Photochemical Modeling Using EPA's Appendix W Changes

April 11, 2018

Midwest Environmental Compliance Conference

Jeff Bennett

Overview

- Regulatory / guidance background
  - Still evolving at this time
- Example using the step-by-step process for determining project ozone impacts
  - Super conservative to highly conservative

revisions to the regulations (Guideline on Air Quality Models)

- July 29, 2015 – EPA proposes revisions to its Guideline on Air Quality Models (40 CFR Part 51, Appendix W) including ozone and $PM_{2.5}$ modeling
- January 17, 2017 – EPA published final changes to Appendix W
- May 22, 2017 – Appendix W is effective after Administration "delay in implementation"

revisions to the Guideline on Air Quality Models

- Ozone and secondary $PM_{2.5}$ modeling for permits
  - Tiered approach:
    - Tier 1 – use technical information between precursors and secondary impacts from existing modeling (e.g., Model Emission Rates for Precursors - MERPs)
    - Tier 2 – sophisticated case-specific photochemical modeling (i.e., comparison to the SILs and/or NAAQS analyses)

BARR

What new guidance has EPA published since the 2016 COE?

- EPA has "provided" a considerable amount of additional information to project proposers on ozone and $PM_{2.5}$ modeling (links for your reference)
  - December 2016 guidance on O_3 and $PM_{2.5}$ Modeling
  - January 2017 Webinar on Draft Guidance on the Development of Modeled Emission Rates for Precursors (MERPs)
  - May 2017 Comments on Draft MERPs
    (Barr comments on page 47)
  - July 2017 Webinar on Appendix W, Section 5
  - August 2017 Memorandum on Use of Photochemical Models for Single-Source impacts
  - September 2017 EPA Modeling Conference Presentation on Tier 1/ Tier 2 Secondary Modeling for Single Sources

and the list goes on…

BARR

10,000' version

- Ozone and secondary $PM_{2.5}$ analyses are necessary for PSD projects (*maybe even non-PSD*)
- Project proposers can use Modeled Emission Rates for Precursors (MERPs) as a screening tool
- Photochemical modeling is possible

EPA MERPs (October 2017)

Table 4-4. Modeled Emission Rates for Project Emission Sources (TPY)

Precursor	Area	8-hr O3	Daily PM	Annual PM
NOX	CUS	126	1,693	5,496
	EUS	170	2,295	10,144
	WUS	184	1,075	3,184
SO2	CUS		238	839
	EUS		628	4,013
	WUS		210	2,289
VOC	CUS	948		
	EUS	1,159		
	WUS	1,049		

BARR

So, what should I know about this stuff?

- EPA's method for determining whether a source needs a more detailed evaluation for ozone is VERY conservative
- Major source of NOx in Iowa, Kansas, Missouri, or Nebraska needs only an emission increase of **126 tons/year** to trigger additional ozone analyses (with no VOC increase)

WHAT?

- For every project with a NOx and/or VOC emission increase above 40 tons/year (at a major PSD facility), an evaluation of ozone impact is required.
- Using the guidance provided by EPA, the need for photochemical modeling is possible.

Example using MERP guidance for ozone impacts, Tier 1

Step 1 – define project emission increases

NOx = 400 tpy; VOC = 100 tpy

Step 2 - evaluate "central US" MERP for ozone, project is OK if:

[NOx Emission increase (tpy) / 126 (tpy)] + [VOC emission increase (tpy) / 948 (tpy)] < 1

[400 tpy / 126 tpy] + [100 tpy / 948 tpy] < 1

3.17 + 0.11 = 3.28 > 1

BARR

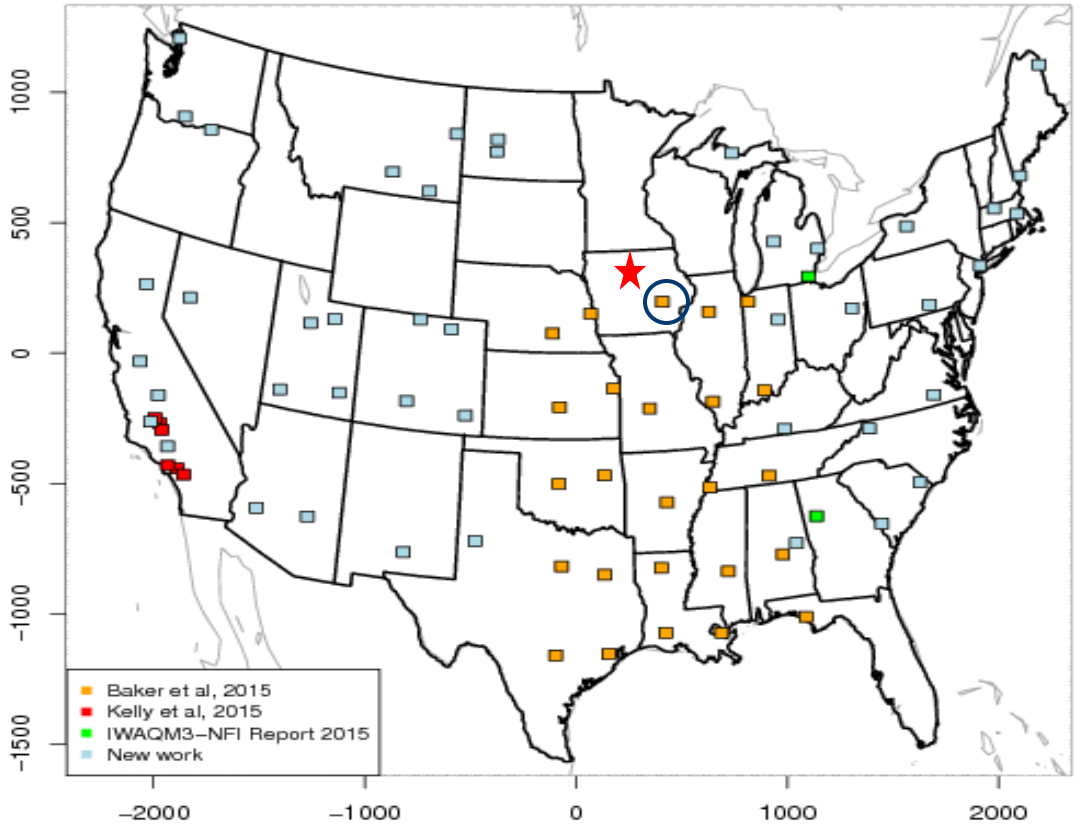
Example #1 using MERP guidance for ozone impacts, Tier 1 (cont.)

Uh-oh, now what …

Step 3 – evaluate location of source and type of source (i.e., tall stack) to arrive at best representation of "local" MERP using EPA modeling database

Step 4 – use "local" MERP value in Step 2 method to evaluate project "impact"

Sources in EPA's MERPs modeling



★ Example source

○ "Representative" Source - CUS #11

BARR

Central US source #11 (500 tpy NOx / 500 tpy VOC increase)

- For each EPA "source", the maximum 8-hour ozone impact was calculated using four different modeling runs for each pollutant
  - 500 tpy elevated stack
  - 1,000 tpy elevated stack
  - 3,000 tpy elevated stack
  - 500 tpy near-surface release

CUS #11 Maximum 8-hour ozone impacts, Step 3

CUS #11 Source ozone impacts

- 500 tpy NOx – 1.37 ppb
- 500 tpy VOC – 0.14 ppb

Local MERP = SIL (ppb) * Modeled Emission (tpy) / Modeled Impact (ppb)

NOx - 1.00 * 500 / 1.37 = **365 tpy**

VOC - 1.00 * 500 / 0.14 = **3,571 tpy**

Example #1, Tier 1, Step 4

Project – 400 tpy NOx; 100 tpy VOC

Local MERP – 365 tpy NOx; 3,571 VOC

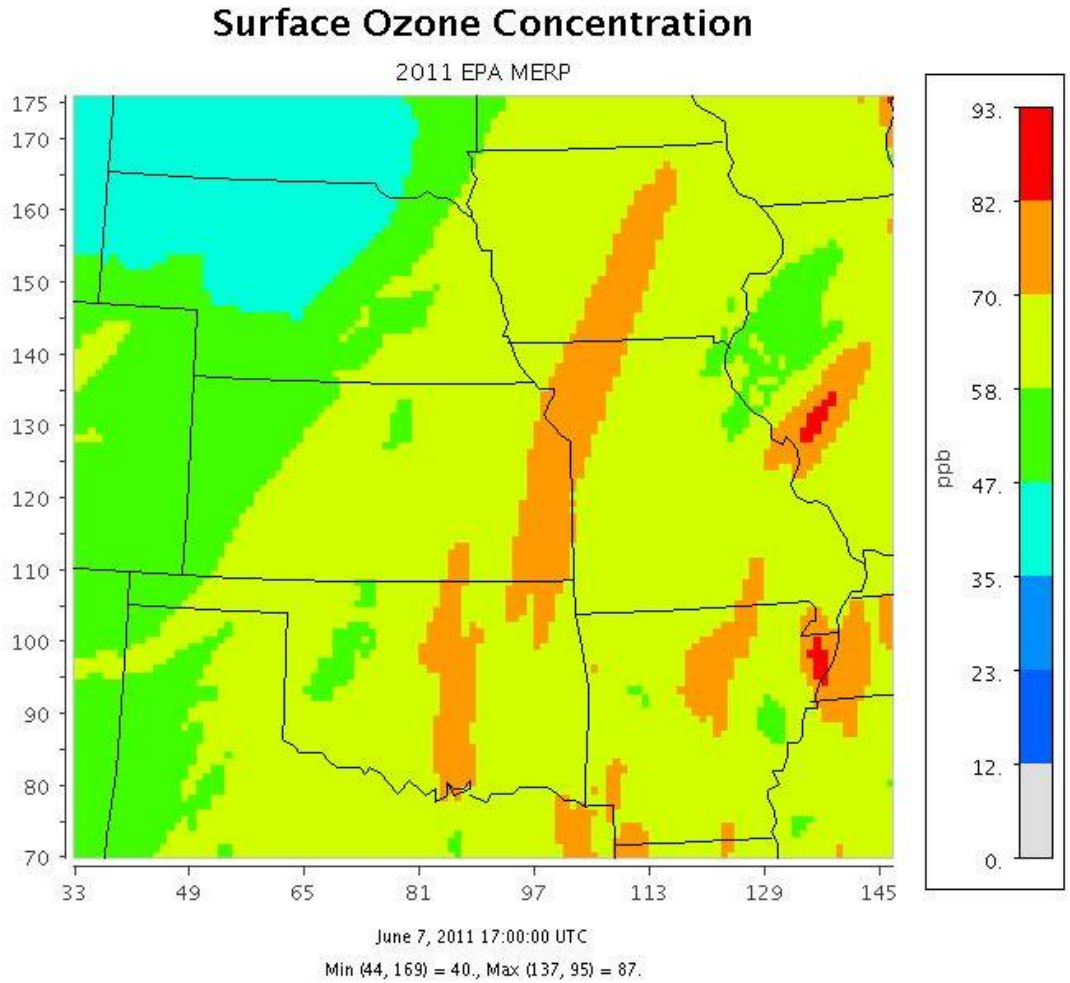
[400 tpy / 365 tpy] +

[100 tpy / 3,571 tpy] =

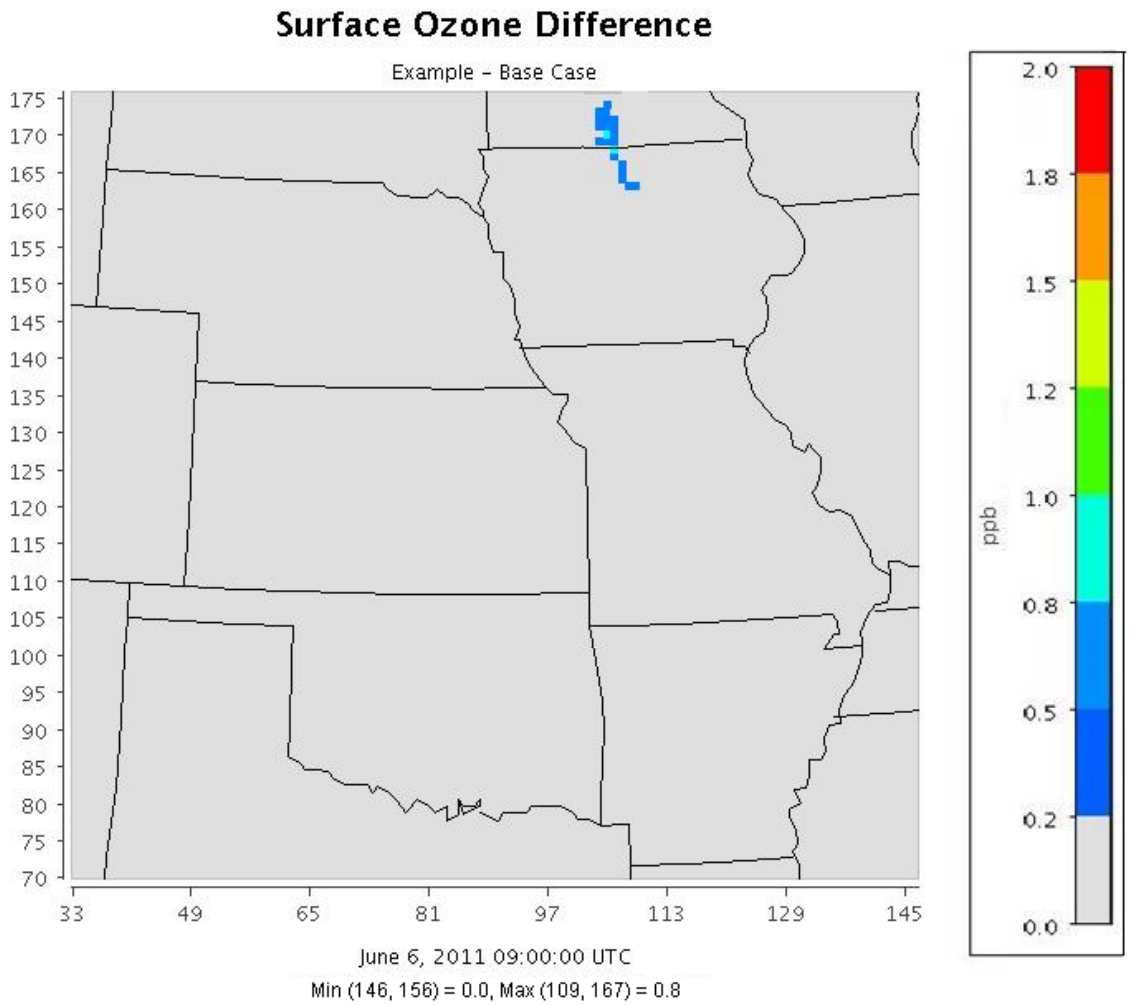
1.12

UH-OH!

CAMx Modeled 8-hour ozone conc, Tier 2



Max modeled 8-hour ozone difference, Tier 2



Example Results, Tier 2

Project – 400 tpy NOx; 100 tpy VOC

Max Modeled 8-hour Impact –

0.75 ppb < Ozone SIL (1.0 ppb)

Yahoo; it passed!

Caveat:

CAMx modeling was not conducted for the entire ozone season (only one episode).

Ozone SIL analyses

- Why does EPA use the maximum source impact on the entire domain at any time to set the MERPs instead of an impact above the NAAQS or, at least, 80-90% of the NAAQS?
- If the SIL analyses is not passed, the guidance does not provide specific detail about a NAAQS-style permit evaluation
    - Please note that there is no way to assess secondary formation without running a cumulative photochemical analyses or making a series of broad assumptions regarding air pollutant concentrations

BARR

Summary

- Ozone and secondary $PM_{2.5}$ analyses are now required for PSD projects that emit NOx / VOC or NOx/SO_2
- EPA has defined a two tier approach
  - Tier 1 – use existing analyses (e.g. Modeled Emission Rates for Precursors (MERPs))
  - Tier 2 – use project-specific photochemical modeling
- Each project should use the simplest applicable method for these analyses

BARR

Questions?

Jeff Bennett

(573) 638-5033

jbennett@barr.com