PMP Webconference

22nd March 2022, 13:00-15:00 CET

Meeting Notes

1. Introduction & Update on GRPE Jan '22
   Barouch Giechaskiel (JRC, PMP chairman) and Rainer Vogt (OICA/Ford Technical Secretary) welcomed participants (64 online).

   Presentations are uploaded on the UNECE/PMP site. This meeting will only cover items relevant to exhaust part.

   At Jan 22 / GRPE Meeting OICA requested the addition of hydrogen (H2) as a fuel to UNR 49 (HDE) & UNR 96 (NRMM).
   GRPE adopted the Consolidated Resolution for Exhaust Ultra-Fine Particle Number Measurement for Heavy Duty Engines (HD Technical Resolution - PN tailpipe measurement and 10 nm protocol). This will be submitted to WP29 for adoption in June 2022

2. Exhaust emissions
   a. PN-PEMS (15 nm)
      Heavy-duty results of the ACEA 2021 campaign were presented by BG. Comparison to literature of engine emissions PEMS23 nm and reference system was given (see presentation)

      Conclusions on emissions:
      The inclusion of sub-23 nm particles increased the >23 nm particle number emissions (1.5×10E11 #/kWh) by 25% to 250%

      The urea injection increased the >10 nm emissions 300-600% (2-5×10E10 #/kWh).

      Connecting the crankcase ventilation to the tailpipe further increased the >10 nm particle number emissions 340-560% (1.4-2.5×10E11 #/kWh)

      PN-PEMS 10 nm versus reference systems were typically within ±35%, but up to ± 50% differences were measured
      There was small or no effect on the differences from engine technology, urea injection or crankcase ventilation on the PEMS performance

      Q. by S. Carli: Why is urea leading to higher emissions. SCR downstream of DPF. Why not evaporate?
      A.: VPR is not hot and/or the residence time probably not

enough to evaporate urea formed particles.

b. Calibration procedures (BG)
JRC summarized results of questionnaire.

Proposal: Procedure according to ISO 27891:2015 with a soot-based aerosol (CAST) for both CPC and PEMS but with different acceptance criteria System efficiency determination.

Calibrate PMP system as a whole unit against traceable reference (e.g. CPC, electrometer.

Next steps:
Material: further narrowing, or widen?
Text improvement: Clarity for instrument family
Specifications consideration (eg Hot CPC, common efficiencies of PMP & PEMS
Test improvements (C40, note: CMD>30 nm)
Determine and include uncertainties for various sizes.
Experimental campaigns (correlation PMP and PEMS)
Input from NMIs and MetroPEMS project. MetroPEMS will give a presentation at PMP informal meeting

Next Webex: only concrete suggestions and proposals will be discussed. Documents to be sent in advance of meeting (min 1 week)

Comment by Bob Anderson (TSI): CEN 17434 standard Determination of the particle number size distribution of atmospheric aerosol using a Mobility Particle Size Spectrometer. NIST PSL 30 nm standard is available now.
Q by Ch. Hafermayer (AIP): What kind of data is meant to be collected?
A by BG: internal calibration data, i.e. calibration certificates would be useful.
Q. by Dieter Florian (AVL): What is the timeline of calibration procedure?
Q. by BG: Impact on 23 nm procedure would be large on existing regulations. For 10 nm not so critical. Data collection is anticipated by end of summer. Finalization by end of 2022.
Comment AVL: 10 nm instruments are delivered to customers. Need calibration procedure ASAP.

c. Total particles (BG JRC)
BG briefly summarized the status of understanding Health Effects: PM mass is the metric which is well established. Elemental carbon, organic matrial and PAHs have biological effects.

PM PN in cities: Road transport contribute 11% to organic aerosol. But in cities could be much higher 70%. Non-exhaust is significant.

Is vehicle TPN versus SPN needed?
TPN to SPN ratio is typically 150-200%
Sometimes >10x difference. Generally, TPN and SPN are similar, except some special cases

Is TPN the right metric?
Direct I/SOV measurement are difficult. Discussion on covering precursors: I/SOVs, NOx, NH3, SOx
Laboratory can give the nucleation mode formation potential.

BG discussed a proposal of a measurement system: sampling from the tailpipe, PND0, aging tube, PND4 & PNC(5nm) (TPN concentration). Two paths are necessary – i.e. parallel measurement of solid particles to be able to correct particle losses.

Discussion:
Is a TPN limit the right metric? Or, are stricter NH3, or HC limits more efficient?
Comment by A. Terres (OICA/BMW): The issue of calibration needs to be considered.
Phillip Eichler (German UBA): Right material should be selected for calibration of system for volatile particle losses
Bob Anderson (TSI): PCRF 5 nm issue with small particles. US standard would be total standard.
Q. by Anna Lutz: Was total PN always larger than solid PN?
A. by BG: No, very often very close within experimental uncertainties
Comment by RV (OICA/Ford) & Sebastian Gramstad (OICA/AUDI): Total PN is for information only, there is no PMP mandate. Total PN is subject of research, especially which is the right metric? HE / impact should also be researched at the same time, not only measurement method.

d. <u>PTI particle number specs recommendations by Anastasios Melas and BG (JRC)</u>
Periodic Technical Inspection topic is given for general information – it is not subject of PMP.
JRC presented correlation plot of WLTP, or NEDC #/km versus hot low idle.
Malfunctioning, or tampered particulate filter can be recognized with low idling condition.

NL and Belgium have limit value of 1E6 #/cm3. Germany

250000 #/cm3.
EU COM has drafted recommendations for harmonization.
JRC testing campaign was carried out with 7 sensors. PTI specifications include counting efficiency against 10 nm CPC, or electrometer.
An initial verification is described incl. linearity check subsequent verification.

Conclusions by JRC: PN-PTI can detect malfanctioning, or tampered DPFs
Instruments used for PN-PTI shall be checked at 3 different levels: 1.) Type approval, 2.) initial verification, 3.) subsequent verification

Comment by A. Terres (OICA/BMW): Deviation needs to be defined and calibration factors whether they are included or not.

3. Next meeting:
   there will be a dedicated meeting on calibration meeting.
   Next PMP exhaust meeting:
   will be invited via email for end of 2022