

# ***Interactive comment on “Tracking Separate Contributions of Diesel and Gasoline Vehicles to Roadside PM<sub>2.5</sub> Through Online Monitoring of Volatile Organic Compounds, PM<sub>2.5</sub> Organic and Elemental Carbon: A Six-Year Study in Hong Kong” by Yee Ka Wong et al.***

**Anonymous Referee #2**

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General Comments:

In this work, Wong et al. developed and validated a positive matrix factorization (PMF)-based analysis approach to apportion PM<sub>2.5</sub> organic carbon (OC) and elemental carbon (EC) measurements into specific vehicle type source contributions. Authors conducted PMF analysis using air quality monitoring data collected over a 6-year measurement period at a near road site in Hong Kong that included semi-continuous OC

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and EC, NO<sub>x</sub>, CO, and speciated volatile organic compounds. Vehicular contributions to OC and EC attributed to diesel and gasoline vehicle exhaust along with three other factors were calculated by PMF analysis. Seasonal and diurnal trends of these source contributions as well as the ambient measurements were discussed in detail. The manuscript was clearly written, and methods were sufficiently explained.

The PMF analysis required only 16 inputs from measurements that are routinely conducted at numerous ambient air monitoring networks, so this apportionment method could potentially be widely used by regulatory agencies. However, one major issue with this manuscript is that authors have not properly explained limitations of this method – can this approach be used in other air monitoring conditions where vehicle emissions are not the major source of PM or other locations outside of Hong Kong? Is the method only robust for data collected from near road sites in Hong Kong? Further guidance on caveats regarding application of this approach to other situations/locations is needed. The other related issue is that the method is heavily weighted towards primary vehicle emissions without accounting for temperature-dependent semivolatile organic partitioning to particle phase or including good tracers for regional air pollution or primary emissions from any other source. Therefore, it's not clear whether trends in OC seasonality are due to SVOC partitioning or regional transport. Further discussion of how to better address these method limitations (e.g. potential underestimation of vehicle related primary/secondary OC or inaccurate contribution of regional air pollution) to better inform regulatory action would be helpful. It is recommended that after addressing these issues, the manuscript may be considered for publication with minor revisions.

Specific comments: Lines 78-79. Clarify what is meant by “highly recommended”. Line 156. Is there a prevalent wind direction in other seasons? Line 161. The results presented here do not appear to explain these reductions in OC over time. Are there any suggested explanations? Could it be improvements in regional air pollution? Line 176. If vehicle exhaust is the main source of OC, why not use OC x 1.2 to estimate OM as

was used with the EC Tracer Method? Lines 183-187. Could these measurements be used in this PMF analysis as a tracer(s) for improve regional air pollution factor? Line 197. Do benzene and ethane have seasonality from their contribution in aged air mass? Line 209. Could average ambient temperatures be plotted over this time period in the supplementary material so that partitioning could potentially be estimated? Line 214. How does this value compare to those determined in vehicle emissions studies or in emission inventories for representative vehicles in Hong Kong? Line 236. Are the relative VOC contributions in the fuel filling profile consistent with the local gasoline fuel composition? Line 274. Is there a possible explanation for this deviation? Line 280. If OC from other factors are added, does the seasonality disappear? Line 305. This would be a good point to stress that limitations of this method in accurately estimating PM<sub>vehicle</sub> (does not take SOA formation, SVOC partitioning, or other emission sources into account) makes it difficult to make these types of policy recommendations. Line 334. The trends for the truck and bus time periods looks strikingly similar. Was this expected? Perhaps traffic patterns have changed since the traffic counting exercise? Figure 1. What is the air quality PM<sub>2.5</sub> standard level? Figure 3. It would be helpful to add Fig. S6 to this figure. Figure S10. It would be useful to see other factor contributions. Figure S11. A time series of modelled and measured OC would be helpful to include.

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