NOx and CO\textsubscript{2} LDV emissions, Initiatives and Challenges

G. Fontaras

Contributors: M. Clairotte, B. Giechaskiel, P. Bonnel, B. Ciuffo, V. Valverde

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Disclaimer: The views expressed are purely those of the presenter and may not in any circumstance be regarded as stating an official position of the European Commission
Outline

NOx emissions from LDVs
- Intro - RDE
- Current situation
- Market surveillance

CO₂ emissions from Passenger cars
- Background
- the WLTP introduction
- CO₂MPAS

Summary & Follow up
Introduction

2007-2010: building evidence of the Diesel NOx problem (NOx TA decoupled from real world emissions)
Status in 2015 (Emissions Analytics)

http://emissionsanalytics.com/real-driving-emissions-how-real-is-it/
Timeline

- November 2010: JRC presentation diesel-NOx emissions on the road
- January 2011: Kick-off RDE working group
- 2011 and 2012:
  - Evaluation of: (i) complementary fixed test cycles, (ii) random test cycles, PEMS on-road testing, (iv) emissions modelling
  - In-depth evaluation of random test cycles and PEMS on-road testing; development of a random cycle generator
- 2013-2014: Development of a PEMS on-road test procedure
  - Boundary conditions & Data evaluation
- May 2015: Adoption of 1st RDE package (2016/427)
- June 2016, WLTP introduction
- (September 2015: Diesel-gate)
- October 2015: Adoption of 2nd RDE package (2016/646)
- December 2016: Adoption of 3rd RDE package
WLTP introduction

• WLTP to replace NEDC. WLTP & RDE developments of very high importance

• Voted positively in June 2016
2015: On-road NOx performance of Euro 6 diesel cars – JRC survey analysis of 234 tests of 36 cars

- Data Sources: ICCT, TNO, AECC, JRC, Emissions Analytics
Real Driving Emissions

Comparison of on-road emissions performance with the Euro 6 vehicles included in the KBA and UK reports + 1st JRC tested vehicle

49 Vehicles in total
Defeat devices

- JRC asked by DG Grow to contribute to surveillance testing
  - Definition of a methodology
  - Selection of the modified conditions and assessment of their impact upon the response of the vehicle emissions control

"Standard" Testing Conditions Values of the test parameters according to the standard (ECE R83)

"Modified" Testing Conditions One test parameters are modified with respect to the standard

"Modified parameters"?
- Ambient temperature
- Vehicle conditioning
- Driving Cycle
- Other....

With the modified parameters, is there any justification for a modification in the physical response of the engine / after-treatment?
### Testing methodology to detect defeat devices

**Application by the JRC, as of 07/2016**

<table>
<thead>
<tr>
<th>Cycle</th>
<th>Category</th>
<th>Defeat Device Trigger</th>
<th>NOx Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard NEDC Acc. to ECE R83</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Hot NEDC</td>
<td>2</td>
<td>Conditioning</td>
<td>1.5</td>
</tr>
<tr>
<td>Cold WLTC</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Hot WLTC</td>
<td>2</td>
<td>Conditioning</td>
<td>1.5</td>
</tr>
<tr>
<td>NEDC @ +10C</td>
<td>2</td>
<td>Temperature</td>
<td>1.5</td>
</tr>
<tr>
<td>NEDC @ +30C</td>
<td>2</td>
<td>Temperature</td>
<td>1.5</td>
</tr>
<tr>
<td>NEDC 2WD/4WD</td>
<td>1</td>
<td>Driving mode</td>
<td>1.1</td>
</tr>
<tr>
<td>NEDC with +/- 10% speed</td>
<td>2</td>
<td>Speed, Distance</td>
<td>1.5</td>
</tr>
<tr>
<td>Reversed NEDC (EUDC-ECE)</td>
<td>2</td>
<td>Speed</td>
<td>1.5</td>
</tr>
<tr>
<td>NEDC without conditioning</td>
<td>2</td>
<td>Conditioning</td>
<td>1.5</td>
</tr>
<tr>
<td>NEDC + load (e.g. lights or AC)</td>
<td>2</td>
<td>Accessory</td>
<td>1.5</td>
</tr>
<tr>
<td>RDE compliant test</td>
<td>3</td>
<td>Several</td>
<td>2-5</td>
</tr>
<tr>
<td>RDE non-compliant test</td>
<td>3</td>
<td>Several</td>
<td>2-5</td>
</tr>
<tr>
<td>Surprise cycle</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>


- **All vehicles**: “Modified” tests selected on a case-by-case basis, depending on findings and vehicle after-treatment technologies.
Tackling defeat devices

• Anomalous results trigger an Authority – Manufacturer dialog

• The manufacturer has to provide a justification for a non properly functioning emissions control system.

• Technical and legal judgement by the Authority

• For “faulty vehicles”, plan of corrective measures including recalls and re-testing of vehicles
Example of experimental Results  
(Applying the methodology)

- **Test results for a Euro 6 diesel**

- **NEDC**: Abnormal NOx emission over the NEDC @ 10°C Cold (x 4-5 times higher)

- **WLTC**: Substantially high NOx emission over the WLTP @ 30°C (ca. 10 times higher)

- **RDE**: High NOx emission over the routes. Summer tests.

Cycles (Error bars stand for min and max values)