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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Reactive Organic Carbon Emissions from Volatile Chemical Products" *by* Karl M. Seltzer et al.

Anonymous Referee #2

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In this work, the authors developed a new framework for building emissions inventories of volatile chemical products (VCPs). VCPs have recently been recognized as a major, if not dominant, source of reactive organic carbon in urban areas. Since much of the focus of emission controls has historically been placed on mobile sources, accurate emission inventories are now needed for VCPs. In this work, the authors consolidated different tracking methods for a wide variety of product use categories under a unifying framework ("VCPy"), intended to be used by air quality models to predict ozone and secondary organic aerosol (SOA) formation. They also compared their emission prediction with field measurements and found good agreement when normalized to carbon monoxide, which gives credence to the method. Monte-Carlo analysis was also performed to explore uncertainties.

Overall, the manuscript was well written and I expect this framework will be used by many in the field of air quality. The description of the method is very detailed, which is necessary for this manuscript to provide good reference for future use. I recommend that this manuscript be published. I only have minor suggestions for the authors to consider, mostly for the purpose of discussion.

1. What is the role of disposal in this framework? If VCPs that are used on a short timescale but are disposed of using open methods, is that included in the framework? For example, VCPs could enter wastewater treatment plants and enter the atmosphere.

2. The Monte Carlo analysis is focused on the uncertainty in the total emissions per capita as the primary outcome. The assumption here is the uncertainty lies primarily in the model inputs, and the outcome is deterministic. I expect this assumption to be valid for total emission per capita as the primary outcome, but may not be so if we examine the composition instead. For example, how does uncertainty in the composition profile affect the emissions?

3. Similarly, for the input variables that were examined (e.g. uncertainty in v_e, depth), what is the uncertainty in the composition of emissions? E.g. what is the uncertainty in median c*? I expect that if v_e increases, it might increase emissions of lower volatility compounds more than it increases those of higher volatility ones.

4. For many of the water-based VCPs, I would expect that evaporation will be based more on K_AW (or Henry's Law constant) rather than K_OA. How much would that change the estimates?

5. What is the fraction of VCPs that are based on fossil-carbon vs modern carbon? Is that something that can be estimated?

6. Lines 296-297: For 4 PUCs, employment statistics were used for the spatial allocation of commercial VCP emissions. I am wondering that regarding the automation considerations, the number of employees might underestimate the VCP emissions from

those sites and sales allocation or GDP of the production sector distribution might be better tools for that purpose.

7. It is not surprising that regional and localized differences are significant. For many of the compounds, the atmospheric lifetimes could be long enough that these differences probably do not matter too much. This might also depend on the scale of air quality modeling.

Minor comments:

In Lines 25-27 (abstract) and in Section 3.3, when comparing to 2017 NEI, the terms “increase” and “decrease” are misleading, since they can be confused with year-to-year increase/decrease. I suggest using terms like “overestimate” or “underestimate”, or just “higher” or “lower”.

Line 80: there are two references for Li et al. 2018.

Figure 6: what does X stand for?

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