May 20, 2011

Comments on Assessing the Public Health Risk of Ozone Exposure in Excess of Policy Relevant Background (PRB)

EPA Clean Air Scientific Advisory Committee - 2014 NAAQS

Nicole V Downey, Ph.D. - Earth System Sciences, LLC – 713.425.4986
nicole.downey@earthsystemsciences.com

Supported by BP America

Today I will discuss the use of policy relevant background (PRB) ozone in the health risk assessment process. I will argue that:

1) Estimates of PRB should be paired in time and space for health risk assessments.
2) An estimate of the uncertainty due to model underprediction at high ozone values must be included in the health risk assessment.
3) PRB should include emissions necessary to maintain a basic level of public health, including food, shelter, heat, and the public health infrastructure.

In the 2006 Criteria Document, and the current Integrated Science Assessment, EPA discusses PRB in a mean sense (i.e. 15-30 ppb). The form of the standard, however, is aimed at the highest extremes (i.e. 4th highest 3-year average MDA8). When regulations were aimed at ≥ 85 ppb (MDA8), this approach was justified by arguing that PRB tends to be low under high ozone conditions (Fiore et al. 2002, 2003). At levels currently proposed for the 2011 NAAQS Reconsideration (60-70 ppb), however, this assumption is no longer valid. Both Fiore et al. (2002, 2003) and Wang et al. (2009) showed that the influence of PRB peaks between 50-70 ppb. An illustration of the difference between PRB calculated as seasonal means vs. annual 4th highest value is shown in Figure 1. Previously, EPA has used monthly average diurnal cycles of PRB for health risk assessments. Again, this approach was justified by arguing that the influence of PRB was low for high ozone events. As shown in Figure 1, in the range of 60 ppb, this is not the case. PRB can represent a significant portion of observed ozone, and this contribution should be taken into account in health risk assessments. Importantly, this contribution varies seasonally, with elevation and with ozone concentration, as observed by Fiore et al. (2002, 2003).
We, therefore, recommend that estimates of PRB be paired with observations at the highest spatial and temporal resolution possible. It is well documented that models tend to underpredict the frequency of high ozone events, partially due to numerical limitations (Rastigejev et al. 2010).

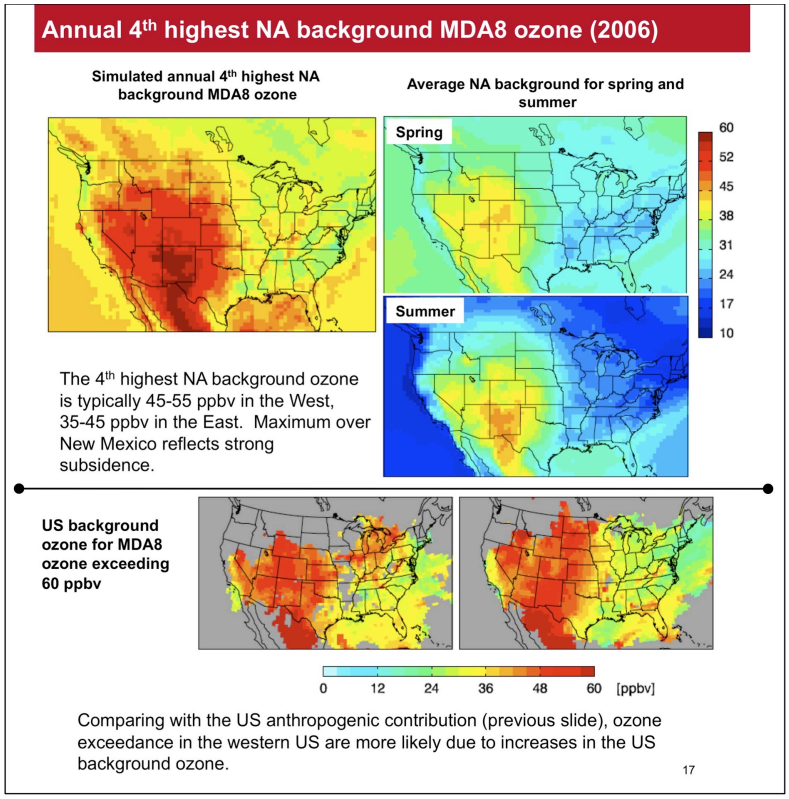

Figure 1. Mean seasonal average PRB, along with the simulated 4th highest PRB. Notice that PRB varies seasonally, by elevation, and that there is a significant difference between mean PRB and the 4th highest PRB value. The bottom panel shows the average contribution of PRB for simulated ozone levels greater than 60 ppb. This figure clearly shows that PRB can significantly affect enhanced ozone concentrations in – and this should be taken into account in health risk assessments. Figures taken from presentations by Zhang and Jacob (2010, 2011) given to BP and EPA.

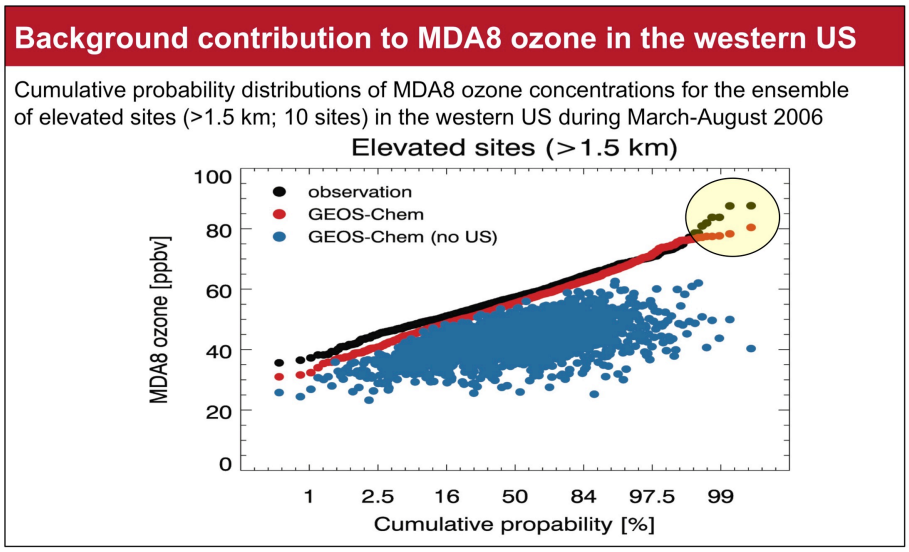

Figure 2. Predicted and observed frequency distribution of MDA8 ozone at Western US sites with the GEOS-Chem model. Notice that performance degrades significantly at 80 ppb. We argue that the uncertainty associated with this systematic underprediction of high-ozone events (and high-PRB events) should be quantified and included in the health risk assessment. Figures taken from presentations by Zhang and Jacob (2010) given to BP.

The most recent version of GEOS-Chem demonstrates the difficulties in predicting the frequency of high-ozone days above ~98th percentile (Figure 2). The numerical limitations that limit model's ability to predict peak-ozone events extend to PRB simulations, and it is likely that peak PRB estimates are also underpredicted. The error associated with this systematic underprediction of high-ozone events should be quantified and effects of this error should be propagated through the health risk assessment process.

Finally, the ISA defines PRB as ambient ozone concentrations in the absence of anthropogenic emissions of ozone precursors. This includes eliminating all sources of combustion and all emissions from agriculture. This scenario itself would have significant negative public health impacts. No allowance is included for the basic sustenance of life and health in the United States. A more reasonable approach would be to include emissions to sustain a basic standard of living, including shelter, food, heat and the public health infrastructure. EPA should optimize the health benefits predicted from reducing ambient ozone levels with the basic needs of human society.