...) are large part of ozone and PM problem
- **1994:** EPA set **Tier 1** standards -- modest NOx control phasing-in between 1996 and 2000
- **1996:** Worked with industry, California, and other stakeholders to develop common statement of principles for stringent new standards; published advance notice
- **1997:** Gained small business input thru SBREFA panel
- **1997:** Published proposal (Sept 24)
- **1998:** FRM Signed (August 27)
- **2001:** Nonroad Technology Review
 - Statutory Authority: Clean Air Act §212, §217, and §222

Nonroad Standards Now

Nonroad Diesel FRM Standards

NMHC+NO _x /PM in g/hp-hr											
hp	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
	Tier 1						Tier 2				
<11		7.8 0.75					5.6 0.60				
≥11 <25		7.1 0.60					5.6 0.60				
≥25 <50	7.1 0.60					5.6 0.45					
			Tier 2				Tier 3				
≥50 <100						5.6 0.30				3.5 *	
≥100 <175					4.9 0.22				3.0 *		
≥175 <300					4.9 0.15			3.0 *			
≥300 <600			4.8 0.15					3.0 *			
≥600 <750				4.8 0.15				3.0 *			
≥750								4.8			

* These PM standards are not established in the FRM.

Nonroad Diesel Inventory Impacts

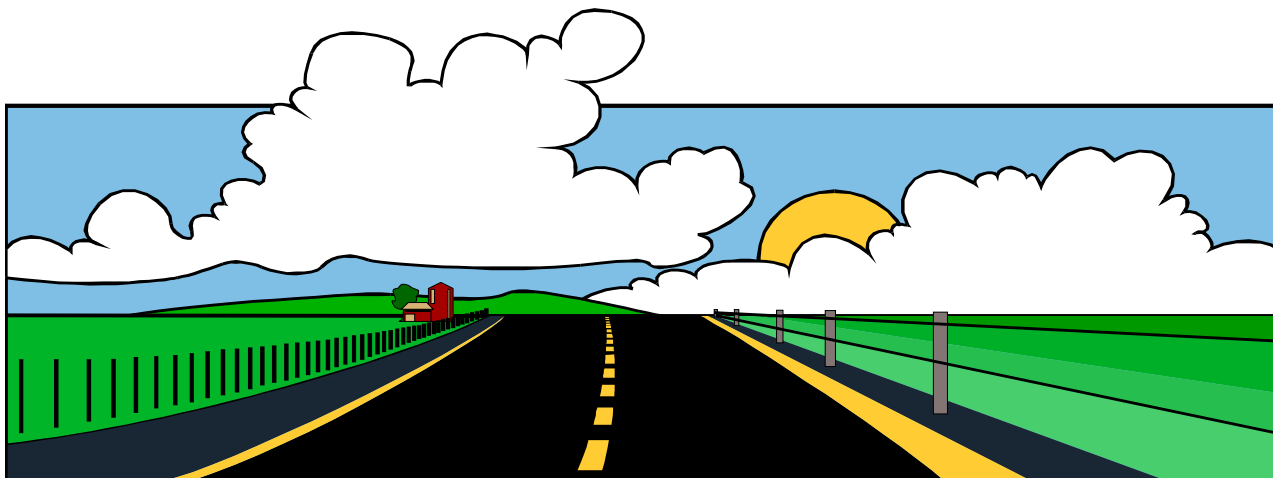


It is anticipated that by 2007,

- More than 50% of mobile source NO_x emissions will be due to Nonroad Applications.
 - and
- Over 70% of mobile source PM emissions will be due to the Nonroad Market

The Road Ahead

- Nonroad Tier 3 Technology Review NPRM will address:
 - Initiating a more effective and stringent PM control strategy
 - Review of NMHC+NO_x standards for this phase
 - Instituting an in-use control effort for the nonroad market
 - Assessment of diesel fuel sulfur level to enable control technology
- Targeting the end of 2001 for the Nonroad Tier 3 FRM



Preparing for the 2001 Rulemaking



- Controlling PM in the Real World
 - Maintaining Harmonization
- Understanding Inventory Implications
- Evaluating Diesel Fuel Implications
- Reviewing Updated Cost of Compliance Information

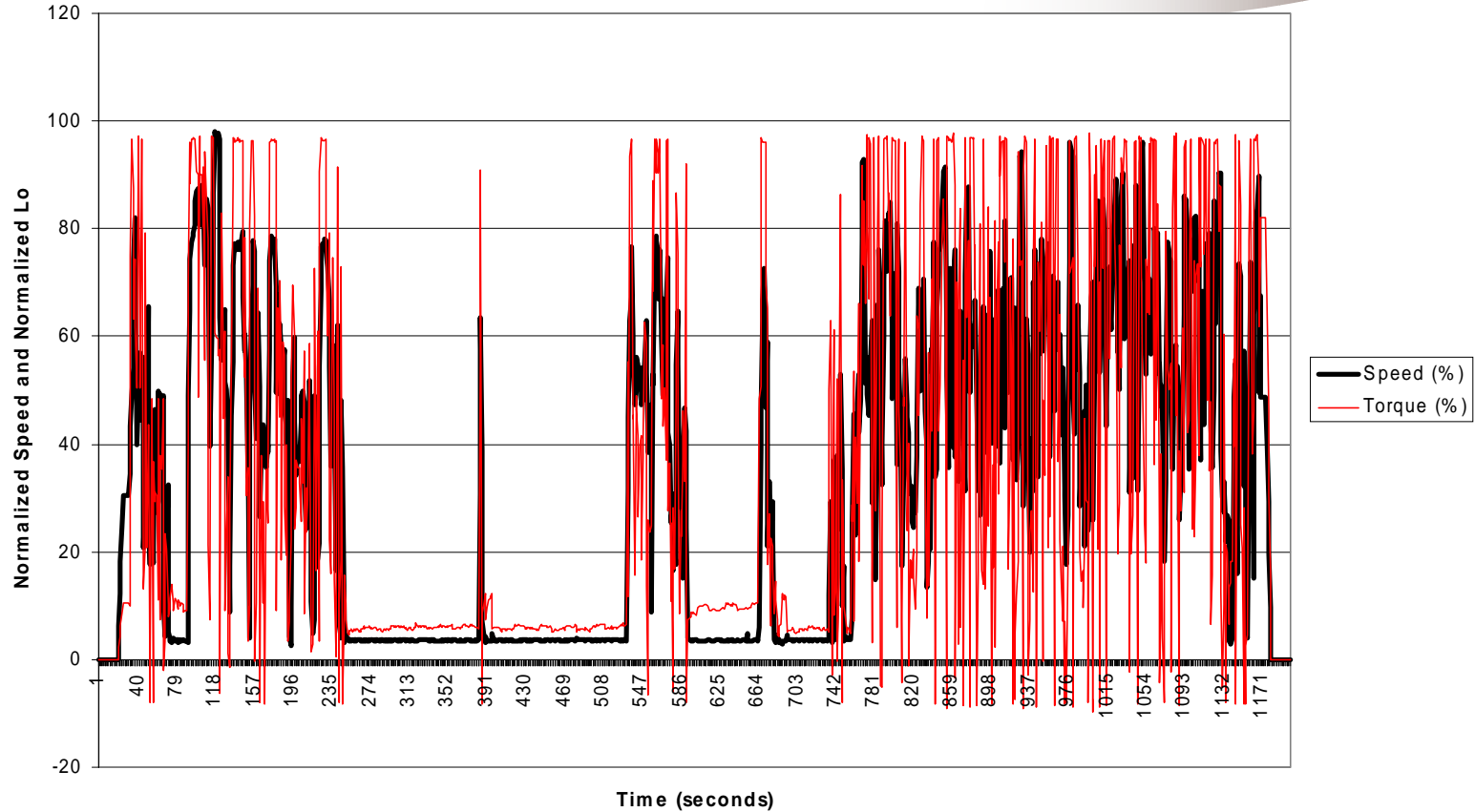
PM Control



- In-Use Control Component
- Supplemental transient test cycle needed
 - Data collected to date indicates the transient nature of nonroad equipment operation
 - PM generation is heavily influenced by transient operation
 - To ensure effective in-use control of PM emissions a supplemental transient test cycle must be added
- Demonstration Engine Effort
- Ten Engine Program to support Test Cycle Selection for PM Control

Real World Nonroad Activity

Wheel Loader Typical Operation 1 Duty Cycle



In-the Field Operation

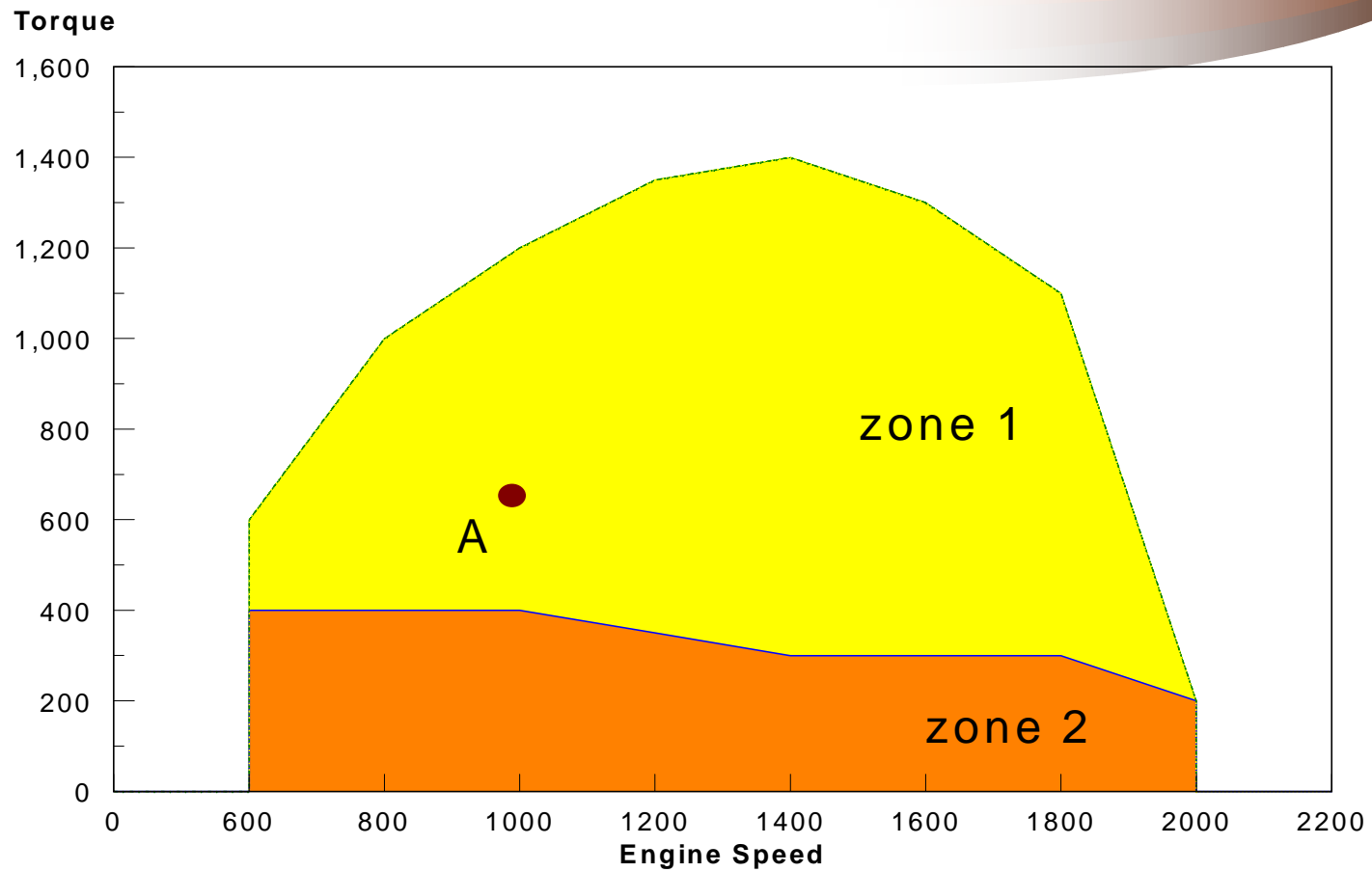


In-Use Control



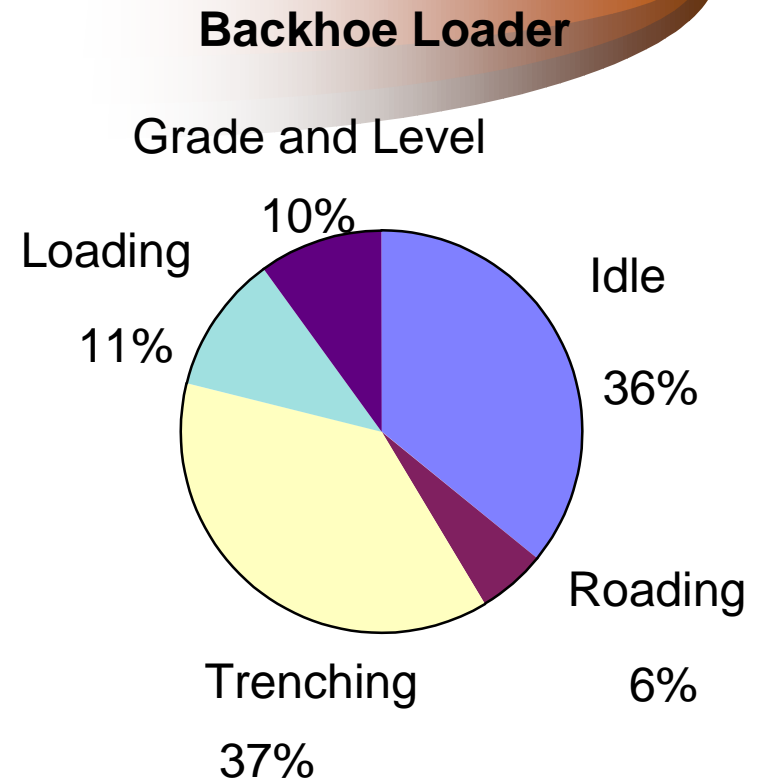
- Likely use of NTE (Not to Exceed) Zone similar to on-highway
 - Similar Zone Dimensions
 - Limit Value appropriately tailored to nonroad
 - Expanded Temperature and Humidity Limits similar to On Highway
 - Applicable to NO_x and PM

Not To Exceed Zone(s)



Backhoe Loader Microtrips and Weightings

- Five microtrips
- 508 Seconds
- The percentage of time which the cycle spends on a microtrip is based on the percentage of time spent in actual operation



Nonroad Low Emissions Engine Development Effort



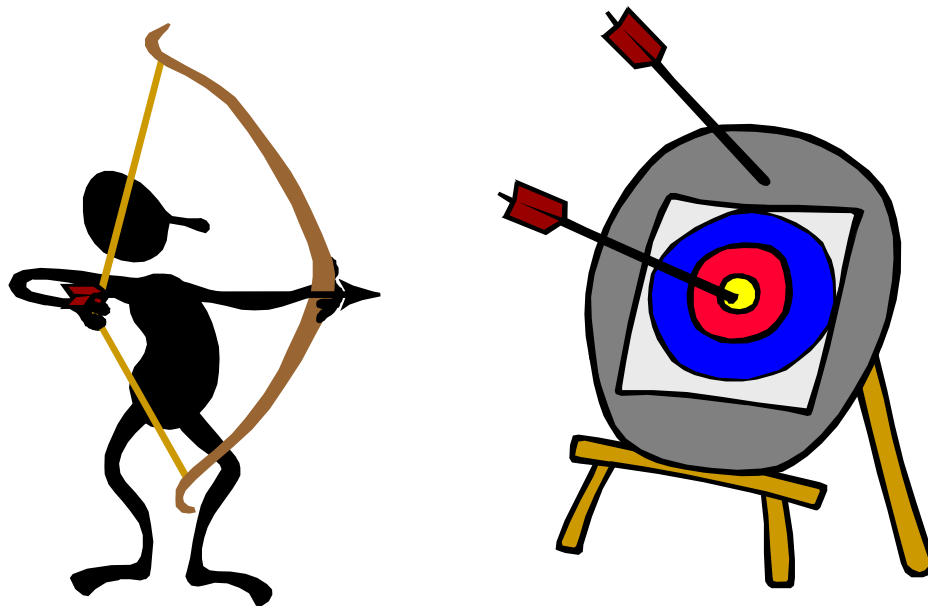
- 50 - 100 hp Category
- NO_x + HC 3.3 g/hp-hr (.38 HC)
- PM 0.113 g/hp-hr
- Fuel Economy Penalty @ rated .8%
- Current Technology: Cooled EGR,
Aftercooling, Electronic Rotary Injection
Pump, and VNT.

Meeting the Targets

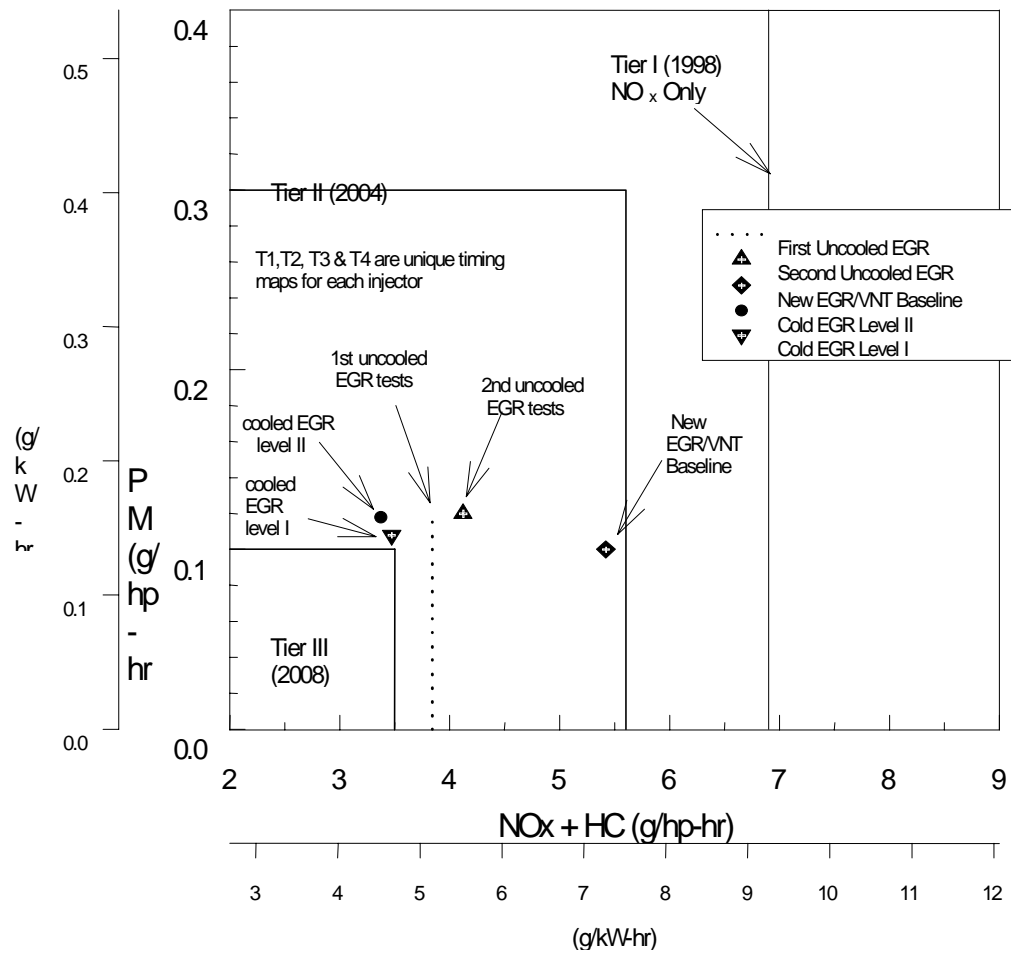
Development Targets

3.5 g/hp-hr NO_x +HC

0.1 g/ hp-hrPM



How did we do?



Ten Engine Duty Cycle Emissions Evaluation Program



- Will provide emissions data on a wide variety of engines over a plethora of real world nonroad duty cycles
- Will provide comparison data for the CVS and PFSS
- Will provide additional chemical characterization of PM resulting from operation of these nonroad engines over nonroad cycles

What about Nonroad Diesel Fuel?



- Assuming transfer of some on highway engine technology to nonroad applications
- Fuel sulfur reduction to enable comparable engine technologies
- Current on-highway certification fuel Sulfur level is an option
 - One proposal the Agency has received from industry includes a 500 ppm S cap for nonroad.
 - Due to distribution concerns and other issues - locomotive, marine, and possibly home heating oil may have S levels comparable to nonroad.

How much will this cost?



- Benefit derived from economies of scale due to transfer of technology from highway market
- Many technologies may be a direct match between highway and nonroad and so most R&D for component design accounted for

Next Steps



- Issues to be addressed in this effort:
 - Pull Ahead (300 hp to 750 hp)
 - Fuel Effects
 - Air Quality Justification
 - Supplemental Test
 - SBREFA
 - PM Control
- FRM by the end of 2001
- and eventually transfer aftertreatment technology to nonroad