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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Elucidating real-world vehicle emission factors from mobile measurements over a large metropolitan region: a focus on isocyanic acid, hydrogen cyanide, and black carbon" *by* Sumi N. Wren et al.

Anonymous Referee #2

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Wren et al. present emissions findings from a short mobile laboratory deployment in the Greater Toronto Area (GTA) in the summer and winter of 2015-2016. Their manuscript results mostly focus on trends in ambient concentrations and emissions factors of black carbon (BC), isocyanic acid (HNCO), and hydrogen cyanide (HCN). A key finding of this study is that emission factors of BC, HNCO, and HCN are lower than those reported in the literature suggesting that the mobile source fleet in GTA is relatively clean. They also report that mobile sources contribute substantially to the ambient concentrations of HNCO and HCN in urban environments and may be more important than biomass

burning in those regions.

The methods used, the presentation of results, and the conclusions based on the results are robust. The manuscript is very well written and easy to follow; amongst the top 10 percentile of manuscripts I have reviewed. I have very few comments on the manuscript (see below) and strongly recommend publication in ACP. Despite being limited to GTA, the methodology and results from this manuscript will be very useful to the air quality and atmospheric chemistry community.

1. Page 5, lines 36-38: The inlet appears to be quite long given that HNCO and HCN – that tend to be sticky molecules – might suffer large losses. Were the losses through this length and this tubing material quantified for HNCO and HCN? What are the implications of tube losses on the study? Also, if the material can stick and be released as and when the equilibrium between the material on the tube and in the tube is perturbed, would the measured delay result in miscalculations?

2. Page 5, line 37: Easy to calculate but what was the residence time in the sampling line?

3. Page 6, line 20: When mentioning the supplement, can you specify the correct section in the supplement?

4. Page 9, line 9: Include findings about agricultural burning from Chandra and Sinha (2016).

5. The seasonal differences described in Section 3.1.1 and visualized in Figure 2 may not be directly interpretable based on differences in the absolute concentrations in the two seasons. For example, for the same emissions and sources, wintertime concentrations for a species can be higher simply from shallower boundary layer heights. So higher wintertime concentrations may not reflect changes in emissions or sources. On the same note, for the same source, ambient temperatures may result in very different emissions, e.g., Suarez-Bertoa et al.(2016) found vehicular emissions of HNCO to be

much higher at lower temperatures. Furthermore, for the same source and emissions, photochemistry could influence the background concentrations and contributions to the total. Would it have been better to compare seasonal differences after ratio-ing the species of interest against an inert tracer such as CO?

6. Isn't the statement starting on page 10, line 42 about LOCAL versus BKG HCN also true for HNCO?

7. Section 3.3: Am I understanding this right that the emission factors are calculated only using the LOCAL estimates? Also, if the LOCAL estimates include emissions from near-road non-mobile sources, the emission factors in this work would serve as an upper bound?

8. It isn't clear to me how one would go about doing this but given the different pollutants measured and differences in their relative proportions in gasoline versus diesel vehicles., there must be a way to apportion the various pollutants measured into their contributions from gasoline and diesel. This would be an interesting exercise with huge value to air quality managers/regulators.

9. Section 3.3.3: Why was HCN compared in Table 6 in mg/km while HNCO was compared in Table 5 in mg/kg-fuel?

10. Assuming that the BKG estimates are representative of ambient concentrations away from the roadway, would it be safe to say that the HNCO concentrations in GTA are significantly lower than the 1 ppbv health threshold suggested by Roberts et al. (2011).

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