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IMPACT OF RECENT US EPA PM_{2.5} GUIDANCE ON NSR PERMITS

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TOPICS

- NSR RECAP
- PM_{2.5} MODELING ISSUES
- PM_{2.5} REGULATORY DEVELOPMENTS
- USEPA GUIDANCE ON SECONDARY PM_{2.5} AQIA
- SUMMARY AND RECOMMENDATION

NSR RECAP

- NSR Program:
 - PSD in attainment/unclassified areas
 - NNSR in non-attainment areas
- Two key elements in NSR PSD permit applications:
 - Best Available Control Technology (BACT) Analysis
 - Air Quality Impact Analysis (AQIA)
- PSD AQIA Objective:
 - Demonstrate that the project emission does not “cause” or “contribute” to the exceedance of NAAQS and increment
- Two levels of PSD AQIA
 - Screening analysis for *project emissions only* comparing to Significant Impact Levels (SILs)
 - Refined analysis using cumulative modeling including all “nearby” sources and background comparing to NAAQS/increment

PM_{2.5} MODELING ISSUES

- Primary Criteria Pollutants are emitted directly by emission sources to the atmosphere
 - NO₂, SO₂, CO, VOC, PM₁₀, PM_{2.5}, Pb
- Secondarily Formed Criteria Pollutants are formed in the atmosphere from precursors via complex photochemical reactions involving many variables
 - Ozone – precursors are NO_x and VOC
 - PM_{2.5} – precursors are SO₂ and NO_x
- PM_{2.5} is the only hybrid criteria pollutant – both primary and secondary
 - Requires different strategies for impact analysis and control
- Primary PM_{2.5} emissions include condensable, which is often difficult to quantify

PM_{2.5} REGULATORY DEVELOPMENT

1997/ | October: Initial/Revised PM_{2.5} NAAQS – Annual/24-hr avg.
2006

2008 | May: PM_{2.5} precursors (NO_x and SO₂) identified “NSR Regulated Pollutants”

2010 | September: Sierra Club petition to engage EPA to evaluate and update modeling techniques for secondarily formed pollutants: Ozone and PM_{2.5}

2010 | October: PM_{2.5} significant impact Level (SIL), significant monitoring concentration (SMC), and increment rulemaking

2012 | June: Revised PM_{2.5} NAAQS and SILs – finalized January 2013

2013 | January: D.C. Court of Appeals vacated two provisions of PM_{2.5} SILs

2017 | January: EPA published revisions to the “Guideline on Air Quality Models” with recommendations for quantitative assessment of secondary PM_{2.5} Impacts

RELEVANT EPA GUIDANCE ON PM_{2.5} MODELING

- 2010 | March: “Modeling Procedures for Demonstrating Compliance with PM_{2.5} NAAQS”
 - Focused on background concentration for secondary PM_{2.5} impact
- 2014 | May: Non-draft version “Guidance on PM_{2.5} Permit Modeling”
- 2016 | December: Guidance on modeling impacts of secondarily formed pollutants from single sources
- 2016 | December: Draft version of Guidance on MERP (Modeled Emission Rates Precursor) for Tier 1 demonstration of Ozone and secondary PM_{2.5}
- 2018 | April: Memorandum on proposed final SILs for PM_{2.5} – for both NAAQS and increment
 - PM_{2.5} Annual/24-hr SILs: 0.2/1.2 µg/m³
- 2018 | June: Proposed revisions to 2014 Guidance on PM_{2.5} Modeling
 - still in the works – presented in RSL 2018 workshop

MAIN ISSUE

- How to realistically model a pollutant which is emitted both directly (**primary**) and formed in the atmosphere (**secondary**)?
- Specifically, how to effectively model atmospheric formation of a photochemical reaction product (PM_{2.5}) from a **single source**?

2017 Revisions to “Guideline on Air Quality Models”

2017 REVISIONS TO GAQM*

- Significant Development
 - Last GAQM change was in 2005
- Acknowledges contribution of secondarily formed pollutants in air quality impact analysis
- Legally binding- unlike guidance
 - though December 2016 guidance is referenced in the rule language
- Provides a tiered approach to modeling single source impacts of secondarily formed pollutants

* Guidance on the Use of Models for Assessing the Impacts of Emissions from Single Sources on The Secondarily Formed Pollutants: Ozone and PM_{2.5}

2017 REVISIONS TO GAQM*

- Tier 1 assessment of secondary PM_{2.5} impacts
 - Correlations based on existing photochemical grid modeling
 - Should provide a *credible and representative* estimate of secondary impact of project emissions
- Tier 2 assessment for secondary PM_{2.5} impacts
 - Mentions Chemical Transport Models (CTM) but no preferred model listed
 - Requires use of the **latest** version of 2016 December EPA guidance for single source impacts for secondarily formed pollutants
 - Case-by-case basis and permitting agency should be consulted
- Both Tiers could be used in both screening and cumulative analysis

2017 REVISIONS TO GAQM – IMPACT

- **Flexibility** (by intent) in conducting AQIA
 - More on What to do; less on How to do
- Case-by-case basis approach may lead to **inconsistencies**
 - Similar projects may have different emission levels for compliance
- **Uncertainties** on what permitting agencies will accept as “credible and representative”
- Changes in 2016 guidance will require change in modeling methodology?
 - Moving target?

2016 EPA Guidance on MERPs

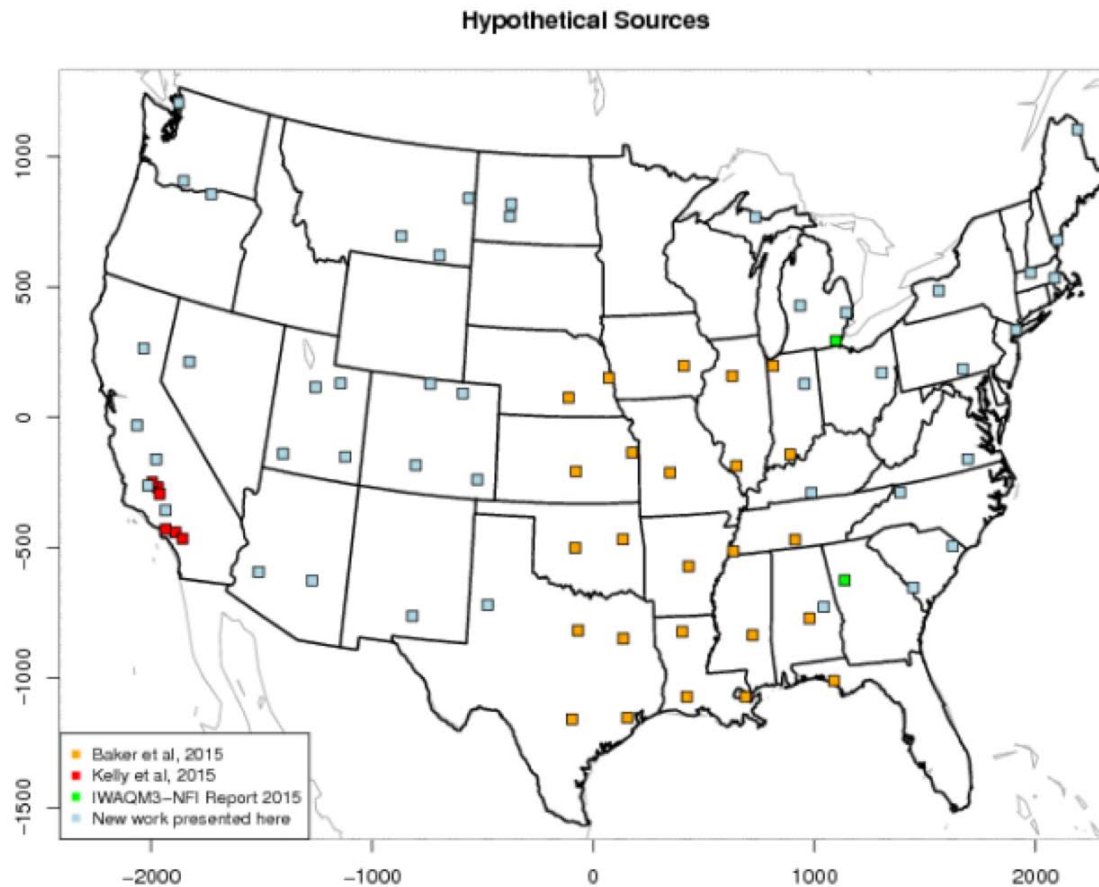
2016 EPA GUIDANCE ON MERPs*

(MODELED EMISSION RATE OF PRECURSORS)

- Emission rate of precursors above which the impact of secondarily formed PM_{2.5}/ and Ozone are above a **critical air quality threshold** (e.g. SIL or NAAQS or other)
 - Separate MERPs for 8-hour Ozone, 24-hr/annual PM_{2.5}
 - Based on data from “credible” analysis conducted by EPA and others
- MERP is a Tier 1 NAAQS compliance demonstration tool for single source impact of secondarily formed pollutants
- Not included in final rule of 2017 GAQM but discussed in preamble
 - Need approval by agencies
 - Not mandatory use by permitting agencies

* Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and PM_{2.5} under the PSD Permitting Program; EPA-454/R-16-006 December 2016

MODELED LOCATIONS FOR DEVELOPING MERPS



EPA REPORTED IMPACTS

- Nationwide Range of MERP for 24-hr PM_{2.5} SIL:
 - NO_x: 1,075 – 2,295 tpy
 - SO₂: 210 – 628 tpy
- Impact varies by emission, location, and stack height

Examples – 24-hr PM_{2.5}

Precursor	Area	Emissions (tpy)	Height	Source	FIPS	State	County	Max. Value (µg/m ³)
NO _x	CUS	500	L	1	18127	IN	Porter	0.26
NO _x	CUS	500	L	3	47055	TN	Giles	0.15
NO _x	CUS	500	L	4	1001	AL	Autauga	0.21
NO _x	CUS	500	L	6	17155	IL	Putnam	0.10
NO _x	CUS	500	L	7	17145	IL	Perry	0.14
NO _x	EUS	500	H	11	26099	MI	Macomb	0.06
SO ₂	CUS	500	L	6	17155	IL	Putnam	0.54
SO ₂	CUS	500	L	7	17145	IL	Perry	0.85
SO ₂	CUS	1000	H	1	18127	IN	Porter	1.13
SO ₂	CUS	1000	H	2	18037	IN	Dubois	0.34
SO ₂	WUS	1000	H	2	38059	ND	Morton	0.34
SO ₂	WUS	1000	H	3	8123	CO	Weld	0.41
SO ₂	WUS	1000	H	4	8011	CO	Bent	0.30

TCEQ GUIDANCE* ON USING MERPs

- TCEQ accepts use of MERPs if the project can demonstrate “representativeness” with the modeled TX locations
 - Allowed both for SIL and NAAQS compliance demonstrations

SIL Compliance Demonstration

$$\frac{\text{Preliminary Direct PM}_{2.5} \text{ Impact } (\mu\text{g}/\text{m}^3)}{\text{PM}_{2.5} \text{ SIL } (\mu\text{g}/\text{m}^3)} + \frac{\text{NO}_x \text{ Increase (tpy)}}{\text{NO}_x \text{ MERP (tpy)}} + \frac{\text{SO}_2 \text{ Increase (tpy)}}{\text{SO}_2 \text{ MERP (tpy)}} < 1$$

- Lowest TX MERPs in tpy for PM_{2.5} SIL
 - NO_x: 2500 tpy (24-hr) and 10,000 tpy (annual)
 - SO₂: 343 tpy (24-hr) and 1,801 tpy (annual)
- TCEQ suggests using the lowest MERP of all TX sites; if specific MERP is used, must demonstrate “representativeness”

* TCEQ – (APDG 6443v3, Revised 09/18) Guidance on the Use of EPA MERP

TCEQ GUIDANCE ON USING MERPs

NAAQS Compliance Demonstration

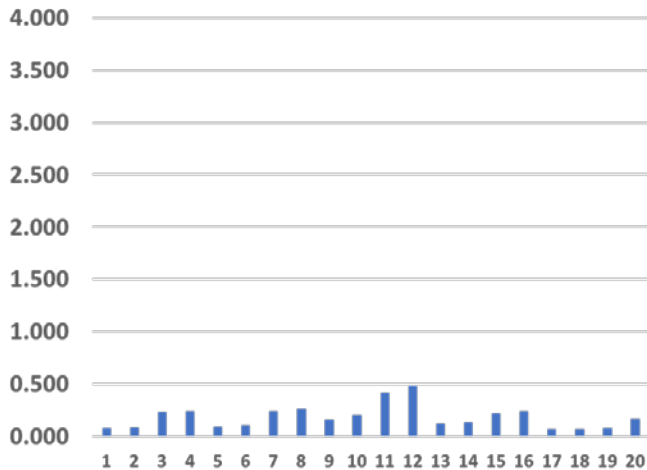
$$BKGND_PM_{2.5}(\mu g/m^3) + DirectPM_{2.5} Impact (\mu g/m^3) + \left(\frac{NO_x Increase (tpy)}{NO_x MERP (tpy)} + \frac{SO_2 Increase (tpy)}{SO_2 MERP (tpy)} \right) * PM_{2.5} SIL (\mu g/m^3) \leq PM_{2.5} NAAQS (\mu g/m^3)$$

- Implied conservatisms:
 - Background, 24-hr average direct $PM_{2.5}$ impact, and 24-hr NAAQS are statistical (98th percentile); secondary $PM_{2.5}$ impact based on MERP is highest impact
 - Direct and secondarily formed $PM_{2.5}$ impacts are assumed collocated; in reality these will be spatially and temporally apart
- What about sources with varying and/or intermittent emissions?

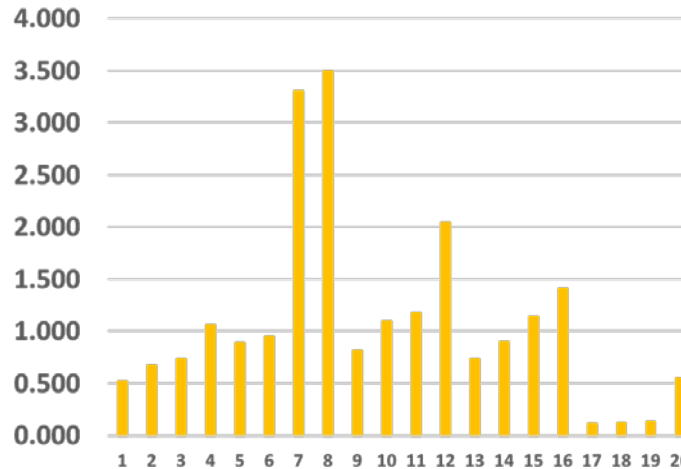
MERP FOR HYPOTHETICAL TEXAS LOCATIONS

SIL: 1.2 $\mu\text{g}/\text{m}^3$

24 hr $\text{PM}_{2.5}$ Impact
($\mu\text{g}/\text{m}^3/1000 \text{ NO}_x \text{ tpy}$)



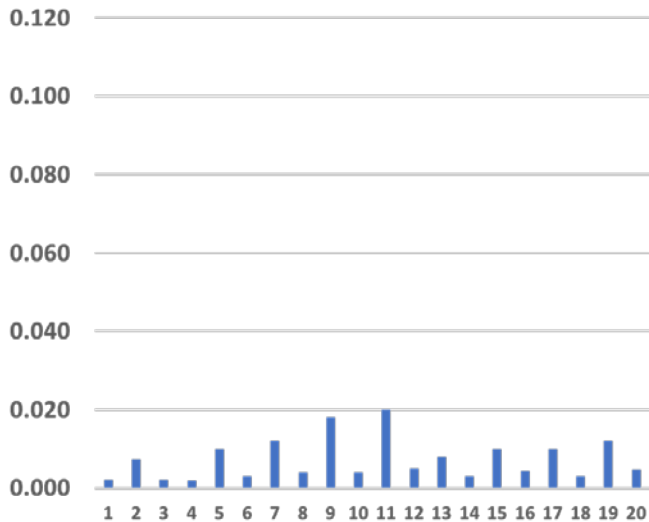
24 hr $\text{PM}_{2.5}$ Impact
($\mu\text{g}/\text{m}^3/1000 \text{ SO}_2 \text{ tpy}$)



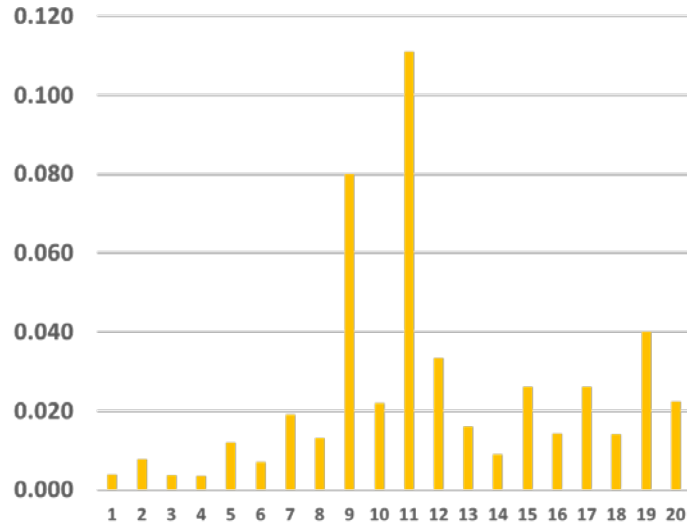
MERP FOR HYPOTHETICAL TEXAS LOCATIONS

SIL: $0.2 \mu\text{g}/\text{m}^3$

Annual $\text{PM}_{2.5}$ Impact
($\mu\text{g}/\text{m}^3/1000 \text{ NO}_x \text{ tpy}$)



Annual $\text{PM}_{2.5}$ Impact
($\mu\text{g}/\text{m}^3/1000 \text{ SO}_2 \text{ tpy}$)



2016 MERP GUIDANCE – IMPACT

- Provides some guidance on how to evaluate $PM_{2.5}$ in Tier 1 analysis thus avoiding complexities of chemical transport modeling
- Demonstration of “Representative” not fully clear and will require thoughtful analysis in each project
- Conservative worst case MERP in Texas may lead to high secondary $PM_{2.5}$ impact, especially for SO_2
- More hypothetical scenario analysis needed to develop MERPs for large areas of the US

2018 Proposed SILs

2018 PROPOSED SIL*

- 2010 SIL rulemaking based on scaling PM₁₀ SIL with PM_{2.5}/PM₁₀ NAAQS ratio
 - 1.2 µg/m³: 24 hr PM_{2.5}
 - 0.3 µg/m³: Annual PM_{2.5}
- Remanded and vacated in 2014 following Sierra Club litigation
- 2018 Proposed SIL based on variability analysis of ambient monitoring data
 - 1.2 µg/m³: 24-hr PM_{2.5}
 - 0.2 µg/m³: Annual PM_{2.5}
- Not mandatory because not yet codified; states may use or develop own SILs; justification necessary in all cases
 - Cannot be higher than 2010 rulemaking values for PM_{2.5} 24-hr and annual SILs

* Peter Tsirigotis memorandum to EPA Regional Directors dated April 17, 2018

2018 PROPOSED SIL - IMPACT

- Lower annual SIL will be exceeded at lower project emissions triggering cumulative modeling – all other factors remaining same
 - Additional controls to avoid cumulative modeling
- Lower annual SIL will extend the impact area for cumulative modeling
 - More challenging NAAQS and increment compliance demonstrations

Example:

In a recent project, the significant impact area increased from a radius of 1.1 km to 1.8 km due to change of SIL from 0.3 ug/m³ to 0.2 ug/m³

- Approximately 6.4 sq. km additional significant impact area
- Approximately 40 tpy additional PM_{2.5} emissions to be explicitly modeled in cumulative analysis

2018 Proposed Revision to PM_{2.5} Modeling Guidance

2018 EPA PROPOSAL FOR REVISION OF PM_{2.5} MODELING GUIDANCE*

- Proposal only at this time – may change in future based on comments
- Emissions of **ANY ONE** of the primary and secondary component of PM_{2.5} will trigger **both primary and secondary** PM_{2.5} impact modeling
 - Primary PM_{2.5} emissions > SER (10 tpy) **OR**
 - NOx emissions > SER (40 tpy) **OR**
 - SO₂ Emissions > SER (40 tpy)
- **Both** NOx and SO₂ impacts will have to be modeled if either primary PM_{2.5} or any of the precursors (NOx or SO₂) are above respective SERs – not just the precursor which is above the SER

* “Ozone and PM_{2.5} Permit Modeling Guidance”; Presented at 2018 EPA Regional, State, and Local Modelers’ Workshop; Boston, MA June 5, 2018

2018 EPA PROPOSAL FOR REVISION OF PM_{2.5} MODELING GUIDANCE

Primary PM _{2.5} Emissions	NOx Emissions	SO ₂ Emissions	Secondary PM _{2.5} Modeling Required?	
			2014 Guidance	Proposed 2018 Guidance
> 10 tpy	> 40 tpy	>40 tpy	YES; Both NOx and SO ₂	YES; Both NOx and SO ₂
> 10 tpy	> 40 tpy	<40 tpy	Yes; Only NOx	Yes; Both NOx and SO ₂
>10 tpy	<40 tpy	>40 tpy	Yes; Only SO ₂	Yes; Both NOx and SO ₂
> 10 tpy	< 40 tpy	< 40 tpy	No	Yes; Both NOx and SO ₂
< 10 tpy	> 40 tpy	< 40 tpy	Yes; Only NOx	Yes; Both NOx and SO ₂
<10 tpy	<40 tpy	> 40 tpy	Yes; Only SO ₂	Yes; Both NOx and SO ₂

2018 proposal: All cases above will also require primary PM_{2.5} modeling

2018 EPA PROPOSAL FOR REVISION OF PM_{2.5} MODELING GUIDANCE - IMPACT

- More projects will trigger secondary PM_{2.5} modeling
- PM_{2.5} primary emission calculations need to be less conservative if NOx and/or SO₂ emissions are > 40 tpy
- Modeling of low-level fugitive PM_{2.5} emissions could be challenging if conservative speciation (PM₁₀ = PM_{2.5}) is used and/or poor dispersion
- Need to have realistic emission factors for NOx and not just AP42 factors to avoid modeling and/or lower the secondary PM_{2.5} impact

SUMMARY AND RECOMMENDATION

- Secondary PM_{2.5} impacts must be accounted for in PSD AQIA
- Tiered approach provides flexibility to avoid complex chemical transport modeling – “credible and representative” justification may be challenging
 - MERP is a viable Tier 1 option to avoid complex chemical transport modeling – justification for “representativeness” required
- Case-by-case approach embedded in regulatory language may lead to inconsistencies across the permitting agencies nationwide
- Lower proposed annual SIL if codified, may lead to additional burden on NAAQS compliance demonstration in highly industrial areas
- Proposed 2018 modeling guidance if finalized will require more projects to conduct secondary PM_{2.5} modeling

Strongly Recommended

Pre-modeling discussion with agencies on PM_{2.5} AQIA approach to avoid remodeling and delay in permit application approval



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