The European Commission’s science and knowledge service

Joint Research Centre
79th UNECE GRPE session

PMP IWG Progress Report

Geneva, 21\textsuperscript{th} - 24\textsuperscript{th} May 2019
PMP meetings in 2018

• 2019-01-10: PMP 49th (GRPE Geneva summary)
• 2019-02-26: Webconference
• 2019-04-03/04: PMP 50th (Brussels)

• NEXT F-2-F MEETING: PMP 51st 29th – 30th October 2019 (Location: JRC Ispra - tbc)
EXHAUST PARTICLE EMISSIONS
Main activities

• Sub-23nm
• PN-PEMs 10 nm
• Raw exhaust sampling
• Round Robin PNC (Particle Number Counter)
• Horizon 2020 projects
• Particle emissions from gas engines
• WLTP low temperature PN testing
• Effect of fuel on PN
In the 49th PMP meeting held on the 10th January 2019 the European Commission asked to finalize the work on the sub-23 nm particle measurement by developing a test procedure by June 2020 in view of the post-Euro 6/VI standards.

In the 50th PMP meeting the following main points have been addressed:

- Adapted or optimized system?
- Evaporation tube or catalytic stripper?
- PN-system calibration material/generation method
- CPC counting efficiency

It has been decided, also on the basis of the available data, that the best option is to adapt the current methodology.

A few points are still open and need additional data/discussion.
A working document has been prepared with the current text of the test procedure as laid down in GTR n.15 and proposed modifications.

The document has been circulated to the members of the group asking for inputs/comments by end of May.

The JRC will collect the inputs and prepare a summary that will be discussed in a next webconference.
Sub23 nm Round Robin

• Main purpose: Monitoring particle emissions of new engine/after-treatment technologies.

• Assessment of the repeatability/reproducibility of the proposed particle counting methodology by means of a “round robin”.

• Two systems with CS and 10nm CPC were circulated

• Each lab PMP system plus a 10nm CPC (was circulated)

• One golden vehicle (Opel Astra GDI – no GPF)
  o The PMP group would have preferred 6d technology for the golden vehicle, this was not available in the program timing and will need investigation later

• 7 EU labs completed. Extension to China / Japan from June 2019
Sub23 nm Round Robin

- Inter-LAB SolidParticleNumber-results comparable for SPN10 and SPN23
  - The variabilities for SPN10 and SPN23 at the same level
  - The reproducibilities were acceptable for SPN10 and SPN23
    - Reproducibility, $s_R$, between 11 % and 23 %

- Sub23nm-fractions varied heavily between the labs
  - Affected by the used SPN10 sampling method
    - LAB systems COLD start Sub23nm (9 ± 12)%, HOT start (26 ± 20)%

- For optimized system Sub23nm-fraction variability and reproducibility acceptable
  - COLD start Sub23nm (18 ± 4)% and HOT start (39 ± 6)%

- **Current methodology feasible for SPN10-measurements by only optimizing SPN10 sampling**

![European Commission logo]
Extension of methodology to PN-PEMS

• Based on laboratory PMP systems penetrations, the PN-PEMS penetrations will be defined

• Newly adjusted PN-PEMS systems (and calibrated) will be tested at JRC at the end of the year

• Instrument manufacturers have already confirmed that such systems are ready

• The 50% margin has to be re-tested
Objective: Raw exhaust sampling via fixed dilution for type approval of heavy duty engines

The exercise covers:

- CNG, DPF regenerations, high bio-fuels
- Crankcase (open system) emissions connected to tailpipe
- Only calibrated systems (especially 10 nm CPCs)

- European timeline from week 41/2018 to week 27/2019 covering 6 OEMS
- Extension to China (VECC and CAAM) and USA under consideration
A well designed experimental programme has been agreed between JRC and ACEA

Objectives:
Assess raw exhaust sampling for type approval
  Uncertainty TP vs CVS or PFDS
  Robustness of TP systems
  Technical specifications
Sub-23 nm
Support PMP
Next steps

• Preliminary results at OEM1 show good results:

  • Excellent comparability partial flow – raw exhaust for both 23 and 10 nm CPCs

  • No artifacts from crankcase emissions

• System with (cold) pre-diluter is also tested at some OEM
NON-EXHAUST PARTICLE EMISSIONS
The development of the novel cycle has been concluded and the cycle has been evaluated through an extensive Round Robin campaign.

The results of the RR were presented to the 50\textsuperscript{th} PMP Meeting and will be released in a report form in the next months.

There are some differences in the recorded brake temperatures between the labs mainly due to different air cooling speed adjustment.
PM$_{10}$, PM$_{2.5}$ as well as PN brake particle emissions are being investigated within TF2.

Results presented to the 50$^{th}$ PMP Meeting suggest different PM emission levels as well as different particle size distributions for different types of pads (NAO vs. Low-Met).

TF2 is currently assessing i. the influence of different types of pads on emissions, ii. volatile removal for PN measurement, iii. reduction of soak times.
No experimental results were presented to the 50th PMP Meeting. Results from two on-going campaigns had been presented to the 48th PMP Meeting.

The EC has mandated the development of a methodology for measuring tyres abrasion rate. DG-GROW will lead this task.

After the development of the methodology the PMP could investigate the relationship between tyre wear PM emissions and their abrasion rate.

For the time being the PMP will continue monitoring on-going projects and published data regarding the physical nature and size distribution of particle emissions from tyre/road wear.
PMP NEXT STEPS
PMP Mandate

Current mandate expires in June 2019
The PMP group has submitted an updated draft version of the ToR (informal document ....) and requests a new mandate with the following main concrete objectives:

- **Sub 23 nm exhaust particles:**
  - Develop by June 2020 a methodology to measure sub-23 nm particle
  - Provide robust data for the validation of **direct raw exhaust sampling** for PN measurement for HD engines
  - Development of a suggested common test procedure for sampling and assessing **brake wear particles** both in terms of mass and number
NON-EXHAUST PARTICLE EMISSIONS

NEXT STEPS – PROPOSED ToR Brakes and Tyres

• Validation of the developed novel test cycle (publication of the report) and application to the investigation of brake wear particle PM and PN emissions

• Definition of the minimum requirements for brake wear particles generation, sampling and measurement (TF2 – Possible timeline end of 2019)

• Validation of the proposed approach for the measurement and characterization of brake wear particles (Possible Round Robin activity – Possible timeline mid of 2020)

• Continue monitoring on-going projects and published data regarding the physical nature and size distribution of particle emissions from tyre/road wear
Any questions?

You can find the PMP leadership team at
Chair: Giorgio Martini - giorgio.martini@ec.europa.eu
Technical Secretary – Rainer rvogt@ford.com