

Interactive comment on “Measurement on PM and its chemical compositions for real-world emissions from non-road and on-road diesel vehicles” by Min Cui et al.

Anonymous Referee #1

Received and published: 25 December 2016

The manuscript by Cui et al. summarizes emissions measurements from multiple generation diesel excavators and trucks under different operating and driving conditions. These types of measurements are unique in China and much needed. The paper is well organized, but it needs a thorough edit as many words, verbs, etc are not used correctly or are missing. Below I highlight the technical weaknesses, minor clarifications, and instances where sentences are confusing and need to be rephrased. I approve publishing the paper after these concerns are addressed.

1. One of the weaknesses of this work is that each truck/excavator was tested only once. Thus it's unknown how representative these results are and how variability in the measurements affect the observed emission factors. I doubt that duplicate runs

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can now be carried out; however, the authors should at least mention and address this weakness. Another weakness is that driving conditions of the trucks were not similar (as shown in Figure S2); since driving conditions and engine load can have significant impacts on the emission factors, how can the results be interpreted in a unified manner? This should also be addressed in the discussion and conclusion sections. Related to this is the variety of the engines tested in this work for both excavators and trucks. For example for excavators, engine powers span a range of 35-169 KW and total weights and engine displacements also vary a lot. On one hand, it's good to have a sampling pool of various engine types/sizes. On the other hand, these difference should be kept in mind and referred to when comparisons are made throughout the paper.

2. For readers who are not familiar with the standards in China, it will be useful to have a table where major particulate and gaseous emissions of each generation standard for trucks/excavators are listed.

3. P7, L23: Although mentioned in Table 2, please indicate in the text the average (or range of) sulfur content of the fuels as well as the limit of GB 252-2015.

4. P8, L 22: what recovery % for each species were achieved?

5. P12, L3: It seems the trucks with China II and China III standards had similar PM emission factors. Why is that so? Do these standards pose similar levels for PM? or is it that the trucks tested don't necessarily represent the standard? or is this an instance where results from a single measurement from a truck are uncertain?

6. P12, L7: unclear what "more volatile" means here

7. P12, L11-13: It doesn't make sense that trucks driven on road with higher grade have lower emissions. Please clarify.

8. P. 12, L17: what's the justification for using OM/OC=1.6 for such fresh emissions? How will the result change if a lower factor, more representative of fresh emissions, is

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used?

9. P13, L9, P14,L2: it is mentioned that diesel sulfur content affected OC/EC. It is unclear to me how fuel sulfur can affect emission of organic compounds and soot. Please explain.

10. P13, L11-26: It is unclear what the elemental emissions are stemming from: the fuel or bad conditions of the engine or the lubricating oil? Please explain. For example, L22, it is mentioned that diesel quality used in E4 was poor. Was the fuel also tested for elemental content? Were Cu and Zn higher in this fuel as well?

11. P13, L23, P14, L4-5, P17, L24-26: Authors mention that % of elemental composition in E1 and E6 was higher. How did absolute concentrations or emission factors of the elements compared for these two vs. the others? Since % values depend on concentrations of other components as well, I don't think they're as relevant to be mentioned, especially since they contribute to a very small fraction of the emissions.

12. P14, L7-10: It is unclear how the authors concluded that alkane/hopane/steranes were influenced by fuel quality and PAHs by combustion. Please explain and clarify.

13. P16, L11: Please explain what reactions in the engine authors refer to.

14. P17, L3: Is it really that presence of metals oxidizes soot?! or do the metals enhance combustion and reduce formation of soot?

Minor comments: 1. Acronyms of PAHs should not be used in the abstract. 2. Define BaP_{eq} in the abstract. 3. P3, L 7: define PM. Throughout the paper indicate what size PM refers to (PM₁, PM_{2.5}, etc). 4. P12, L12: consider using "higher road grade" 5. P20, L3: Do authors mean excavators rather than diesel truck here or should E1, E2, ... be T1, T2, etc? 6. Figures: Axis labels are all too small and need to be modified for better quality figures. 7. Fig 7: what do the error bars represent? Unclear from the caption what the difference between A-B and C-D symbols are. 8. Fig. S3. What are the crosses and dashed lines in these box and whisker plots?

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Sentences needing to be rephrased: 1. P3, L 13-15 2. P4, L18-20 3. P7, L12-14 4. P12, L1-3 5. P. 13, L19-20 6. P.18, L3-4

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