Ozone/PM2.5/Regional Haze Modeling Guidance Overview

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Topics to be covered

- The guidance team
- Status of guidance
- Components of the guidance
- Issues to be resolved and additional updates
- Next steps

O3/PM2.5/RH Modeling Guidance Team

- Brian Timin- Team lead
- Pat Dolwick
- Sharon Phillips
- Norm Possiel

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
- Will finalize guidance in June/July timeframe

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 Fall 2005
- 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
      - Screening test (unmonitored areas)
    - 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)
- Other factors
  - Relevant experience of available staff and/or contractors
  - Time and resource constraints
  - Consistency with other nearby applications

Choosing an Air Quality Model con't

- Types of air quality models
  - PM2.5 model applications may need to use a combination of photochemical grid and dispersion models
    - Determine secondary PM2.5 from photochemical model and primary PM2.5 from dispersion model
    - Use of dispersion models assumes that primary PM2.5 may be responsible for a violation or a "hot spot"
  - There are additional NSR/PSD issues related to the use of dispersion models for the PM2.5 NAAQS
    - More details will be contained in the PM2.5 implementation rule

Current Recommendations for "Episode" Selection

- Ozone NAAQS
  - Model all met regimes which cause high ozone
  - At least "several" 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 PM2.5
- RRFs are calculated for ozone and for each component of PM2.5 and regional haze

Applying the Modeled Tests

- Future concentrations are estimated using (component specific) RRF's and ambient measurements
  - RRF X ambient concentration = Future concentration
- Ambient data
  - Ozone- ozone data from AIRS
  - PM2.5- FRM and PM2.5 speciation measurements
  - Regional haze- IMPROVE measurements

Application of (Speciated) Modeled Attainment Test

- Ozone
  - Relatively simple because ozone is just ozone
  - Well established monitoring network with hourly measurements
- PM2.5
  - Need to deal with individual components
    - Sulfate, nitrate, organic carbon, elemental carbon, ammonium, crustal, unknown
  - Speciated monitoring network is relatively sparse
  - 24 hour average data is collected on a 1/3 or 1/6 schedule

Annual PM2.5 NAAQS Attainment Test- Short Version

- Compute observed quarterly mean PM2.5 composition and mass for each monitor
- Using model results, derive component specific RRFs at each monitor and apply to observed air quality at each monitor to obtain a projected quarterly PM2.5 estimate
- Calculate the projected annual mean PM2.5 for each site (by averaging the 4 quarters)
- Determine if each projected annual mean is < 15 ug/m3

Detailed application of SMAT will be reviewed on Friday

Application of Speciated Modeled Test for Regional Haze

- Regional Haze
  - The ambient data is readily available for the regional haze reasonable progress test
    - IMPROVE data
  - Components for visibility calculation:
    - Ammonium sulfate, ammonium nitrate, organic carbon, elemental carbon, soil/crustal, coarse mass
    - IMPROVE visibility equation:
    - $\mathbf{b_{ext} = 3((\mathit{f(rh)})[SO_4] + 3((\mathit{f(rh)})[NO_3] + 4(\mathit{f'(rh)})[OC] + 10[EC] + 1[IP] + 0.6[CM]}$

Regional Haze Reasonable Progress Test

- Estimate current b_{ext} from monitored data
  - Follow procedures in “Draft Guidance for Tracking Progress Under the Regional Haze Rule”
    - Calculate extinction for 6 components
    - Calculate 20% worst days and 20% best days (5 years)
- Model “current” PM concentrations
- Model future PM concentrations
- Calculate RRF for each component (change in mass)
  - 20% best days and 20% worst days
- Estimate future b_{ext}
- Convert difference in future and current b_{ext} to deciviews
- Determine if reasonable progress goal is met

Changes in the Draft Final Ozone Guidance

- Certain chapters were extensively updated, others were only “cleaned up”
  - Most updates were relatively minor
- Major changes:
  - “Current” design values calculated using <u>average</u> of three design value periods (5 years of data)
    - e.g. average of 2000-2002, 2001-2003, and 2002-2004
    - Consistent with CAIR
  - All attainment demonstrations should include “supplemental” analyses to corroborate the modeling results
    - Previously only recommended for “weight of evidence”; if attainment was not modeled

Ozone Guidance Updates

- Attainment test for the 8-hour ozone NAAQS
  - Average design values
  - Adjusted rounding and truncation of design values and RRFs
  - Updates to the “screening test”
  - “Optional” use of interpolated spatial fields
- Supplemental analyses/weight of evidence (extensively rewritten)
  - Supplemental analyses recommended for all attainment demonstrations, even if all monitors in the future are < 85 ppb
    - “Weight of evidence” if some monitors are > 85 ppb

Ozone Guidance Updates- con’t

- Choosing days
  - Episodes or full season
- Selecting domain & spatial resolution
  - 12 km resolution generally acceptable unless higher resolution is shown (or known) to be necessary
- Developing met inputs (extensively rewritten)
- Developing emissions inputs (extensively rewritten)
- Evaluating model performance/diagnostic analyses (extensively rewritten)

Comments

- Requested comments on these specific areas:
  - Use of the screening test and/or spatial fields
    - Eliminate or revise screening test or use spatial fields?
  - Minimum (and/or maximum) number of days used in an RRF calculation
    - Currently says to use “several days”
  - 70 ppb modeled threshold to determine if a day should be used in RRF calculation
    - Calculate the mean RRF using all days with a modeled value of > 70 ppb at the monitor
    - Is a 70 ppb threshold too low?
  - Use of grid cell array around each monitor
    - Take the highest ozone prediction in an array of grid cells around the monitor (3 X 3 for 12km resolution and 7 X 7 for 4km resolution)

Ozone Guidance- Updates to Final Guidance

- Will address comments and proposed final guidance updates later today

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 for PM2.5 and RH
  - Model performance evaluations
- Hope to release a revised draft this fall (combined ozone/PM2.5/Regional Haze modeling guidance)