



UNITED NATIONS

# 72th UNECE GRPE session

## PMP IWG Progress Report

**Joint Research Centre**  
the European Commission's  
in-house science service



JRC Science Hub: [ec.europa.eu/jrc](http://ec.europa.eu/jrc)



## PMP meetings

4 <sup>th</sup> -5 <sup>th</sup> March 2015 (Brussels):	36 <sup>th</sup> PMP meeting
7 <sup>th</sup> - 8 <sup>th</sup> October 2015 (Brussels):	37 <sup>th</sup> PMP meeting
13 <sup>th</sup> January 2016 (Geneva) :	38 <sup>th</sup> PMP meeting
9 <sup>th</sup> -10 <sup>th</sup> March 2016 (Brussels) :	39 <sup>th</sup> PMP meeting

# Exhaust particle emissions

## Calibration of PN systems

- Current procedure has been reviewed
- Decision to minimize changes to the current procedure – in any case the accuracy of the measurement would be only marginally improved
- Few remaining open issues:
  - *Volatile removal efficiency (new test to be evaluated)*
  - *Calibration material for PNCs (Round Robin on going)*
  - *Applicable also to 10nm and PN-PEMS ??*

# Sub23nm measurements

## Need to lower the 23nm?

- Literature review and Experimental investigation at JRC
  - *There are particles <23nm - Sometimes they are an artifact*
- For GDIs 30-40% not counted (50% taking into account losses), higher in some cases e.g. higher ethanol concentration
- For motorcycles (2-s engines) up to >200% particles are not counted
- For PFIs 50-100%
- For DPFs this percentage is 5%.
- High emitters are still detected by PMP23nm
- Thus not critical yet for current engine technologies to which the PN limit is applicable

# Sub23nm measurements

Can we measure  $<23\text{nm}$ ?

- Experimental investigation at JRC
  - *Artifacts were confirmed in specific conditions*
  - *Existing systems with small modification can measure below 23nm (from 10 nm) -*
  - *Below 10 nm the measurements will have high uncertainty*
- From 10 nm some areas need investigation like:
  - *PCRf definition  $\rightarrow$  same if down to 10nm (and controlled losses  $<23\text{nm}$ )*
  - *Specification of  $>10\text{nm}$  systems  $\rightarrow$  ok (catalytic stripper highly recommended especially if all cases need to be covered e.g. 2-stroke engines)*
  - *Catalytic stripper  $\rightarrow$  Draft specifications ready*
  - *New need of calibration procedures  $\rightarrow$  under investigation if necessary*

## Key question:

Should the PMP develop a draft test procedure with a cut off size of 10 nm?

A change at this point would make sense:

- *If PN limit will be extended to other engine technologies*
- *PN-PEMS are being finalized, thus a change to 10nm could be considered*
- *Calibration procedures are being updated now*

However:

- *Sub23nm particles will be measured only partly due to losses in the PN systems (estimation 50%)*
- *A catalytic stripper is not necessary for current engine technologies but necessary if others will be covered in the future.*
- *Long term experience is lacking*

## PN Counting for HD engines from Raw Exhaust via Fixed Dilution

- Interest in this approach confirmed by some engine manufacturers and some instrument manufacturers
- 01 Series of amendments to UNECE Reg. 132 already includes such possibility but the procedure is not defined
- First analysis of potential benefits/issues presented during the last meetings
- Correlation with other methods (CVS and partial flow system) and advantages/disadvantages to be checked – Additional data needed to answer specific questions (*primary dilution, losses, volatile removal efficiency, pressure effects, time alignment...*)



# Non-exhaust particle emissions

(Particles generated from brake and tyre/road wear)



## Background - Objective

Following the GRPE-69-23 Informal Document, the PMP IWG has identified and focused its work regarding non-exhaust particle emissions on 4 WI:

- WI-1: Investigation of “typical” driving patterns
- WI-2: Compilation and monitoring of on-going projects related to non-exhaust particle emissions
- WI-3: Networking and exchange of information with experts in the field
- WI-4: Development of a set of recommended measurement techniques and sampling procedures

## WI 1 - Investigation of “typical” driving patterns – Status

- An analysis based on activity data collected in the framework of the WLTP project has been conducted
- Parameters relevant for both brake and tyre/road wear have been calculated.
- Among others distributions of speed, acceleration, deceleration, number of braking events, etc. were calculated and presented in the last PMP meeting
- One of the main results is that the differences in typical driving/braking patterns relevant for non-exhaust emissions are quite limited among the different regions



## WI 1 - Investigation of “normal” driving patterns – Next Steps

- The final complete report and a summary with the main results will be released in the next weeks and will be available on the PMP IWG dedicated webpage
- Currently real world data provided by industrial partners as well as industrial cycles for brake testing are being processed with the aim of comparing them to the data derived from the WLTP database – preliminary results will be presented in the next face to face meeting
- Depending on the GRPE decision, this set of data could represent a good basis for the development of a test cycle to assess particle emissions from brake wear

## WI2 & WI3 - Related research projects & Networking - Status

- So far, information on several research projects – mostly related to brake wear – have been presented to the F2F meetings. Also the results of the TIP project on tyre/road wear were discussed in detail
- A document that contains information related to the projects for keeping the group informed has been created and updated regularly

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- Several experts from different origins (industry, research institutes, universities) have already been following the activities and contribute with their knowledge to the work done within the PMP IWG
  - A list of experts who participate in the PMP IWG has been created and is available at the PMP website

## WI 4 - Sampling procedures and measurement techniques - Status

- Two possible approaches: test rig based measurements and measurement of emissions from the whole vehicle (either in the lab or on the road)
- Although there are experimental setups capable of measuring particle emissions from brake/tyre/road wear under real world conditions (on-road), the approach presents difficulties and high uncertainties
- As far as brake wear emissions are concerned and in view of a possible development of a standardized measurement procedure for particle emissions, there is consensus among the PMP members that a test rig approach focusing on the brake system (disk + pad) is much less technically challenging than measuring particle emissions from a whole vehicle

## WI 4 - Sampling procedures and measurement techniques - Status

- Several different test rigs configurations, based on a brake dyno, are currently used - some of them have already been presented to the PMP group and quite extensively investigated.
- Two main issues to be addressed: comparison of different test rig configurations and correlation with real world emissions (e.g. a test rig approach does not cover technologies like regenerative braking and vehicle to vehicle communication that could reduce anyway particle emissions)
- Regarding tyre/road wear particles currently existing sampling methods fail to distinguish particles coming from the tyre and the road surface

## Non-exhaust particle emissions – Key messages

Brake wear emissions:

- Industry (OEMs and instrument manufacturers) is actively working on the development of brake dyno rigs to assess particle emissions from brake systems
- It is likely that in the near future data and experience acquired in these activities may represent a good basis for the development, in case this is considered necessary, of a standardised measurement procedure based on the brake dyno concept



## Non-exhaust particle emissions – Key messages

Tyre and road wear particle emissions:

- Much more challenging situation – difficult to separate tyre and road contribution.
- A standardized methodology (ISO TS) for measuring the contribution of TRWP on air pollution for research purposes is under development – results presented by tyre industry based on such methodology suggest a limited contribution of tyres to PM10 and PM2.5
- No clear pathway for the development of a standardized methodology for the direct measurement of TRWP emissions (e.g. particle mass and/or particle number)
- A large scale investigation on the open issues, notably those related to the sampling and measurement techniques would be needed.



## Next steps

- The Chairman of GRPE requested in June 2015 a summary report as result of the information collection phase to be discussed within GRPE and WP29
- The PMP group will work on this document over the next months with the objective of submitting it to GRPE by June 2016
- On the basis of the information that will be made available, a decision will have to be taken about the next steps (e.g. extend the mandate of the PMP to specific objectives like the development of harmonized test cycles and measurement procedure)
- PMP appreciates guidance on priorities, indication of preferred timing and next steps from GRPE and will present a request for an updated mandate at the 73rd GRPE –June 2016 and a proposed timeline for the further activities



## Stay in touch



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