Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2020-1078-RC2, 2020

Atmospheric Chemistry and Physics
Discussions
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Interactive comment on "Volatile organic compound emissions from solvent- and water-borne coatings: compositional differences and tracer compound identifications" *by* Chelsea E. Stockwell et al.

Anonymous Referee #2

Received and published: 21 December 2020

This manuscript considers emissions of VOCs from volatile consumer products (VCPs). There is a specific focus on emissions from paints/coatings, and the use of two compounds (Texanol and PCBTF) as tracers. The manuscript is relevant to the recent interest in VCP emissions and atmospheric chemistry in the wake of declining emissions from combustion sources.

General comments: (1) The manuscript's results are broken into three main sections: (1) ambient mobile observations, (2) laboratory samples, and (3) analysis of an emissions inventory. These three sections are not connected very well, and came across

more as three stand-alone chunks rather than a single cohesive narrative. The inventory section in particular seemed to be the least connected to the other two main sections.

Comments on mobile sampling: (1) Figure 1 - what is the spatial resolution of the binning? It looks like the bins are strictly based on longitude. Is that correct? Does an east-west binning introduce any biases? I imagine that there are also strong north-south gradients in Manhattan.

(2) Are the data in Figure 1 from a single drive? Or are there road segments that were sampled on more than one occasion? If there are multiple passes over a road segment (or spatial bin), how were those handled?

(3) Line 183 notes isolated plumes - this suggests that emissions are episodic. If emissions are dominated by episodic events, it underscores the importance of how the mobile sampling data are binned and averaged. It's easy to imagine a case where the data end up being biased by capturing more plumes on one sampling day, or in one neighborhood, just by luck or chance. There are multiple papers that discuss spatial and temporal averaging needs for mobile sampling data (e.g., Messier et al, ES&T, 2018; E. Robinson et al, ES&T, 2019); the authors should at least acknowledge that this literature exists. If the data in Fig 1 are from a single driving pass, the authors should be clear about this, and they should also acknowledge that the data therefore represent a snapshot more than the typical or long-term spatial pattern.

(4) The correlations of PCBTF and Texanol with CO (Fig 1) are useful context. However, I would also like to see the correlation between PCBTF and Texanol. A visual inspection of the top part of Fig 1 suggests that these are not correlated very well. Given that the source(s) are the same, is this poor correlation expected? (It seems that this poor correlation is discussed in more detail in the section on the laboratory experiments. Nonetheless, it would be helpful to readers to give it some attention here.)

(5) Can the authors be more specific about what they mean by "industrial" uses of

paints and coatings? It seems like construction is one example of industrial use, but I can also imagine that industrial uses would include painting or coating of manufactured products. I think that these different types of industrial uses could be apparent in the data. E.g., are some of the Texanol spikes near large construction projects? In Figure 2 there seems to be a large area in northern Indiana with high PCBTF concentrations. Could this be emissions from non-construction industrial uses? My impression is that this region still has a lot of heavy industry.

(6) Figure 3 - Please define how the enhancement is determined (i.e., what is the background?).

Comments on laboratory tests: (1) Figure 4 and related discussion - PCBTF is only present in the solvent-borne paints, and not in the water-borne samples. However, prior to this point, the authors assert that PCBTF is a general paint/coating tracer. I think this needs to be clarified in the previous section.

(2) I do not see Texanol in Fig 4. Since that is the other tracer used in this work, I think it would be good to show it in this figure.

(3) One concern that I have about VCPs is that there can be so many sources of variability - e.g., between types of coatings (e.g., indoor vs outdoor, latex vs low VOC vs oil based), between specific formulations (e.g., different gloss levels of latex paint sold by the same manufacturer), and between manufacturers. Obviously it is impossible to capture all of these sources of variability in one paper, but they should at least be acknowledged. While the paint samples used here might be representative in the sense that they can be purchased commercially, there is a lot of potential variability that is not controlled for here.

(4) Figure 5 - are the total emission rates indicated in the figure (e.g., 586 ppb/mg for the zero VOC paint) the average over the whole experiment, or from a portion of the experiment?

(5) Figure 7b - does this show the instantaneous or integrated emissions? E.g., the purple line for acetone flattens out around 2% very quickly. Does this reflect that the volatile components are emitted quickly (including a big burst of acetone), or does acetone keep getting emitted at around 2% of total VOCs for the entire 19 hours of the experiment?

(6) Line 372-379 note that the trend in VOC emissions tracks the stated VOC content of the products. While that is true, there does not seem to be a linear relationship between stated VOC content and measured emissions. Latex paint emits 20x more VOCs than primer/sealer even though there is 2.5x the VOC content. There is a similarly large jump in VOC emissions between the stain and the latex paint for another factor of $\sim$2 change in VOC content.

Comments on inventory section: (1) As I note above, I do not feel like this section is connected very well to the rest of the manuscript.

(2) This section focuses heavily on the emissions for California. How representative is CA of the rest of the US?

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