NAAQS in Permitting:

1-hour SO2, 1-hour NO2, and
Annual & 24-hour PM2.5 Standards

Federal Update

December 9, 2014

George M. Bridgers
OAQPS-AQAD-Air Quality Modeling Group

2014 NACAA Permitting and Enforcement Workshop, Chicago, IL

Challenges to Our Current Air Quality Models

- States and sources report difficulty demonstrating compliance with 1-hour NO_2 & SO_2 and both $PM_{2.5}$ NAAQS.
  - Accuracy of models receiving greater scrutiny. EPA has been asked to address model inputs and science for existing regulatory models.
  - Past practices for NAAQS compliance demonstrations under NSR/PSD that may be "overly conservative" in some cases
- Sierra Club Petition Grant – Ozone and $PM_{2.5}$
  - In January 2012, the EPA granted a petition submitted by the Sierra Club.
  - In the petition grant, the EPA committed to engage in rulemaking to evaluate updates to Appendix W to 40 CFR 51, and, as appropriate, incorporate new analytical techniques or models for ozone and secondary $PM_{2.5}$ for new and modified sources.
- Overall renewed tension between environmental protection and economic growth

Guidance for $PM_{2.5}$ Permit Modeling

Draft Guidance for $PM_{2.5}$ Permit Modeling

- Publically released on Monday, March 4, 2013.
- Initial 45 day comment period through April 17, 2013 was extended by 45 days through May 31, 2013.
  - Numerous requests to extend the comment period by co-regulators, industry, and environmental groups.
  - The extension through May gave an opportunity for the entire dispersion modeling community to discuss the draft guidance document at the 2013 Regional, State, and Local Modelers' Workshop in Dallas, TX (April 22nd through 25th)
- At the end of the comment period, EPA had received 30 comprehensive comment packages.

Comments Received

- Most of the comments were supportive and positive.
- Earth Justice (Sierra Club) was very critical of our use of SILs throughout the draft guidance given the January 22, 2013 court decision.
- Industrial comments warned that the processes laid out in the draft guidance were complex and would be an additional burden on top of their issues with existing background levels of $PM_{2.5}$.
- Several industry related comments desired a more simplistic (surrogate) approach as was previously policy.

Comments Received *(Cont.)*

- A few of the industrial comments were emissions / stack testing related and have been shared with the appropriate groups within EPA.
  - Interim guidance for the treatment of condensable particulate matter test results in the PSD and NSR permitting programs http://www.epa.gov/ttn/emc/methods/psdnsrinterimcmpmemo4814.pdf
- Most of the co-regulating agency comments provided specific feedback along the lines of the NACAA workgroup recommendations.
- Several of the co-regulating agencies desired more prescriptive approaches, especially in the assessment of secondarily formed $PM_{2.5}$.

Guidance for $PM_{2.5}$ Permit Modeling

- Signed by Steve Page and released on May 20, 2014 during the middle of the 2014 RSL Modelers' Workshop in Salt Lake City, UT.

- Available for download from the EPA's SCRAM website: http://www.epa.gov/ttn/scram/guidance/guide/Guidance_for_PM25_Permit_Modeling.pdf

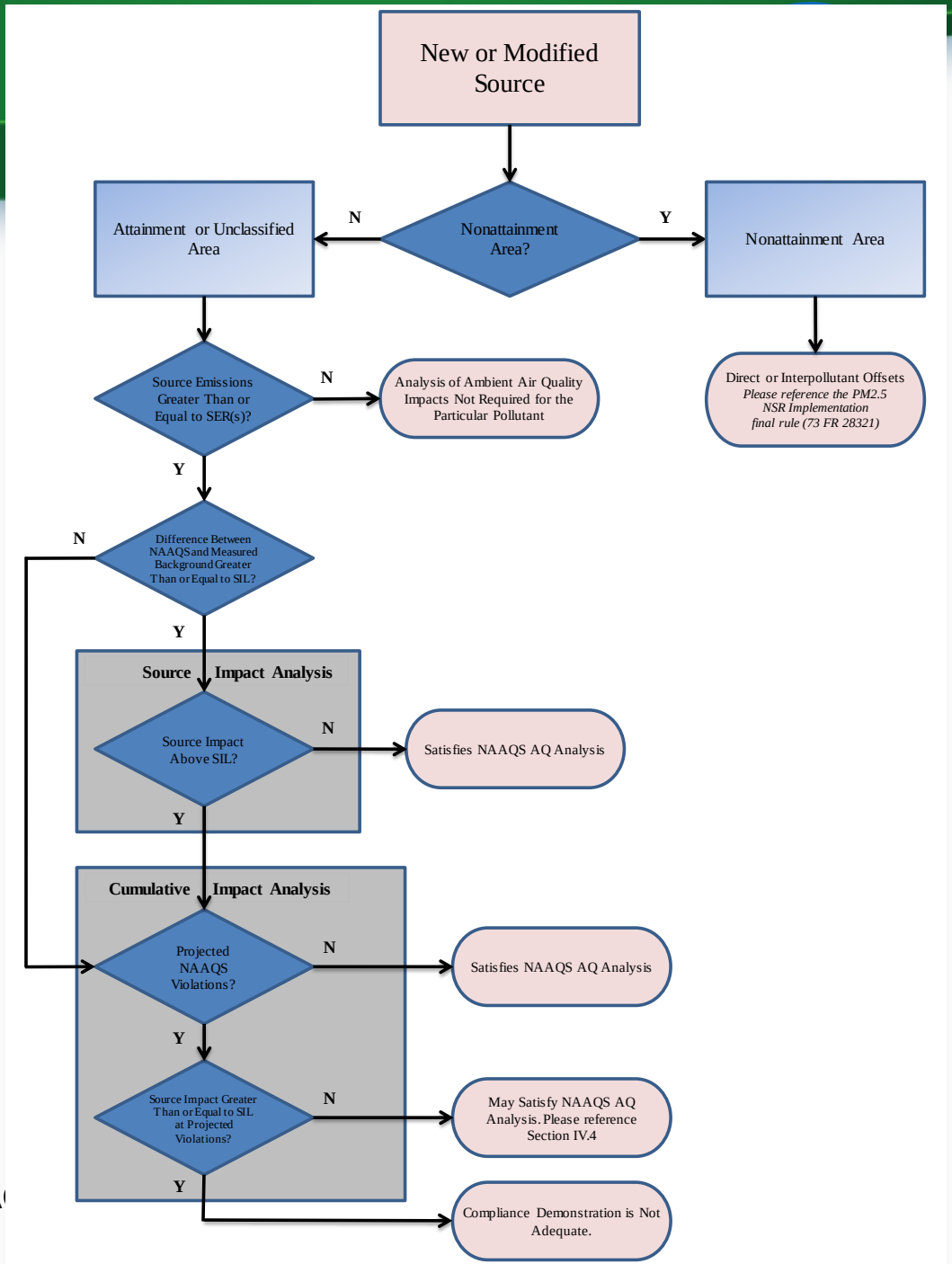
Guidance for $PM_{2.5}$ Permit Modeling *(Cont.)*

- Noteworthy changes made to the draft version include:
  - Clarifications throughout with respect to procedures for adequately addressing primary and secondarily formed $PM_{2.5}$.
  - Inclusion of an example hybrid (qualitative/quantitate) secondary $PM_{2.5}$ impact assessment based on a location representative of more typical background $PM_{2.5}$ concentrations. *(Reference Appendix D)*
  - Revision of a second tier cumulative $PM_{2.5}$ NAAQS compliance approach. *(Reference Section IV.3 and Appendix E)*
  - Revision of Section V and other sections relative to PSD Increment for $PM_{2.5}$.

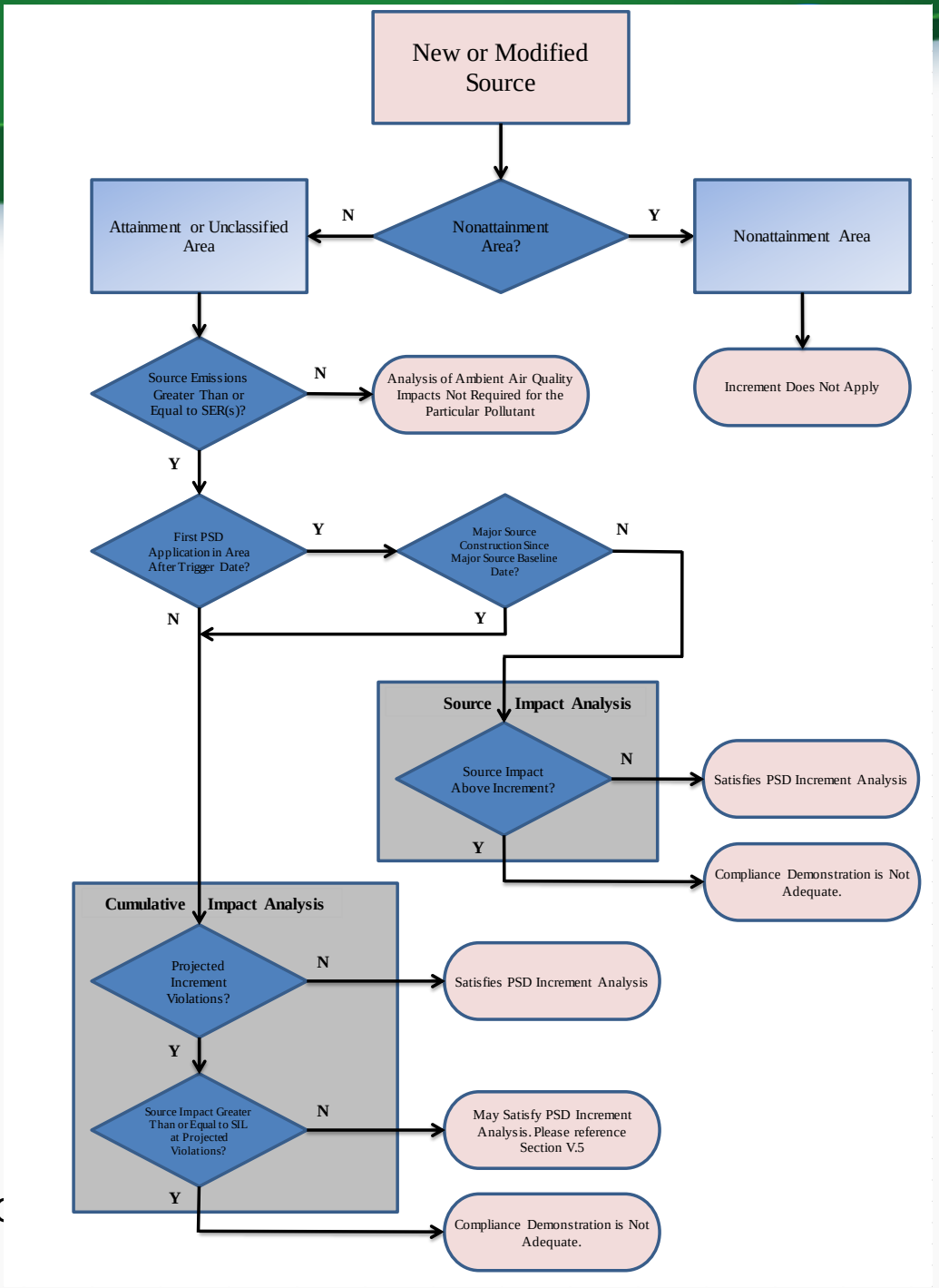
Appropriate Use of SILs

- Per a January 22, 2013 U.S. Court of Appeals decision, any permitting authority wishing to use a particular SIL value as a screening tool in a significant impact analysis should determine whether a substantial portion of the NAAQS has already been consumed.
  - Preconstruction monitoring data (or adequately representative monitoring data from an existing monitoring network) should be evaluated against the respective $PM_{2.5}$ NAAQS.
  - If the difference (headroom) between the NAAQS and the measured $PM_{2.5}$ background in the area is greater than the applicable SIL value, then the EPA believes it would be sufficient in most cases for permitting authorities to conclude that a source with an impact below that SIL value will not cause a new NAAQS violation.

- Reference: Figure II-1. *(NAAQS)*



- Reference: Figure II-2. *(Increment)*



$PM_{2.5}$ Compliance Demonstration: Assessment Cases

- We have established 4 different scenarios or assessment cases that further define what air quality analyses, *if any*, that an applicant would follow for compliance demonstrations of the $PM_{2.5}$ NAAQS or PSD Increments.

- Each of these 4 scenarios are outlined in the table on the following slide.

$PM_{2.5}$ Compliance Demonstration: Assessment Cases *(Cont.)*

- Reference: Table III-1. *(NAAQS)* and V-2. *(Increment)*

Assessment Case	Description of Assessment Case	Primary Impacts Approach	Secondary Impacts Approach
Case 1: No Air Quality Analysis	Direct PM2.5 emissions < 10 tpy SER Both NOx and SO2 emissions < 40 tpy SER	N/A	N/A
Case 2: Primary Air Quality Impacts Only	Direct PM2.5 emissions ≥ 10 tpy SER Both NOx and SO2 emissions < 40 tpy SER	**Appendix W preferred or approved alternative dispersion model**	N/A
Case 3: Primary and Secondary Air Quality Impacts	Direct PM2.5 emissions ≥ 10 tpy SER Both NOx and/or SO2 emissions ≥ 40 tpy SER	**Appendix W preferred or approved alternative dispersion model**	• **Qualitative** • **Hybrid qualitative / quantitative** • **Full quantitative photochemical grid modeling**
Case 4: Secondary Air Quality Impacts Only	Direct PM2.5 emissions < 10 tpy SER Both NOx and/or SO2 emissions ≥ 40 tpy SER	N/A	• **Qualitative** • **Hybrid qualitative / quantitative** • **Full quantitative photochemical grid modeling**

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)

Assessment of Secondarily Formed $PM_{2.5}$

- Case 3 and 4 requires some level of assessment of precursor pollutant emissions to the secondary formation of $PM_{2.5}$.
- The assessment of the precursor pollutant emissions to 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 grid modeling exercise.
- The combination of the modeled direct impacts of $PM_{2.5}$ with that of secondarily formed $PM_{2.5}$ will require additional thought and justification depending on assessment approach.
- Consultation with the appropriate permit reviewing authority 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.

Revised Second Tier for 24-hour $PM_{2.5}$ NAAQS Compliance Demonstration

- The second tier method for 24-hour $PM_{2.5}$ NAAQS compliance demonstrations was proposed to provide flexibility and relieve a degree of conservativeness in the modeling that resulted from situations where background $PM_{2.5}$ concentrations peaked in seasons that were offset from the seasons to which the source $PM_{2.5}$ impacts peaked.
- The second tier methodology proposed in the draft guidance could have unintended consequences of being higher or more conservative than the first tier.

Revised Second Tier for 24-hour $PM_{2.5}$ NAAQS Compliance Demonstration *(Cont.)*

- In the final guidance, the second tier methodology was appropriately updated to avoid unintended consequences.
  - Coordination with EPA's Office of Transportation and Air Quality (OTAQ), experience gained from interactions with industrial stakeholders, and internal testing of real-world examples of facilities in a variety of $PM_{2.5}$ environments.
- Revised second tier methodology is consistent with EPA's original SIP modeling guidance

$PM_{2.5}$ Increments

- The recommendations for assessing secondary $PM_{2.5}$ impacts associated with precursor emissions on NAAQS analyses, based on the four assessment cases, are also applicable for increment analyses.

- First source into an increment impact area should be able to exercise a typical Source Impact Analysis with a minimal “headroom” check.
  - Reference Figure II-2.

$PM_{2.5}$ Increments *(Cont.)*

- Expanded conversation on the use of monitoring to track increment (consumption and expansion) in the baseline area based on regional considerations.
  - Additional clarification will be necessary as more real-world application of using monitoring in a cumulative increment compliance demonstration is gained.

- **Early coordination** with the reviewing authority is encouraged to identify the appropriate baseline concentration and baseline area for the proposed new/modified source, and the inventory of increment-affecting sources.

New / Future Clarification Memorandums

Supplemental NO_2 Clarification Memo

- "Clarification on the Use of AERMOD Dispersion Modeling for Demonstrating Compliance with the NO_2 National Ambient Air Quality Standard"
- Status of the Ambient Ratio Method (ARM) and Ambient Ratio Method 2 (ARM2) Tier 2 modeling approaches for demonstrating NAAQS compliance under the PSD program.
- ARM2 was developed by API with close coordination with EPA-OAQPS and included in the AERMOD version 14134 release as a beta option.

Supplemental NO_2 Clarification Memo *(Cont.)*

- Selection and application of the NO_2/NOx In-Stack Ratio (ISR) for use in Tier 3 NO_2 modeling application
- The appropriate applications for the Ozone Limiting Method (OLM) and Plume Volume Molar Radio Method (PVMRM) Tier 3 NO_2 modeling schemes.
- The treatment of background sources and monitoring data in compliance demonstrations.
- Available for download from the EPA's SCRAM website: http://www.epa.gov/ttn/scram/guidance/clarification/NO2_Clarification_Memo-20140930.pdf

Nearby Sources/Significant Concentration Gradient Clarification Memo

- The practice of modeling the entire Significant Impact Area (SIA) and all sources within is not recommended in Appendix W.
- With previous standards, it has not been an issue and was standard practice; however, that practice is causing significant problems with the more stringent 1-hour NO_2 and SO_2 and revised $PM_{2.5}$ standards.
- Understanding what the background monitor truly represents and which nearby sources then need to be explicitly modeled is paramount.

Nearby Sources/Significant Concentration Gradient Clarification Memo *(Cont.)*

- Appendix W discusses the concept of significant concentration gradients but is vague on the definition.
  - *"All sources expected to cause a significant concentration gradient in the vicinity of the source or sources under consideration for annual emission limit(s) should be explicitly modeled. The number of such sources is expected to be small except in unusual situations."*
  - These locations can include the area of maximum impact of the source, the area of maximum impact of nearby sources, and the area where all sources combine to cause maximum impact.

Nearby Sources/Significant Concentration Gradient Clarification Memo *(Cont.)*

- The clarification memo will go into more detail of how to calculate concentration gradients and provide some examples of where sources should and should not be included in a cumulative modeling demonstration.
- Emphasis that the applicants and reviewing authority should still exercise best professional judgment in the selection of nearby sources to explicitly model.
- Hopefully released in early 2015 and portions of the memo will be incorporated into the Appendix W revisions.

Appendix W Revisions
&
11th Conference on Air Quality Modeling

Appendix W Revisions

- Revisions throughout all portions of Appendix W based on experiences gained since the 2005 update.
  - Clarification memorandums, guidance documents, and Model Clearinghouse actions.
  - Incorporate new analytical techniques to address Ozone and secondary $PM_{2.5}$.
  - Updates for conducting individual source and cumulative impact analysis for new 1-hour NAAQS.
  - Update, as appropriate, current EPA-preferred models to address input and science issues.
- Slight realignment of chapters to more appropriately address direct & secondarily formed criteria pollutants.

Working Groups: Getting the Work Done

- Established formal working groups of OAQPS and Regional Office Modelers
  - AERMOD Development & Evaluation (Roger Brode)
  - Screening Techniques (James Thurman)
  - NO_2 Modeling (Chris Owen)
  - Near-road Modeling (Chris Owen)
  - Meteorological Inputs (James Thurman)
  - Policy & Technical Coordination (George Bridgers)
  - IWAQM Phase 3: Near field impacts & Long-range transport (EPA and FLMs)
- Refer to 2014 RSL Modelers Workshop presentations on the SCRAM website for details on priorities and activities of each workgroup:

  http://www.cleanairinfo.com/regionalstatelocalmodelingworkshop/archive/2014/agenda.htm

Takes a Community to Revise the Guideline

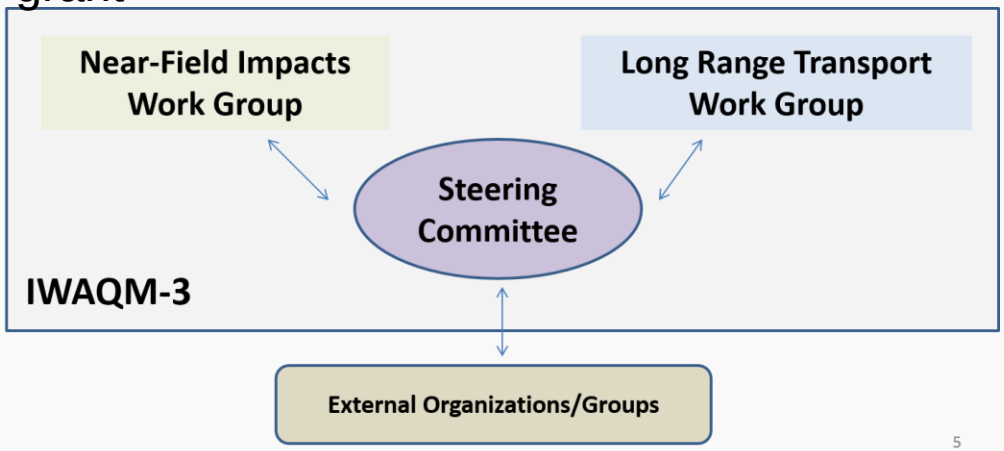
- EPA Regional Offices
  - R3: Tim Leon-Guerrero
  - R5: Randy Robinson, Michael Leslie
  - R6: Erik Snyder
  - R7: Andy Hawkins
  - R9: Cleve Holladay
  - R8: Rebecca Matichuk
  - R10: Robert Elleman, Herman Wong
- Office of Research & Development
  - Sue Kimbrough, David Heist, Steve Perry
- Office of Transportation and Air Quality
  - Chris Dresser, Meg Patulski

Appendix W Revisions *(Cont.)*

- Consideration of all recently released beta options within AERMOD as promulgated options.
  - ADJ_U*, LOWWIND1 * 2, and ARM2
- Formulation other significant updates to the AERMOD Modeling System.
  - AERSCREEN, BLP, PRIME downwash modifications, capped/horizontal stacks, AERCOARE, OCD & shoreline dispersion, industrial heat-island consideration (AISI), MMIF…
- Significant updates with respect to the tools and techniques for assessing Ozone and secondarily formed $PM_{2.5}$ as well as visibility, long range transport and AQRVs based on IWAQM Phase 3 efforts.

IWAQM Phase 3

- IWAQM (phase 3) initiated in July 2013 to provide a mechanism for updating Appendix W and related guidance documents in partnership with the Regional offices and other Federal Agencies (short term)
  - Increase knowledge regarding NSR/PSD program and single source secondary impacts
  - Understand and evaluate modeling techniques for single source secondary impacts for Ozone and secondary $PM_{2.5}$
  - Products from the IWAQM3 process intended to inform and support regulatory revisions to Appendix W in response to Sierra Club petition grant



IWAQM Phase 3 Participants

Near-Field impacts working group
Kirk Baker, OAQPS (Chair)
Jim Kelly, OAQPS
George Bridgers, OAQPS
Andy Hawkins, Region 7
Randy Robinson, Region 5
Jaime Wagner, Region 5
Rebecca Matichuk, Region 8
Bob Kotchenruther, Region 10
Richard Monteith, Region 4
Rynda Kay, Region 9

Long range transport working group
Bret Anderson, US FS (Chair)
Tim Allen, US F&W
Mike Barna, US NPS
John Notar, US NPS
Craig Nicholls, BLM
Kirk Baker, US EPA OAQPS
Chris Owen, US EPA OAQPS
Gail Tonnesen, US EPA Region 8
Michael Feldman, US EPA Region 6
Rick Gilliam, US EPA Region 4

Steering Committee
Tyler Fox, US EPA OAQPS
Bret Anderson, US FS
Tim Allen, US F&W
Annamaria Coulter, Region 2
Erik Snyder, Region 6
Robert Elleman, Region 10
Carol Bohnenkamp, Region 9
John Vimont, US NPS
Craig Nicholls, BLM
Val Garcia, US EPA ORD
Shawn Roselle, US EPA ORD

Appendix W Revisions *(Cont.)*

- Updates for other dispersion modeling applications such as mobile sources and transportation related.

- Rulemaking proposal projected for late May 2015 ahead of the 11th Conference on Air Quality Modeling.

- Final revised Appendix W publication in mid-2016.

11th Conference on Air Quality Modeling

- The 11th MC will serve as the public hearing for the proposed Appendix W revisions rulemaking.
  - Announced through publication in the Federal Register.
  - Formal docket for supporting material, transcripts, and comment submission.
  - Summary of Comments and Response to Comments documents will follow the 11th MC.
- Tentatively scheduled for June 10th and 11th, 2015 at the EPA Campus in RTP, NC.
- Also, tentatively holding June 8th and 9th for an abbreviated 2015 RSL Workshop in RTP, NC.

Additional Requests / Issues Coming From Industry

- Treatment of “Ambient Air” and receptor placement.
- Desire for paired-sums approach in cumulative modeling to combine background and modeled concentrations.
- Defining the significant impact area based on a initial screen using a H4H or H8H instead of H1H value.
- Varying approaches to apply the intermittent emissions “policy” for comp1-hour NO_2 and SO_2.
- Extension of the intermittent emissions “policy” to $PM_{2.5}$.
- Issues with Condensable $PM_{2.5}$ and Emission Factors
- Desire for Monte Carlo approaches for PSD compliance.

Discussion & Questions?