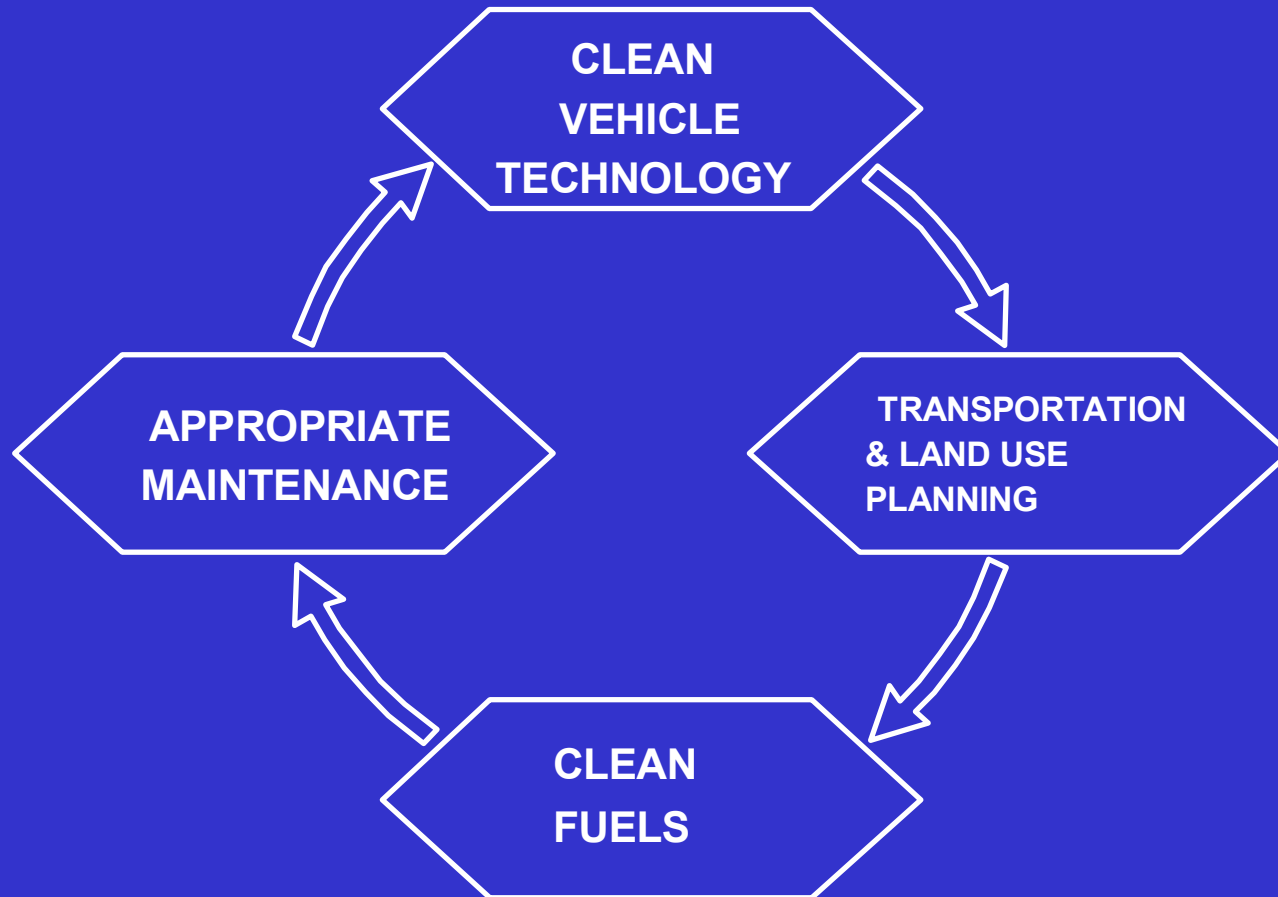




Vehicle Emission Standards

The Basis For Vehicle Emission
Control

ELEMENTS OF A COMPREHENSIVE VEHICLE POLLUTION CONTROL STRATEGY



Why Are Emissions Standards Important?

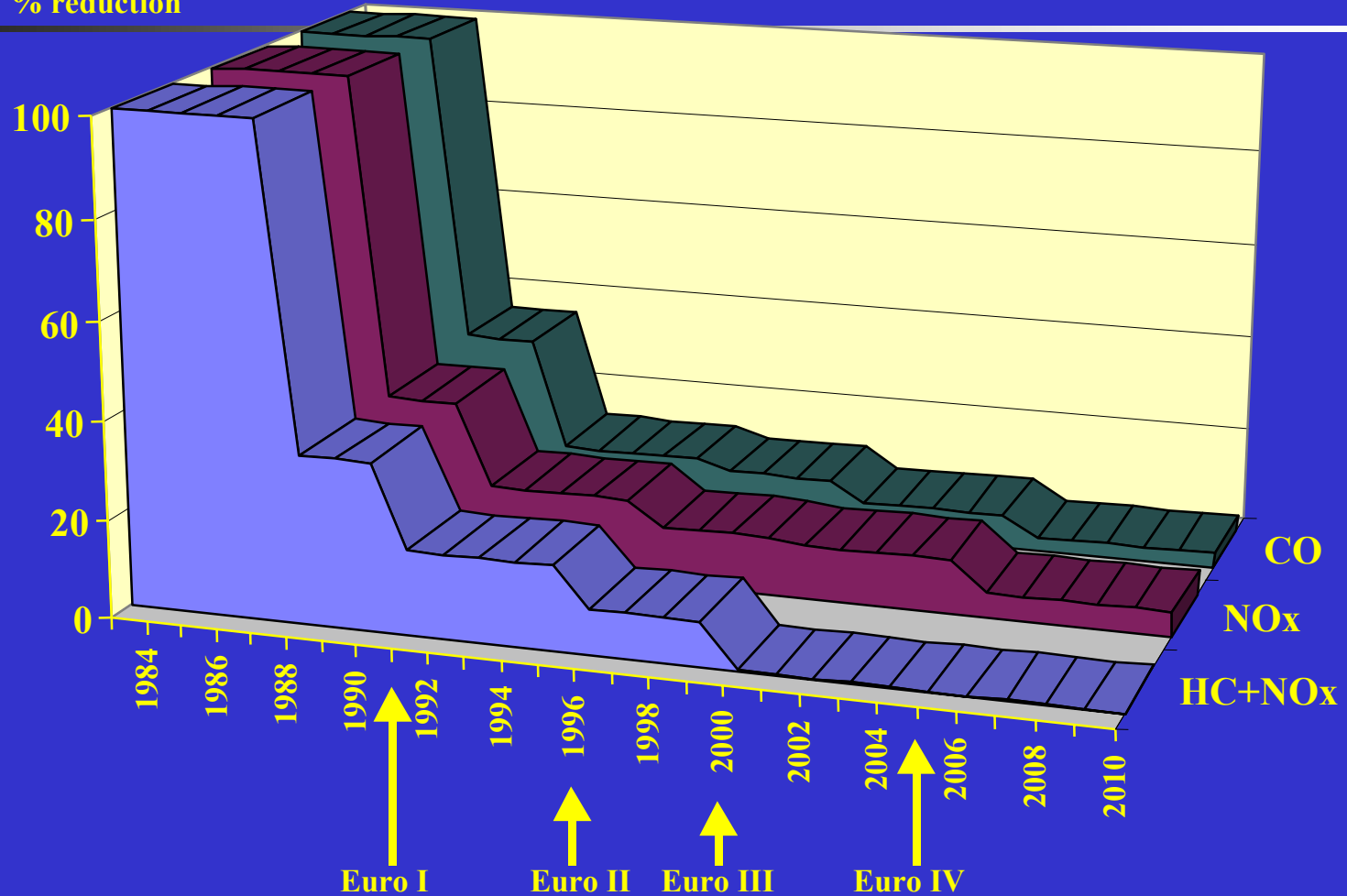
- Major Determinant of Technology Applied To New Vehicles
 - Engine Modifications
 - Catalytic Converters
 - Electronic Control Systems
 - Particulate Filters
 - NOx Adsorbers
 - Advanced Powerplants
- Technology Determines Actual Emissions

What Are Emission Standards?

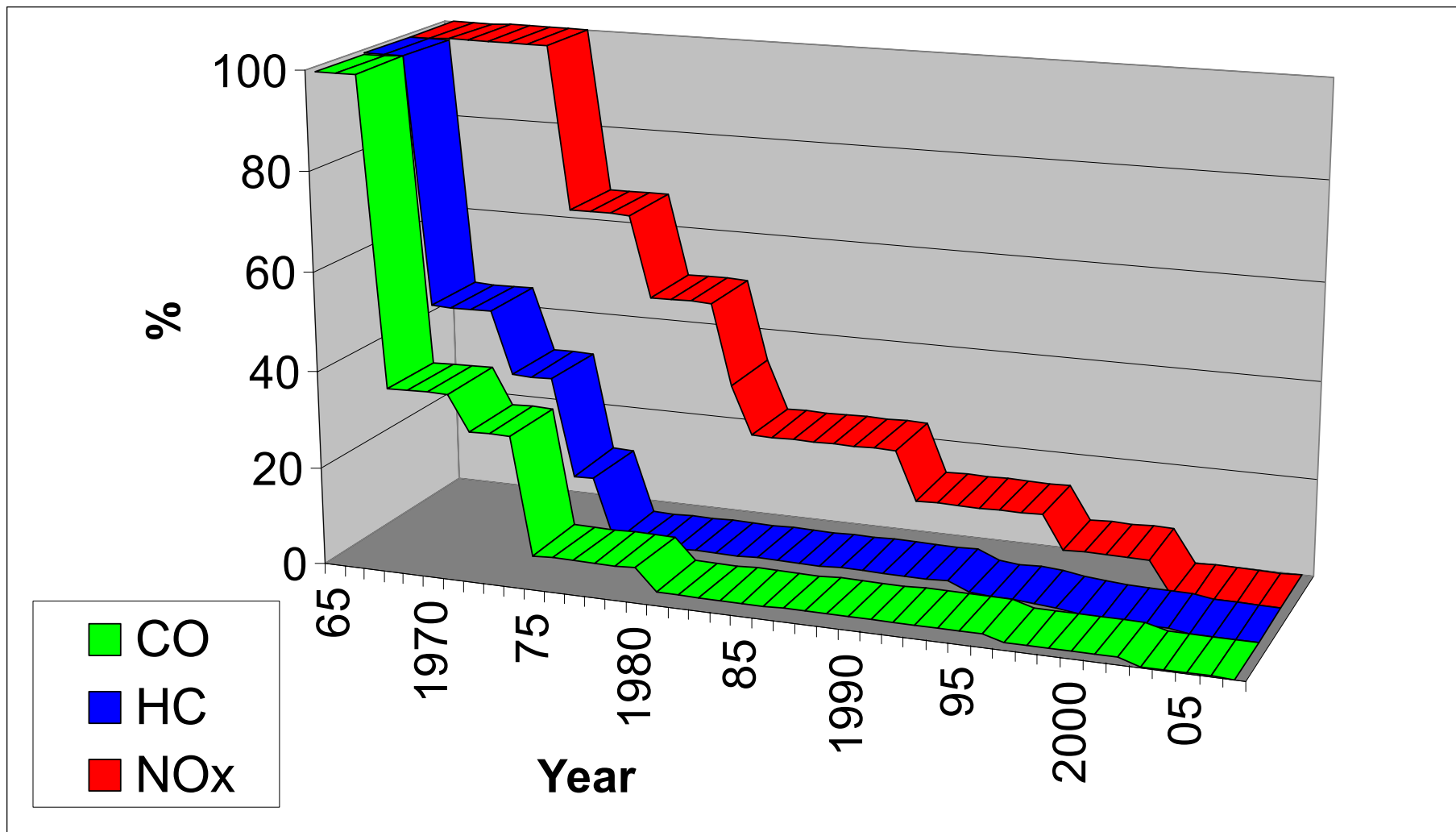
- Numerical Standard (e.g., grams per kilometer)
- Test Procedure (s)
- Fuel
- Ambient Conditions
- Enforcement
- Durability (Useful Life)
- In Use Compliance

EU Petrol Car Emission Limit Reductions

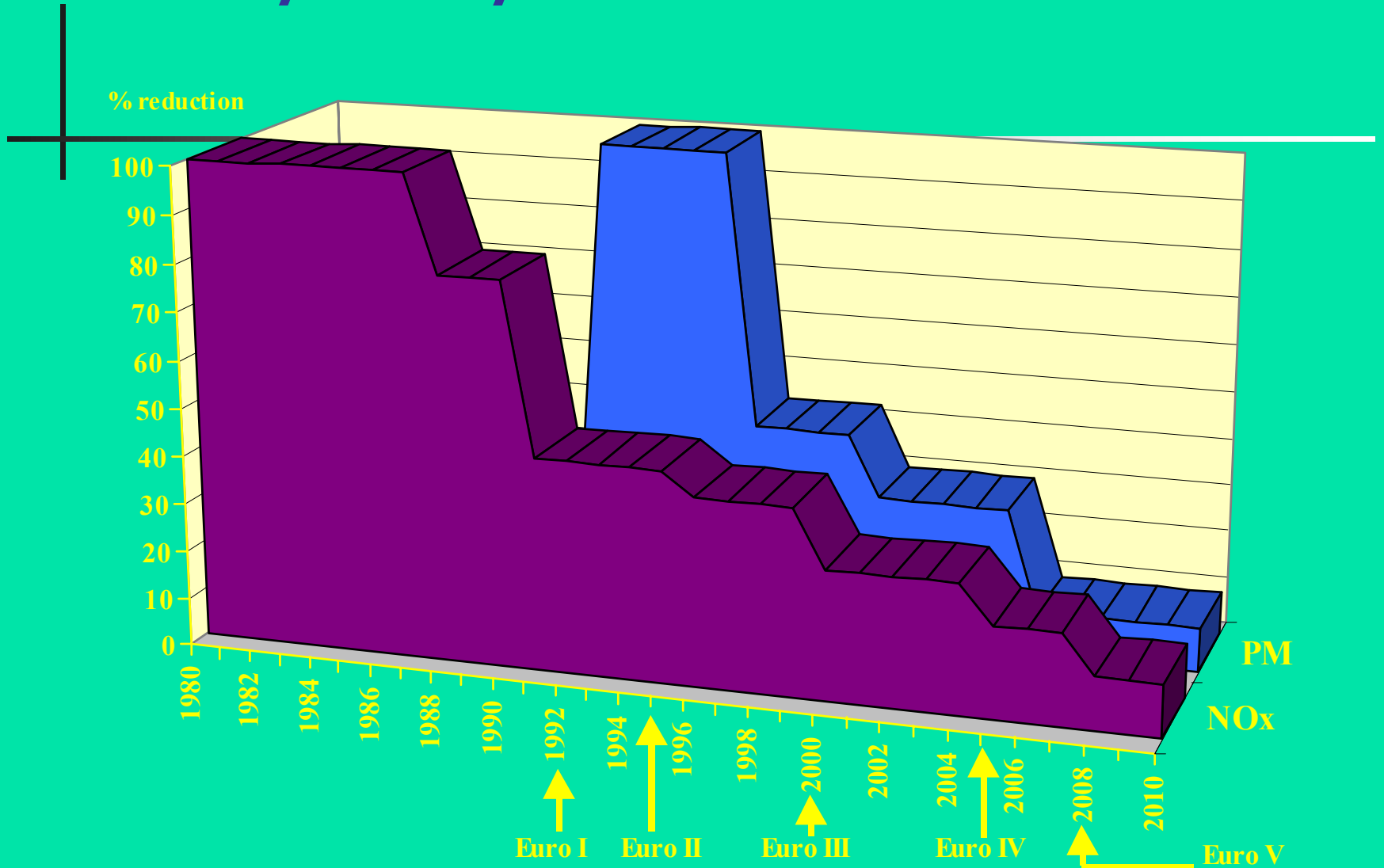
% reduction



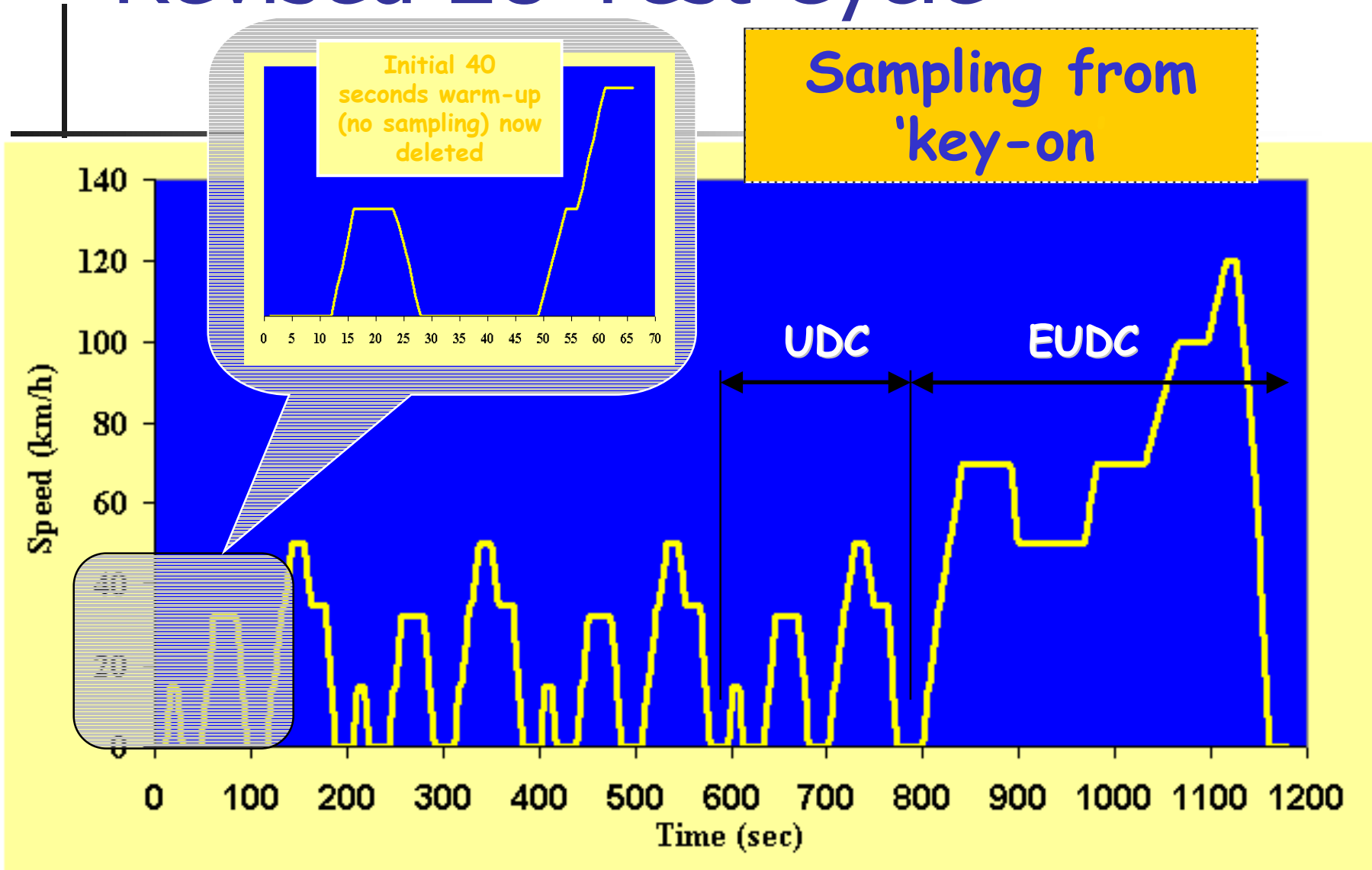
US Passenger Car Emission Limit Reductions



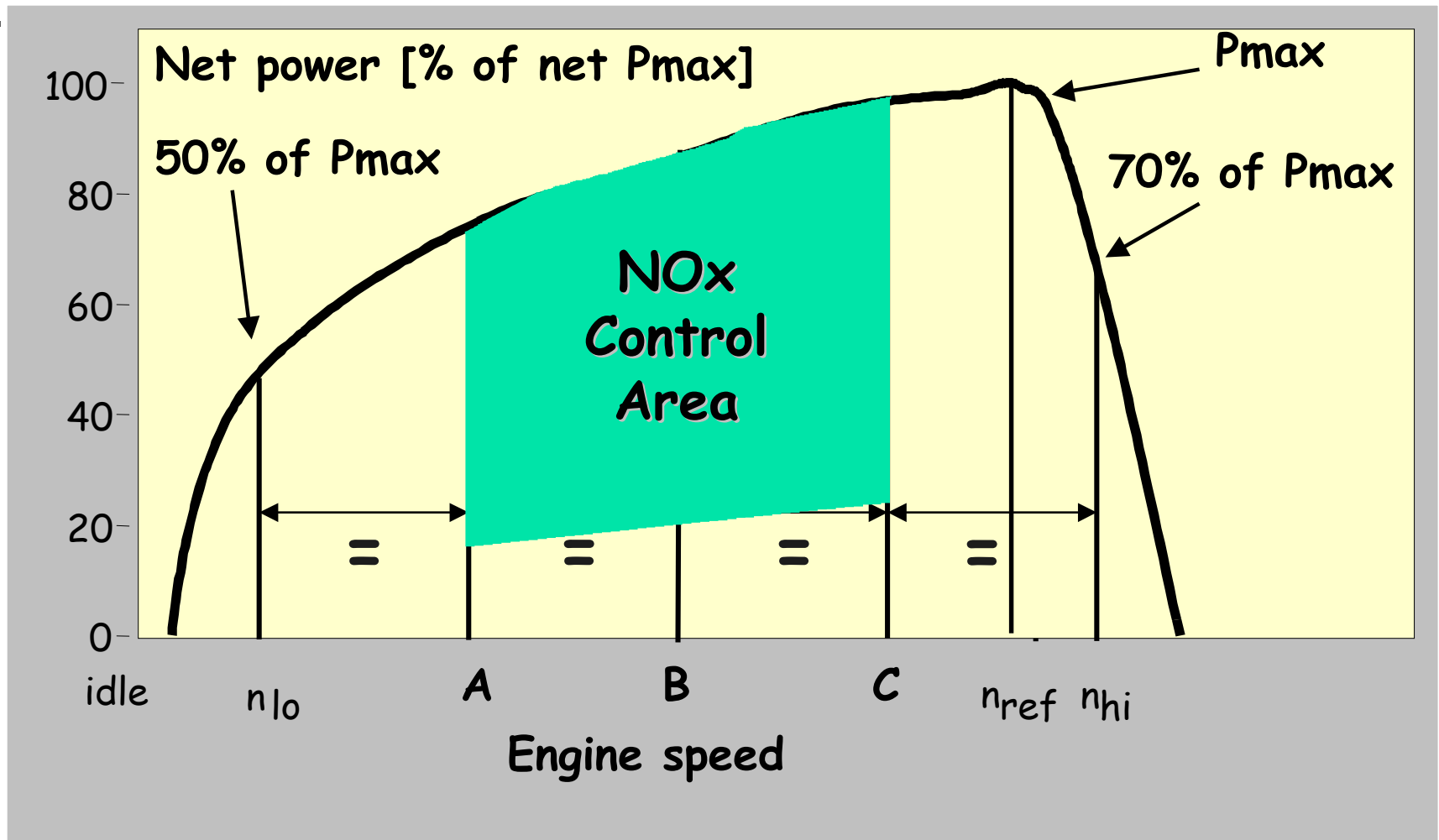
Heavy-duty vehicles on ETC



Revised EU Test Cycle

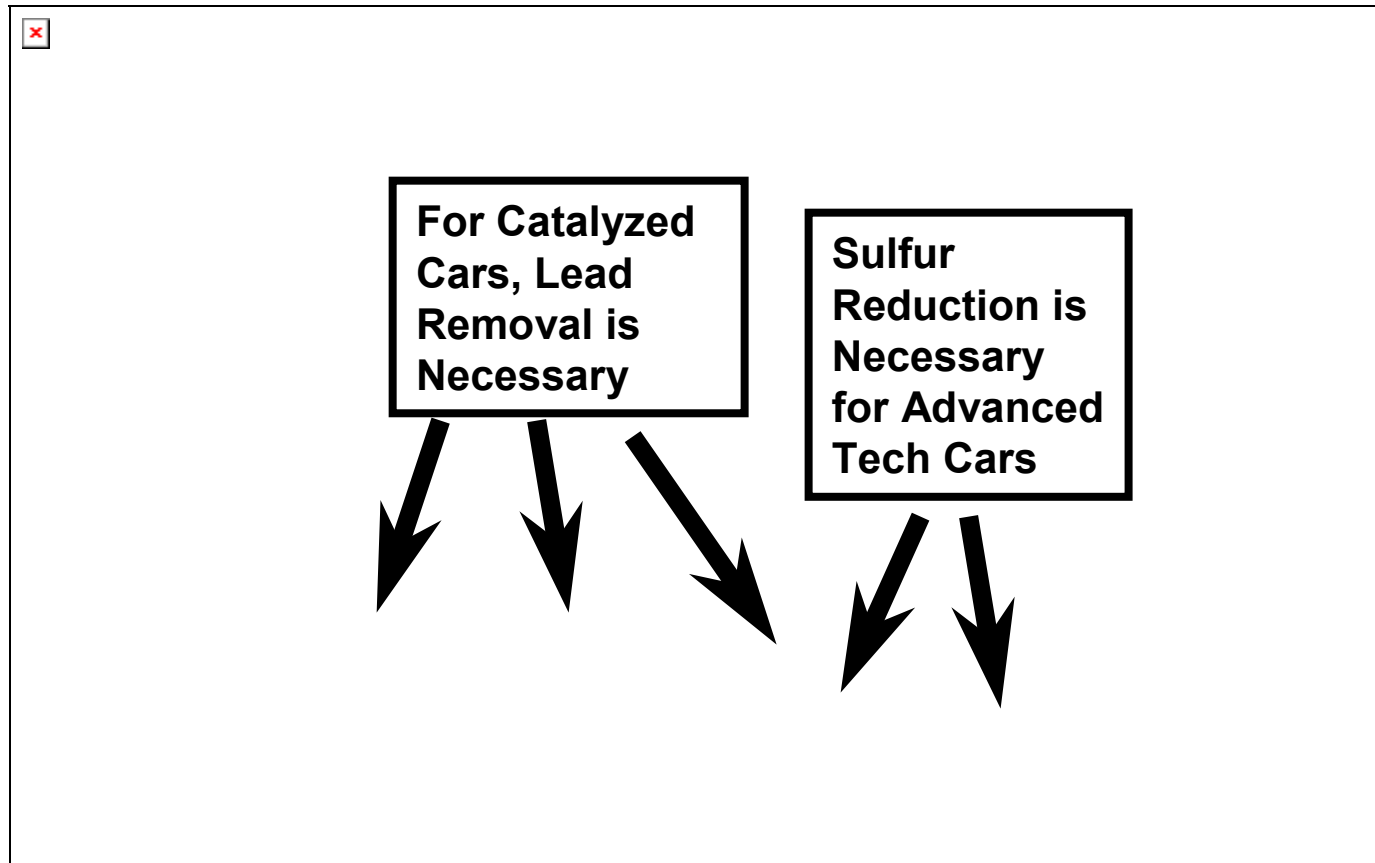


European Steady Cycle (ESC)



Enabling Emissions Control

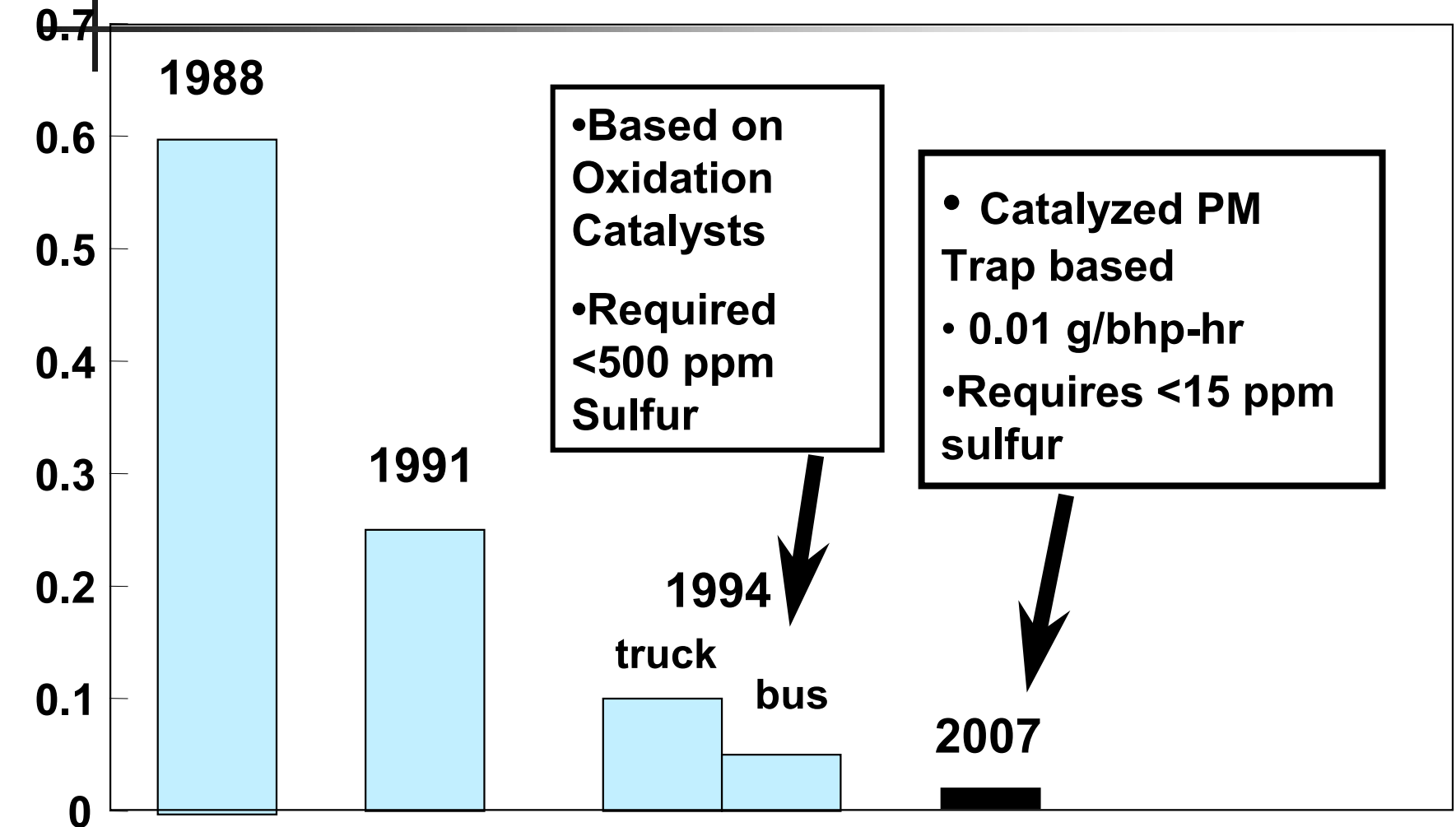
US Gasoline Cars and Trucks



Enabling Emissions Control

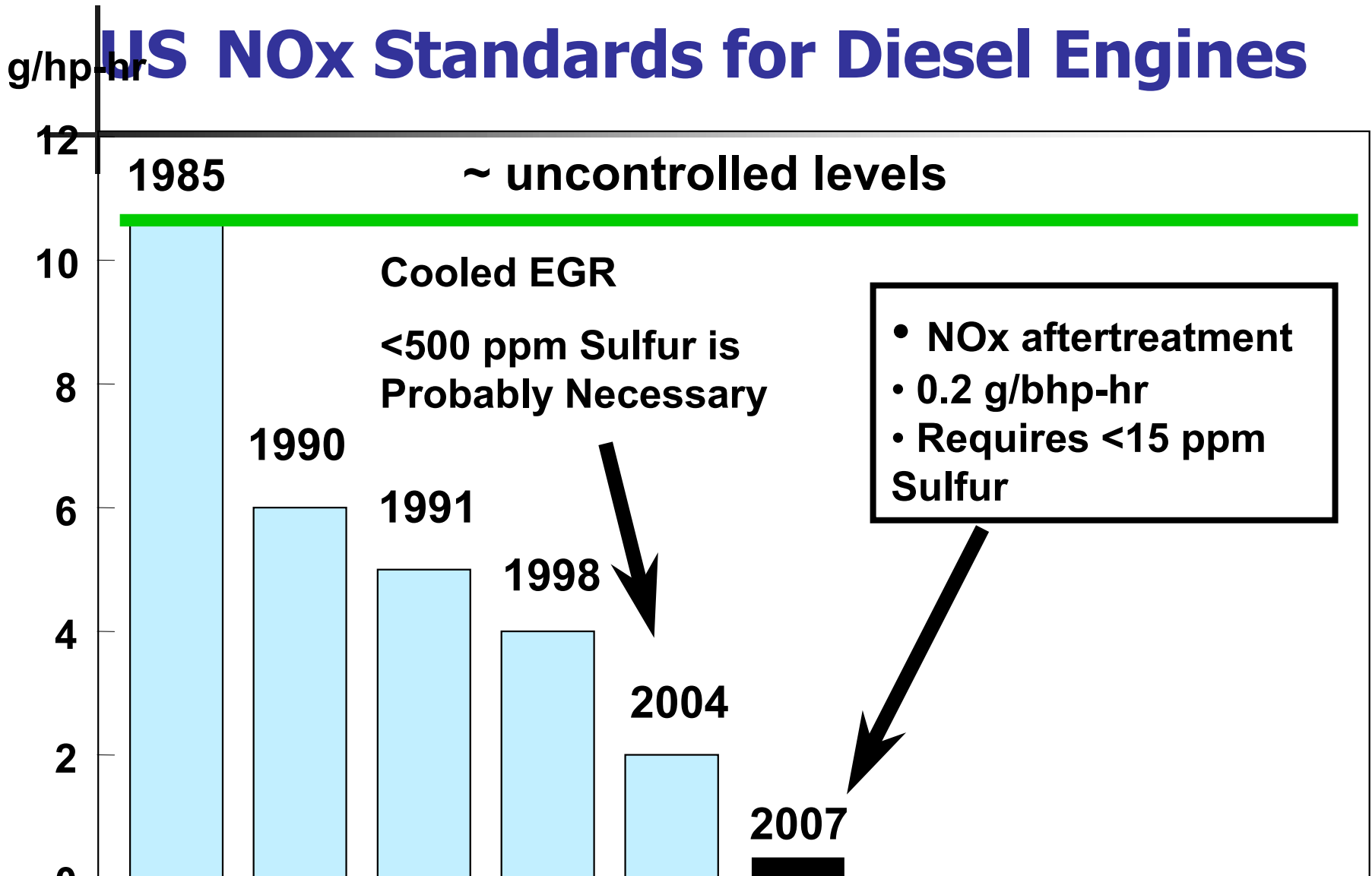
PM Standards for Diesel Engines

g/hp-hr



Enabling Emissions Control

US NOx Standards for Diesel Engines



Enforcing Emission Standards

When Tested	What Vehicles Tested	Requirement	Emission Test method	
			Comprehensive	Short Test
Before production	Representative of Production	(Certification) Type approval	Main test	Should Be Based On Technology
At shipment	Production sampling			Durability
After sale	In field	In-use Test	Expensive	Relatively Easy
		COP		

Conclusions

- New Vehicle Standards Are Critical Element of Comprehensive Program
- Takes Many Years To Have Full Impact
- Full Impact Dependent On Degree of Enforcement
- Fuel Quality Critical