

**Supplemental Comments to the Review and Critique of the
U. S. Environmental Protection Agency's Second External Review Draft of
the "Integrated Science Assessment for Ozone and Related Photochemical
Oxidants"**

By

**Jon M. Heuss
George T. Wolff
Air Improvement Resource, Inc.**

**Prepared for
The Alliance of Automobile Manufacturers**

December 30, 2011

Since the submittal of our comments¹ in November, an important new paper² has appeared in press. The new paper, Emery et al. (2011), which is attached to our comments along with the paper's supplemental material, employs a regional model, CAMx, run at a 12 km resolution over the continental U.S. to model ozone and estimate policy relevant background ozone (PRB) for the entire year of 2006. Boundary conditions were obtained using GEOS-Chem. PRB was estimated by removing all anthropogenic emissions in the U.S., Canada and Mexico. This study is significant not only because it uses such a high resolution grid but also because it uses CAMx, the most widely used and validated photochemical grid model for regulatory applications.

One of the main points we made in our comments was that the latest modeling estimates of PRB were higher than those used by EPA in the last ozone review. The PRB estimates of Emery et al. further support this as their CAMx estimates are even higher than the latest GEOS-Chem estimates. The main conclusions drawn by Emery et al. are:

1. The mean spring and summer PRB across the U.S. from CAMx ranged 25-50 ppb while simultaneous GEOS-Chem predictions ranged 20-45 ppb. So on average, CAMx predicted PRBs 5 ppb higher than GEOS-Chem.

2. CAMx predicted PRBs well over 60 ppb in the Western U.S. and attributed such events to stratospheric intrusions and wildfires. However, based on a case study, the authors

¹ Heuss, J.M., Wolff, G.T. and Kahlbaum, D.F. Review and Critique of the U.S. Environmental Protection Agency's Second External Review Draft of the "Integrated Science Assessment for Ozone and Related Photochemical Oxidants." Air Improvement Resources, Prepared for the Alliance of Automobile Manufacturers, November 2011.

² Emery, C., Jung, J., Downey, N., Johnson, J., Jimenez, M., Yarwood, G. and Morris, R. (2011), "Regional and global modeling estimates of policy relevant background over the United States," *Atmos. Environ.*, doi:10.1016/j.atmosenv.2011.11.012.

concluded that CAMx, like GEOS-Chem, also underestimates the stratospheric exchange of ozone to surface monitors.

3. CAMx performed better than GEOS-Chem in replicating observations at remote sites and remained better at higher concentrations. This further underscores our earlier conclusions that EPA's use of monthly average PRB is inappropriate as it significantly underestimates PRB on high ozone days.

4. The authors further conclude: "CAMx showed a higher correlation between modeled PRB and total observed ozone, which is significant for health risk assessments." The third column in Figure S-6 in the paper's supplemental material clearly shows that PRB is correlated with total ozone and increases as total ozone increases. This is also consistent with earlier research that indicated that the strongest signal of stratospheric intrusions can occur in the part of the air mass containing the highest ozone.³

Thus, it appears the CAMx results are more realistic than the GEOS-Chem predictions and the PRB estimates are even higher than those from the latest GEOS-Chem simulations.^{4,5} Part of the improved estimates from CAMx can be attributed to the higher grid resolution which allows for a more realistic depiction of atmospheric mixing and chemistry in the smaller grid cells. Part of the improvement is also due to the superior way CAMx handled the stratospheric intrusions and the wildfires.

For these reasons, it would be expected that CAMx would produce better estimates of U.S. Background ozone (USB) as well, and they too would be expected to be higher than the estimates derived from GEOS-Chem. EPA needs to add this material to the final ISA. Furthermore, we urge U.S.EPA to use the CAMx estimates of PRB and to run CAMx to derive USB, which is a more appropriate measure of the minimum ozone concentration achievable if all U.S. anthropogenic emissions were eliminated in the Eastern two-thirds and the Southwestern U.S., than PRB.

³ Wolff, G.T., Ferman, M.A. and Monson, P. R. (1979), "The distribution of beryllium-7 within high-pressure systems in the Eastern U.S.," *Geophys. Res. Lett.*, 6:637-639.

⁴ Zhang, L; Jacob, DJ; Downey, NV; Wood, DA; Blewitt, D; Carouge, CC; Van donkelaar, A; Jones, DBA; Murray, LT; Wang, Y. (2011), "Improved estimate of the policy-relevant background ozone in the United States using the GEOS-Chem global model with $1/2^\circ \times 2/3^\circ$ horizontal resolution over North America," *Atmos. Environ.* 45:6769-6776.

⁵ ICF International (2011), "Modeling for North American Background Concentrations," Contract No. EP-C-09-009, Oct. 28, 2011.