

The Future of Vehicle Emissions Regulation in the EU and Internationally

June 5, 2013

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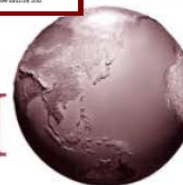
Key Points

- Urban, Regional and Global Air Pollution Challenges Remain Daunting
- Vehicles Remain Major Contributor
- EU Standards Have Been Much Less Effective Than Intended – Well Known For Long Time
- Euro 6 Still Not Sufficient – Diesel NO_x; GDI PN; No Improvement in Gasoline Cars, Euro 6B?
- Non Road PN
- 400 PPM CO₂; Need Real Reductions and Strong 2025 Target


Over 3.2 Million Premature Deaths Worldwide And Over 74 Million Years Of Healthy Lives Lost

The Global Burden of Disease 2010

- Systematic Comparison of Air Pollution and Other Risks Globally and Regionally
- Outdoor Air Pollution analysis by >20 worldwide experts, led by Health Effects Institute and St. Georges, University of London
- Published in *the Lancet* 15 December 2015 (Lim, et al)



HEI



Health effects of fine particles (PM_{2.5})

Breathing fine particles (PM_{2.5}) causes adverse effects on the cardiovascular and respiratory systems

Ambient (outdoor) PM_{2.5} exposures linked to

Premature death

Heart attacks

Strokes

Hospital and emergency room visits

Acute and chronic bronchitis

Asthma-related effects

PM_{2.5} may also be associated with infant mortality, low birth weight, and cancer

New: June 2012 - WHO Classifies Diesel Engine Exhaust As Group 1 Known Carcinogen




Diesel engine exhaust carcinogenic



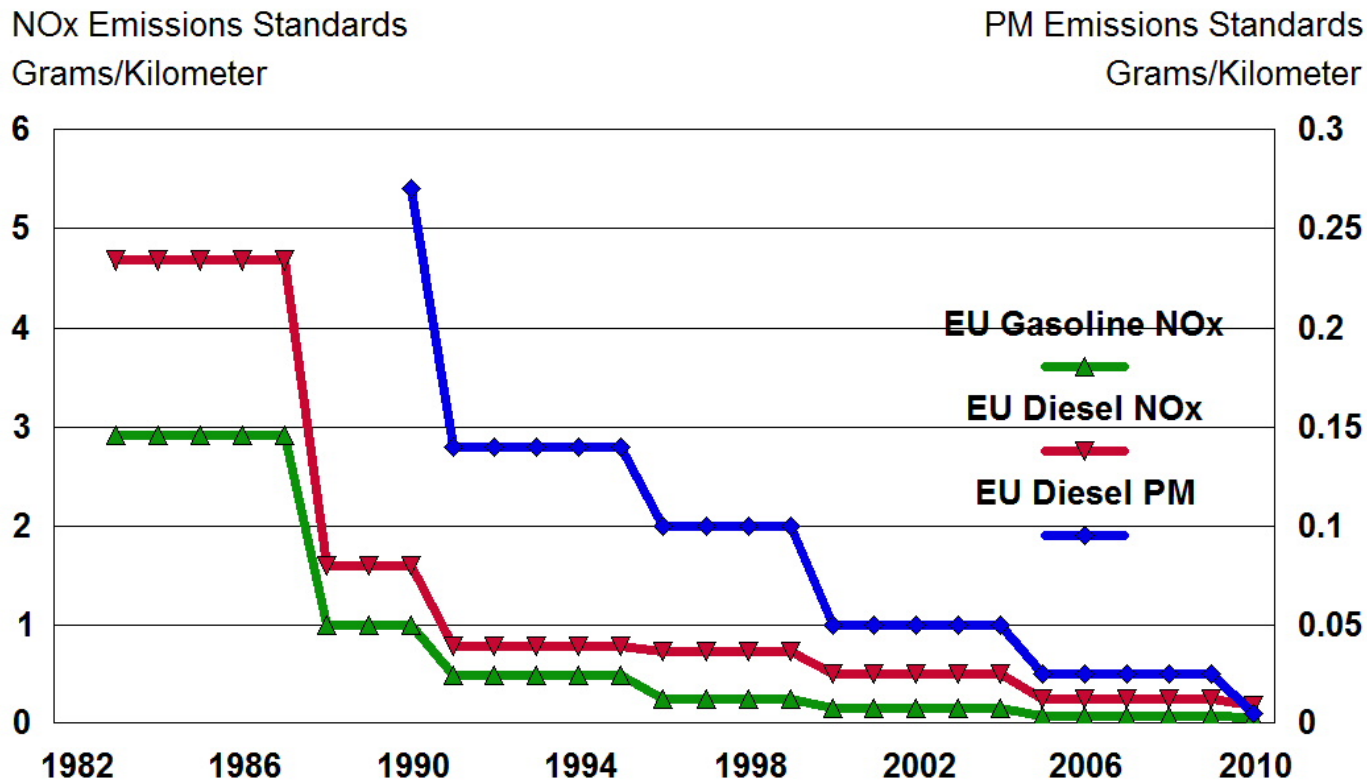
WHO/PAHO

12 June 2012 -- After a week-long meeting of international experts, the International Agency for Research on Cancer (IARC), which is part of the World Health Organization, today classified diesel engine exhaust as carcinogenic to humans (Group 1), based on sufficient evidence that exposure is associated with an increased risk for lung cancer.

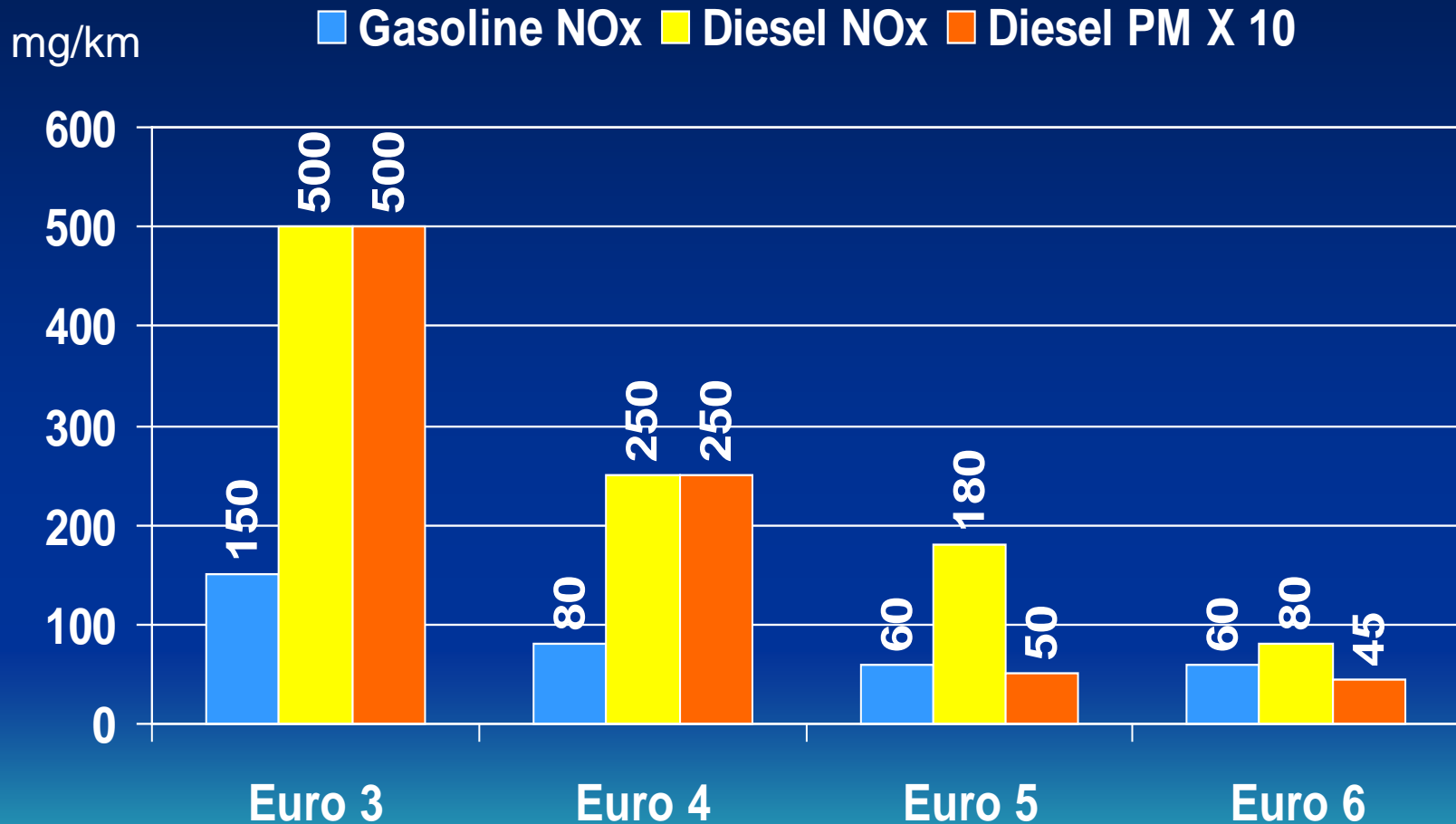
[Read the press release from IARC on diesel engine exhaust](#) 

We've Come a Long Way!

EU Passenger Car Exhaust Emissions Standards

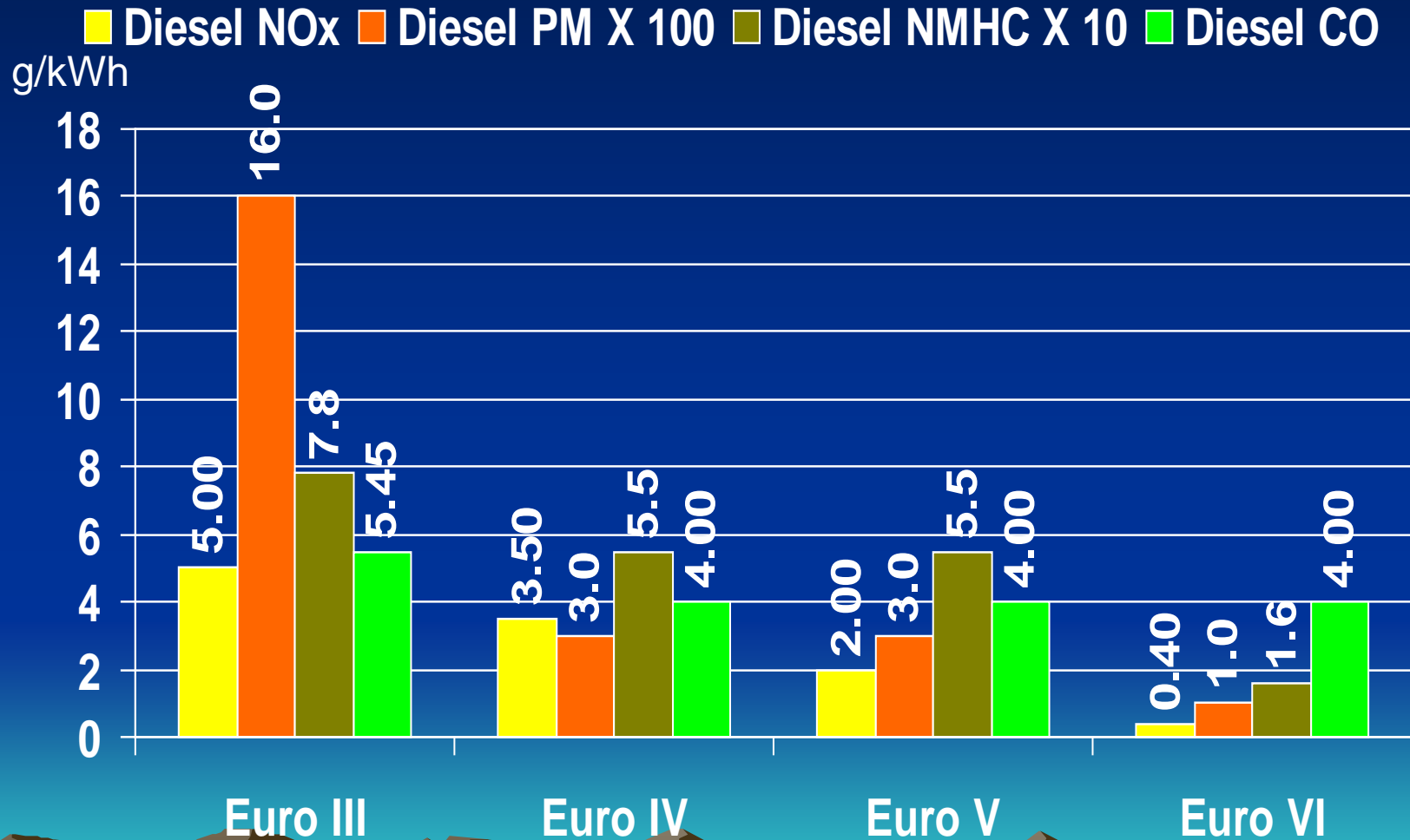


European Union Light-Duty Vehicle Emission Standards



Euro 5+ (2011) and 6 include $6 \times 10^{11}/\text{km}$ particle number limit
Euro 6 PM mass limit uses revised PMP mass protocol

European Union Heavy-Duty Engine Transient Cycle Emission Standards



Euro VI includes particle number limit

Note: Euro VI uses THC rather than NMHC

But Air Quality in Europe Remains Very Polluted

- % Urban Population in EU Exposed to Air Pollution Above WHO Reference Levels (2008-2010)

PM2.5	90-95%
PM10	80-81%
O3	Over 97%
NO2	6-12%

Source: EEA Air Quality in Europe 2012



Report From European Environment Agency

February 28, 2013



Results Are Alarming

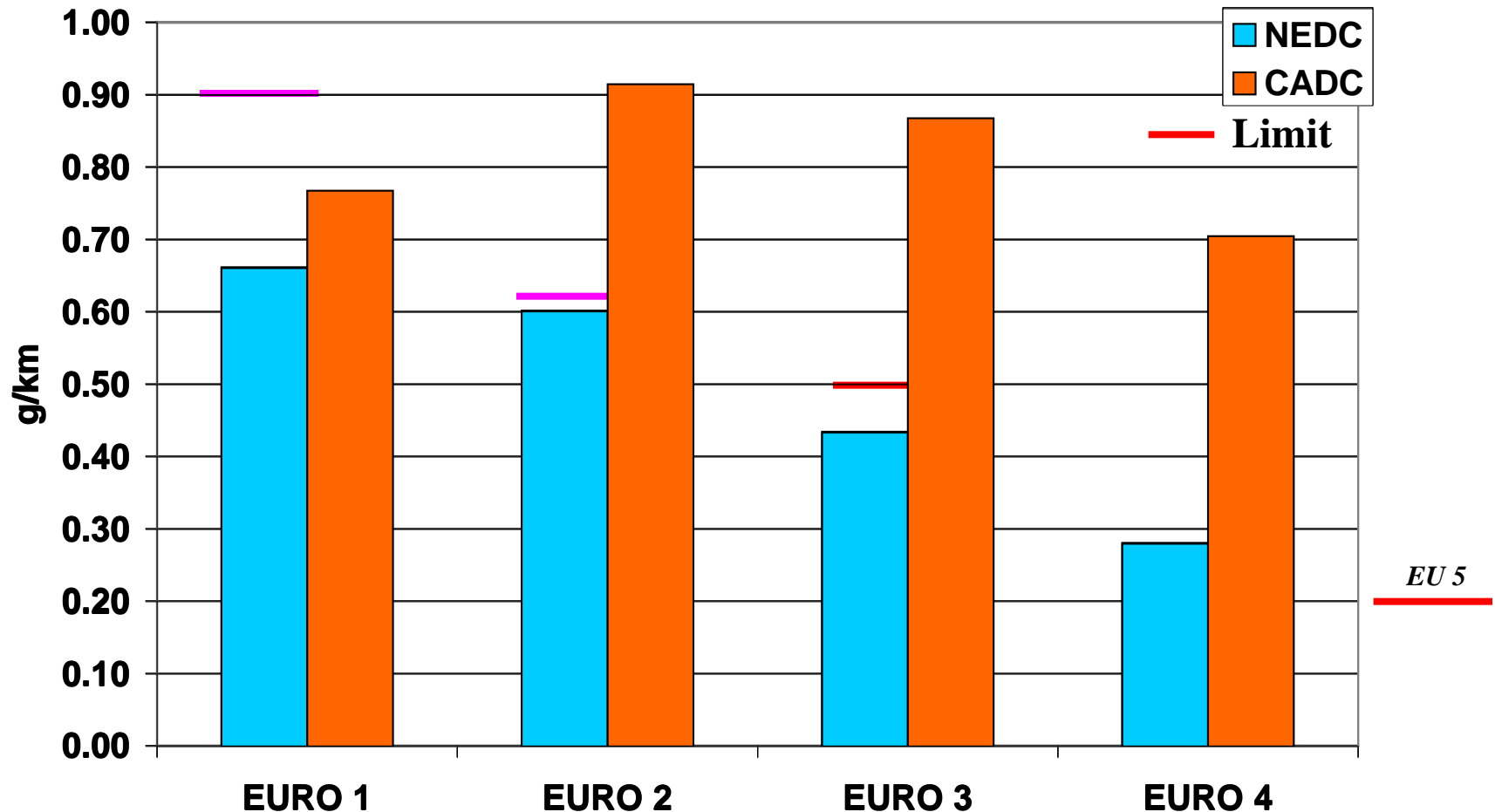
- Air Pollution Causes 350,000 premature Deaths/Year
- Transport Air Pollution Costs €100 billion/Year
- Heavy Goods Vehicles alone Cause €43-46 billion/Year in Health Damage

Non Compliance with The NO_x Emissions Ceiling Remains Serious

- Many Member States Over Ceiling
- Road transport approximately 40 % of EU-27 NO_x
- Reductions of NO_x from this sector not as large as anticipated partly because real-world emissions higher than anticipated with vehicle emission standards.

This Problem Was Known in 2006 When This Data Was Presented At An EU Workshop

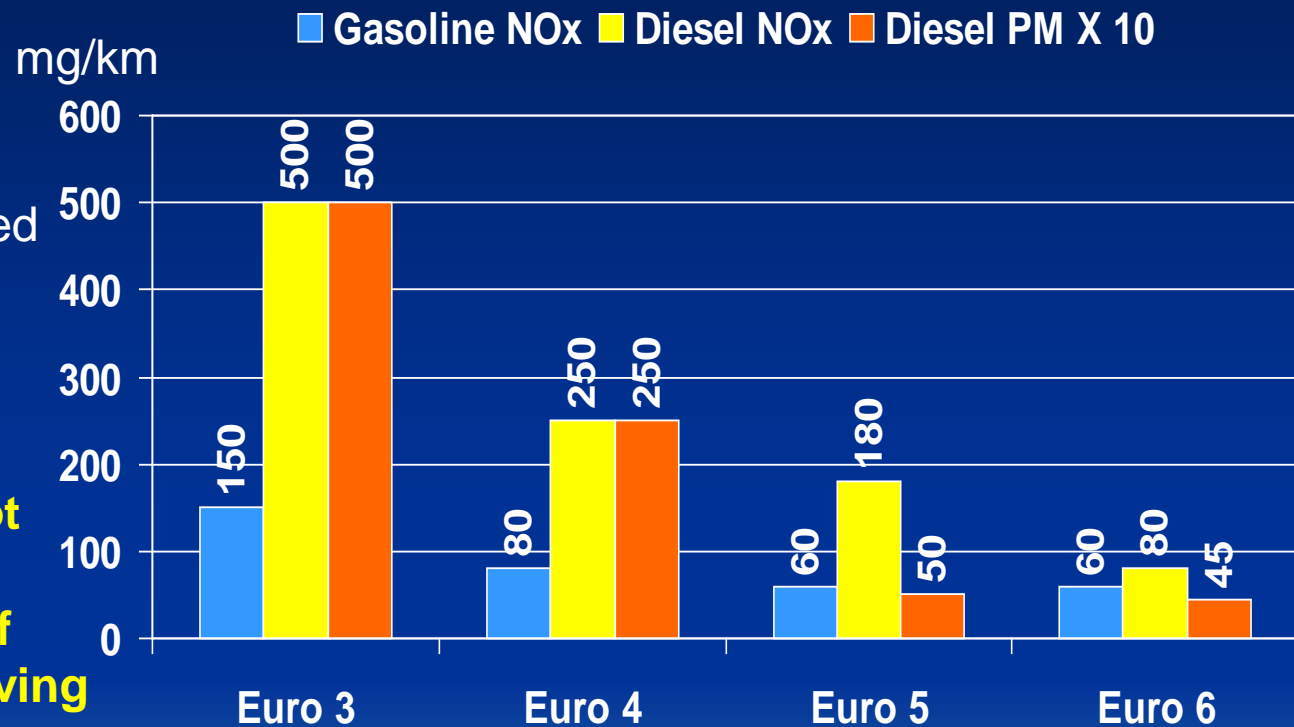
How have specific NO_x emissions of diesel passenger cars evolved in the past?



European Union Light-Duty Vehicle Emission Standards

But it was Not Addressed
In Euro 5 and is
Implicitly “allowed” At
The Start of Euro 6

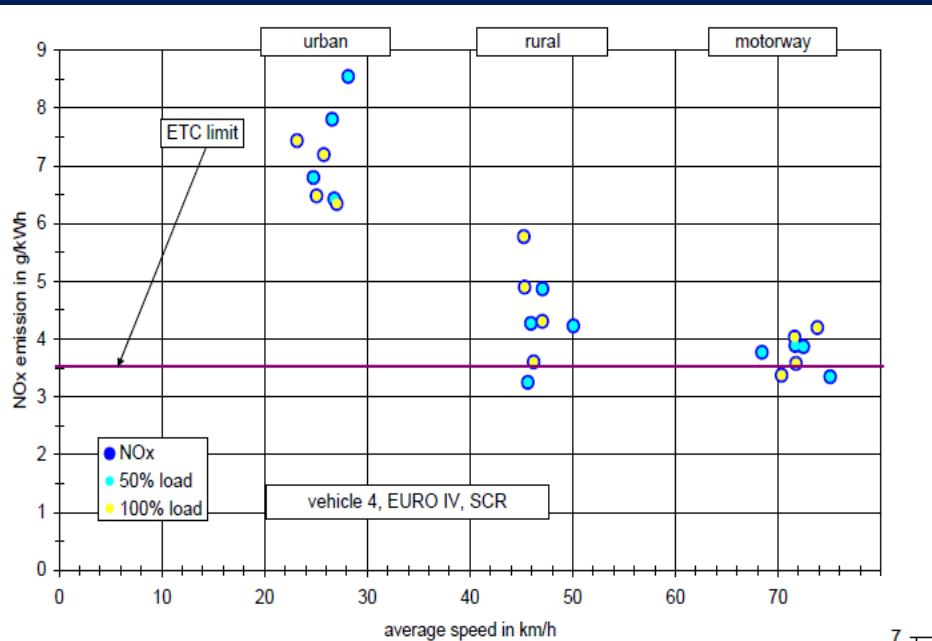
**Are Manufacturers Not
Responsible For The
In Use Performance of
Their Cars in Real Driving
Or Only in the
Laboratory?**



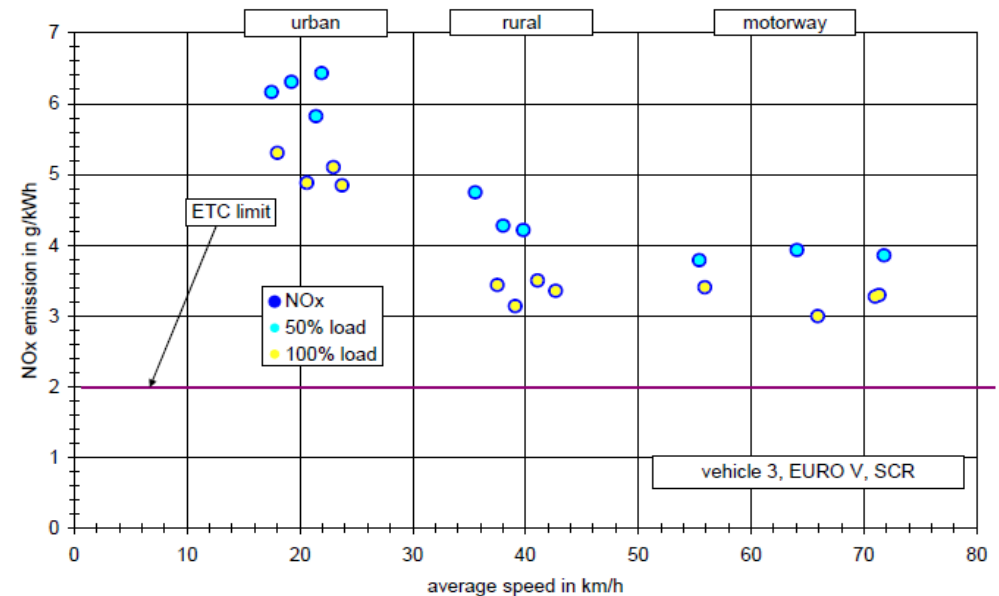
Euro 5+ (2011) and 6 include $6 \times 10^{11}/\text{km}$ particle number limit
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What About Trucks?

The problem: High off-cycle NO_x emissions in urban applications



In-use PEMS testing of Euro IV and Euro V trucks in The Netherlands found emission well above standard in urban driving in 2008!



Source: Kleinebrahm 2008

We Now Face A New Global Challenge: Climate Change

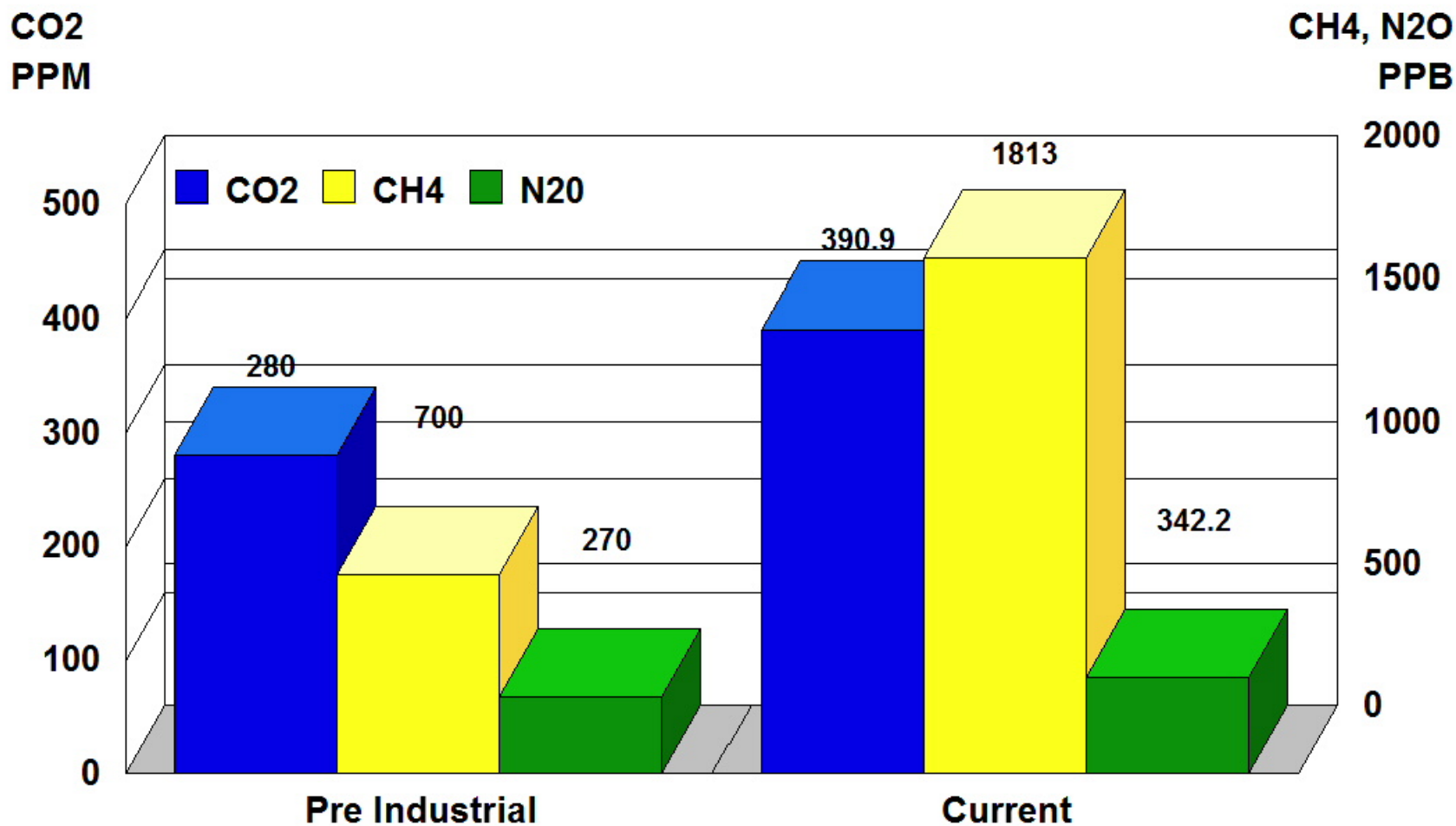
Melt descending
into a moulin,
a vertical shaft
carrying water
to ice sheet base.



*Source: Roger Braithwaite,
University of Manchester (UK)*

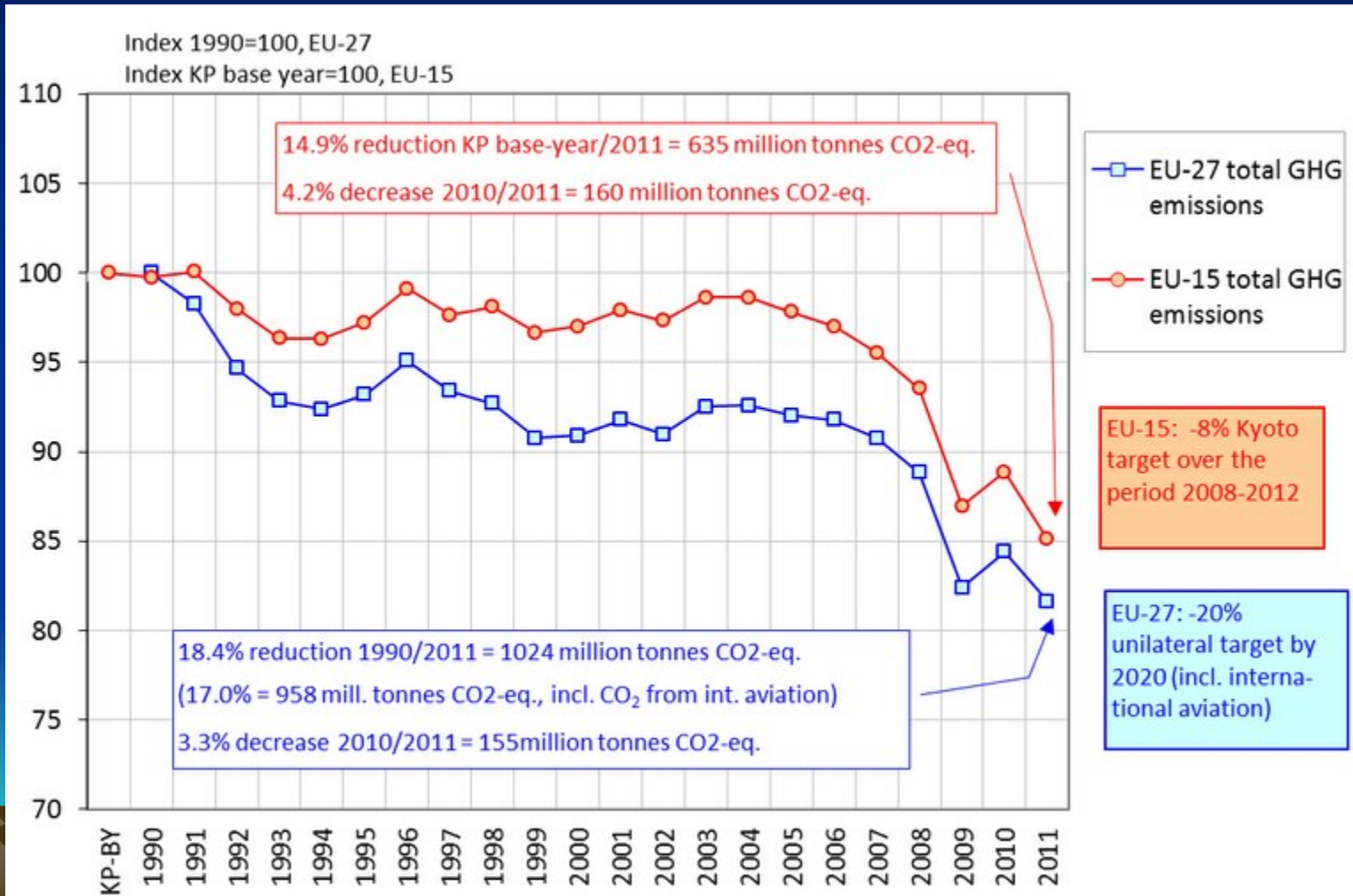
GHG Concentrations Are Reaching New Peaks

CO2 Reached 400 PPM in the Last Few Weeks!

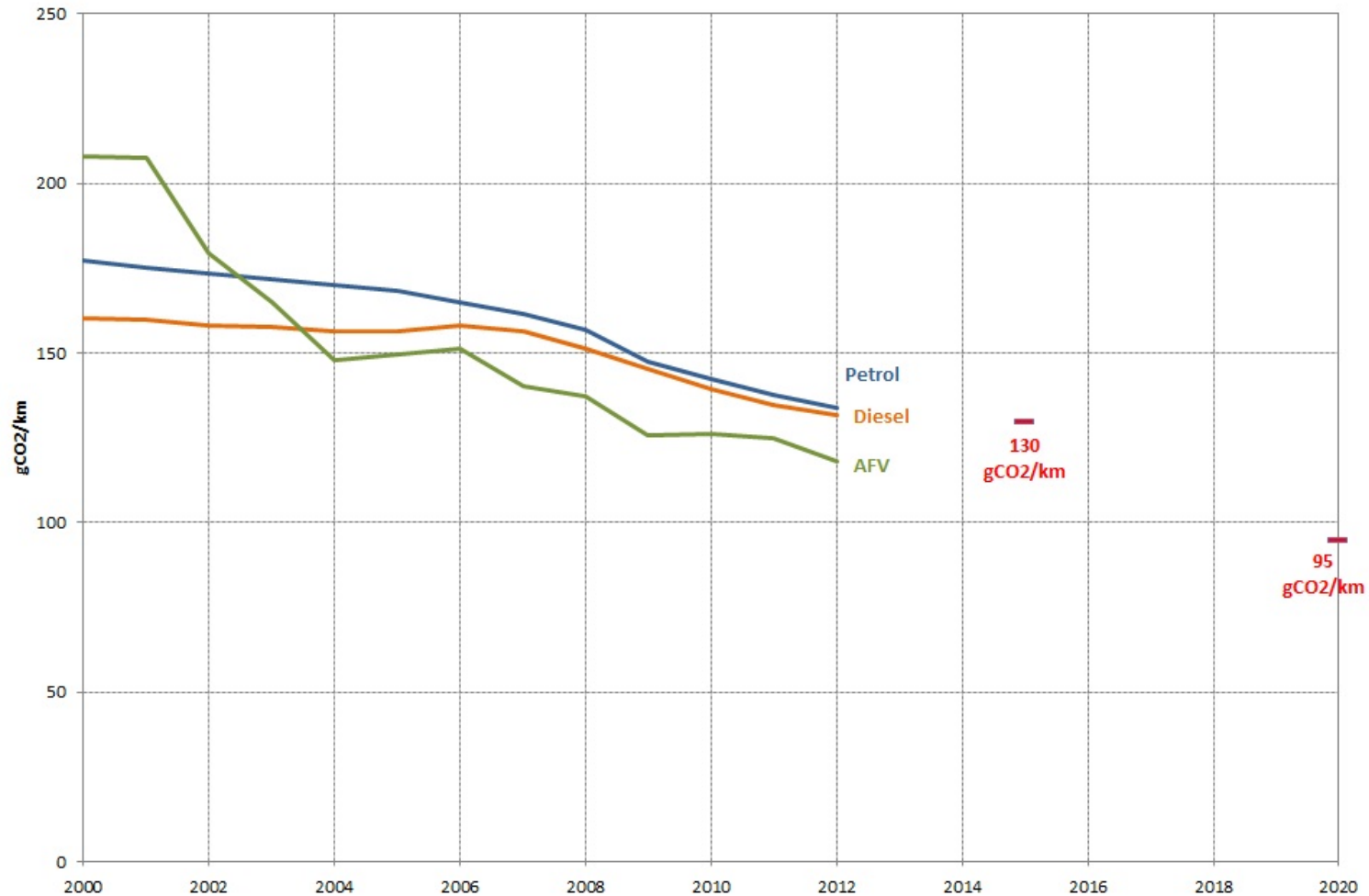


Source; WMO GHG Bulletin Number 8

The EU Is To Be Commended For Making Significant Progress Toward Its 20% Reduction Target

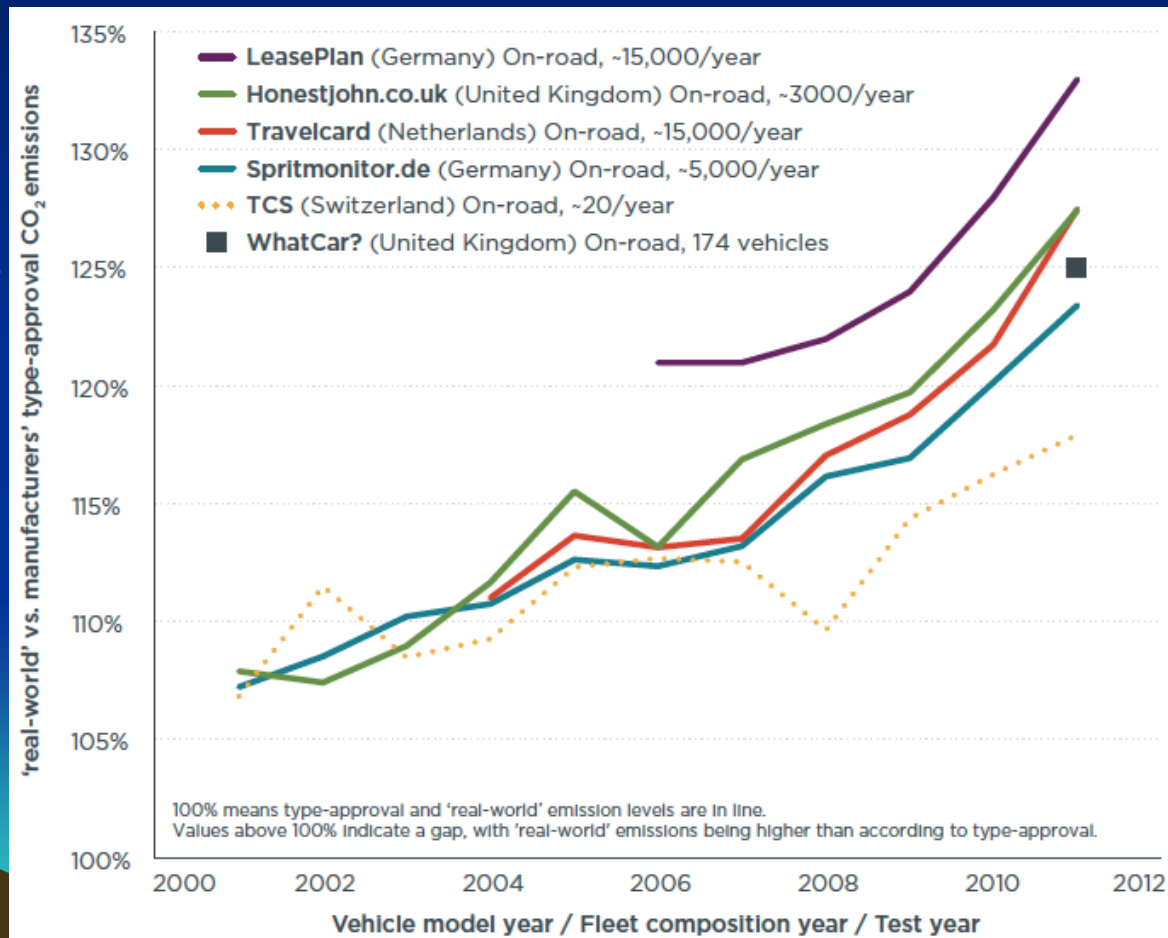


And The Auto Industry Is Contributing Its Share



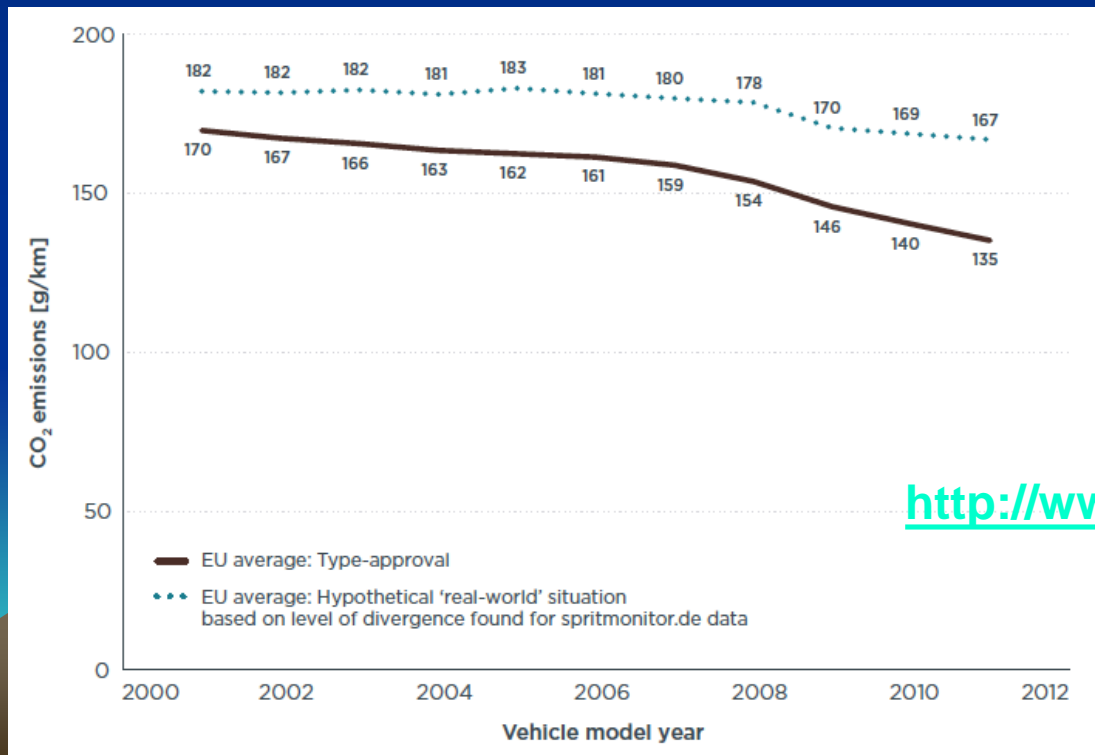
Or Is It? - 'Gap' between type-approval and on-road CO₂ emissions for cars increases

- 25% gap in 2011
- Data for 0.5 million vehicles
- Private and company cars
- All datasets confirm trend



Or Is It? Only half the CO₂ reduction achieved on-road compared to type-approval

- 20% CO₂ reduction according to type-approval values (2001-2011)
- On-road most likely only about 10% CO₂ reduction
- Need to introduce new test procedure (WLTP) soon
- Need to introduce additional correction factors
- Need to introduce compliance testing



<http://www.theicct.org/laboratory-road>



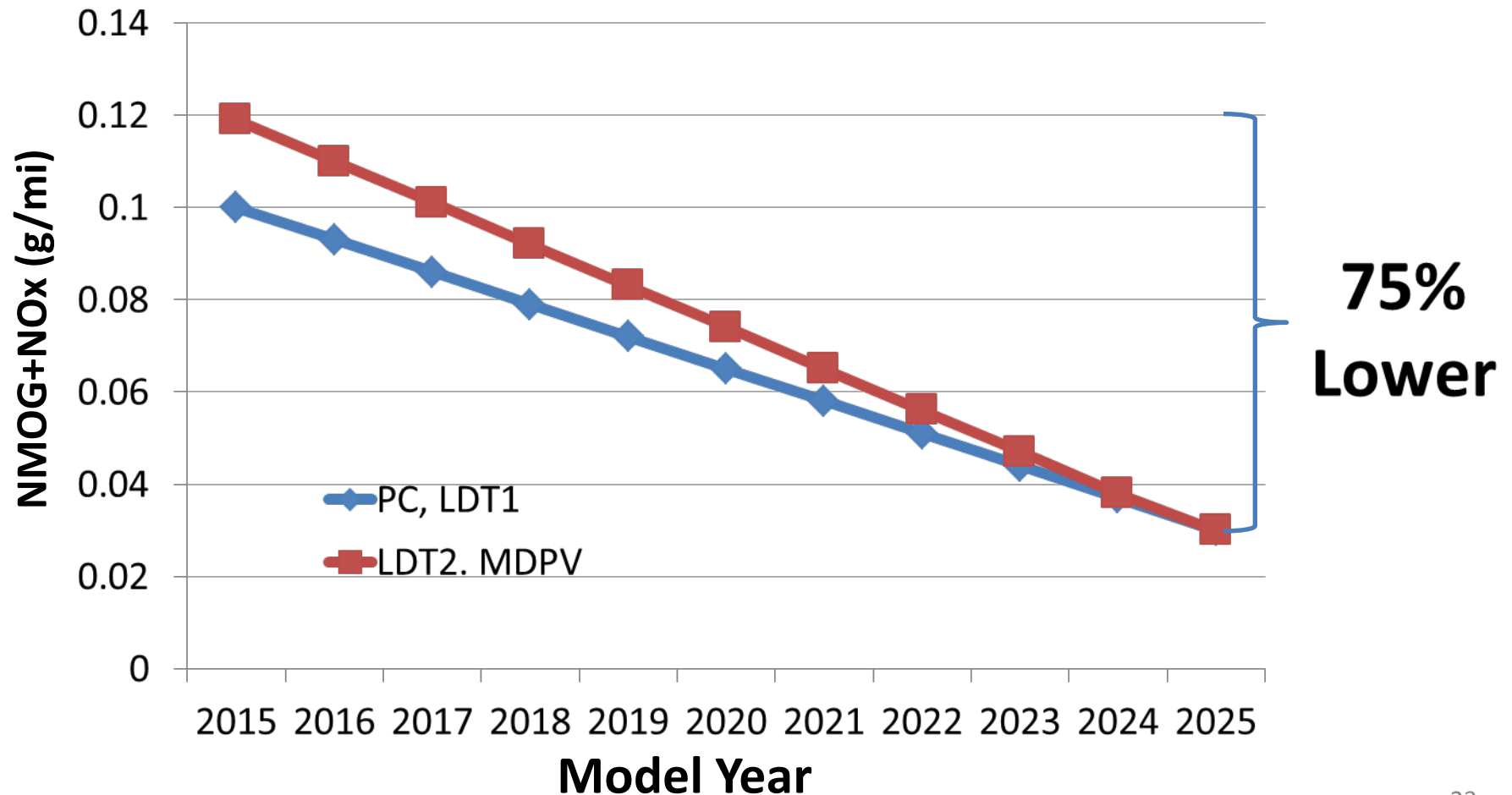
Emerging Standards

- Non Road Vehicles
 - Without a PN Standard will lose Ultrafine and BC Control
- GDI Technology
 - Why should PN be 10x Diesels for next several years when control technology exists now

Fleet Average Emission Standards

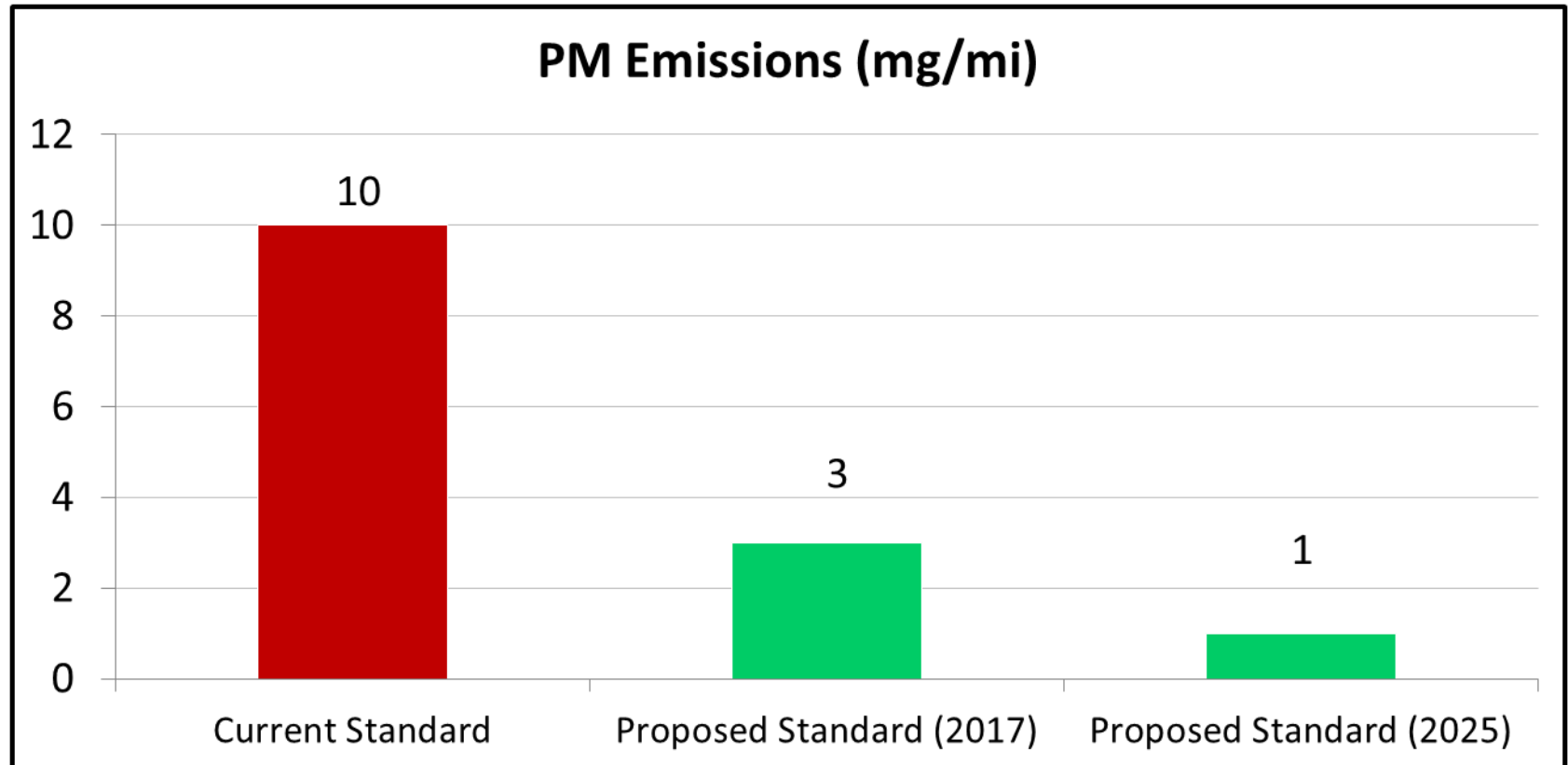
Advanced Clean Cars

150,000-mile New Vehicle Fleet Average Emissions



LEV III Particulate Matter Standards

Advanced Clean Cars





Evaporative Emissions



Advanced Clean Cars

- Extend zero-evaporative emission requirements currently in place for PZEVs to the entire light-duty vehicle fleet by MY 2022
- Extend Onboard Refueling Vapor Recovery (ORVR) requirements to all complete vehicles less than 14,000 pounds GVWR

Conclusions

- In Spite of Great Progress, Air Pollution and Climate Problems Remain at Crisis Levels with Millions of Premature Deaths and CO₂ Crossing 400PPM
- Vehicles Have Made Substantial Progress But Much More in the Laboratory than in the Real World
- Manufacturers Should Be Responsible For Real World Performance and Compliance Procedures Must Be Strengthened To Assure This
- NonRoad and GDI PN Standards Needed Quickly
- It Is Premature To Stop – Euro 7/VII and Next (2025) Stage of CO₂ Control Should Be Adopted Soon

Thank You

