Comment on acp-2021-547

Anonymous Referee #3

Referee comment on "Modeling secondary organic aerosol formation from volatile chemical products" by Elyse A. Pennington et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-547-RC3, 2021

This manuscript describes a modeling effort where VCP emissions are included into CMAQ. Overall, inclusion of these emissions improves predictions of SOA, HCHO, and O3 concentrations, though SOA remains under predicted.

Overall the manuscript is well written and is an important contribution. My main concern is that, as written, the manuscript seems to rely on readers having a good working knowledge of the VCPy inventory. I think adding more detail on the inventory in a few key places will help readers to better understand the findings of this study (without having to refer back to Seltzer et al several times). Tow examples of this are:

1. Presumably VCPy is both spatially and temporally resolved. The temporal resolution seems to be especially important, since there seems to be some evidence that personal care product VCPs have stronger emissions in the morning than later in the day. It would be worthwhile to spend a few sentences on some of the important temporal profiles of VCPs.
2. I think the discussion of temperature-dependent biases in Fig 5 would also benefit from more detail on the emissions. It seems like the added VCP emissions include some temperature-dependent evaporative emissions (hence improvements in bias relative to the no-VCP case at higher temperature), but that some sources may be missing (since the bias at high temperature is still large). Right now there is a text description of some of these trends; it would be helpful to have a figure showing how some of the VCP emissions perhaps vary with temperature and/or time of day.

Other comments:

I'm not sure what is meant by "these alkane surrogates" in line 129. I thought the point was to reallocate IVOCs into classes that form SOA.

Figure 1 - it would be good to explicitly state what parts of this map are new to this work. I think it's everything in orange font.

Fig 4b and 4c could benefit from including the 1:1 line.

Non-oxygenated IVOCs contribute the most to the additional SOA made in the "with VCP" case (e.g., Fig 4c). What are the major sources of these emissions?