

Interactive comment on “Impact of primary formaldehyde on air pollution in the Mexico City Metropolitan Area” by W. Lei et al.

Anonymous Referee #2

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Review of Impact of primary formaldehyde on air pollution in the Mexico City Metropolitan Area: by Lei et al for ACP

Model calculations are presented that show the effects of primary HCHO on HCHO, radical, and ozone concentration. Other modeling studies on Mexico City (some by Lei and co-workers) have been pointing towards the strong dependence of O₃ on radical production rates. The importance of this work in quantifying the effects of primary HCHO emissions is very nicely given by the comparison between an 8% increase in peak O₃ concentration due to primary HCHO and a 19% decrease in peak O₃ by cutting NO_x and VOC emissions by a factor of 2. I do not know what degrees of freedom vehicle manufactures have, but it seems that control of HCHO should be a priority in a Mexico City ozone reduction strategy. Calculations are credible and except

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for a lack of results on the magnitudes of various radical sources, well presented.

I recommend publication after minor modifications.

General Comments In order to put primary HCHO in perspective it is necessary to have a diurnal diagram or a Table of the major categories of radical sources. The closest information that I can find is Sum OH(new) in Table 3 but this includes indirect effects and does not say anything about other sources and absolute magnitudes.

This is somewhat of a digression: It would be of interest to distinguish the direct effects of primary HCHO on O₃ production from the indirect effects. According to Page 19618, line 9, primary HCHO increases surface peak O₃ concentrations by an average of 8%. What is the percent increase in Sum OH(new) due just to the direct effect of increased HCHO? What O₃ production rate increase would be expected if it were proportional to radical production rate under high NO_x conditions?

Specific Comments Page 19611. line 5. factor of 7 increase in HCHO emission relative to inventory This is a very important point as the factor of 7 increase causes primary HCHO to be a significant factor in the photochemistry. There are literature references but it would be worthwhile to summarize a few key findings that show the inventory to be low.

Background HCHO, Section 3.1 Why is there a separate category for background HCHO with a fixed concentration. Background HCHO occurs in Garcia et al (2006) as an unaccounted source in a regression analysis (i.e. not correlated with CO or O₃). What sources in the present model study are not accounted for? There is transport from outside the region but that should follow from boundary conditions. Are there emission sources of HCHO or HCHO precursors missing from the model calculation? Otherwise all HCHO should be primary or secondary.

Page 19614, line 21 and elsewhere. indirect effect of emitted HCHO is bracketed in the secondary term. Maybe this can be re-worded. I do not understand the use of

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bracketed.

Page 19615, line 15, Eq. (3) Could you please clarify equation. Are OH(new), HO₂(new) and RO₂(new) production of radicals by photolysis and ozonolysis? How is HONO treated?

Page 19615, lines 22-23 contribution of primary HCHO to OH concentration increases from 7% in the early morning to 16% in the late morning ... Also time trends for HO₂ and sum OH(new) and on Page 19616, lines 8-11 a summary statement that primary HCHO is most important to HCHO in the morning and most important to radicals and production rates later in the day. I would have thought that primary HCHO would reach its peak importance to photochemistry in the early morning when there are low concentrations of secondary O₃ and HCHO. Are the effects of primary HCHO in the early morning diluted by large contributions from HONO and ozone+alkenes? Or is there another explanation?

Page 19619, lines 16-18. Why do daily and daytime OH have the same 8% enhancement but daily and daytime HO₂ and Sum OH(new) differ by almost a factor of 2? I assume that daily means a 24 hour value. I would expect that the daily values would all be about a factor of 2 lower than the daytime because all 3 quantities are high in the daytime and near zero at night. Is the averaging done by calculating an enhancement for each hour and then averaging those numbers over either 24 hours or daylight hours? In that case the daily enhancements are hard to interpret.

Fig. 7. Should bottom right ellipse be H₂O₂, ROOH?

Typographical errors, etc.

Page 19615, line 1 either HCHO can also affect or HCHO can affect

Page 19619, line 2 should be A distinguishing feature

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