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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Emission factor ratios, SOA mass yields, and the impact of vehicular emissions on SOA formation" *by* J. J. Ensberg et al.

Anonymous Referee #1

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The paper by Ensberg et al. is a well-organized and well-written paper addressing one of the standing issues in urban secondary organic aerosol (SOA) formation. The paper is motivated by lack of a closure between modeling and measurements of SOA as well as recent contradictory findings on the contribution of diesel and gasoline emissions to urban SOA. The paper provides an overview of the recent research in this area and, more importantly, explores some of the plausible reasons for discrepancies in the recently published work related to these two issues. The analysis indicates that uncertainties in the emission factors, drive-cycle dependent emission ratios, or addition of non-vehicular emissions are not enough to explain the observed enhancements in

OOA/CO ratios. Conclusions of the paper are that 1) SOA mass yields are significantly higher in the ambient compared to the laboratory, and/or 2) anthropogenic fossil activity other than vehicular emissions contribute significantly to SOA in Southern California. This analysis is highly valuable since the approach taken to address urban SOA formation is different than those of the recent published work and it improves understanding of urban aerosol formation in the Los Angeles Basin. I support its publication in ACP after the following minor comments are addressed: 1) Figure 2. When using yields from Figure 2c in the analysis, the assumption is that fuel composition and vehicular exhaust composition are similar. What is the basis for that? 2) Are the SOA yields plotted in Figure 2b based on yields when all of the parent hydrocarbon in the chamber is used up or do they account for contribution of 2nd generation products as well? 3) Are all the errors (e.g., in Eq. 11, 13, 14, etc) propagated uncertainties from each element? 4) As I understand, [OH]$\sim$1.5$\times$106 molecule cm-3 is needed to get to the mentioned exposure of $\sim$58.3$\times$109 molecule cm-3 s for 0.45 day photochemical age. Considering that most of the vehicular emissions are during the day, shouldn't a higher average OH be considered that is more typical of daytime OH in the summer? This would result in a higher fraction of VOCs reacting in 0.45 days and a lower required SOA yield. 5) On p 27793, lines 18-26: authors provide some evidence that indicate vehicular emissions dominate the anthropogenic reactive hydrocarbons in the LA Basin. Why do they conclude then that vehicular emissions might not dominate SOA formation in the area (line 9-10 on P. 27795)? 6) On. P. 27785, it's indicated that 90% of gasoline and diesel fuel has been identified by recent analytical work. Couldn't the 10% unidentified components of fuel contribute to the unmeasured components of vehicle exhaust which can form SOA?

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 27779, 2013.