Informal document GRPE-82-35
82nd GRPE, 12-15 January 2021
Agenda item 7

European Commission

82nd UNECE GRPE session

PMP IWG Progress Report

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Webconf, 12th -14th January 2021

UNITED NATIONS

Joint Research Centre

PMP meetings in 2020

2020-01-13:	PMP 52nd (GRPE Geneva summary)
2020-04-02	PMP Webconference on exhaust emissions
2020-05-11	PMP Webconference on exhaust emissions
2020-05-20	PMP Webconference on non-exhaust emissions
2020-11-06	PMP Webconference on exhaust emissions

NEXT F-2-F MEETING: tbd

EXHAUST PARTICLE EMISSIONS

Summary of the IWG activity

- Proposal for a sub-23 nm particle measurement methodology for HD almost finalized
- Proposal for PN measurement for HD with direct sampling from raw exhaust almost finalized
- Well advanced proposal for on-road sub-23 nm particle measurement for LD (PEMS-PN)
- Reports on experimental activities on LD and HD being finalized
- The first two proposals have been submitted as an informal document for contracting parties consideration

Proposal for a sub-23 nm particle measurement for HD engines

- Informal document **GRPE-82-29 (and the accompanying explanatory note GRPE-82-30)**
- The new proposal is a technical document containing:

  a) The solid PN measurement procedure as laid down in Reg. 49 with the necessary modifications in order to allow the use of catalyzed volatile particle remover (VPR) and with minor improvements

  b) As a second option a solid PN measurement methodology with a cut-off size at 10 nm (SPN10).

- The documents reflects very closely the changes already introduced in the PN measurement procedure laid down in the GTR 15 for LD vehicles.
- Any decision on when and how this procedure will be introduced in a regulatory act will be taken later

Proposal for a sub-23 nm particle measurement for HD engines

Subject	Reg. 49 - Original requirements	Proposed changes for SPN23	Proposed changes for SPN10	Reasoning
PNC efficiency	50±12 % @ 23 nm, >90% @ 41nm	None	65±15 % @ 10 nm, >90% @ 15nm	Typical PNC-efficiency, well tested in the field.
Maximum VPR-loss requirement	@ 30nm 30% and @ 50 nm 20% higher than @ 100 nm	None	Addition @15 nm 100 % higher than at 100 nm	No additional requirement below 15 nm since generation of particles < 15 nm challenging, uncertainties high
Polydisperse validation of VPR	a polydisperse 50 nm aerosol may be used for validation	None	Removed	Uncertainties @ 15 nm or below high → test serves no purpose

Proposal for a sub-23 nm particle measurement for HD engines

Subject	Reg. 49 – Original requirements	Proposed changes for SPN23	Proposed changes for SPN10	Reasoning
VPR validation	> 99.0 % vaporization of 30 nm tetracontane particles, with an inlet concentration of ≥ 10,000 per cm^3 (Monodisperse)	None	> 99.9 % removal efficiency of tetracontane particles with count median diameter > 50 nm and mass > 1 mg/m3. (Polydisperse)	Secure the functioning of VPR also for PNC with 65±15 % @ 10 nm, >90% @ 15nm
Volatile Particle Remover (VPR)	All parts (of SPN-system) -- shall not react with exhaust gas components	- VPR may be catalyzed (both heated evaporation tube and catalytic stripper allowed)	- the VPR shall be catalyzed (use of catalytic stripper only)	Minimize the risk of artefacts for SPN10. Comparability of PNC10 and PNC23 and possibility of using new sampling systems with CS also for SPN23 by fitting a PNC with a D50 @ 23 nm.

Proposal for PN particle measurement for HD engines with direct sampling from exhaust gas

- Informal documents **GRPE-82-29 (and the accompanying explanatory note GRPE-82-30)**
- The new proposal is a technical document contains:

  a) The solid PN measurement procedure as laid down in Reg. 49 with the necessary modifications in order to allow the sampling directly from raw exhaust with fixed dilution ratio in addition to the already existing options (sampling from full flow dilution tunnel and from proportional partial flow dilution systems)

- The document is based on the results of the experimental campaign carried out in Europe, China , Japan
- Any decision on when and how this procedure will be introduced in a regulatory act will be taken later

Proposal for particle measurement for HD engines with direct sampling from raw exhaust

Subject	Proposed changes	Reasoning
Pre-diluter	A cold or hot pre-diluter may be located at the end of the particle sampling probe and in front of the PTT. A fixed dilution ratio >5:1 shall be applied to the cold or hot dilution stage. Cold dilution is defined as a dilution with (unheated) dilution air and/or diluter temperature ≥20°C.	Cold dilution similar to proportional partial flow system's should be acceptable
Losses	The penetration for each model (definition in A.8.1.2.5) of pre-diluter shall be determined as described in A.8.1.3.3.7 The final system penetration (pre-diluter and VPR) shall fulfil the requirements of A.8.1.3.3.6. The particle concentration reduction factors of each pre-diluter shall be determined as described in A.8.2.2.2. The complete system (pre-diluter and VPR) shall fulfil the requirements of A.8.1.3.3.4	The pre-diluter needs to be characterised
Sampling line	When sampling directly from the tailpipe the residence time until the pre-diluter or the VPR shall be ≤ 1 seconds. The tubing shall be heated at ≥150° C if >10 cm, otherwise only insulated. Any unheated parts shall be <10 cm	Reduced residence time, hot sampling line to avoid condensation and minimise particle losses

Briefly about the experimental Exercises

- LD Sub23nm
  - Europe done
  - Equipment returning from Asia, exercise interrupted due to Covid-19

- HD Tailpipe (Investigate the possibility of using direct sampling with fixed dilution from raw exhaust and SPN10 or SPN23)
  - Europe done
  - China done

Next steps

- Update, if necessary, the two technical documents on PN measurement for HD engines on the basis of the comments received. Final version ready by June 2021
- Submit a technical report with the data supporting the two procedures by June 2021
- Present the proposal on on-road PN measurement for vehicles to the RDE IWG to be incorporated in the future RDE GTR

Procedural issue

Submissions of an informal proposal for HD raw exhaust PN sampling and extension of sub-23 nm procedure to HD engines

The PN measurement method for HD is described in UNECE Reg. 49 and not in GTR 4.

For this reason the proposal is defined as a technical document and not as an amendment to GTR 4.

NON-EXHAUST PARTICLE EMISSIONS

European Commission

PMP Workshop on how to regulate brake wear emissions – 13th January 2021

Summary of the main points discussed

- All the participants agreed on the increasing importance of non-exhaust emissions (NEE) and to develop a robust measurement procedure which could be used in future regulation

- Several concerns and questions have been raised – not for all it is possible to provide an answer at the moment

  - ✓ Concerns about the possibility to effectively control real world brake wear emissions (and more in general NEE) with a lab based approach
  - ✓ Concerns about the contribution of extreme brake events – is the WLTP derived brake cycle suitable?
  - ✓ Exposure: more a local than a regional issue
  - ✓ Classification issue – Different models sharing same brake systems, different front an rear brakes…
  - ✓ Essential to consider vehicle parameters (weight distribution, load, configuration, engine braking,…) – Worst case combination approach possible?

PMP Workshop on how to regulate brake wear emissions – 13th January 2021

Summary of the main points discussed (cont.)

- ✓ Metrics: general agreement on the necessity to look at both PM and PN. Issue of toxicity – no sufficient knowledge to assess this aspect
- ✓ Limits: at vehicle or component level? Relative limits based on best available technologies?
- ✓ Necessity to take into consideration new technologies – How to assess and promote the use of technologies that could mitigate the emissions (new brake designs, filters, regenerative braking,…)?
- ✓ Spare parts?
- ✓ HD vehicles: Very sophisticated braking systems – multiple systems with different priorities
- ✓ HD vehicles: wide range of applications – Necessity of different brake cycles as for CO2 assessment?

- Several research programmes on-going (CARB, UK,…)
- Next steps: Minutes of the workshop will be prepared and shared – The PMP group will discuss all the raised points and will present an updated proposal at the next GRPE session

Brake Emissions – Summary

Very few activities during the last months

- ✓ 81st GRPE – TF1 submitted the Informal Document GRPE-81-12 entitled "***Non-Exhaust Brake Emissions — Laboratory testing — Part 1: Inertia Dynamometer Protocol to Measure and Characterise Brake Emissions Using the WLTP-Brake Cycle***"

  Feedback on several elements of the document has been received from various laboratories. The next weeks they will be discussed in dedicated meetings. A revision of the Part 1 Protocol is expected as a result of these discussions

- ✓ Current status – TF2 is still in the development phase. The definition of the ***minimum requirements*** for measuring brake particle emissions will be finalized in the next weeks

  A testing phase including a RR exercise will follow. PMP members able to follow the specified requirements can participate. The campaign will start in Q2 2021 and finish by the end of Q4 2021.

- ✓ Current status – Organization of the Workshop "Towards a regulation on brake wear emissions". Extension of the discussion to other technologies (i.e. regenerative braking) and vehicle categories (i.e. vehicles >3.5t)

Brake Emissions – next steps

Very few activities during the last months

- ✓ The activity has slowed down significantly in 2020 due to the Coronavirus crisis and also to a potential issue with a patent request

- ✓ The issue of patents on the measurement methodology is not new in the PMP group and also other IWG have had similar problems – on going discussion within UNECE on how to prevent these problems

- ✓ On going discussion with the company that has submitted the patent request – Potential solution: Patent (if granted) will be made freely available for an unlimited time under conditions to be discussed

- ✓ The activity of the PMP sub group on brake emissions will continue only after the solution has been confirmed by the company and presented at the group for agreement

Tyre Emissions – Summary

H2020 Project

✓ The LC-MG-1-14-2020 call aims in addressing the issue of **particle emissions** and noise from tyres. The winning consortium has been identified (LEON-T) and will work among others on the following topics.

- Assessment and characterization of tyre wear particles emitted under different driving conditions both in the laboratory and on-road
- Development of reliable and repeatable methodologies for the assessment of tyre emissions in the laboratory and on-road and for mrasuring tyre abrasion rate
- Particles tracing and quantification in different environmental compartments with focus on microplastics emissions

Abrasion Rate

✓ ETRMA has completed the feasibility assessment regarding the development of a tyre abrasion methodology. ETRMA has committed to present their proposal at the next F2F PMP Meeting.

✓ PMP's target remains to explore the possible correlation of tyre abrasion rate with PM_{10} and $PM_{2.5}$ emissions as soon as the method becomes available

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Thank you

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