

Particulate emissions from vehicles: contribution of research to EU policy development



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Research-Based Policy Support

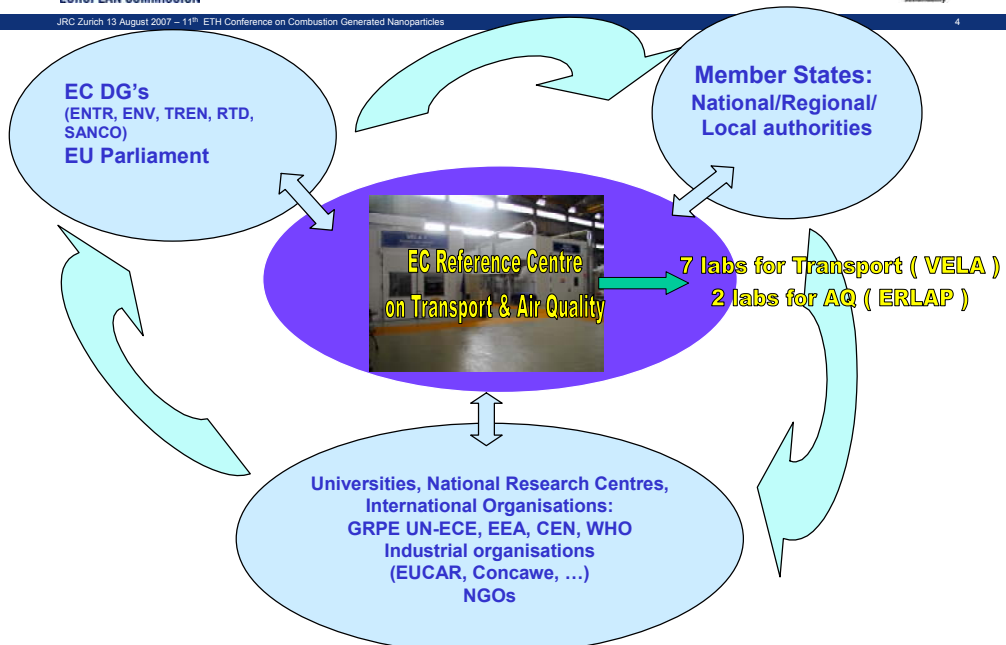
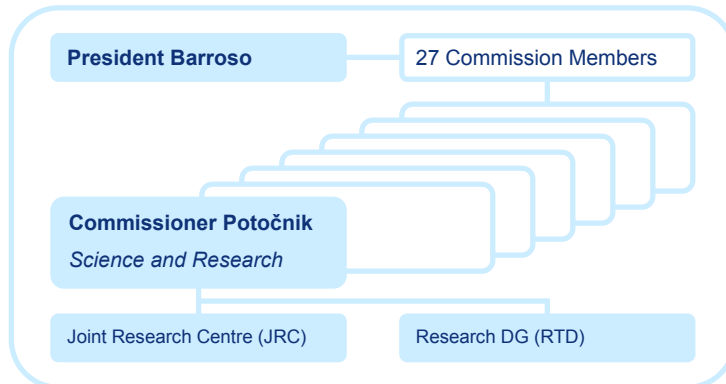
JRC - Robust Science for Policy Making

As a Directorate-General
of the European Commission,
the JRC provides customer-driven
scientific and technical support
to Community policy making



Supporting citizen's security, health
and environmental protection, safety of
food and chemicals, alternative energies,
nuclear safety, econometrics, prospective
technologies...

Where does the JRC fit in the European Commission?



NEW EMISSION STANDARDS FOR LD VEHICLES

Euro 5 & 6 standards approved by the Parliament on 13th December 2006:

(Regulation No. 715/2007 of the EP and the Council of 20 June 2007)

Implementing measures being defined through comitology

Euro 5 & 6 emission standards

- Emission limit for particulate mass greatly reduced (from 25 mg/km to 5 mg/km)
- Introduction of a complementary particulate emission limit based on particle number (as soon as possible and for Euro 6 at the latest)
- **PMP Project** :
explicitly mentioned as basis for the definition of the particle number limit and the related measurement procedure as well as of the revised mass procedure

Implementing measures: current version

- **Euro 5** : stricter mass limit
- **Euro 5 +** : introduction of the number limit and revised mass measurement procedure
- **Euro 6** : number limit for DI positive ignition engines

Euro 5 & 6 emission limits

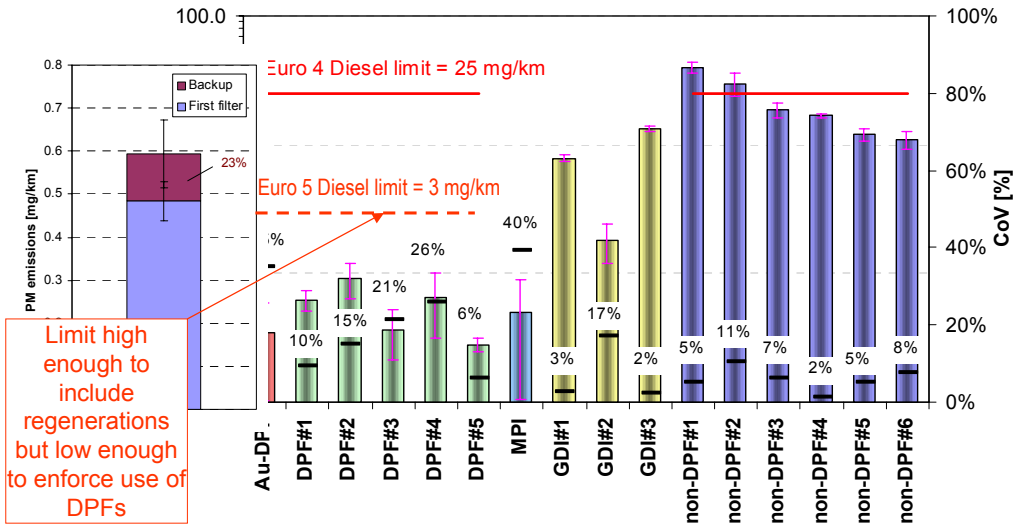
		Mass of <i>particulate matter</i> (PM)		Number of <i>particles</i> (P)	
		L_4 (mg/km)		L_5 (#/km)	
Category	Classes	PI	CI	PI	CI
M	— All	5.0/3.0	5.0/3.0	-	5.0x10 ¹¹
N ₁	I RM ≤ 1305	5.0/3.0	5.0/3.0	-	5.0x10 ¹¹
	II 1305 < RM ≤ 1760	5.0/3.0	5.0/3.0	-	5.0x10 ¹¹
	III 1760 < RM	5.0/3.0	5.0/3.0	-	5.0x10 ¹¹

Implementing measures: current version

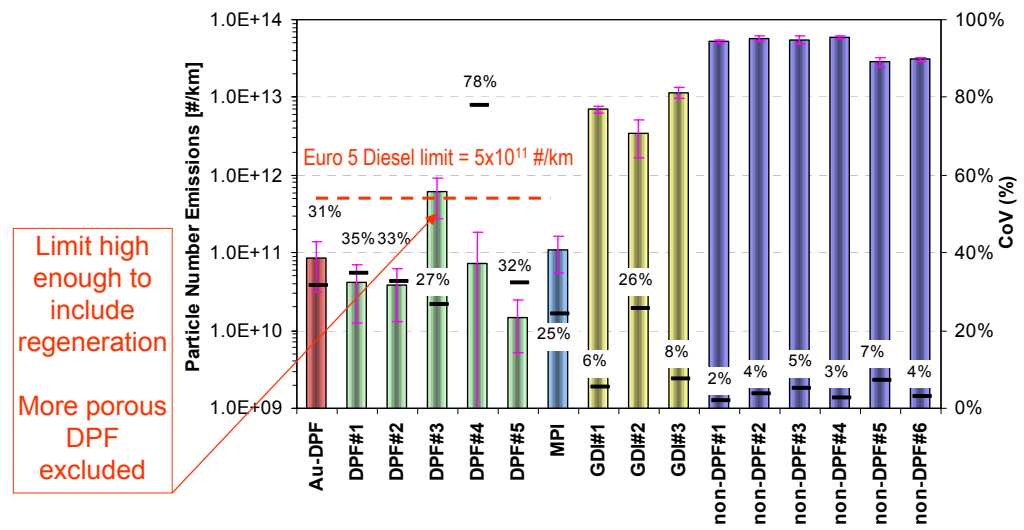
Article 13 :

- Recalibrated limits for particulate mass and new limits for particle number:
 - 1 September 2011 for the type approval of new types of vehicles (...)
 - 1 September 2012 for all new vehicles sold
- A particle number limit shall not apply at the Euro 5 stage for spark ignition DI vehicles. However an emission limit shall be set for Euro 6.

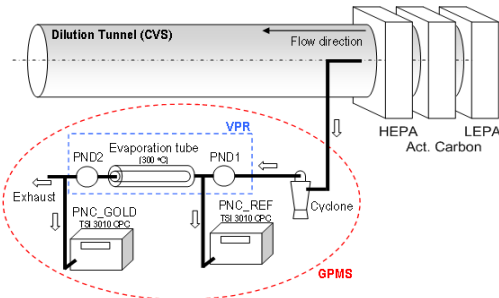
Technical background of the Commission's proposal



Technical background of the Commission's proposal



Calibration procedures for particle number measurement



PMP protocol not yet accepted at GRPE (June 2007) as the calibration procedure has to be finalised

Discussion in progress within a working group in PMP

JRC is involved in the calibration procedure development

Implementing measures: current version

OBD THRESHOLDS FOR PARTICULATE EMISSIONS

- **Euro 5** : only mass (50 mg/km)
- **Euro 6**: mass and number of particles (6 mg/km and 1×10^{12} #/km)

New sensor technologies to be developed to make these thresholds feasible

NEW EMISSION STANDARDS FOR HD ENGINES

EURO VI consultation launched on 16th July 2007

The scenarios under discussion are presented in the DG-ENTR website.

Comments due by 05 September 2007

Table	Euro VI scenarios							
	A		B		C		D	
g/kWh	CI ²⁾	PI ³⁾	CI ²⁾	PI ³⁾	CI ²⁾	PI ³⁾	CI ²⁾	PI ³⁾
PM	0.01	0.01	0.02	0.02	0.015	0.02	0.015	0.01
NOx	0.4	0.4	0.2	2.0	1.0	2.0	0.5	1.0
THC	0.16	0.66	0.55	1.05	0.55	1.05	0.55	1.05
CO	4.0	4.0	4.0	3.0	4.0	3.0	4.0	3.0
NH ₃ ¹⁾	10 ppm	10 ppm	10 ppm	10 ppm	10 ppm	10 ppm	10 ppm	10 ppm
Increased CO ₂ ⁴⁾	2-3 %	-	5-6%	-	Neutral	-	Neutral	-

NEW EMISSION STANDARDS FOR HD ENGINES

DG-ENTR has stated in several occasions that a complementary limit based on particle number could be introduced

The decision will be taken on the basis of the GRPE/PMP HD inter-laboratory comparison exercise results

PMP Heavy Duty Validation Exercise and Round Robin Both coordinated by the JRC

PMP HD Validation Exercise

- Golden Engine-1
- Golden Systems
- Golden Engineer
- Same fuel and lubricant
- Both full flow system and partial flow system
- Participant: JRC, UTAC, AVL MTC, EMPA, ...

PMP HD Round Robin exercise

- Golden Engine-2
- Instrument chosen by each lab
- No Golden Engineer
- Standard ref. fuel/lubricant
- Both full flow system and partial flow system
- 9 laboratories from EU, Japan Korea, Canada

PMP HD Validation Exercise: Current status

- Upgrade of the test cell completed
- Golden Engine installed and running
- Lubricant and fuel OK
- Test protocol revised by the Golden Engineer
- Golden Instruments: contract being finalized
- Expected start: fall 2007

PARTICULATE MATTER FROM MOPEDS

Research programme in collaboration with Swiss Institutions:

TTM, Technik Thermische Maschinen, CH

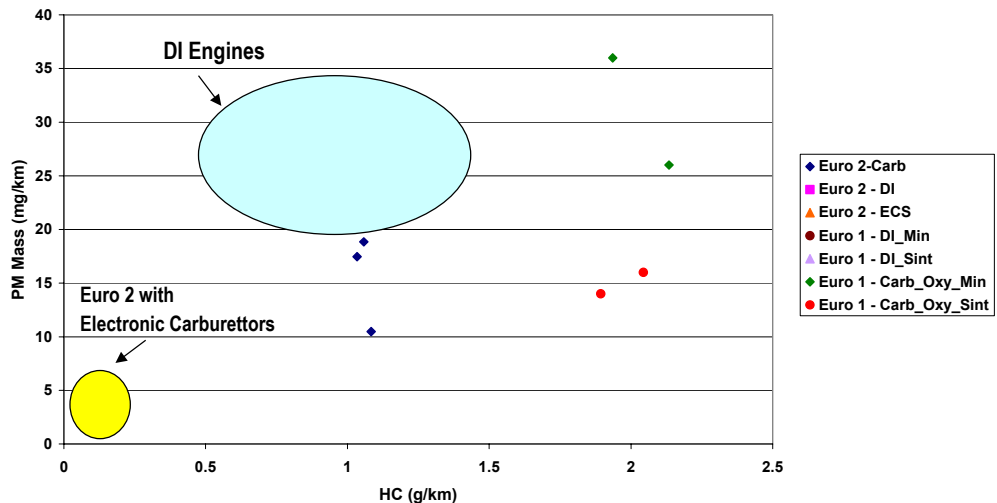
University of Biel-Bienne

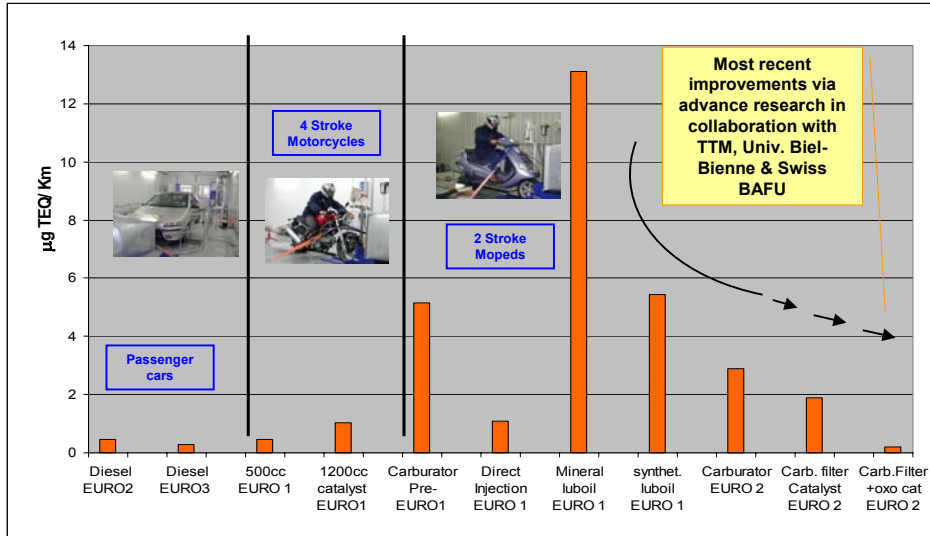
Swiss Government (BAFU)

Objectives of the collaboration

1. Search for new technologies which can help to reduce the environmental impact of the two stroke motorcycles
2. Generation of emissions data as an input for the emissions inventories and/or source apportionment
3. Scientific support to asses for possible new limits during future emission legislation development

PM Emissions vs HC Emissions from EURO 1 and EURO 2 Mopeds
ECE 47 - Hot Phase (5-6-7-8)





New motorbike and moped technologies have toxic emissions similar to EURO 3 passenger cars

Main outcomes of the project:

Several technologies have been found to be able to greatly reduce PM emissions (secondary air system, electronic carburetors, new after-treatment devices, high quality lubricants,...)

Further research is necessary to optimize some of these technologies (particularly after-treatment devices)

The JRC and the Swiss Federal Office for the Environment (BAFU) are going to sign a MoU for a collaboration on traffic related environmental aspects

CONCLUSIONS

Research is fundamental for the development of the new European emission legislation

The JRC is playing a central role:

In EU : close cooperation with DGs (ENTR, TREN, ENV,..) and main stakeholders (industry, member states, TA authorities,...)

At global level:

- Chairing and coordinating several activities within GRPE
- MoU with environmental agencies of many countries (Japan, China, US, Korea, [India](#), [Switzerland](#), [Brasil](#) [Mexico](#)...)