Future EU vehicle emissions regulations:

- Principles and requirements for real-world emissions –
- Status of on-going activities – committees -

SUN Conference

September 2012, Ann Arbor, USA

Pierre Bonnel, Adolfo Perujo, Martin Weiss

European Commission DG - Joint Research Centre (JRC)

IET - Institute for Energy and Transport

Outline

- Background
- Expectations of the legislators
- Existing regulatory elements
- Underlying principles for implementing real-world requirements
- Critical issues
- On-going efforts

Background

- **EU Air Quality Directives**
  - **Persisting NO_2 exceedances in urban areas despite more stringent emissions standards**
  - **Main contributor is road transport, significant deviations between actual and expected NO_x emissions**
- **Strategy for climate and GHG emissions**
- **Long term vision for transport in Europe - 2011 Transport White Paper:**
  - **60% CO_2 reduction over the 1990 levels by 2050**
  - **Halve the use of 'conventionally fuelled' cars in urban transport by 2030; phase them out in cities by 2050**

Expectations of the legislators

- To have clean vehicles on the road and not only in the test cell
- To improve the ability to measure and quantify the real life emissions
- To push for an optimized design of emissions control technologies within the normal operating conditions
- To introduce cost-efficient[1] regulatory tools, able to cope with the upcoming technologies and limiting the use of defeat devices / strategies

Existing regulatory elements

- **EURO VI 582/2011 & 64/2012: In-Service Conformity and type approval for heavy-duty engines, based on real-world vehicle testing with portable measuring equipment (PEMS)**

- **Verifies conformity of heavy-duty engines on vehicles during normal driving – at type approval and during their normal life ("In-Service")**

- **Does not explicitly include to 'real-world' emissions requirements but provides a functional and performance check of the emissions control technologies**

Underlying principles (1)

- **Range of applicable normal vehicle operating conditions**
  - **Ambient temperature, atmospheric pressure**
  - **Vehicle / engine condition (cold / hot) and usage (e.g. speed, acceleration, engine power)**
- **Testing**
  - **Under real on-road driving conditions with Portable Emissions Measurement Systems (PEMS) as 'golden' method**

Underlying principles (2)

- **Data evaluation rules[1]**
  - **Suitable averaging principles and statistics need to be developed due to variability of conditions within a test and longer test durations than for the conventional laboratory tests.**
- **Not To Exceed principle**
  - **Vehicle / engine need to comply within the range of predefined operating conditions**
- **Decisions made from sound statistical methods and samples of vehicles / engines**

Critical issues

- **Portable instrumentation for light-duty vehicles**
  - **Power consumption, size and weight acceptable for heavy-duty vehicles**
  - **Equipment needs to be smaller for light-duty vehicles**
- **Definition of boundary conditions in which the real-world requirements must be fulfilled**
- **Engine / vehicle development processes will become more challenging[1]**

On-going efforts (HDE)

- **Heavy-Duty Engines**

  In-Service Conformity:

  - **Review of Euro VI PEMS In-Service Conformity procedures (practicability, implementation) by the end of 2014**
  - **PEMS PM Instrumentation evaluation exercise completed: instrumentation requirements proposed**
  - **PEMS PM Pilot Program (Industry run program)**

  Real Driving Emissions:

  - **Assessment of existing requirements to check whether they ensure that EURO VI+ engines are sufficiently clean. Attention paid to urban and low load operation.**

On-going efforts (HDE PEMS PM)

- **PEMS PM Instrumentation evaluation program**
  - **Total PM + Real-time sensor whose integrated signal is scaled by the total mass**
  - **Requirements proposed for gravimetric and real-time PM measurements**
  - **Instrumentation for gravimetric measurements (e.g. proportional dilution, sampling, filters) mostly aligned with existing laboratory standards**
  - **Real-time sensors key measurement performance is a particle penetration rate at a given particle size (e.g. limiting the influence of ultra-fine particles**

On-going efforts (LDV)

- **Light-Duty Vehicles**

  Real Driving Emissions (RDE):

  - **Development of procedures (PEMS and laboratory random cycle) by the end of 2013.**
  - **Joint effort EU authorities and industry**
  - **Implementation for Euro 6 vehicles, calendar and implementation measures (e.g. sampling of vehicles, administrative aspects) not officially agreed.**

On-going efforts (NRMM)

- **Non-Road Mobile Machinery Engines**

  In-Service Conformity:

  - **Pilot Program (Industry run program) to be completed by the end of 2012**
  - **Implementation for Stage IV or V standards (under discussion)**
  - **Contributions from major EU and US engine manufacturers**
  - **Adaptation of heavy-duty procedures to NRMM**
  - **Equivalence with US methods being assessed**

- **Many thanks for your attention !!!**
- **For further information, please contact:**

- **Pierre Bonnel – EC JRC – *pierre.bonnel@jrc.ec.europa.eu***
- **Adolfo Perujo – EC JRC *- adolfo.perujo@jrc.ec.europa.eu***