

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2021-547

Anonymous Referee #1

Referee comment on "Modeling secondary organic aerosol formation from volatile chemical products" by Elyse A. Pennington et al., Atmos. Chem. Phys. Discuss.,
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This is an important study that models the role of VCPs in SOA formation. The study acknowledges current uncertainties and challenges to modeling the role of VCPs. The following points need additional discussions and clarifications:

1. Line 145: What is the justification for assuming the VCP emissions profile peaks at noon and has no weekday-weekend differences?
2. Line 455: The slight increase in POA concentrations is with respect to what? This sentence needs rephrasing and clarification.
3. Is POA considered semi-volatile and do different POA sources have different volatilities?
4. How does the modeled volatility distribution of SOA affect model-measurement bias with respect to temperature? Since the bias is shown to increase with temperature, is the modeled SOA too volatile? What is the role of particle-phase oligomer formation on volatility distribution of SOA from the dominant SOA sources?
5. Why is modeled formaldehyde higher in CMAQ+VCP case compared to zero VCP case? Is this related to increase in radicals and ozone in the CMAQ+VCP case that increase formaldehyde production as temperature increases?
6. Line 495: It is not clear to me if we can make a general statement that formaldehyde is an important indicator of SOA formation. First, SOA products have a range of volatilities,

and ultimately SOA could be lower volatility than currently assumed (see comment 4). In contrast formaldehyde is volatile. Secondly, the chemistry for SOA products is much more complex than formaldehyde. One could likely say VCP-SOA precursor emissions could correlate with formaldehyde as a function of temperature.

7. Given the motivation mentioned a role of oxygenated VOCs, it was surprising that oxygenated VOCs have much smaller role in SOA formation from VCPs. Same is the case for siloxanes. Can one neglect the role of siloxanes and oxygenated VOCs in SOA formation from VCPs? This needs more discussion.