Draft $PM_{2.5}$ Permit Modeling Guidance

10th Conference on Air Quality Modeling

RTP, NC

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Draft $PM_{2.5}$ Permit Modeling Guidance

- The Draft $PM_{2.5}$ Permit Modeling Guidance was originally going to be released in the fall of 2011 for review and comment by the co-regulating and regulated modeling community.
  - A collaborative engagement with the draft guidance was desired by the U.S. EPA and requested by the co-regulating agencies given the complexity of issues regarding the $PM_{2.5}$ NAAQS and single source compliance modeling demonstrations.
- This timing aligned with the originally planned dates for the 10th Modeling Conference.

Draft $PM_{2.5}$ Permit Modeling Guidance

- One *(of many)* aspects in the delay of the 10th Modeling Conference until March 2012 was to allow additional time to appropriately develop this draft guidance.

- The best laid plans… good intentions...
  …we're still not to the finish line on releasing the draft guidance document for review and comment.

- Internal review and additional coordination with senior management, the Policy Division, and OGC still must occur before we can release the draft guidance.

Draft $PM_{2.5}$ Permit Modeling Guidance

- We still intend to release the Draft $PM_{2.5}$ Permit Modeling Guidance in the near future for review and comment from the modeling community.

- The comments and feedback on the draft guidance are not directly connected to the 10th Modeling Conference and will be welcome after the comment period / Docket for the Conference have officially closed.

Draft $PM_{2.5}$ Permit Modeling Guidance

- We will discuss the "current" form of the Draft $PM_{2.5}$ Permit Modeling Guidance with the state, local, and tribal agencies at the 2012 R/S/L Modelers' Workshop along with any feedback received through the 10th Modeling Conference.

- The anticipated finalization of the draft guidance is late 2012 after consideration of all the comments, suggestions, and overall feedback received and any additional required collaboration with the modeling community.

Draft $PM_{2.5}$ Permit Modeling Guidance

- Disclaimer: The slides in the remainder of this presentation offer a substantial glimpse into the current form of the Draft $PM_{2.5}$ Permit Modeling Guidance, but please understand that the information in this presentation should not be taken as a formal recommendation or endorsement of a particular approach conducting a compliance modeling demonstration for the $PM_{2.5}$ NAAQS.

Draft $PM_{2.5}$ Permit Modeling Guidance

- Background:
  - Daily and Annual $PM_{2.5}$ NAAQS originally established on July 18, 1997:
    - Daily or 24-hour $PM_{2.5}$ NAAQS was set at 65 $\mu g/m^3$
    - Annual $PM_{2.5}$ NAAQS was set at 15.0 $\mu g/m^3$
  - Citing significant technical difficulties with respect to $PM_{2.5}$ monitoring, emissions estimation, & modeling, the U.S. EPA established the PM_{10} Surrogate Policy on October 23, 1997.
    - Allowed permit applicants to use compliance with the applicable PM_{10} requirements as a surrogate approach for meeting $PM_{2.5}$ NSR requirements.
  - The $PM_{2.5}$ NAAQS was revised on October 17, 2006:
    - 24-hour $PM_{2.5}$ NAAQS was reduced to 35 $\mu g/m^3$
    - Annual $PM_{2.5}$ NAAQS was retained at 15.0 $\mu g/m^3$

Draft $PM_{2.5}$ Permit Modeling Guidance

- Background: *(Continued)*
  - The final rules governing the implementation of the NSR program for $PM_{2.5}$ was promulgated on May 16, 2008.
    - Establishment of the Significant Emissions Rate (SER) for $PM_{2.5}$ and for the $PM_{2.5}$ Precursors which define the rates at which a net emissions increase will trigger major NSR permitting requirements. Any lower emissions increases are considered *de minimis*.
      - Direct $PM_{2.5}$ SER = 10 tpy
      - $PM_{2.5}$ Precursor – NO_x = 40 tpy and $PM_{2.5}$ Precursor – SO_2 = 40 tpy
    - This rule also included a "grandfathering provision" that allowed applicants for federal PSD permits to continue relying upon the PM_{10} Surrogate Policy.
  - On February 11, 2010, the U.S. EPA published a proposal to repeal the grandfathering provision and an early end to the PM_{10} Surrogate Policy

Draft $PM_{2.5}$ Permit Modeling Guidance

- Background: *(Continued)*
  - To assist sources and permitting authorities in carrying out the required air quality analysis for $PM_{2.5}$ compliance demonstrations, a guidance memorandum entitled "Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS" was released on March 23, 2010.
    - Often referred to as the "Page Memo."
    - Addressed interim procedures to address the probabilistic form of the NAAQS.
    - Acknowledged that there are technical complications associated with the ability of existing models to estimate the impacts of secondarily formed $PM_{2.5}$.
    - Recommended special attention be given to the evaluation of monitored background air quality data since this data readily accounts for the contribution of both primary and secondarily formed $PM_{2.5}$.

Draft $PM_{2.5}$ Permit Modeling Guidance

- Background: *(Continued)*
  - On October 20, 2010, the final rule on $PM_{2.5}$ Increment, Significant Impact Levels (SILs), and Significant Monitoring Concentration (SMC) was promulgated.

	Class I	Class II	Class III
Significant Impact Levels (SILs), µg/m^3			
Annual	0.06	0.3	0.3
24-hour	0.07	1.2	1.2
Increments, µg/m^3			
Annual	1	4	8
24-hour	2	9	18
Significant Monitoring Concentration (SMC), µg/m^3			
24-hour	4	4	4

Source: Prevention of Significant Deterioration (PSD) for Particulate Matter Less Than 2.5 Micrometers (PM2.5) - Increments, Significant Impact Levels (SILs) and Significant Monitoring Concentration (SMC) final rule (75 FR 64864)

Draft $PM_{2.5}$ Permit Modeling Guidance

- Background: *(Continued)*
  - The PM_{10} Surrogate Policy officially ended on May 16, 2011.
    - PSD compliance demonstrations must now be completed for $PM_{2.5}$, include primary $PM_{2.5}$ and, if applicable, secondarily formed $PM_{2.5}$ from precursor emissions.
  - On July 21, 2011, Gina McCarthy signed a memorandum entitled, "Revised Policy to Address Reconsideration of Interpollutant Trading Provisions for Fine Particulates ($PM_{2.5}$)."
    - This policy revision revoked our support of the presumptive interpollutant trading ratios provided in the preamble to the 2008 $PM_{2.5}$ NSR Implementation Rule.
    - This revised policy does not affect the U.S. EPA rule provisions that allow states to adopt as part of their $PM_{2.5}$ NSR programs appropriately supported interpollutant offset provisions involving $PM_{2.5}$ precursors.

NACAA $PM_{2.5}$ Modeling Implementation Workgroup

- Formed in early 2010 at the request of the U.S. EPA
- Objective of providing technical recommendations to the agency to aid in further development of $PM_{2.5}$ permit modeling guidance.
- Comprised of air dispersion modelers, permit engineers, and technical staff from federal state, local, and tribal agencies from throughout the country.
- The Workgroup focused its efforts on three specific issues:
  1) Emissions Inventories;
  2) Secondary Formation from Project Source; and
  3) Representative Background Concentrations.

NACAA $PM_{2.5}$ Modeling Implementation Workgroup

- Each sub-workgroup developed a specific charge and worked throughout much of 2010 to develop a set of recommendations relative to the issue facing their respective issue.
- On January 7, 2011, a final report was shared with the U.S. EPA with a compilation of these efforts and recommendations.
- This report is available for review on the 10th Modeling Conference web page on the SCRAM website:
  - http://www.epa.gov/ttn/scram/10thmodconf.htm

NACAA $PM_{2.5}$ Modeling Implementation Workgroup

- Emissions Inventories Sub-workgroup:
  - Chair Person: Jim Hodina, Linn County Public Health
  - Sub-workgroup Members:
    Joe Sims, Alabama Department of Environmental Management
    Leigh Bacon, Alabama Department of Environmental Management
    Bob Betterton, West Virginia Department of Environmental Protection
    Lynn Barnes, South Carolina Department of Health & Environmental Control
    Leland Villalvazo, South Joaquin Valley Unified Air Pollution Control District
    Tien Nguyen, Louisiana Department of Environmental Quality
    Regg Olson, Utah Division of Air Quality
    Frank Forsgren, Nevada Division of Environmental Protection
    Brenda Harpring, Nevada Division of Environmental Protection

NACAA $PM_{2.5}$ Modeling Implementation Workgroup

- Emissions Inventories Subworkgroup Recommendations:
  - Emphasize the development of reliable $PM_{2.5}$ emission factors.
  - Until new emission factors are developed, quality assured, and are available for use, the workgroup recommends utilization of existing state programmatic work, most significantly that of the California Air Resource Board (CARB).
  - Provide guidance as to what types of emissions sources are required to include secondary formation in their modeling analyses (e.g., only combustion sources).

NACAA $PM_{2.5}$ Modeling Implementation Workgroup

- Secondary Formation from Project Source Sub-workgroup:
  - Chair Person: Bob Hodanbosi, Ohio EPA Division of Air Quality
  - Sub-workgroup Members:

    Mike Koerber, Lake Michigan Air Directors Consortium
    Tim Martin, Alabama Department of Environmental Management
    Leigh Bacon, Alabama Department of Environmental Management
    Alan Dresser, New Jersey Department of Environmental Protection
    Margaret McCourtney, Minnesota Pollution Control Agency
    Clint Bowman, Washington Department of Ecology
    Glenn Reed, San Joaquin Valley Unified Air Pollution Control District
    James Sweet, San Joaquin Valley Unified Air Pollution Control District
    Jim Boylan, Georgia Environmental Protection Division
    Byeong Kim, Georgia Environmental Protection Division
    Gerri Garwood, Louisiana Department of Environmental Quality
    Sarah VanderWielen, Ohio EPA Division of Air Quality
    Mike Mosier, Indiana Department of Environmental Management
    Frank Forsgren, Nevada Division of Environmental Protection
    Tyler Fox, EPA OAQPS
    Annamaria Coulter, EPA OAQPS

NACAA $PM_{2.5}$ Modeling Implementation Workgroup

- Secondary Formation from Project Source Sub-workgroup Recommendations:
  - Establish a 4-tiered modeling approach for conducting air quality analyses to address compliance with the PSD increment and NAAQS.
  - Reconsider use of maximum modeled values for comparison to the 24-hour NAAQS. Also, review and, if necessary, revise guidance for addressing NAAQS and PSD increments for other criteria pollutants.
  - Develop offset ratios which reflect geographic and seasonal variation for the purpose of single-source permitting.
  - Complete evaluation of plume models and, as necessary, clarify the guidance for the Tier III modeling approach.

NACAA $PM_{2.5}$ Modeling Implementation Workgroup

- Secondary Formation from Project Source Subworkgroup Recommendations: *(Continued)*
  - Consider adding comprehensive chemistry to AERMOD. Note that if this were done, then the recommended 4-tiered modeling approach would need to be revisited.
  - For use of photochemical grid models (i.e., Tier IV), the following issues need to be addressed:
    a) how to best apply the model (e.g., difference method, source apportionment, or sub-grid plume sampling);
    b) whether it is better to use plume-in-gird for the new source (with sub-grid sampling) or ensure small spatial grid spacing in the vicinity of the source (e.g., 1 km or less);
    c) whether to use absolute or relative model results; and
    d) whether to use the photochemical model for primary and secondary impacts or just secondary impacts.

NACAA $PM_{2.5}$ Modeling Implementation Workgroup

Table 2-1 - Recommended Approach for Assessing Secondarily Formed $PM_{2.5}$ from New (Project) Sources

Model Requirement	Tier	Approach
Single-source screening analysis to compare with SILs	Tier I	**Primary & Secondary:** AERMOD with region- (or state-) specific offset ratios
Cumulative-source analysis to compare with NAAQS and PSD increments	Tier II	**Primary & Secondary:** AERMOD with region- (or state-) specific offset ratios
	Tier III	**Primary:** AERMOD **Secondary:** Use of a chemistry plume model (e.g., SCICHEM)
	Tier IV	**Primary**: AERMOD **Secondary**: CAMx (or CMAQ) with fine grid and PiG for new source

NACAA $PM_{2.5}$ Modeling Implementation Workgroup

- Representative Background Concentrations Sub-workgroup:
  - Chair Person: Clint Bowman, Washington Dept of Ecology
  - Sub-workgroup Members:

    Bobby Lute, Virginia Department of Environmental Quality
    Dennis Becker, Minnesota Pollution Control Agency
    Gail Good, Wisconsin Department of Natural Resources
    Glenn Reed, San Joaquin Valley Unified Air Pollution Control District
    Jim Owen, Alabama Department of Environmental Management
    John Glass, South Carolina Department of Health and Environmental Control
    Jon McClung, West Virginia Department of Environmental Protection
    Josh Nall, Wyoming Department of Environmental Quality
    Leigh Bacon, Alabama Department of Environmental Management
    Lori Hanson, Iowa Department of Natural Resources
    Margaret McCourtney, Minnesota Pollution Control Agency
    Michael Kiss, Virginia Department of Environmental Quality
    Pete Courtney, Georgia Environmental Protection Division
    Yvette McGehee, Louisiana Department of Environmental Quality
    Roger Brode, EPA OAQPS
    Annamaria Coulter, EPA OAQPS
    Phil Lorang, EPA OAQPS

NACAA $PM_{2.5}$ Modeling Implementation Workgroup

- Representative Background Concentrations Sub-workgroup Recommendations:
  - Include the “Paired-Sums” approach using continuous $PM_{2.5}$ monitoring data with or without inverse-distance (1/R) interpolation.
  - Include the "Paired-Sums" approach even where only 1:3 day $PM_{2.5}$ monitoring data are available.
  - Develop an analysis technique that will help determine whether one or more monitoring sites can be used to estimate the daily background concentration.
  - Investigate fusion of model predictions with observations across a region as a way to produce a gridded estimate of background concentrations.
  - Modify AERMOD to read in an hourly background $PM_{2.5}$ concentration file and then add the hourly background values to the hourly model source impacts to allow pairing in time (hour-by-hour basis).
  - Modify 40 CFR 51 Appendix W to accommodate the above recommendations.

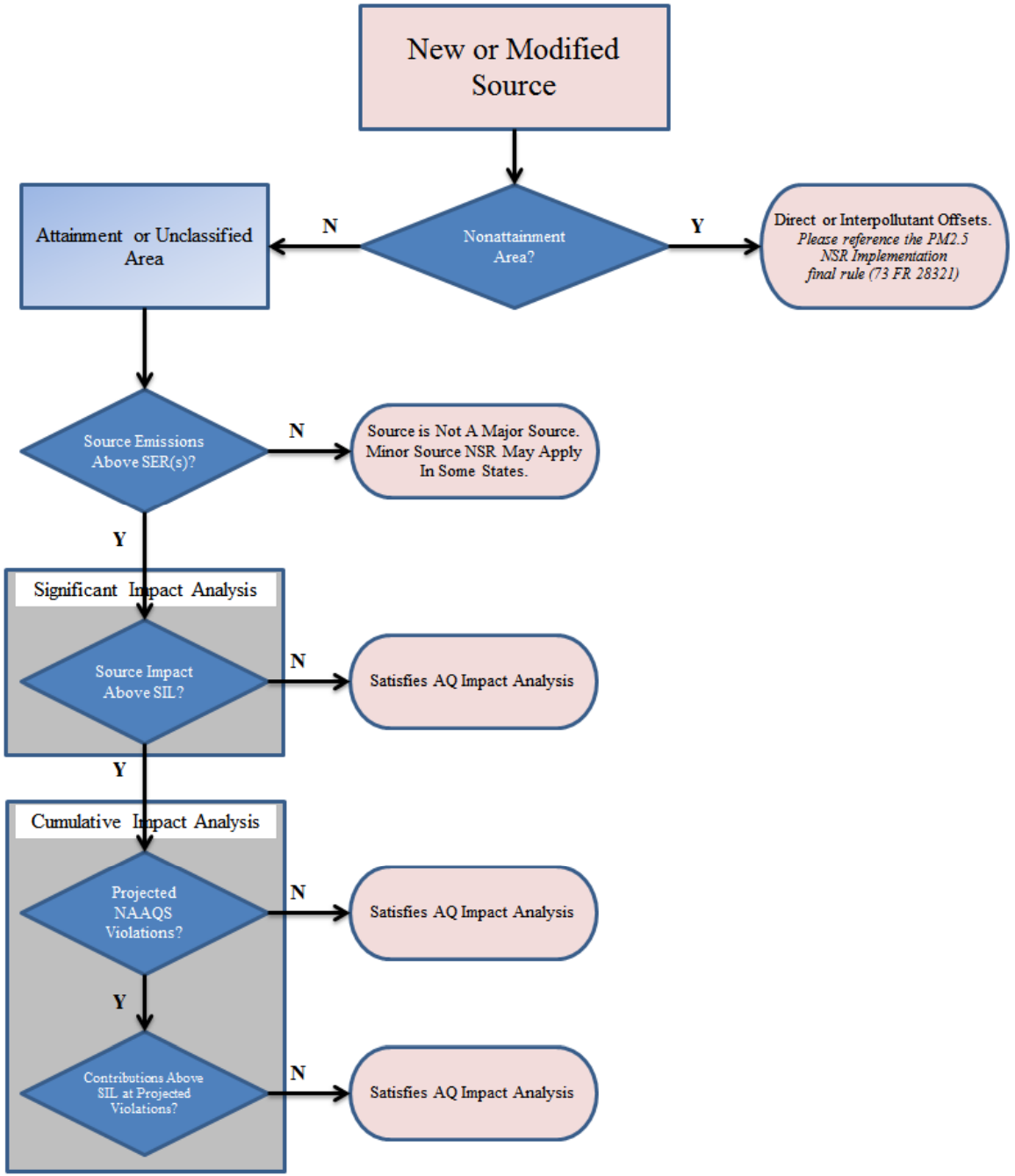
PSD Modeling of $PM_{2.5}$: Screening Nature, Consultation, & Protocol

- Given the potential contribution of secondary formation of $PM_{2.5}$ (not explicitly accounted for by dispersion models) and prominent role of background concentrations in the cumulative impact analysis, certain aspects of standard modeling practices used for other criteria pollutants may not be appropriate.

- As such, PSD modeling of $PM_{2.5}$ should be viewed as screening-level analysis analogous to the screening nature of Section 5.2.4 of App W for NO_2 impacts.

PSD Modeling of $PM_{2.5}$: Screening Nature, Consultation, & Protocol

- As stated in Section 5.2.2.1.c of Appendix W, the "[c]hoice of methods used to assess the impact of an individual source depends upon the nature of the source and its emissions. Thus, model users should consult with Regional Office to determine the most suitable approach on a case-by-case basis."
- A modeling protocol should be developed and approved by the EPA Regional Office, the state/local agency, and the applicant to ensure that the analysis conducted will conform to the recommendations, requirements, and principles of Appendix W Section 3.2.2.


New or Modified Source
Nonattainment Area?
N
Y
Attainment or Unclassified Area
Direct or Interpollutant Offsets. Please reference the PM2.5 NSR Implementation final rule (73 FR 28321)
Source Emissions Above SER(s)?
N
Source is Not A Major Source. Minor Source NSR May Apply In Some States.
Y
Significant Impact Analysis
Source Impact Above SIL?
N
Satisfies AQ Impact Analysis
Y
Cumulative Impact Analysis
Projected NAAQS Violations?
N
Satisfies AQ Impact Analysis
Y
Contributions Above SIL at Projected Violations?
N
Satisfies AQ Impact Analysis

$PM_{2.5}$ Compliance Demonstration: Assessment Cases

- We are proposing 4 different scenarios or cases that will further define what air quality analyses, *if any*, that an applicant would following for compliance demonstration of the $PM_{2.5}$ NAAQS.

$PM_{2.5}$ Compliance Demonstration: Assessment Cases

- Case 1: If $PM_{2.5}$ emissions < 10 tpy and NO_x & SO_2 emissions < 40 tpy, then no $PM_{2.5}$ compliance demonstration is required.

- Case 2: If $PM_{2.5}$ emissions > 10 tpy and NO_x & SO_2 emissions < 40 tpy, then $PM_{2.5}$ compliance demonstration is required for direct $PM_{2.5}$ emission based on dispersion modeling, but no analysis of precursor emissions from the project source is necessary.

$PM_{2.5}$ Compliance Demonstration: Assessment Cases

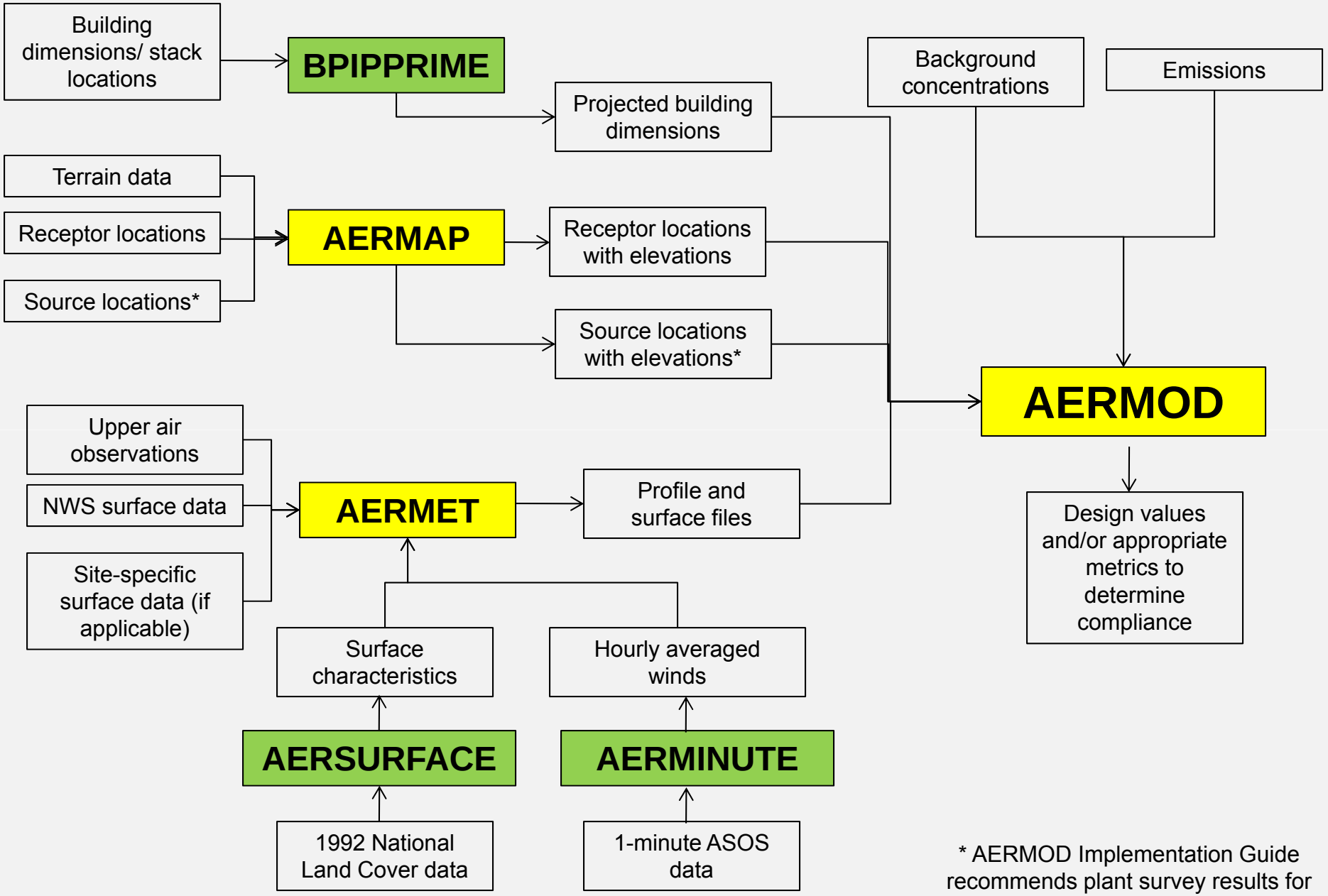
- Case 3: If $PM_{2.5}$ emissions > 10 tpy and NO_x &/or SO_2 emissions > 40 tpy, then $PM_{2.5}$ compliance demonstration is required for direct $PM_{2.5}$ emission based on dispersion modeling, AND the applicant must account for impact of precursor emissions from the project source.
  - The assessment of the precursor emissions on the secondary formation of $PM_{2.5}$ could be completely qualitative in nature, could be a hybrid qualitative / quantitative approach, or may be a full photochemical modeling exercise.
  - We anticipate that only a handful of situations would require explicit photochemical modeling.

$PM_{2.5}$ Compliance Demonstration: Assessment Cases

- Case 4: If $PM_{2.5}$ emissions < 10 tpy and NO_x &/or SO_2 emissions > 40 tpy, then $PM_{2.5}$ compliance demonstration not required for direct $PM_{2.5}$ emissions and no analysis of precursor emissions from project source necessary (based on presumption that primary NO_2 and SO_2 NAAQS are controlling).
  - This case is still under review and consultation with the Policy Division and OGC.
  - Compliance with the NO_2 and SO_2 NAAQS are still required.

Modeling of Directly Emitted $PM_{2.5}$

- Cases 2 & 3 both require compliance demonstration for the direct $PM_{2.5}$ through dispersion modeling.
- Typical significant impact and cumulative impact analysis approach.
- Model Selection:
  - AERMOD, *EPA's preferred near-field dispersion model.*
- Model Considerations:
  - Modeling domain.
  - Source inputs.
  - Meteorological inputs.
- Cumulative impact analyses would necessitate the inclusion of background (monitored and/or other sources explicitly modeled)



* AERMOD Implementation Guide recommends plant survey results for source elevations

Receptor Grid and Placement

- Receptor grid is unique to modeling domain depending on complexity of terrain, sources modeled, etc.
- Receptors should be placed in areas considered ambient air and of such density to detect significant concentration gradients.
- Current provisions of 40 CFR 58.30 state that the PSD source impact analysis with respect to the NAAQS is required to consider modeled air quality impacts only "at existing $PM_{2.5}$ monitoring locations, as well as locations that are appropriate for comparing predicted $PM_{2.5}$ concentrations to the NAAQS based on $PM_{2.5}$ monitor siting requirements and recommendations." (73FR 28336, May 16, 2008)
  - That is, PSD modeling is required to include receptors that are located at population-oriented sites.
  - Also, for the annual standard, PSD requirements are considered only at receptors that are considered to represent community-wide air quality.

Emissions and Source Characterization

- Maximum allowable emissions or federally enforceable limits should be basis of emissions used in modeling
  - Follow Section 8.1 of Appendix W
  - Emission input data can be calculated using Table 8-2
- Source characterization
  - Source release parameters should reflect modeled emissions levels
  - If modeling controlled emissions for demonstration, release parameters should reflect source “with controls in place”
  - Accurate locations
    - Sources and Buildings (if needed for downwash)
  - Urban vs. rural classification
    - Important in determining dispersion coefficients

Meteorology

- 5-years of representative National Weather Service data or at least one year of site-specific data (Appendix W)
  - 3-year standard does not pre-empt use of 5 years of NWS data
  - Calculate design values for modeled period , not 3-year averages
    - Example: Modeling 2005-2009, do not need to calculate 3-year averages for 2005-2007, 2006-2008, and 2007-2009
  - Recommend use of AERMINUTE hourly averaged winds to supplement standard NWS observations to reduce calms and missing data that will be important for modeling of a daily standard

Monitored Background *(Cumulative Impact)*

- Representative background monitored concentrations of $PM_{2.5}$ will entail different considerations from those for other criteria pollutants.
- Monitored background $PM_{2.5}$ concentrations:
  - Should account for the contribution of secondary $PM_{2.5}$ formation associated with existing sources represented in the modeling domain.
  - Consideration should be given to the potential for double-counting the impacts from modeled emissions that may be reflected in the background monitoring
    - Likely not as important for secondary contributions.
    - There could be some issues if the monitor is located relatively close to a nearby source of primary $PM_{2.5}$.

Monitored Background *(Cumulative Impact)*

- It may be appropriate to account for seasonal variation in background $PM_{2.5}$ levels which may not be correlated with seasonal patterns of the modeled primary $PM_{2.5}$ levels.
  - Primary $PM_{2.5}$ of fugitive or low-level emission sources likely occur during winter months due to longer periods of stable atmospheric conditions.
  - Maximum levels of secondary $PM_{2.5}$ (in the eastern U.S.) typically occur during the spring and summer months due to high levels of sulfates.
  - Relative composition of $PM_{2.5}$ and temporal patterns associated with the highest daily $PM_{2.5}$ levels may differ significantly from that associated with the annual average $PM_{2.5}$ levels, especially in western states.

Comparison to the $PM_{2.5}$ NAAQS

- Combining the modeled and monitored concentrations of $PM_{2.5}$ for comparison to the NAAQS also entails considerations different from those for other criteria pollutants.
- The probabilistic form of the $PM_{2.5}$ NAAQS requires additional careful considerations.
- The representative monitored $PM_{2.5}$ design value should be used as a component of the cumulative analysis rather than the overall maximum monitored background concentration.
  - Annual $PM_{2.5}$ design value is based on a 3-year average of the annual average $PM_{2.5}$ concentrations.
  - Daily $PM_{2.5}$ design value is based on the 3-year average of the 98th percentile 24-hour average $PM_{2.5}$ concentrations.
    - 8th highest based on 365 daily samples in a year.
    - Reference Appendix N to 40 CFR Part 50 for other ranks.

Comparison to the $PM_{2.5}$ NAAQS

- Annual $PM_{2.5}$ NAAQS Comparison: (*SIL*)
  - The highest average of the modeled annual averages across the 5-years (NWS) or the highest modeled annual average for one year (site-specific) should be compared to the respective annual $PM_{2.5}$ SIL.
    - 0.06 µg/m^3 – Class I areas & 0.3 µg/m^3 – Class II and III areas
- Annual $PM_{2.5}$ NAAQS Comparison: (*Cumulative*)
  - The highest average of the modeled annual averages across the 5-years (NWS) or the highest modeled annual average for one year (site-specific) should be added to the monitored annual design value.
  - The resulting cumulative annual concentration would then be compared to the annual $PM_{2.5}$ NAAQS of 15.0 µg/m^3.
  - If a NAAQS violation is projected, then a source contribution analysis would be required to demonstrate compliance.

Comparison to the $PM_{2.5}$ NAAQS

- Daily $PM_{2.5}$ NAAQS Comparison: (*SIL*)
  - The highest average of the maximum modeled 24-hour averages across 5-years (NWS) or the highest modeled 24-hour average for one year (site-specific) should be compared to the respective daily $PM_{2.5}$ SIL.
    - 0.07 µg/m^3 – Class I areas & 1.2 µg/m^3 – Class II and III areas
- Daily $PM_{2.5}$ NAAQS Comparison: (*Cumulative*)
  - For a First Tier modeling analysis, the highest average of the maximum modeled 24-hour averages across 5-years (NWS) or the highest modeled 24-hour average for one year (site-specific) should be added to the monitored daily design value.
  - The resulting First Tier cumulative daily concentration would then be compared to the daily $PM_{2.5}$ NAAQS of 35 µg/m^3.
  - If a NAAQS violation is projected, then a source contribution analysis may be considered or possibly a Second Tier modeling analysis.

Comparison to the $PM_{2.5}$ NAAQS

- Daily $PM_{2.5}$ NAAQS Comparison: (*Cumulative*)
  - For applications where impacts from primary $PM_{2.5}$ emissions are not temporally correlated with background $PM_{2.5}$ levels, following the First Tier modeling analysis may be overly conservative.
  - In such cases, combining the monitored and modeled $PM_{2.5}$ concentrations on a seasonal or quarterly basis through a Second Tier modeling analysis might be more appropriate.
  - This is likely more of an issue for the daily $PM_{2.5}$ NAAQS, but it could be an important factor for both NAAQS in some cases.

Comparison to the $PM_{2.5}$ NAAQS

- Daily $PM_{2.5}$ NAAQS Comparison: (*Cumulative*)
  - For a Second Tier modeling analysis, four seasonal background values would be combined with the modeled concentrations on a seasonal basis.

    The recommended input for the Second Tier modeling analysis is the 98th percentile of monitored concentrations for each season, averaged across three years of monitoring.

  - The resulting Second Tier cumulative daily concentration would then be compared to the daily $PM_{2.5}$ NAAQS of 35 µg/m^3.
  - If a NAAQS violation is projected, then a source contribution analysis would be required to demonstrate compliance.
  - AERMOD has the capabilities to allow the user to track the contributions from background concentrations to the cumulative modeled design value.

Assessment of Secondarily Formed $PM_{2.5}$

- Case 3 is the only case that requires some level of assessment of precursor emissions on the secondary formation of $PM_{2.5}$.
- As stated previously in the presentation, the assessment of the precursor emissions on the secondary formation of $PM_{2.5}$ could be completely qualitative in nature, could be a hybrid qualitative / quantitative approach, or may be a full photochemical modeling exercise.
- Consultation with the EPA Regional Office is paramount, including the approval of a modeling protocol that includes a well constructed conceptual description of the $PM_{2.5}$ for the region surrounding the project source.

Assessment of Secondarily Formed $PM_{2.5}$

- Qualitative only approach:
  - Situations where precursor emissions levels are marginally higher than the level of the SERs, monitored background levels are very low, and the primary $PM_{2.5}$ impacts are also very low or not correlated in space and time with secondary formation such that the combination of the background and primary impacts are still well below the level of the NAAQS.
  - It is already a fair assessment that the primary $PM_{2.5}$ and the secondarily formed $PM_{2.5}$ concentrations will not be co-located in time and space.
  - Potentially augment with additional weight-of-evidence style discussion from recent SIP related photochemical modeling exercises in the region.
  - Recent Region 10 OCS drill ship permits are an example.

Assessment of Secondarily Formed $PM_{2.5}$

- Hybrid qualitative / quantitative approach:
  - In most situations, background concentrations in addition to the primary $PM_{2.5}$ impacts from the project source are already going to be relatively close to the NAAQS.
  - If a facility has sizable precursor emissions in such an environment, additional pseudo-quantitative analysis will be required beyond a weight-of-evidence style discussion.
  - The development of region specific offset ratios that can be applied to the precursor emissions to determine a related $PM_{2.5}$ concentration is one option.
  - Other techniques such as the development of a PM2.5 Impacts Screening Tool based on region specific photochemical modeling could be explored.

(Similar to the R. Morris Presentation on an ozone screening tool this afternoon)

Assessment of Secondarily Formed $PM_{2.5}$

- Chemical transport modeling:
  - As described in the NACAA $PM_{2.5}$ Implementation Workgroup recommendations for their Tier III and Tier IV cumulative impact assessments, the use of a Lagrangian or Eulerian model may be required for very large sources with a tremendous net increase of $PM_{2.5}$ precursor emissions.
  - We anticipate this being the rare case, especially in light of compliance requirements of the recently revised 1-hour NO_2 and SO_2 NAAQS.
  - The Lagrangian models (e.g. SCICHEM) are an emerging technical resource that could gain prominence with regards to the assessment of secondarily formed $PM_{2.5}$.
    (Will be discussed in greater detail in the afternoon Emerging Models and Technics Session)

Assessment of Secondarily Formed $PM_{2.5}$

- Chemical transport modeling:
  - The Eulerian models (e.g. CAMx & CMAQ) are wildly used for SIP attainment modeling purposed but have limited application thus far for single source impacts.
    (Will be discussed in greater detail in the afternoon Emerging Models and Technics Session)
  - The next few slides provide a brief overview of several single source application techniques for the Eulerian photochemical models.

Use of Photochemical Models for Single-Source Impact

- Brute Force "Zero-Out"
  - Simulate two sets of conditions, one with all emissions and one with the source of interest removed from the simulation. The difference between these simulations provides an estimate of the impact or contribution from the source.
- Source Apportionment Techniques
  - Some photochemical models have been instrumented with source apportionment, which tracks emissions from specific sources through chemical transformation, transport, and deposition processes to estimate a contribution to predicted air quality at downwind receptors.

Use of Photochemical Models for Single-Source Impact

- Direct Decoupled Method (DDM)
  - Some photochemical models have been instrumented with DDM, which tracks the sensitivity of an emissions source through all chemical and physical processes in the modeling system. Sensitivity coefficients relating source emissions to air quality are estimated during the model simulation and output at the resolution of the host model.
- Sub-Grid Treatment
  - In situations of source-receptors within close proximity, a photochemical model instrumented with sub-grid plume treatment and sampling may better represent the contribution from the source.

Outstanding Issues to Resolve Regarding Photochemical Models for Single-Sources

- Meteorological Inputs:
  - Number of years or episodic?
  - Selection criteria in terms of sufficiently conducive to secondary formation
- Emissions Inputs:
  - Appropriateness of Table 8.2 of Appendix W?
- Horizontal Grid Resolution:
  - 12km, 4km—what is sufficient or necessary?
  - With sub-grid treatment?

Outstanding Issues to Resolve Regarding Photochemical Models for Single-Sources

- "Absolute" vs "Relative" Modeling Approaches:
  - For PSD and NSR programs, the absolute modeled concentrations are compared to significance thresholds, whereas relative modeled concentrations are used for area SIP demonstrations.
  - Additional work is needed to fully understand the implications of using an absolute, relative, or a combination approach for the purposes of assessing single source impacts with a photochemical grid model.
- Use the Photochemical Model for Primary and Secondary Impacts or Just Secondary Impacts?
- Defining PM2.5 in Terms of Size and Chemical Speciation.
- Performance Evaluation Methods and Metrics:
  - Evaluate like dispersion model or photochemical model?

Outstanding Issues to Resolve Regarding Photochemical Models for Single-Sources

- Existing guidance for photochemical models may not be totally applicable for this purpose.
- Wide ranging applications of photochemical models are currently ongoing (e.g., NEPA, DOJ, etc).
- Such applications need to be consistent for the purposes of assessing the impacts of single sources on secondarily formed pollutants such as ozone and $PM_{2.5}$.

Web Links of Interest

- Support Center for Regulatory Atmospheric Modeling (SCRAM)
  - http://www.epa.gov/scram001/
  - Links to AERMOD modeling system
    - http://www.epa.gov/ttn/scram/dispersion_prefrec.htm#aermod
  - SIP modeling guidance
    - http://www.epa.gov/ttn/scram/guidance_sip.htm
  - Guideline on Air Quality Models
    - http://www.epa.gov/ttn/scram/guidance/guide/appw_05.pdf
  - Clarification memorandum
    - http://www.epa.gov/ttn/scram/guidance_clarificationmemos.htm