COMMENTS ON RECENT ADVANCEMENTS IN MODELING OF POLICY RELEVANT BACKGROUND OZONE

EPA Clean Air Scientific Advisory Committee
Ozone Review Panel for the Reconsideration of 2008 NAAQS

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February 18, 2011

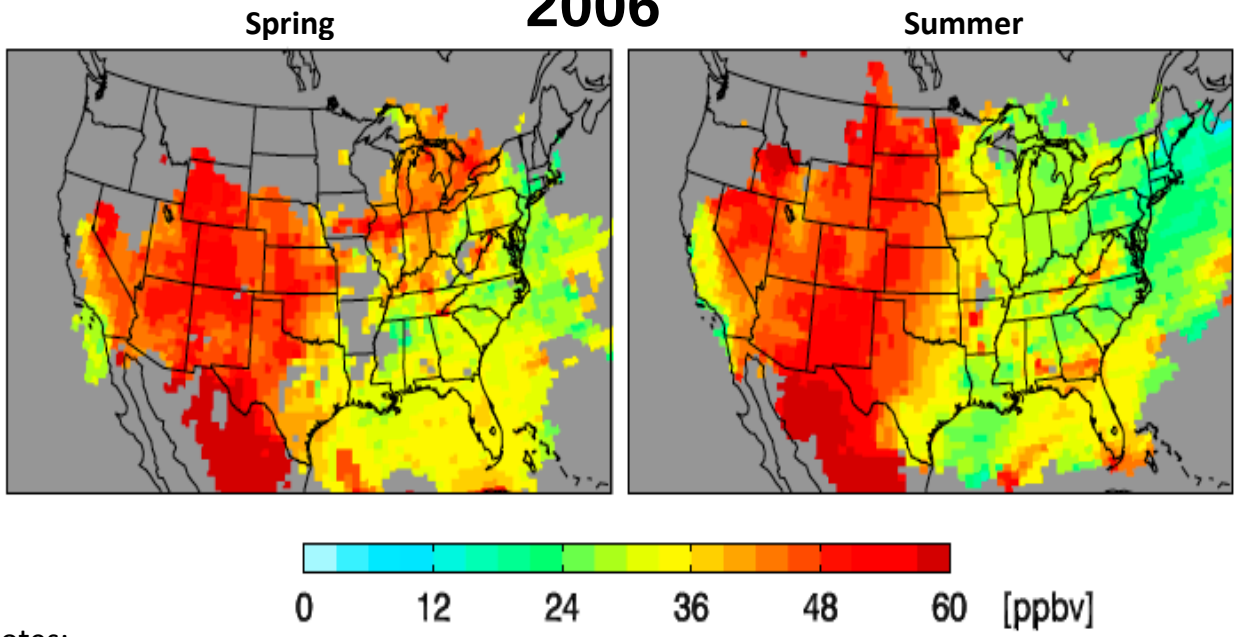
Slide 1

Policy Relevant Background

- EPA defines **Policy Relevant Background (PRB)** as the concentration that would occur in the US in the absence of anthropogenic emissions in continental North America (US, Canada, and Mexico)
- EPA assesses risks to human health and environmental effects from O_3 levels in excess of PRB
- PRB defines the ozone baseline concentration that cannot be reduced through an EPA regulatory program for U.S. sources
  - If EPA establishes an ozone NAAQS less than the highest level of PRB, much of the U.S. **will not be able to comply** regardless of the level of controls on U.S. sources
- Recent GEOS-CHEM modeled PRB is showing 60 ppb in the West
  - In the 2007 ISA, EPA asserted PRB to be only **15-35 ppb**

Slide 2

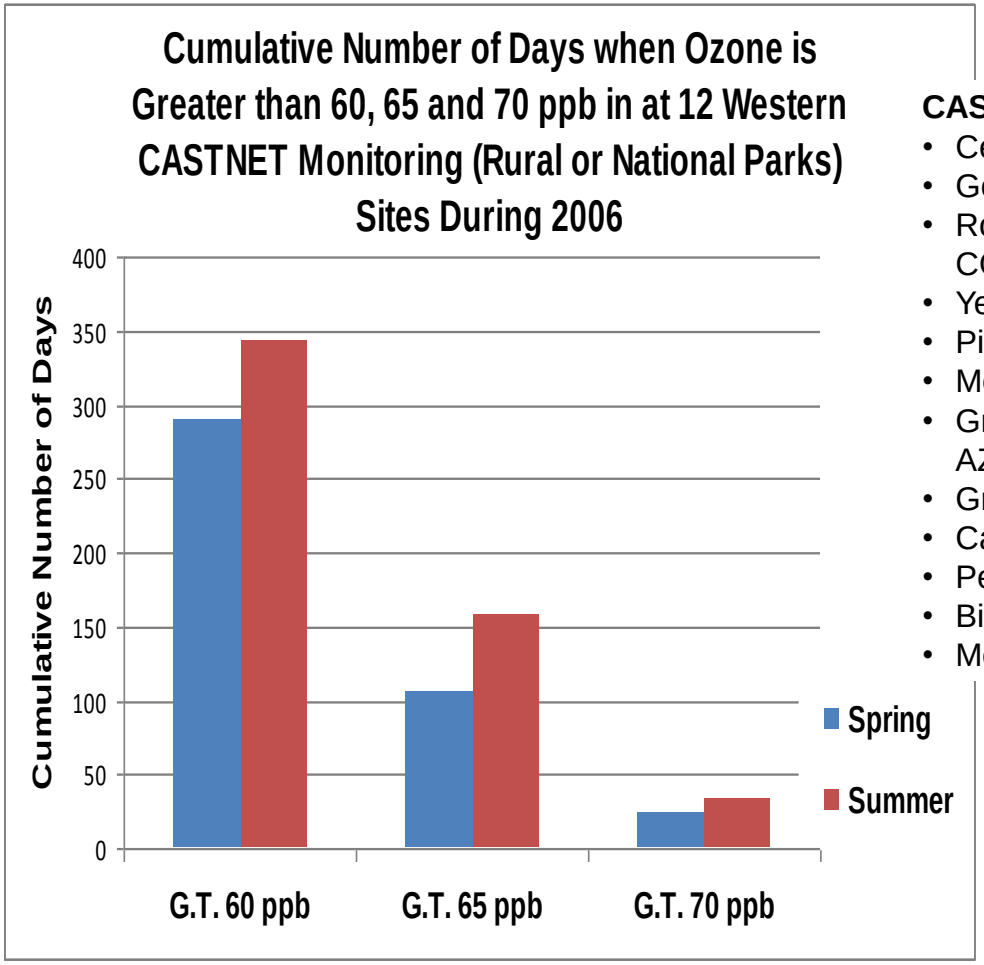
Recent GEOS-CHEM Modeled PRB for 2006



Notes:

1) This slide shows the contribution of PRB for days with an MDA8
2) In the West and Great Lakes region (Spring) when O_3 is elevated PRB is elevated
3) Model evaluation indicated both peak O_3 and frequency of occurrence are underestimated

Source: Lin Zhang and Daniel J. Jacob, Harvard University November 8, 2010



CASTNET Sites

- Centennial, WY
- Gothic, CO
- Rocky Mountain N.P., CO
- Yellowstone N.P., WY
- Pinedale, WY
- Mesa Verde N.P., CO
- Grand Canyon N.P., AZ
- Great Basin N.P., NV
- Canyonlands N.P., UT
- Petrified Forest, AZ
- Big Bend N.P., TX
- Mount Rainier NP, WA

Western Ozone Concerns

- Ozone concentrations > 60, 65, 70 ppb occur frequently in the West
- In the West, elevated ozone concentrations occur almost as often in the spring as the summer
- Researchers are just beginning to understand spring ozone events
- **More than half of the US will exceed the proposed ozone NAAQS of 60-70 ppb due to PRb according to recent modeling and detailed analysis of monitoring data**
- States, tribes, and local agencies have no ability to reduce ozone impacts below PRB
- EPA claims that exceedances due to PRB can be dealt with during implementation of the rule
  - However, the only regulatory tool for "excluding" high monitored PRB ozone events from ozone non-attainment designation is the "**Exceptional Events**" requirements of 40 CFR 50.14

Exceptional Events Concerns

- Addressing elevated PRB events as part of the Exceptional Events regulation is not a workable approach given:
  - Very difficult threshold – "**there would have been no exceedance or violation but for the event**" (40 CFR 50.14(c)(3)(iv)
  - The number of such events that are occurring in the West
  - The case-by-case approach in analyzing such events
  - The lack of tools or protocol for conducting such analysis
- Given the changes in PRB as a result of recent research and implementation issues, **it is recommended that EPA not finalize the reconsideration of the 2008 O_3 NAAQS and continue the ongoing 2014 O_3 NAAQS Review**

Comments on
Recent Advancements in Modeling of
Policy Relevant Background Ozone

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Slide 2

Policy Relevant Background is defined by EPA as the background ozone concentration in the U.S. resulting from both North American and transcontinental natural emissions as well as non-North American anthropogenic emissions. EPA presumes that ozone precursor emissions from Canada and Mexico will or can be controllable to U.S. emission standards (either by Canadian and Mexican regulations or by U.S. sources paying for the installation of emission controls on foreign sources). Regulatory history has shown that this presumption is not true. As demonstrated through modeling and analysis of monitoring data that identifies PRB episodes, the PRB concentration varies by location, elevation and the time of year.

The ozone concentration associated with PRB is important in the EPA standard setting process because EPA uses the background concentration in the assessment of human health risks associated with ozone concentrations in excess of PRB. In conducting health risk assessments for ozone, EPA examines the potential reduction in human risk that would result from implementation of the NAAQS at different levels relative to PRB. From a policy perspective, there is no health or environmental benefit in establishing an ozone NAAQS below the PRB concentration (PRB concentration needs to be expressed in a form that is consistent with the statistical form of the standard)[1]. Because of this, the

[1] Compliance with the NAAQS is defined at the 4th highest concentration averaged over a 3-year period

ambient ozone concentration cannot be reduced below PRB levels through controls imposed through the EPA regulatory program. Furthermore, States, tribes, and local agencies cannot achieve compliance with an ozone standard that is established below the concentration level of PRB because they cannot control emissions from natural or international sources..

As part of the 2008 revision of the ozone NAAQS, EPA used a 2003 GEOS-Chem model study that was discussed in a paper published by Dr. Arlene Fiore. EPA asserted that PRB is between 15-35 ppb despite discussions in the paper that concluded PRB is actually higher in much of the U.S. The paper states that there were "incidences of 40-50 ppb at high altitude western sites in the spring." In fact, Yellowstone National Park showed levels of 58 ppb on several days. However, EPA used the 15-35 ppb ozone concentration as input to the health risk assessment.

BP has reviewed the modeling that was used in the 2008 NAAQS. Based on that review, BP concluded that there were substantial technical limitations in the Fiore modeling that resulted in underestimating PRB[2].

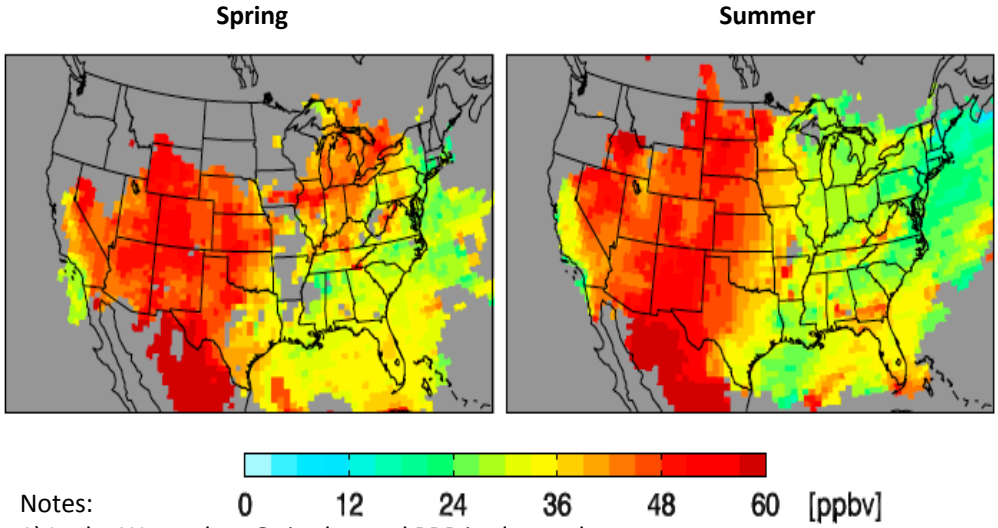
Slide 3

Because PRB is the reference level concentration in terms of ozone health based risk assessment, BP has initiated a study of PRB levels based on GEOS-Chem conducted by Dr. Daniel Jacob and Dr. Lin Zhang of Harvard University. This GEOS-Chem modeling study compares a 2 by 2.5 degree grid and the nested version using a 2 by 2.5 degree grid with a 0.5 by 0.6 degree nested grid over North America for 2006 retaining the EPA definition of PRB. The analysis also includes a model performance evaluation of the nested version of the model over CASTNET monitors located in the West. Several modeling issues were identified in the initial results, and Dr. Zhang and Dr. Jacob have corrected some of these problems, but the nested version of the model continues to under-predict the frequency and intensity of high ozone events at western US sites.

[2] BP America Comments on EPA's Proposal to Revise the National Ambient Air Quality Standards for Ozone, Docket No. EPA-HQ-OAR-2005-0172, March 2010.

While this study has not been completed, there are preliminary results for both spring and summer PRB levels for the U.S that are indicated in Slide 3.

Slide 3. Recent GEOS-CHEM Modeled PRB for 2006



Notes:
1) In the West when O_3 is elevated PRB is elevated
2) Model evaluation indicated both peak O_3 and frequency of occurrence are underestimated

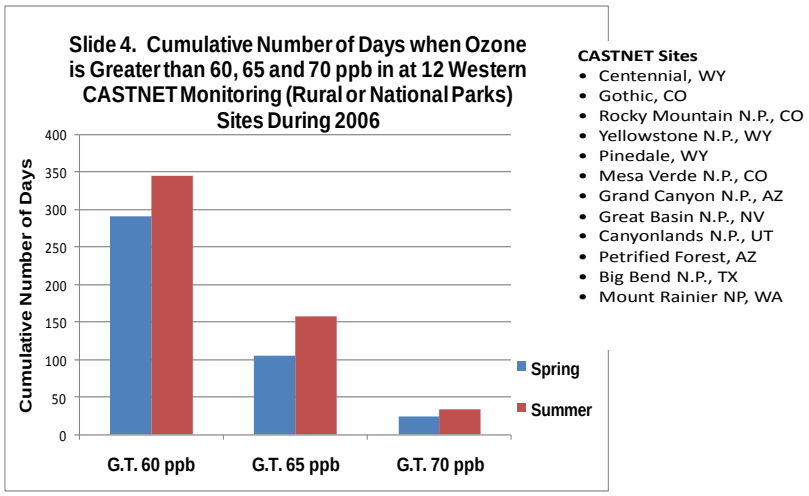
Source: Lin Zhang and Daniel J. Jacob, Harvard University November 8, 2010

As indicated in this figure, PRB concentrations (using the EPA definition of PRB) in the West during spring and summer are approximately 60 ppb. These concentrations represent a seasonal average for US Background ozone for the maximum daily 8 hour average ozone exceeding 60 ppb. The study has shown that when ozone is high in the west, background ozone is also high. Based on analysis of modeling results and analysis of monitoring data, the spring time PRB impacts are a result of downward mixing of elevated ozone near the top of the troposphere. Since 2006 was a year with substantial wildfires in the West, it is believed that the summer PRB events are a result of those fires. Based on the refined Zhang and Jacob modeling, estimates of PRB in the West are nearly double what EPA used in the 2008 ozone standard review and the re-proposal of the standard. Furthermore, the model performance evaluation that was conducted as part of

the Jacob modeling analysis indicated that peak concentrations were under estimated and that the frequency of occurrence of concentrations in excess of 60 ppb, 65 ppb and 70 ppb were also underestimated[3]. Thus, the modeled estimates of PRB may actually underestimate the actual impacts of PRB sources.

Slide 4

Slide 4 presents monitored ozone concentrations for the cumulative number of days in the spring and summer that ozone concentrations were above 60, 65 and 70 ppb at 12 CASTNET (rural sites or national parks) in the West during 2006.



As shown in Slide 4, there were in excess of 600 cumulative days during the spring and summer of 2006 at these 12 rural sites or national parks when ozone concentrations were above 60 ppb (an average of 50 days per site).

Slide 5

Slide 4 indicates that monitored concentrations in excess of 60, 65 and 70 ppb occur quite frequently in the West and for 2006 the elevated concentrations occurred almost as frequently in the spring as the summer. Researchers are just beginning to understand spring ozone events. At the present time it is not possible to conclude that all of the

[3] Jacob, D and Lin Zhang, 2010, PRB Presentation to BP

spring ozone events identified in Slide 4 are related to PRB emissions, however, based on modeling and analysis of monitoring data, there is evidence of a strong correlation between PRB emissions and rural Western spring ozone events[4,5,6]. For summer events, additional research is needed to determine the frequency of occurrence of fires on rural summer ozone events versus U.S. regional transport. However, modeling indicates that PRB emissions (fire) played a significant role in elevated PRB concentrations in the West during 2006.

More than half of the U.S. will exceed the proposed ozone NAAQS in the range of 60-70 ppb due to PRB according to recent modeling and detailed analysis of monitoring data[7]. As a result of large PRB impacts, States and tribes have no ability to reduce ozone impacts from PRB because modeling indicates that local or regional sources are not responsible for these impacts.

EPA claims that exceedances due to PRB can be dealt with during implementation of the rule. However, the only regulatory tool for "excluding" high monitored PRB ozone events from ozone non-attainment designation is the "**Exceptional Events**" requirements of 40 CFR 50.14 which is not a workable approach for the following reasons.

Slide 6

First, under the requirement for the demonstration of an Exceptional Event to be excluded from attainment status determination, a State or tribe must show "**that there would have been no exceedance or violation but for the event".** This requirement establishes a very high threshold which is unworkable in a policy setting.

Second, if the ozone standard is established at 60 ppb, for the spring and summer of 2006 there were over 600 ozone events greater than 60 ppb for only 12 CASTNET sites, an average of 50 days per site, that would require State, tribal, or local agency analysis and a

[4]Stoeckenius, T.E., et.al., 2009, "Air Quality Modeling Study for the Four Corners Region" Environ
[5] Jacob, D and Lin Zhang, 2010, PRB Presentation to BP
[6] Jaffee, D. 2010, "Relationship between Surface and Free Tropospheric Ozone in the Western U.S." ES+T
[7] Ozone map reference

case-by-case approval by EPA. EPA has established a limited amount of time to submit Exceptional Events analyses to EPA. The level of effort and the amount of time that would be required by States, tribes, or local agencies to prepare Exceptional Events analyses for EPA review as well as the necessary action from EPA will create an unworkable situation.

Third, in the case of PM, EPA has developed tools to use in an Exceptional Events analysis, however, it is a very difficult process to get data flagged and excluded from attainment status. In the case of ozone, there are no approved protocols or tools to perform such analyses.

In conclusion, given the changes in PRB as a result of recent research and implementation issues, it is recommended that EPA not finalize the reconsideration of the 2008 ozone NAAQS and rather continue the ongoing 2014 ozone NAAQS Review. The newest research on PRB must be considered in setting an ozone NAAQS.