This manuscript describes a series of vehicle emissions tests conducted in 2009 on a broad suite of diesel vehicles (both heavy-duty and light duty), gasoline vehicles, and scooters relevant to the European on-road vehicle fleet. It describes emissions of both regulated and unregulated pollutants from the tested vehicles.

In addition to the manuscript, I have also read the comments from the other Anonymous Referee (posted July 28, 204), and I have reached the same conclusion: this manuscript is not suitable for publication in its current form, and I am unsure if *ACP* is the proper journal for this manuscript.

In general I am supportive of the publication of new data on vehicle emissions. Emissions standards in Europe and the U.S. change rapidly, and there are significant vehicle-to-vehicle variations; therefore new data in this arena should always be welcome. However, this data needs to be presented with some amount of context or novelty. At the very least the data need to be compared to existing vehicle emissions data (which this manuscript does not do – the data are presented in a vacuum). Preferably the manuscript would incorporate a novel aspect or fill an existing data gap, e.g., testing classes of vehicles that have not been tested (or have received very limited attention) previously, presenting results for measurements of previously unmeasured pollutants, or developing a new method for quantifying emissions. This manuscript does none of these.

The failure to compare this data to other measurements is a fatal flaw in this manuscript (but sadly not the only flaw). While the data were collected in 2009, there is no reason for the manuscript to display a 2009-level understanding of emissions measurements or a similarly dated reading of the existing emissions literature. A quick check of my EndNote library reveals multiple recent papers from Rob Harley,[1-5] Allen Robinson,[6-8] the ACES study,[9] and others.[10-13] I have not rigorously checked the list of references in the previous sentence to the works cited in the manuscript, but the vast majority were not cited by the authors, nor did they compare their data to any of these studies.

I also have serious reservations about the relevance of the vehicle fleet in 2014. The experiments were conducted in 2009 with a fleet of vehicles produced from 2002-2006. I am unsure of vehicle turnover rates in Europe, but it seems that emissions data for 8-12 year old vehicles is of relatively limited utility unless the authors present some novel measurements or interpretation.

The presentation of results was extraordinarily difficult to follow, and did not reveal a compelling narrative. Rather, the Results read like list after list of vehicles and numbers: “Vehicle X had Y emissions of component Z.” Repeat ad nauseam. Figures 3-6 are nearly impossible to read. Figures 3 and 4 suffer from major scale issues. Figure 3 has a logarithmic scale where each tick mark notes a factor of 100! I don’t understand what the authors expect the audience to learn from reading this figure.

The description of the methods (Section 2) is entirely too long and rambling, with far too many subsections. Each instrument does not require a separate subsection, especially when many of the descriptions are only 1 paragraph long. It makes the manuscript a horrible bore to read.

The other referee criticized the long description of the AMS but lack of any mass spectra, and I wholeheartedly agree. The AMS is a fantastic instrument that is ubiquitous at this point. We as a community need to get away from the knee-jerk reaction to fill every manuscript in *ACP* with a half-page description of the instrument and another

reference to DeCarlo et al. (2006). And of course the AMS data were analyzed in Igor using Squirrel – there is no other choice! In this manuscript the AMS was used to measure OA mass concentrations, and the Aiken (2008) frag table was used. Say this in two sentences and save the audience some time.

Speaking of the frag table, the use of the Aiken (2008) frag table should be justified in the revised manuscript if it presents AMS mass spectra. Was there evidence from the pTOF data that there was particle mass at *m/z* 28 to warrant using frag table? My understanding from the literature is that the Allen frag table[14] is more common when the AMS is used to sample fresh exhaust.

Lastly, the authors need to address their sampling methodology. My understanding of a CVS is that it collects a proportional sample. How was proportional sampling ensured for the REMPI and FTIR connected to the tailpipe?

Other comments

-The authors claim to use 1-s data from the MAAP. Before I believe that this data is reliable, the authors need to prove that the mass accumulation on the filter tape was sufficient to resolve the measurements at this resolution. I have serious doubts that the gasoline cars had high enough BC emissions to yield usable MAAP data at 1-s.

-Equation 1 - how is F_{TP} determined? (Also this is called F_{TP} in the text and F_{exh} in the equation.)

-Are the data points in Fig 3 for the single speed tests, or do they represent different speed points extracted from the transient tests? If it's the latter, was there any consideration that an accelerating point at X km/hr will have different emissions than a decelerating point at the same speed? Also do these data include all fuels, or just standard fuels?

-Section 3.1.4 - "No nucleation mode" appeared for the HDDV vehicle. However in the methods section, no mention was made of an instrument to measure particle size in the nucleation mode. The AMS, with its cutoff around 40-50 nm, cannot properly see the full nucleation mode.

-Page 16612, paragraph starting at line 18 describes an increase in PM sulfate at 140 km/hr. In how many tests was this observed? Was this a consistent phenomenon or an artifact in one test where the catalyst released built-up sulfate.[15]

-I can't interpret Fig 5 at all.

References:

1. Dallmann, T. R.; DeMartini, S. J.; Kirchstetter, T. W.; Herndon, S. C.; Onasch, T. B.; Wood, E. C.; Harley, R. A., On-road measurements of gas and particle phase pollutant emission factors for individual heavy-duty diesel trucks. *Environ. Sci. Technol.* **2012,** *46*, (15), 8511-8518.

2. Dallmann, T. R.; Harley, R. A.; Kirchstetter, T. W., Effects of diesel particle filter retrofits and accelerated fleet turnover on drayage truck emissions at the port of Oakland. *Environ. Sci. Technol.* **2011,** *45*, 10773-10779.

3. Dallmann, T. R.; Kirchstetter, T. W.; DeMartini, S. J.; Harley, R. A., Quantifying on-road emissions from gasoline-powered motor vehicles: Accounting for the presence of medium- and heavy-duty diesel trucks. *Environ. Sci. Technol.* **2013,** *47*, 13873-13881.

4. Gentner, D. R.; Worton, D. R.; Isaacman, G.; Davis, L. C.; Dallmann, T. R.; Wood, E. C.; Herndon, S. C.; Goldstein, A. H.; Harley, R. A., Chemical composition of gas-phase organic carbon emissions from motor vehicles and implications for ozone production. *Environ. Sci. Technol.* **2013,** *47*, 11837-11848.
5. Worton, D. R.; Isaacman, G.; Gentner, D. R.; Dallmann, T. R.; Chan, A. W. H.; Ruehl, C. R.; Kirchstetter, T. W.; Wilson, K. R.; Harley, R. A.; Goldstein, A. H., Lubricating oil dominates primary organic aerosol emissions from motor vehicles. *Environ. Sci. Technol.* **2014,** *48*, 3698-3706.
6. May, A. A.; Nguyen, N. T.; Presto, A. A.; Gordon, T. D.; Lipsky, E. M.; Karve, M.; Guitierrez, A.; Robertson, W. H.; Zhang, M.; Chang, O.; Chen, S.; Cicero-Fernandez, P.; Fuentes, M.; Huang, S.-M.; Ling, R.; Long, J.; Maddox, C.; Massetti, J.; McCauley, E.; Na, K.; Pang, Y.; Rieger, P.; Sax, T.; Truong, T.; Vo, T.; Chattopadhyay, S.; Maldonado, H.; Maricq, M. M.; Robinson, A. L., Primary gas and PM emissions from light and heavy duty vehicles. *Atmos. Environ.* **2014,** *88*, 247-260.
7. May, A. A.; Presto, A. A.; Gordon, T. D.; Nguyen, N. T.; Hennigan, C. J.; Robinson, A. L., Gas-particle partitioning of primary organic aerosol emissions: (2) Diesel vehicles. *Environ. Sci. Technol.* **2013,** *47*, (15), 8288-8296.
8. May, A. A.; Presto, A. A.; Nguyen, N. T.; Hennigan, C. J.; Gordon, T. D.; Robinson, A. L., Gas-particle partitioning of primary organic aerosol emissions: (1) Gasoline vehicle exhaust. *Atmos. Environ.* **2013,** *77*, 128-139.
9. Khalek, I. A.; Blanks, M. G.; Merritt, P. M. *Phase 2 of the Advanced Collaborative Emissions Study Final Report*; Coordinating Research Council: Alpharetta, GA, November 2013, 2013.
10. Hallquist, A. M.; Fridell, E.; Westerlund, J.; Hallquist, M., Onboard measurements of nanoparticles from a SCR-equipped marine diesel engine. *Environ. Sci. Technol.* **2013,** *47*, 773-780.
11. Hallquist, A. M.; Jerksjo, M.; Fallgren, H.; Westerlund, J.; Sjodin, A., Particle and gaseous emissions from individual diesel and CNG buses. *Atmos. Chem. Phys.* **2013,** *13*, 5337-5350.
12. Sonntag, D. B.; Bailey, C. R.; Fulpert, C. R.; Baldauf, R. W., Contribution of lubricating oil to particulate matter emissions from light-duty gasoline vehicles in Kansas City. *Environ. Sci. Technol.* **2012,** *46*, (7), 4191-4199.
13. Zheng, Z.; Durbin, T. D.; Xue, J.; Johnson, K. C.; Li, Y.; Hu, S.; Huai, T.; Ayala, A.; Kittelson, D. B.; Jung, H. S., Comparison of particle mass and solid particle number (SPN) emissions from a heavy-duty diesel vehicle under on-road driving conditions and a standard testing cycle. *Environ. Sci. Technol.* **2014,** *48*, 1779-1786.
14. Allan, J. D.; Delia, A. E.; Coe, H.; Bower, K. N.; Alfarra, M. R.; Jimenez, J. L.; Middlebrook, A. M.; Drewnick, F.; Onasch, T. B.; Canagaratna, M. R.; Jayne, J. T.; Worsnop, D. R., A generalised method for the extraction of chemically resolved mass spectra from Aerodyne aerosol mass spectrometer data. *J. Aerosol Sci.* **2004,** *35*, (7), 909-922.
15. Herner, J. D.; Hu, S.; Robertson, W. H.; Huai, T.; Chang, M. C. O.; Rieger, P.; Ayala, A., Effect of advanced aftertreatment for PM and NOx reduction on heavy-duty diesel engine ultrafine particle emissions. *Environ. Sci. Technol.* **2011,** *45*, 2413-2419.