Guidance for Implementing 1-hour NO$_2$ NAAQS for PSD

Part 2: Applicability of Appendix W Modeling Guidance for the 1-hour NO$_2$ NAAQS

Webinar July 15, 2010
Outline

- Form of the 1-hour NO$_2$ standard
- Role of NOx chemistry for NO$_2$ modeling
- Summary of existing guidance in Appendix W (40 CFR Part 51)
- Discussion of key issues in applying Appendix W guidance for 1-hour NO$_2$ NAAQS compliance
Form of 1-hour NO$_2$ Standard

- The 1-hour NO$_2$ NAAQS is based on the 98$^{th}$ percentile of the annual distribution of maximum daily 1-hour concentrations, averaged across the number of years modeled.
- Monitored design values (see Appendix S to 40 CFR Part 50) are based on 3-year averages.
- Monitoring guidance does not preempt or alter Appendix W requirement for use of 5 years of National Weather Service (NWS) meteorological data or at least 1 year of site-specific data.
Modeling Guidance for NO$_2$

• New 1-hour (and existing annual) NAAQS are based on ambient concentrations of NO$_2$, whereas majority of NOx emissions are in the form of NO rather than NO$_2$.

• Modeling guidance in Appendix W (40 CFR Part 51) acknowledges that a source’s impact on ambient NO$_2$ depends in part “on the chemical environment into which the source’s plume is to be emitted” (see Section 5.1.j).
Current Modeling Guidance for NO$_2$

40 CFR Part 51, Appendix W

Figure 5–1

Multi-tiered Screening Approach for Estimating Annual NO2 Concentrations from Point Sources

Tier 1: Assume Total Conversion of NO to NO$_2$

Tier 2: Multiply Annual NO$_x$ Estimate by Representative Equilibrium NO$_2$ / NO$_x$ Ratio (e.g., 0.75 National Default Ratio)

Tier 3: Detailed Analysis on Case-by-Case Basis
Current Modeling Guidance for NO\textsubscript{2}

- Appendix W (Section 5.2.4) recommends a three-tiered screening approach for annual NO\textsubscript{2} modeling:
  - **Tier 1**: Assume total conversion of NO to NO\textsubscript{2}
  - **Tier 2**: Ambient Ratio Method (ARM) – national default NO\textsubscript{2}/NOx ratio of 0.75
  - **Tier 3**: Detailed screening methods on case-by-case basis, e.g. Ozone Limiting Method (OLM);
    - Plume Volume Molar Ratio Method (PVMRM) should also be considered as a Tier 3 “detailed screening method”
Applicability to 1-hour NO$_2$ NAAQS

- AERMOD is the preferred model for estimating NOx impacts in near-field applications (out to 50 km)
- Three-tiered screening approach is generally applicable for 1-hour NO$_2$ modeling, but additional and/or different considerations may arise:
  - **Tier 1** applies to 1-hour NAAQS without additional justification;
  - **Tier 2** may also apply to the 1-hour NAAQS in many cases, but additional consideration may be needed regarding appropriate ratio for peak hourly impacts since the current default ARM is representative of “area wide quasi-equilibrium conditions”;
  - **Tier 3** “detailed screening methods” will be on a case-by-case basis, but representativeness of background O$_3$ data and in-stack NO$_2$/NOx ratios will be more important for 1-hour NAAQS.
Applicability to 1-hour NO$_2$ NAAQS

• Table 8-2 in Appendix W summarizes guidance regarding source emission input data for NAAQS compliance demonstrations

• Permit modeling inventories for annual NO$_2$ compliance may not be adequate for 1-hour NO$_2$ NAAQS since guidance for emission rates differs somewhat between long-term (quarterly or annual) and short-term ($\leq$ 24 hour) standards

• Maximum ground-level concentrations likely more sensitive to operating levels and startup/shutdown conditions for 1-hour than for annual NAAQS
Tier 3 Detailed Screening Methods

- OLM specifically mentioned in Appendix W under Tier 3; PVMRM should also be considered in this category until more robust model evaluations can be completed

- OLM and PVMRM are available as non-regulatory-default options in AERMOD
  - Requires justification and approval from RO on case-by-case basis as alternative modeling techniques, in accordance with Section 3.2.2.e of Appendix W

- Applications of OLM option in AERMOD (subject to Section 3.2.2.e) should routinely utilize the “OLMGROUP ALL” option for combining plumes
Tier 3 Detailed Screening Methods

• Several documents are available on the SCRAM website related to PVMRM and its implementation in AERMOD:
  – Addendum to AERMOD Model Formulation Document provides technical description of implementation of PVMRM within AERMOD

• Evaluations of PVMRM show encouraging results, but the amount of data is too limited to categorize PVMRM as a refined method for NO₂

• Evaluations are being updated and extended to include OLM and examine model performance for predicting hourly NO₂ concentrations
Contact Information

• For follow-up questions regarding NO$_2$ modeling guidance, contact:

  Tyler Fox, Leader
  Air Quality Modeling Group
  fox.tyler@epa.gov