IMPACT OF RECENT US EPA PM$_{2.5}$ GUIDANCE ON NSR PERMITS

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PRESENTED IN THE A&WMA GULF COAST CHAPTER ANNUAL CONFERENCE AND EXHIBITION | MARCH 21, 2019
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
  - NO$_2$, SO$_2$, CO, VOC, PM$_{10}$, 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 NOx and VOC
  - PM$_{2.5}$ – precursors are SO$_2$ and NOx

- 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

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

2006  | May: PM$_{2.5}$ precursors (NOx and SO$_2$) 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/m$^3$

2018 | June: Proposed revisions to 2014 Guidance on PM2.5 Modeling
• still in the works – presented in RSL 2018 workshop
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:
  - NOX: 1,075 – 2,295 tpy
  - SO$_2$: 210 – 628 tpy

- Impact varies by emission, location, and stack height

Examples – 24-hr PM$_{2.5}$

<table>
<thead>
<tr>
<th>Precursor</th>
<th>Area</th>
<th>Emissions (tpy)</th>
<th>Height</th>
<th>Source</th>
<th>FIPS</th>
<th>State</th>
<th>County</th>
<th>Max. Value (µg/m$^3$)</th>
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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 (\(\mu g/m^3\))}}{PM_{2.5} \text{ SIL (\(\mu g/m^3\))}} + \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)
  - SO\(_2\): 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

\[
\text{BKGND}_{\text{PM}}_{2.5}(\mu g/m^3) + \text{DirectPM}_{2.5} \text{Impact} (\mu g/m^3) \leq \text{PM}_{2.5} \text{NAAQS} (\mu g/m^3)
\]

\[
\frac{\text{NO}_x \text{ Increase (tpy)}}{\text{NO}_x \text{ MERP (tpy)}} + \frac{\text{SO}_2 \text{ Increase (tpy)}}{\text{SO}_2 \text{ MERP (tpy)}} \times \text{PM}_{2.5} \text{SIL (} \mu g/m^3 \text{)}
\]

- 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 μg/m³

24 hr PM₂.₅ Impact (μg/m³/1000 NOx tpy)

24 hr PM₂.₅ Impact (μg/m³/1000 SO₂ tpy)
MERP FOR HYPOTHETICAL TEXAS LOCATIONS

SIL: 0.2 µg/m³

Annual PM$_{2.5}$ Impact
(µg/m$^3$/1000 NOx tpy)

Annual PM$_{2.5}$ Impact
(µg/m$^3$/1000 SO$_2$ 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 $\text{PM}_{10}$ SIL with $\text{PM}_{2.5}/\text{PM}_{10}$ NAAQS ratio
  - $1.2 \mu g/m^3$: 24 hr $\text{PM}_{2.5}$
  - $0.3 \mu g/m^3$: Annual $\text{PM}_{2.5}$

- Remanded and vacated in 2014 following Sierra Club litigation

- 2018 Proposed SIL based on variability analysis of ambient monitoring data
  - $1.2 \mu g/m^3$: 24-hr $\text{PM}_{2.5}$
  - $0.2 \mu g/m^3$: Annual $\text{PM}_{2.5}$

- 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 $\text{PM}_{2.5}$ 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
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
  - SO$_2$ Emissions > SER (40 tpy)

Both NOx and SO$_2$ impacts will have to be modeled if either primary PM$_{2.5}$ or any of the precursors (NOx or SO$_2$) 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

<table>
<thead>
<tr>
<th>Primary PM$_{2.5}$ Emissions</th>
<th>NOx Emissions</th>
<th>SO$_2$ Emissions</th>
<th>Secondary PM$_{2.5}$ Modeling Required?</th>
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<tr>
<td>&gt; 10 tpy</td>
<td>&gt; 40 tpy</td>
<td>&gt;40 tpy</td>
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<td>&lt;40 tpy</td>
<td>&lt;40 tpy</td>
<td>YES; Both NOx and SO$_2$</td>
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</table>

2018 proposal: All cases above will also require primary PM$_{2.5}$ modeling
More projects will trigger secondary PM$_{2.5}$ modeling

PM$_{2.5}$ primary emission calculations need to be less conservative if NOx and/or SO$_2$ emissions are > 40 tpy

Modeling of low-level fugitive PM$_{2.5}$ emissions could be challenging if conservative speciation (PM$_{10}$ = 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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