An Update on EPA Attainment Modeling Guidance for Ozone/PM2.5/Regional Haze

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Topics to be covered

- Why is guidance needed?
- Status of guidance
- Components of the guidance
- Updates and next steps

Why Do We Use Photochemical Grid Models in Regulatory Applications ?

- The ultimate goal of ozone and particulate matter modeling is to assist policy makers in determining the most efficient ways of reaching a **future** air-quality goal.
  - Models are used to predict the effects of future control strategies
    - Controls necessary for State Implementation Plan (SIP) attainment demonstrations (States)
    - Air quality impacts of national rules (EPA)

Attaining the NAAQS

- States must submit SIPs for ozone, PM2.5, and Regional Haze by 2007-2008
- EPA provides modeling “guidance” documents to assist States that are performing photochemical modeling
  - Ozone guidance
  - PM2.5/Regional Haze guidance
- Guidance helps to ensure national consistency and maintain basic standards

Status of Ozone Modeling Guidance

- "Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-hour Ozone NAAQS"
  - Original draft released in 1999
  - Released "Draft Final" version on February 17th, 2005
    - Comments received in March
- Available on EPA's website at: http://www.epa.gov/ttn/scram/guidance/guide/draft-final-o3.pdf
- In final review
  - Final version to be released in October

Status of PM2.5/Regional Haze Modeling Guidance

- "Guidance for Demonstrating Attainment of Air Quality Goals for PM2.5 and Regional Haze"
  - January, 2001
- Available on EPA's website at: http://www.epa.gov/scram001/guidance/guide/draft_pm.pdf
- Revised draft will be available by the end of 2005
  - Final version in early 2006
- Plan to incorporate final version of ozone and PM2.5 guidance into a single document

What's in the Guidance?

- Part I- Using Model Results
  - Modeled Attainment tests
    - 8-hour ozone NAAQS
      - Unmonitored area analysis
    - Annual and 24-hour PM2.5 NAAQS
      - Hot spot modeling (high primary PM2.5 areas)
    - Regional Haze reasonable progress
  - Supplemental analyses/weight of evidence
  - Activities to support Mid-Course review and future modeling
  - Required documentation

What's in the Guidance?

- Part II- Generating Model Results
  - Conceptual description
  - Modeling protocol
  - Selecting a model(s)
  - Choosing days/episodes
  - Selecting domain & spatial resolution
  - Developing met inputs
  - Developing emissions inputs
  - Evaluating model performance/diagnostic analyses

Choosing an Air Quality Model

- There is no “preferred model”
  - Models should meet Appendix W requirements for “alternative models”
- Models should be:
  - Peer reviewed
  - Demonstrated to be applicable to the problem being addressed
  - Adequate data bases should be available to run the model
  - Model should be shown to have performed adequately in the past
  - Source code must be available at no cost (or for reasonable cost)
- Almost all States will use the latest version of either CMAQ or CAMx
  - Both models can simulate ozone, PM, regional haze, and mercury

Current Recommendations for "Episode" Selection

- Ozone NAAQS
  - Model most frequent meteorological regimes which cause high ozone
  - At least 10 "high" ozone days at each monitor
- Annual PM2.5 NAAQS
  - Model full year or >= 15 days per quarter
- 24 Hour NAAQS
  - Model days > 55 ug/m3
- Regional Haze
  - Preferred approach is to model a full year
  - Model at least 10 worst (and best) visibility days at each Class 1 area

Modeling Domain and Resolution

- Horizontal resolution
  - Ozone- Recommend <= 12 km resolution
    - Some areas may need finer resolution
  - PM2.5- Recommend <= 12 km resolution for urban scale modeling
    - <= 36 km for regional modeling
    - Higher resolution may be necessary in areas with high primary PM2.5 concentration gradients
  - Recommend <= 36 km resolution for regional haze modeling

Modeled Attainment Tests

- All O3/PM2.5/RH modeled attainment tests use model estimates in a “relative” sense
  - Premise: models are better at predicting relative changes in concentrations than absolute concentrations
- Relative Reduction Factors (RRF) are calculated by taking the ratio of the model’s future to current predictions of ozone or PM2.5
  - Ambient concentration X RRF = Future concentration

Application of (Speciated) Modeled Attainment Test

- Ozone
  - Relatively simple because ozone is just ozone
- Attainment tests for PM2.5 and Regional Haze need to use all of the PM2.5 component species
  - Individual RRFs are calculated for each PM2.5 species (e.g. sulfate, nitrate, organic carbon, elemental carbon, ammonium, crustal, etc.)
  - Total PM2.5 is reconstructed from the sum of individual components

Application of Speciated Modeled Test for Regional Haze

- The Regional Haze test also calculates RRFs for PM2.5 components
  - Ammonium sulfate, ammonium nitrate, organic carbon, elemental carbon, soil/crustal, coarse mass
- Visibility is calculated from reconstructed PM2.5 using the IMPROVE equation
  - $\mathbf{b_{ext} = 3((f(rh))[SO_4] + 3((f(rh))[NO_3] + 4(f'(rh))[OC] + 10[EC] + 1[IP] + 0.6[CM]}$
- Change in deciviews is calculated for the 20% worst days and 20% best days in each Class I area to determine if reasonable progress is met

Supplemental Analyses/"Weight of Evidence"

- All attainment demonstrations should include supplemental analyses to assess the validity of the modeled attainment test projection.
  - Guidance suggests amount of supporting information should be greatest for those areas with modeled projections near the NAAQS.
- Three separate types of supplemental analyses should be considered within an attainment demonstration.
  - Additional air quality modeling evidence
  - Trends in ambient air quality and emissions
  - Other air quality analyses that can identify potential control targets

Supplemental Analyses/"Weight of Evidence" con't

- "Weight of evidence" differs from "supplemental analyses" in that:
  - 1) WOE is a set of supplemental analyses for areas whose attainment test results indicate future AQ levels near the NAAQS.
  - 2) WOE combines and weights the various supplemental analyses with the results of the attainment test … the end result being an aggregate, weighted conclusion as to whether a set of control strategies will yield attainment by the relevant future year.

Ozone Guidance- Next Steps

- Finalize document in October
  - Recent major updates:
    - "Current" design values calculated using average of three design value periods (5 years of data)
    - All attainment demonstrations should include "supplemental" analyses to corroborate the modeling results
    - Replaced "screening test" with an unmonitored area analysis
    - Recommend modeling longer time periods
    - Raised minimum threshold for RRF calculation to 85 ppb
    - Redefined weight of evidence as 82-87 ppb

PM2.5/Regional Haze Guidance- Next Steps

- Beginning to revise the draft PM2.5 guidance
  - Major updates include the details of the attainment test calculations (SMAT) for PM2.5 and RH
  - Model performance evaluations
- Hope to release a revised draft by the end of the year (combined ozone/PM2.5/Regional Haze modeling guidance)