Modeling for the New NAAQS

Gerri G. Garwood, PE
Air Quality Assessment Division
Louisiana Department of Environmental Quality
Introduction

- $\text{PM}_{2.5}$
- $\text{NO}_2$ 1-hour standard
- $\text{SO}_2$ 1-hour standard
PM$_{2.5}$
- New annual and 24-hour standards for PM$_{2.5}$
- PM$_{10}$ NAAQS modified

10/23/97
- PM$_{10}$ surrogate policy established

9/21/06
- Revised 24-hour NAAQS for PM$_{2.5}$
- Revoked PM$_{10}$ annual standard
- Effective 12/18/06
<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/25/07</td>
<td>Promulgated non-NSR part of the implementation rule</td>
</tr>
<tr>
<td>5/16/08</td>
<td>Promulgated final rules for NSR</td>
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<tr>
<td></td>
<td>Grandfathering provision</td>
</tr>
<tr>
<td></td>
<td>SER of 10 tpy for direct PM$_{2.5}$ emissions (40 tpy NO$_x$ or SO$_2$)</td>
</tr>
<tr>
<td>8/12/09</td>
<td>EPA Administrative Order (Louisville Gas and Electric) requires appropriateness</td>
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<td></td>
<td>demonstration for PM$_{10}$ surrogacy</td>
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</table>
2/11/10 • Proposal to repeal grandfathering published

3/23/10 • OAQPS issues “Modeling Procedures for Demonstrating Compliance with PM$_{2.5}$ NAAQS”

9/29/10 • EPA establishes SILs, SMC, and increments
          • Published 10/20/10
### PM$_{2.5}$ Increments

<table>
<thead>
<tr>
<th>Averaging Period</th>
<th>NAAQS (µg/m$^3$)</th>
<th>Increments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Class I</td>
</tr>
<tr>
<td>Annual</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>24-hour</td>
<td>35</td>
<td>2</td>
</tr>
</tbody>
</table>

### PM$_{2.5}$ Significant Impact Levels

<table>
<thead>
<tr>
<th>Averaging Period</th>
<th>NAAQS (µg/m$^3$)</th>
<th>SIL (µg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Class I</td>
</tr>
<tr>
<td>Annual</td>
<td>15</td>
<td>0.06</td>
</tr>
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<td>24-hour</td>
<td>35</td>
<td>0.07</td>
</tr>
</tbody>
</table>
Points to Note

• Annual PM$_{10}$ increment still effective
• SMC for PM$_{2.5}$ = 4 μg/m$^3$ (24-hour average)
• Increment used the percentage-of-NAAQS approach
• SILs scaled by PM$_{2.5}$-to-PM$_{10}$ NAAQS ratio
• Initially - condensable PM not required; estimating techniques being developed
• PM$_{2.5}$ viewed as new pollutant so new dates
Dates of Interest

- Major Source Baseline Date = 10/20/10
- SILs and SMC effective date = 12/20/10
- Minor Source Baseline Date = date first complete application for a PSD permit is submitted
- Trigger Date (for increments) = 10/20/11
Increment Modeling

Prior to the trigger date, increment modeling does not need to be included with an application for it to be considered complete.

However an increment analysis will be required before the permit is issued if the date of issuance will occur after the trigger date.

(No Grandfathering)
Modeling PM$_{2.5}$

- **24-hour**
  - Monitored: average of the 98$^{th}$ percentile 24-hour values over 3 years
  - Modeled (NAAQS): average of the max 24-hour averages over 5 years
  - Modeled (Increment): one exceedance per year

- **Annual**
  - Monitored: average of the annual mean concentration over 3 years
  - Modeled (NAAQS): average of the modeled annual averages over 5 years
  - Modeled (Increment): highest modeled annual average

- SILs may be used for NAAQS analysis once effective
Modeling PM$_{2.5}$

- Background = monitor design value
- Monitored data should account for the contribution of secondary PM$_{2.5}$ formation
- Presently, based on modeling only direct PM$_{2.5}$ emissions
- Second tier analysis - combine monitored and modeled concentrations seasonally/quarterly
- Significant contribution - comparison of the 5 year average of the modeled concentrations at the receptor location showing the violation
Looking Ahead

- Additional details on second tier analysis
- Interpreting the SILs for increment analysis
- Development of emission inventories
- Representative background concentrations
- Secondary formation
1-hour \( \text{NO}_2 \)
Background

- January 22, 2010 – new hourly NO$_2$ standard announced
- February 9, 2010 – final rule published
- April 12, 2010 – standard effective
- Include in all PSD permits on/after April 12, 2010

“100 ppb (~189 μg/m$^3$) based on the 3-year average of the 98$^{th}$-percentile of the annual distribution of daily maximum 1-hour concentrations”
Guidance

- Available on SCRAM website: http://www.epa.gov/ttn/scram
- 2/25/10 - Notice Regarding Modeling for New Hourly NO2 NAAQS (Updated)
- 6/29/10 – Stephen Page Implementation Memo
  - 6/28/10 – Tyler Fox Memo on Applicability of GAQM
  - 6/28/10 – Anna Marie Wood Memo on General PSD Implementation and interim SIL
AERMOD still preferred model
40 tpy SER
Interim SIL = 4 ppb (~7.5 μg/m$^3$)
Use max lb/hr
Must still model five years
Average over all met years
Rolling 3-year averages not required
Comparison to the 1-hour NAAQS

- Run AERMOD, retaining hourly concentrations at each receptor for each hour
- For each receptor:
  - Determine max 1-hour concentration each day
  - Determine 8th-highest daily 1-hour max concentration from the 365/366 daily 1-hour max concentrations
  - Average the 8th-highest daily 1-hour max concentrations across the years
- Compare highest receptor (+background) to NAAQS
- For significance analysis use 5-year average of the max 1-hour NO\textsubscript{2} concentration
Combining Monitors and Modeling

- Modeled portion should be in the form of standard
- Monitor “first tier” assumption – overall highest hourly background NO\textsubscript{2} concentration
- Additional refinements to this “first tier”, i.e. temporal pairing, will be handled case-by-case
Emergency Equipment/Startups

- EPA policy – NO$_x$ emissions can’t be excluded from the source impact analysis
- No exemption during periods of emergency operation or startups
- Permits may include enforceable conditions that specifically limit the testing/maintenance of emergency equipment to certain periods of time (i.e. when other equipment is down)
Section 5.2.4 of Appendix W — three-tiered screening approach for annual NO\textsubscript{2} modeling:

- **Tier 1** — full conversion of NO to NO\textsubscript{2}
- **Tier 2** — ARM — multiply Tier 1 result by 0.75 (default NO\textsubscript{2}/NO\textsubscript{x} ratio)
- **Tier 3** — detailed screening methods
  - Ozone Limiting Method (OLM)
  - Site-specific ambient NO\textsubscript{2}/NO\textsubscript{x} ratios
Modeling the 1-Hour Standard

- Appendix W for annual applies to 1-hour, generally
- Don’t assume defaults
- Tier 1 - OK
- Tier 2 - may be OK, but additional consideration needed for appropriate ambient ratio
  - Current default considered to be representative of “area wide quasi-equilibrium conditions” not short-term
  - OK for now?
Modeling the 1-Hour Standard

- Tier 3 - OK
- Still case-by-case
- Needs EPA Regional Office approval
- Includes
  - Ozone Limiting Method (OLM)
  - Plume Volume Molar Ratio Method (PVMRM)
  - Site-specific ambient ratio for \( \text{NO}_2/\text{NO}_x \)
OLM/PVMRM Considerations

- **In-stack ratios of NO$_2$/NO$_x$**
  - No “default”
  - Become more important and need better justification
  - Potential variability under different operating conditions

- **Background ozone concentrations**
  - Single “representative” background ozone likely to produce conservative results
  - Hourly ozone data must be concurrent with modeling met data
  - Missing data substitution methods will be heavily scrutinized
Looking Ahead

- Rulemaking to develop SIL
- Generic AERMOD post-processor
- Limited AERMOD interim use NO$_2$ postprocessor
- Additional guidance on culpability analysis for modeled violations
1-hour $\text{SO}_2$
Background

- June 2, 2010 – new hourly NO2 standard announced
- June 22, 2010 – final rule published
- August 23, 2010 – standard effective
- Include in all PSD permits on/after August 23, 2010

“75 ppb (~195 μg/m³) based on the 3-year average of the 99th-percentile of the annual distribution of daily maximum 1-hour concentrations”
Guidance

- Available on SCRAM website: http://www.epa.gov/ttn/scram
- 8/23/10 – Stephen Page Implementation Memo
  - 8/23/10 – Tyler Fox Memo on Applicability of GAQM
  - 8/23/10 – Anna Marie Wood Memo on General PSD Implementation and interim SIL
1-hour SO$_2$ Modeling

- AERMOD still preferred model
- 40 tpy SER
- Interim SIL = 3 ppb (~8 µg/m$^3$)
- Use max lb/hr
- Must still model five years
- Average over all met years
- Rolling 3-year averages not required
Additionally…

- Revocation of 24-hour and annual SO₂ standards
- But wait! Transition Period (~3 years)
- Existing SO₂ increments not revoked
- No provisions for exempting emissions occurring during equipment start-up/shutdown
- Permits may include enforceable conditions that specifically limit the testing/maintenance of emergency equipment to certain periods of time (i.e. when other equipment is down)
Run AERMOD, retaining hourly concentrations at each receptor for each hour

For each receptor:
- Determine max 1-hour concentration each day
- Determine 4th-highest daily 1-hour max concentration from the 365/366 daily 1-hour max concentrations
- Average the 4th-highest daily 1-hour max concentrations across the years

Compare highest receptor (+background) to NAAQS

For significance analysis use 5-year average of the max 1-hour SO₂ concentration
Combining Monitors and Modeling

- Modeled portion should be in the form of standard
- Monitor “first tier” assumption – overall highest hourly background SO\textsubscript{2} concentration
- Additional refinements to this “first tier”, i.e. temporal pairing, will be handled case-by-case
Looking Ahead

- Rulemaking to develop SIL
- Evaluation of SMC
- Additional guidance on culpability analysis for modeled violations
- New increment (?)
SCRAM website:
http://www.epa.gov/ttn/scram

Louisiana DEQ
225-219-3417

Gerri Garwood
gerri.garwood@la.gov

Yvette McGehee
yvette.mcgehee@la.gov

Tien Nguyen
tien.nguyen@la.gov