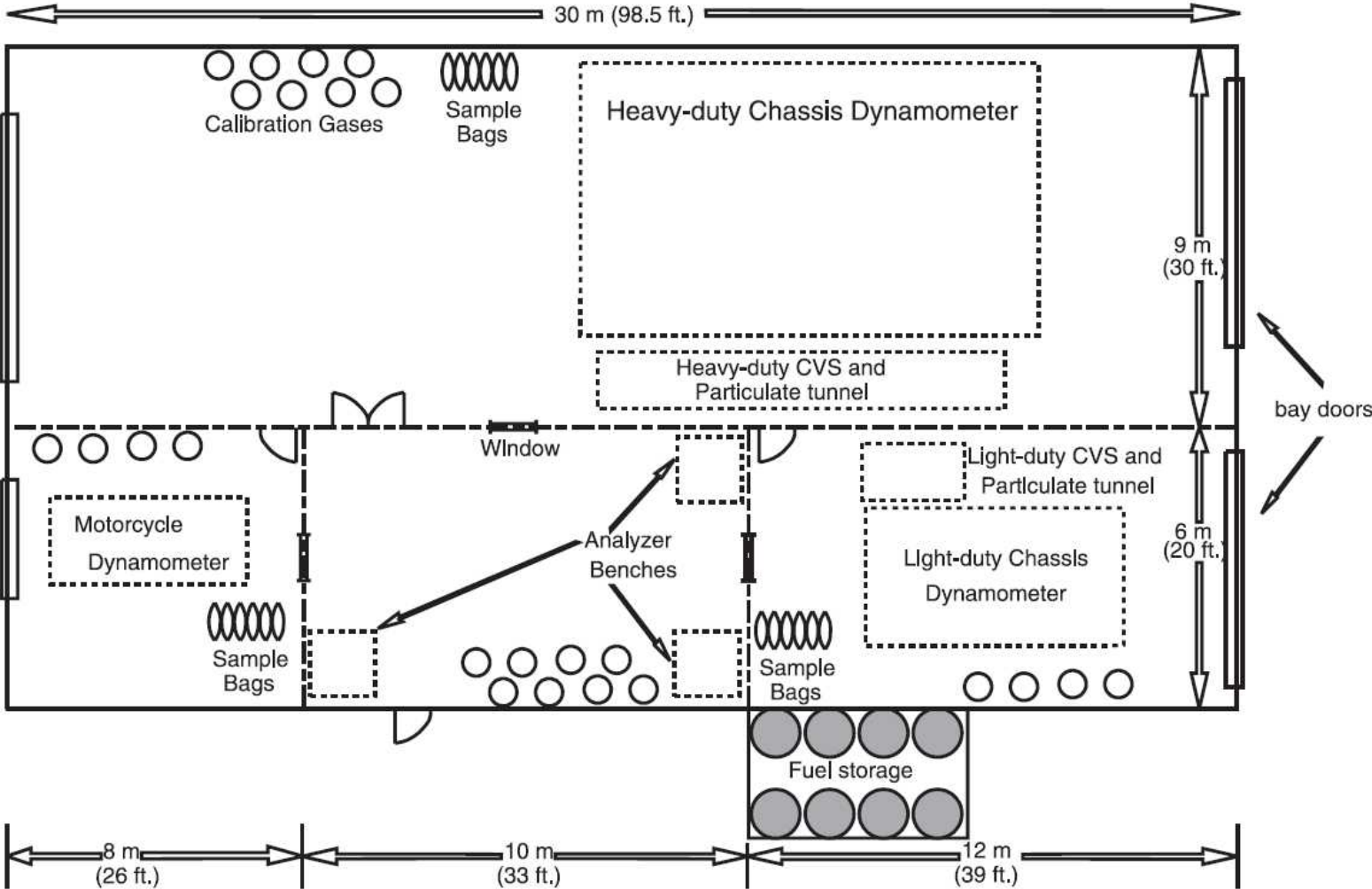


Mobile Emissions Test Cycles

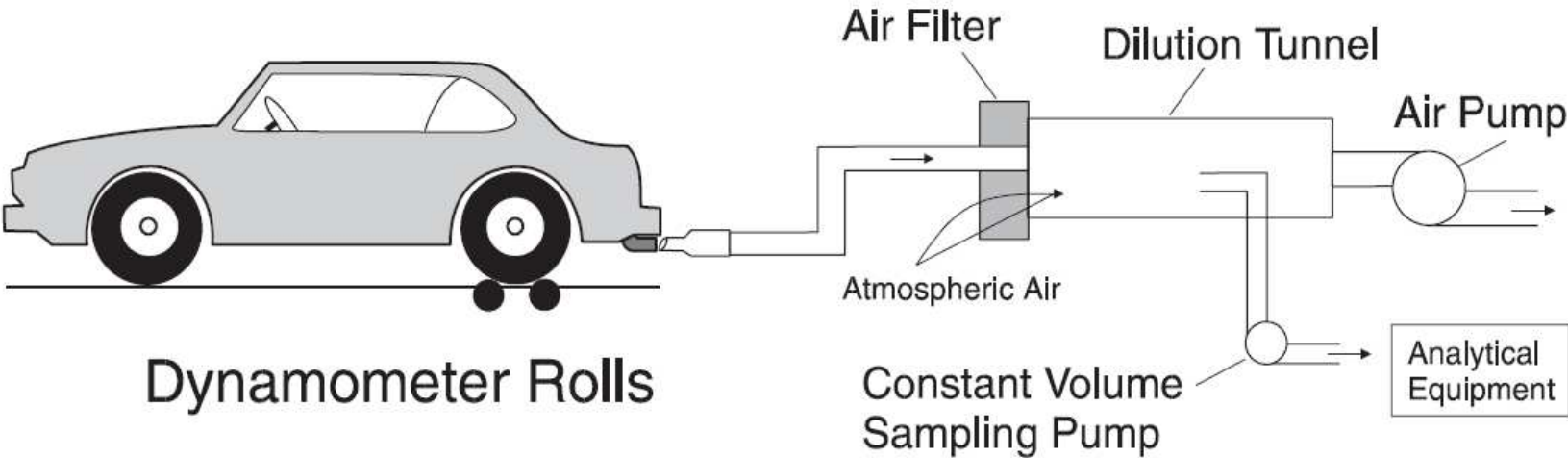
Typical layout of an emission test laboratory



Exhaust emissions test for LD vehicles

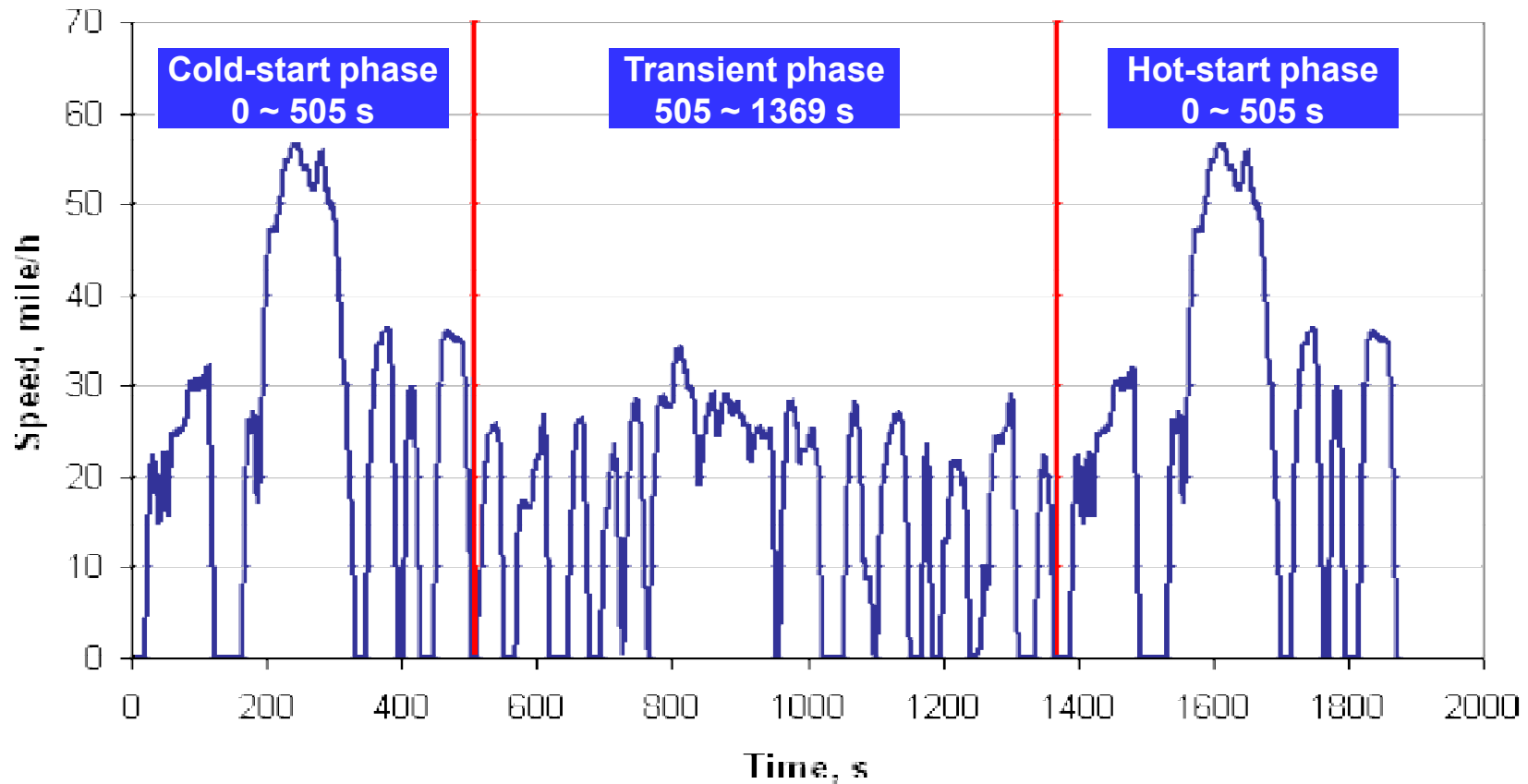
Mandatory: Chassis Test

CVS Sampling System



Engine-out emission tests for LDVs in USA

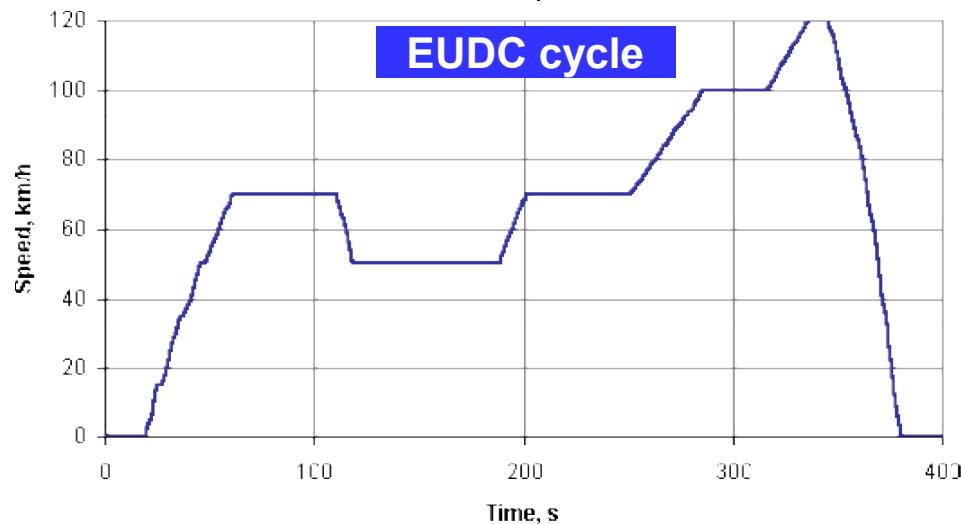
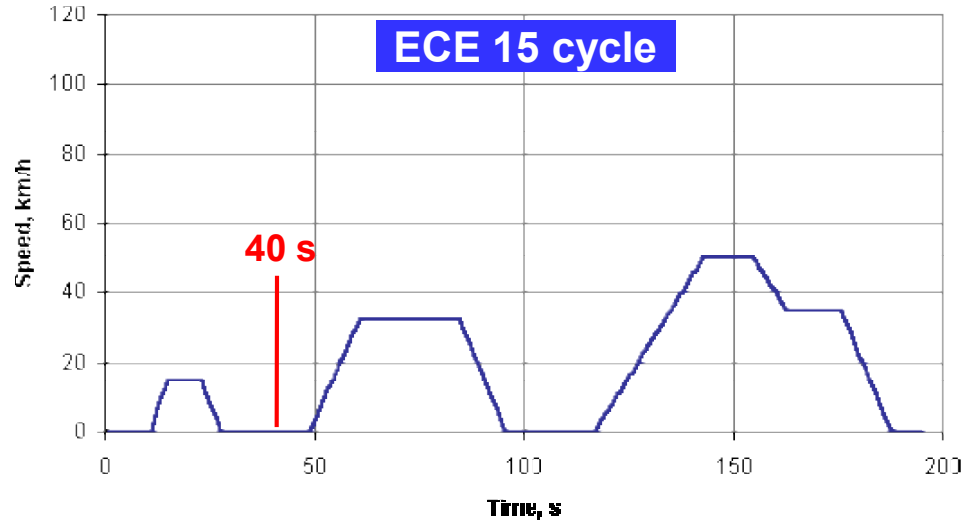
FTP 72 (1st & 2nd phase) + 3rd phase = FTP 75 cycle



Test procedure: “Cold-start phase” + “Transient phase” -> stopping for 10 min -> “Hot-start phase”.

After MY 2000, FTP 75 + Supplemental Federal Test Procedures (SFTP) = aggressive, high speed driving (US 06) + the use of air conditioning (SC03)

Engine-out emission tests for PCs and LDVs in EU



- Up to December 31, 1999:
ECE 15 + EUDC = MVEG-A cycle (Motor Vehicle Emissions Group)
- After January 1, 2000:
ECE 15 + EUDC = NEDC (or MVEG-B) (New European Driving Cycle)

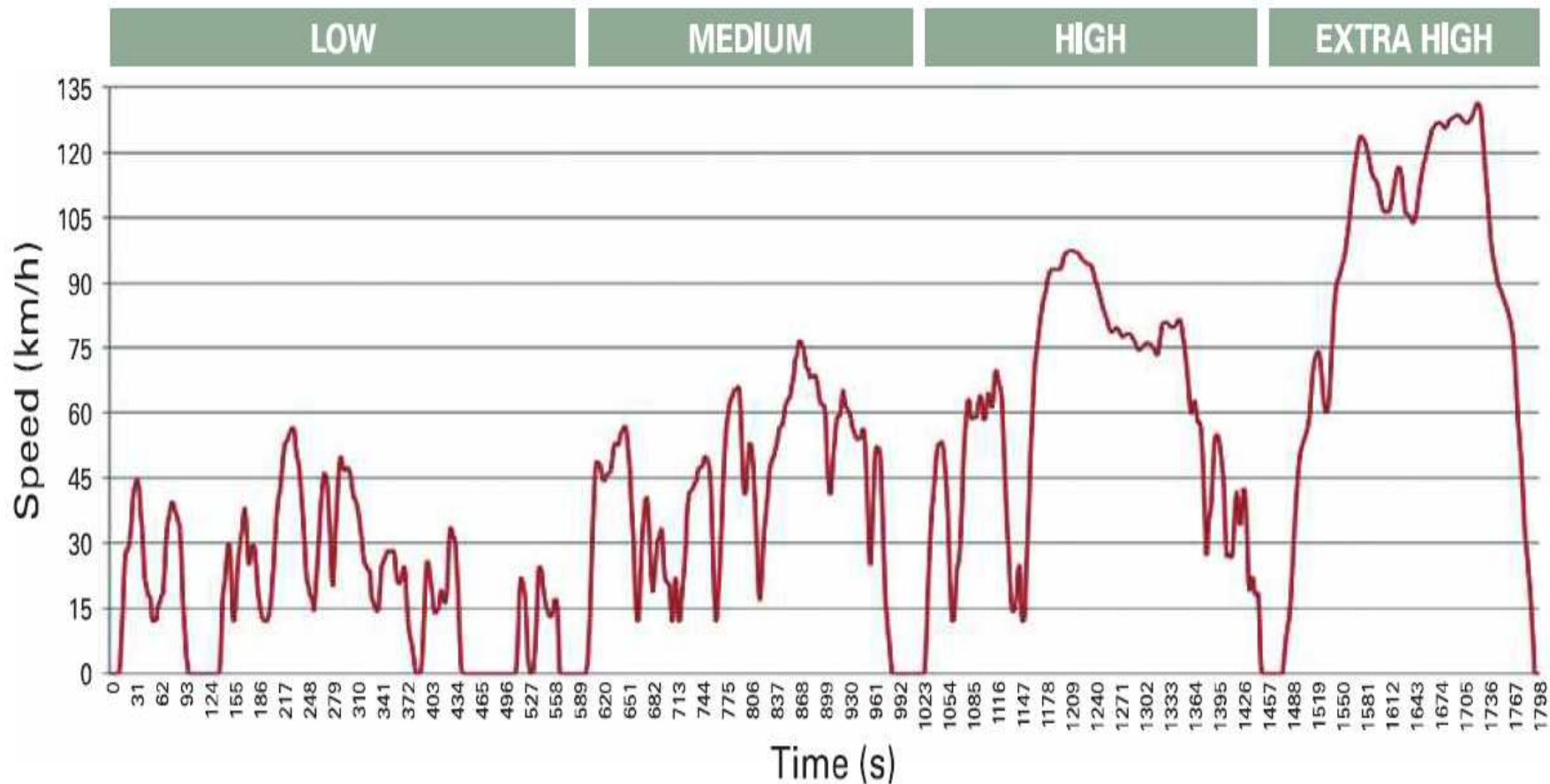
- MVEG-A cycle: begins the emission sampling after idling for 40 s.
- NEDC cycle: begins the emission sampling w/o the idling at 0 s.

Test procedure: 4 repeated ECE cycles w/o interruption following 1 EUDC cycle.

Source: European Union Directive 90/C81/01.

New proposed EU test cycle: WLTC

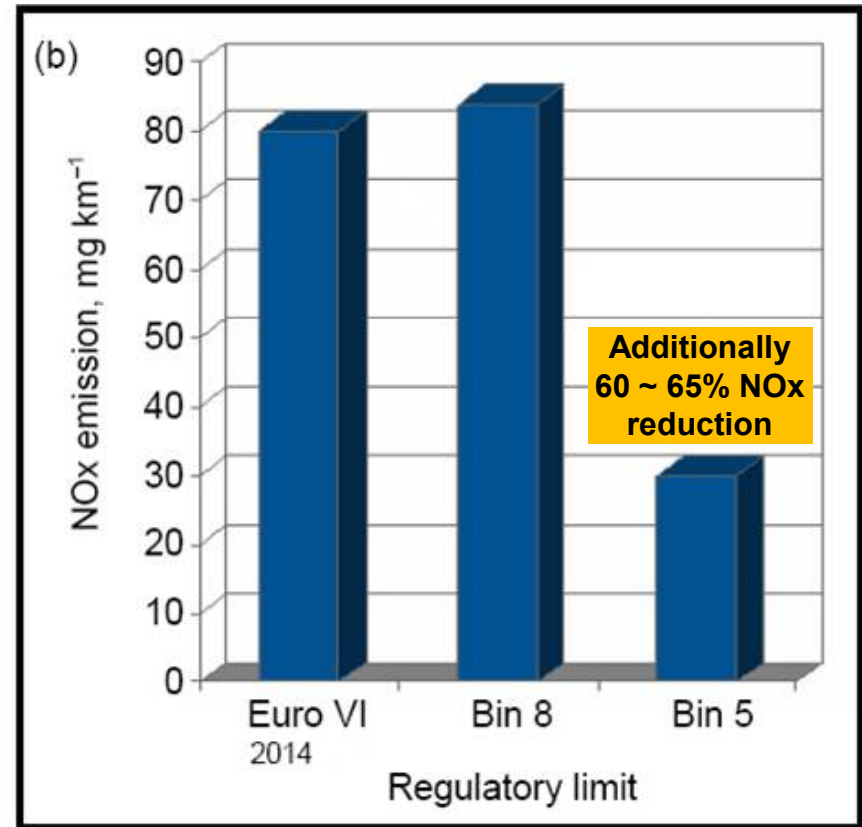
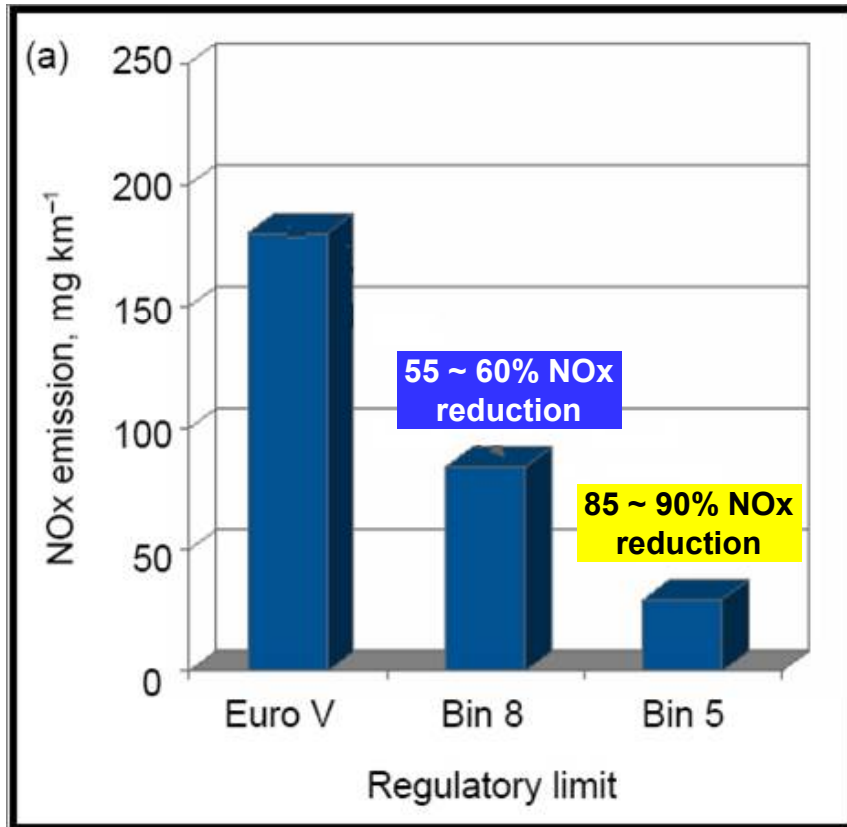
- Expected application in 2017
- Additional pollutants regulations: Ethanol, Aldehydes, NO₂, N₂O, NH₃



Source: UNECE, Report of the Working Party on Pollution and Energy, 2008.

Future EU NOx emission limits for LD diesel vehicles

(a) About 55 to 60% NOx control will be needed for a Euro V (2009) diesel to hit the U.S. Bin 8 maximum allowable emission (45 states). For Bin 5 (50 states) nominally 85 to 90% NOx control is needed; (b) For Euro VI (2014), the requirement is 65 to 70% additional NOx reduction



Source: T. Johnson, Platinum Metals Rev., 52 (2008) 23.