Atmos. Chem. Phys. Discuss., 12, C8918–C8919, 2012
www.atmos-chem-phys-discuss.net/12/C8918/2012/

Interactive comment on "Particle and gaseous emissions from individual diesel and CNG buses" by Å. M. Hallquist et al.

Anonymous Referee #2

22 January 2013

General comments:

The authors characterized the particle and gaseous emissions from 28 individual diesel-fuelled and 7 compressed natural gas (CNG)-fuelled buses under real-world dilution when the buses were driving in an accelerating mode or in a constant speed mode. The buses used different after-treatment systems. The results showed that the particle number emission factors for CNG-fuelled buses were higher than for the diesel buses, just opposite to the mass emissions factors. Differences were also found in the particle number size distributions indicating that the emitted particles from the CNG buses were smaller. From the climatic and health point of view this issue is topical, interesting and important. The manuscript is mostly well-written; however, I raise some critical questions which should be addressed.

Specific comments:

1. Introduction: All nucleation mode particles do not need to be secondary particles. For example, Rönkkö et al (EST, 2007) found that a Euro IV heavy-duty diesel vehicle with EGR emits nucleation mode particles that have a nonvolatile core formed before the dilution process.

2. Section 2 should be rewritten throughout. Experimental method is poorly described, and it is hard to understand how the experiments were performed; when and where (other traffic?), how many repetitions, and under which conditions. Did you measure background concentrations and are they subtracted. No information was given about the engine and driving parameters (bus type, engine type, engine speed, gear, torque etc.), please, add into Table 1. The fuel sulphur content of diesel fuel should also be mentioned.

   Description of CO_2 measurements from Section 2.1. (Particle sampling) could be moved to Section 2.2. (Gas sampling); and description of emission factors for gases from Section 2.2. to Section 2.3. (Calculation of emission factors).

3. The gaseous NO, HC and CO were measured by a remote sensing device (AccuScan RSD 3000). How close to the particle measurements did the transmitter and the receiver locate. I am not familiar with the system; I expect the method is fine for rather low ambient concentrations. Therefore, I am wondering the high concentrations of NO, NOx, CO and CO_2 in the calibration gas, the mixing ratios sound to be valid for raw exhaust measurements. Could you, please, explain more about this issue.

4. Particle mass concentration and emission factors EF(PM) were calculated from the EEPS measurements by assuming spherical particles with unit density. No mass monitor was installed in the measurements setup. I am somewhat skeptical about these values because soot particles are agglomerates. Is it necessary to include EF(PM) in this paper? At least, uncertainty of the results should be estimated and discussed. Table 4 compares the EF(PM) with other studies. By taking into

account that this study concern $PM_{0.56}$ while the others mostly give PM_{10} and $PM_{2.5}$, the paragraph (p. 27748, lines 7-) needs more precise discussion.

5. The particle sample was led through a thermodenuder at 298 K. Rönkkö et al. (2007) measured 95% losses at 6 nm particles, 74% at 10 nm, and 28-40% at 30 nm for the temperature range 28-275 ^{o}C. Did you correct the losses in the thermodenuder?

6. The measured EFs (Table 3 and Fig.3) were compared to the modelled data (Table 2) from the HBEFA 3.1 model for a standard urban bus with a posted speed of 30 km/h and with stop and go traffic. The authors conclude that the modelled values are generally significantly lower than the measured values. What might be the reasons; these should be discussed. Comment also why the EF(PN) is smallest for a CNG bus, contrary to the results obtained in this work.

Technical comments:

7. The sentence “The shape of the CO2 peak…” on p.27746 lines 14-17 should be clarified.