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October 2012

Summary of Public Comments

10th Conference on Air Quality Modeling

Research Triangle Park, NC.

March 13 – 15, 2012

Air Quality Modeling Group
Air Quality Analysis Division
Office of Air Quality Planning and Standards
U.S. Environmental Protection Agency

October 2012

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ACRONYMS – General

10 th MC	10 th Conference on Air Quality Models also known as 10 th Modeling Conference
AERMAP	Terrain preprocessor for AERMOD
AERMET	Meteorological data preprocessor for AERMOD
AERMIC	American Meteorological Society (AMS)/United States Environmental Protection Agency (EPA) Regulatory Model Improvement Committee
AERMINUTE	Processes 1-minute ASOS wind data to generate hourly average winds for input to AERMET in Stage 2
AERMOD	EPA's preferred model for near-field (up to 50 km) regulatory applications in simple and complex terrain, http://www.epa.gov/ttn/scram/dispersion_prefrec.htm#aermod
AERSURFACE	Tool that processes land cover data to determine the surface characteristics for use in AERMET
ADMS	Atmospheric Dispersion Modeling System
AQRV	Air Quality Related Value
ARM	Ambient Ratio Method
ARM2	Ambient Ratio Method 2
ASOS	Automated Surface Observing Stations
BACT	Best Available Control Technology
BPIP	Building Profile Input Program
BPIPPRM	Building Profile Input Program for PRIME
CAA	Clean Air Act
CALMET	3-D diagnostic meteorological model for CALPUFF
CALPOST	Postprocessor for CALPUFF
CALPUFF	EPA's preferred model for assessing long range transport of pollutants and their impacts (AQRVs) on Federal Class I areas, http://www.epa.gov/ttn/scram/dispersion_prefrec.htm#calpuff
CAMx	Comprehensive Air Quality Model with Extensions, http://www.camx.com/
CMAQ	Community Multi-scale Air Quality, http://www.cmaq-model.org/
CMAQ-APT	CMAQ - Advanced Plume Treatment
CMAQ-MADRID	CMAQ - Model of Aerosol Dynamics, Reaction, Ionization, and Dissolution
CEM	Continuous Emissions Monitoring
EBDs	Equivalent Building Dimensions
EMVAP	Emissions Variability Processor
EPA	U.S. Environmental Protection Agency
FLAG	Federal Land Managers AQRV Work Group
FLM	Federal Land Manager
Guideline	Common reference to the Guideline on Air Quality Models, the Modeling Guideline or Appendix W to 40 CFR Part 51, http://www.epa.gov/ttn/scram/guidance/guide/appw_05.pdf
GEP	Good Engineering Practice
HUSWO	Hourly US Weather Observations

ACRONYMS – General (*Continued*)

ISHD	Integrated Surface Hourly Data (also known as TD-3505 format, it integrated METAR, TD-3280, and other formats)
IWAQM	Interagency Workgroup on Air Quality Modeling
MACT	Maximum Achievable Control Technology
MCB	Model Change Bulletin
MM5	Fifth-Generation NCAR / Penn State Mesoscale Model, http://www.mmm.ucar.edu/mm5/
MMIF	Mesoscale Model Interface Program
NAAQS	National Ambient Air Quality Standard(s)
NPS	U.S. National Park Service
NSPS	New Source Performance Standards
NSR	New Source Review
NWS	National Weather Service
OAQPS	U.S. EPA's Office of Air Quality Planning and Standards
OLM	Ozone Limiting Method
ORD	U.S. EPA's Office of Research and Development
PVMRM	Plume Volume Molar Ratio Method
PSD	Prevention of Significant Deterioration
SCICHEM	SCIPUFF model with an embedded full chemistry mechanism
SCIPUFF	Second-order Closure Integrated Puff model
SIA	Significant Impact Area
SIL	Significant Impact Level
SIP	State Implementation Plan
USFS	U.S. Forest Service
UTM	Universal Transverse Mercator
WRF	Weather Research and Forecasting model, http://www.wrf-model.org/

ACRONYMS – Comment Submitters

ACW	Alpha Coal West, Inc.
AEPSC	American Electric Power Service Corporation
AF&PA	American Forest and Paper Association
AISI	American Iron and Steel Institute
API	American Petroleum Institute
APS	Arizona Public Service Company
A&WMA	Air & Waste Management Association, AB-3 Committee on Meteorology
BGNA	Barrick Gold of North America, Inc.
BP	BP America, Inc.
Coulter	Coulter Air Quality Services
DE	Duke Energy Corporation
EEANC	Environmental Energy Alliance of New York, LLC
EPRI	Electric Power Research Institute
Exponent	Exponent, Inc.
FI	The Fertilizer Institute
NIC	NAAQS Implementation Coalition (<i>Prepared by Hunton & Williams</i>)
Koogler	Koogler and Associates, Inc.
NDDH	North Dakota Department of Health
NEDA	The National Environmental Development Associations’ Clean Air Project
NMA	National Mining Association
OPC	Oglethorpe Power Corporation
PE	Peabody Energy
SC	Southern Company
Sears	Camille Sears
SRP	Salt River Project Agricultural Improvement and Power District
Tri-State	Tri-State Generation and Transmission Association, Inc.
UARG	Utility Air Regulation Group (<i>Prepared by Hunton & Williams</i>)
West	West Associates
WMA	Wyoming Mining Association

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TABLE OF CONTENTS

- 1.0 Introduction 1

- 2.0 Model Clearinghouse and Procedural Comments 3
 - 2.1 General Stakeholder Involvement 3
 - 2.2 Expanded Access to the Model Clearinghouse 4
 - 2.3 Public Access to Model Evaluation Databases..... 5
 - 2.4 Requirements of “Data Quality Act”..... 5
 - 2.5 Modeling Guidelines and Guideline Models Update Process 5
 - 2.6 Ad-hoc Guidance, Clarification Memos, and Clearinghouse Activities 6

- 3.0 Comments on Development of Schedule to Address Comments and Implement Model Changes 7
 - 3.1 Hunton and Williams for NAAQS Implementation Coalition 7
 - 3.2 American Petroleum Institute..... 9
 - 3.3 BP America 10
 - 3.4 The National Environmental Development Association’s Clean Air Project 12

- 4.0 Comments Related to AERMOD..... 12
 - 4.1 Low Wind Speeds..... 12
 - 4.2 Treatment of Downwash 15
 - 4.3 Modeling Domain Limitation..... 16
 - 4.4 AERMOD Update Process 17
 - 4.5 Buoyant Line Sources..... 17

- 5.0 Fugitive Dust Comments..... 17
 - 5.1 Treatment of Emissions and Modeling for Surface Mines 17
 - 5.2 Relevance to CAA, Section 234..... 19

TABLE OF CONTENTS (Continued)

6.0 Comments Related to CALPUFF..... 19

6.1 Adoption of Improvements to CALPUFF..... 19

6.2 Relationship of CALPUFF v6.4 to BART Rule..... 20

6.3 Application of Appendix W, Section 3.2 to CALPUFF v6.4..... 21

6.4 Application of CALPUFF to Nearby Sources..... 21

6.5 Individual Source Impacts on PM_{2.5} and Ozone..... 22

7.0 NAAQS Compliance Demonstration Comments..... 23

7.1 NAAQS Compliance Demonstration General Comments 23

7.2 Ambient Air..... 23

7.3 Background Concentrations 24

7.4 Significant Impact Levels for revised 1-hour NO₂/SO₂ and PM_{2.5} NAAQS 24

7.5 1-hour NO₂/SO₂ NAAQS 25

7.5.1 1-hour NO₂/SO₂ NAAQS General Comments..... 25

7.5.2 1-hour NO₂ – Refined Tier 2 and Tier 3 Methods, ARM2 Implementation, and Field Studies 26

7.5.3 1-hour NO₂ – NO₂ to NO_x Ambient Equilibrium Ratios and In-stack Emissions Ratios 26

7.5.4 1-hour SO₂ – Use of Variable Emissions and EMVAP Implementation..... 26

7.6 PM_{2.5} NAAQS 28

7.7 Monitoring in Lieu of Modeling..... 28

8.0 Emerging Models and Techniques Comments..... 29

8.1 Mesoscale Model Interface Program (MMIF) Comments 29

8.2 Single Source PM_{2.5} and Ozone Modeling 30

TABLE OF CONTENTS (Continued)

Attachment A 1

 Summary of 10th Conference on Air Quality Modeling Comment Submissions 1

 NAAQS Implementation Coalition (*Prepared by Hunton & Williams*) 1

 Utility Air Regulation Group (*Prepared by Hunton & Williams*)..... 3

 Electric Power Research Institute 5

 Environmental Energy Alliance of New York, LLC 7

 Southern Company 9

 American Electric Power Service Corporation 10

 Duke Energy Company 11

 Arizona Public Service Company 12

 Salt River Project Agricultural Improvement and Power District 13

 Tri-State Generation and Transmission Association, Inc..... 13

 Oglethorpe Power Corporation 13

 West Associates 14

 American Petroleum Institute 15

 BP America, Inc. 17

 American Iron and Steel Institute 19

 National Mining Association 21

 Wyoming Mining Association 23

 Alpha Coal West, Inc. – 23

 Barrick Gold of North America, Inc. 24

 Peabody Energy 25

 The National Environmental Development Association’s Clean Air Project 26

 American Forest & Paper Association 28

 The Fertilizer Institute..... 30

 Koogler and Associates, Inc..... 32

 Coulter Air Quality Services 32

 Camille Sears 33

 North Dakota Department of Health 34

 Air & Waste Management Association, AB-3 Committee on Meteorology, includes
 Exponent, Inc. 35

TABLE OF CONTENTS (Continued)

Attachment B 1

 Summary of 10th Conference on Air Quality Modeling Individual Presentations 1

 AERMOD Applications Development..... 1

 Ron Petersen -- CPP Inc..... 1

 Bob Paine – AECOM for API and UARG..... 2

 Randy Robinson – EPA Region 5 2

 Chatten Cowherd – MRI Global 3

 Currently Preferred AQ Models -- CALPUFF 4

 Gale Hoffnagle -- TRC Companies, Inc..... 4

 PM_{2.5} Modeling..... 4

 Ryan Gesser – American Forest & Paper Association..... 4

 1-hour NO₂/SO₂ Modeling 5

 Bob Paine, AECOM..... 5

 Mark Podrez – RTP Env. Assoc. Inc 6

 Steven Hanna -- Hanna Consultants 6

 Dan Dix – All4..... 7

 Emerging Models / Techniques..... 7

 Ralph E. Morris -- ENVIRON International Corporation..... 7

 Public Presentations..... 8

 Pietro Catizone, A&WMA AB-3 Meteorology Committee – Introductory Comments 8

 Lloyd L. Schulman -- Building Downwash Modeling with AERMOD (A&WMA AB-3)... 8

 Joseph S. Scire -- Assessment of EPA’s ETEX Evaluation Study (A&WMA AB-3)..... 9

 Joseph S. Scire -- New Developments and Evaluations of the CALPUFF Model (A&WMA AB-3) 10

 Andy Berger – West Associates..... 11

 Steve Hanna – Hannah Consultants for API..... 11

 Ryan Gesser – American Forest & Paper Association..... 15

 Bob Paine – AECOM for Electric Power Research Institute..... 15

 Bob Paine – AECOM for Electric Power Research Institute..... 15

 Bob Paine – AECOM for Electric Power Research Institute..... 16

 Allen Dittenhoefer -- Enviroplan Consulting..... 16

 Qiguo Jing -- Breeze, Trinity Consultants 17

TABLE OF CONTENTS (Continued)

Bob Paine – AECOM..... 17

George Schewe -- Trinity Consultants 17

Sergio Guerra -- Wenck Associates, Inc. 17

Dana Wood – BP..... 18

Nicole Downey -- Earth System Sciences, LLC..... 18

Cindy Langworthy – UARG 19

Mark Bennett – CH2M Hill for Rio Tinto 19

Stephen Mueller -- Tennessee Valley Authority 20

Steve Gossett – Eastman Chemical Company & Bob Paine -- AECOM..... 20

Ashley Jones – Trinity Consultants..... 20

Anand Yegnan – ERM..... 21

Anand Yegnan – ERM..... 21

Eladio Knipping -- Electric Power Research Institute 22

Steven Hanna – Hanna Consultants on research supported by Defense Threat Reduction Agency 22

Steven Hanna – Hanna Consultants on research supported by Defense Threat Reduction Agency 23

David Long -- American Electric Power Service Corporation 23

Tony Colombari – Trinity Consultants 23

Justin Walters – Southern Company 24

Attachment C 1

 Presentations, Transcripts, and Docket Links 1

Attachment D..... 1

 Modeling Action Items and Prioritization Summary Table 1

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1.0 Introduction

Background

The Guideline on Air Quality Models (hereafter, called the *Guideline*, which is found in Appendix W to 40 CFR part 51), is used by the EPA, states and industry to prepare and review new source permits, source permit modifications, and State Implementation Plan submittals and revisions. The *Guideline* serves as a means by which national consistency is maintained in air quality analyses. We originally published the *Guideline* in April 1978, and it was incorporated by reference in the regulations for the Prevention of Significant Deterioration of Air Quality in June 1978. We revised the *Guideline* in 1986, and updated it with supplement A in 1987, supplement B in July 1993, and supplement C in August 1995. We published the *Guideline* as Appendix W to 40 CFR part 51 when we issued supplement B. We republished the *Guideline* in August 1996 (61 FR 41838) to adopt the CFR system for labeling paragraphs.

To support the process of developing and revising the *Guideline* during the period 1977–1988, we held the First, Second, and Third Conferences on Air Quality Modeling as required by CAA Section 320 to help standardize modeling procedures. These modeling conferences provided us with comments on the *Guideline* and associated revisions, thereby helping us introduce improved modeling techniques into the regulatory process.

In October 1988, we held the Fourth Conference on Air Quality Modeling to advise the public on new modeling techniques and to solicit comments to guide our consideration of any rulemaking needed to further revise the *Guideline*. We held the Fifth Conference in March 1991, which served as a public hearing for the proposed revisions to the *Guideline*. In August 1995, we held the Sixth Conference as a forum to update our available modeling tools with state-of-the-science techniques and for the public to offer new ideas. The Seventh Conference was held in June 2000 and served as a public hearing for the proposed changes to the recommended air quality models in the *Guideline* (now referred to as Appendix W) including the CALPUFF modeling system, AERMOD modeling system, and ISC–PRIME model. We held the Eighth Conference on Air Quality Modeling in September 2005, which provided details on changes to these recommended air quality models, including the Notice of Data Availability published in September 2003 related to the incorporation of the PRIME downwash algorithm in the AERMOD dispersion model in response to comments received from the Seventh Conference, and details on available methods for model performance evaluation. Additionally, at the Eighth Conference, there was a panel of experts discussion on the use of state-of-the-science prognostic meteorological data for informing the dispersion models.

The Ninth Conference on Air Quality Modeling held in October 2008. The conference began with an overview presentation and review of Appendix W and plans to reinstitute the Model Clearinghouse. Several presentations were made on non-guideline applications of dispersion models as well as a continuation of discussions from the Eighth Conference on the use of prognostic meteorological data with respect to informing the Appendix W models. Updates were provided on the regulatory status, recent coding changes, and future development of the AERMOD modeling system, the EPA's preferred model for near-field regulatory applications, and the CALPUFF modeling system, the EPA's preferred model for long-range transport of criteria pollutants and their impacts on Federal Class I areas. The Ninth Conference concluded

with a collection of presentations reviewing the available model evaluation methods and reviewing new and emerging models and techniques for future consideration under Appendix W.

The most recent conference, the Tenth Conference on Air Quality Modeling, was conducted from March 13 through 15, 2012. The conference followed a familiar agenda with initial status presentations on Appendix W, the Model Clearinghouse, and the currently preferred air quality models (AERMOD and CALPUFF). To conclude the first day of the conference, there was a review of the prognostic meteorological data processing tool for dispersion models, MMIF. Almost a full day of presentation and discussion was devoted to compliance demonstration modeling for the PM_{2.5} NAAQS and the 1-hour NO₂ and SO₂ NAAQS, including an overview presentation of the draft PM_{2.5} (primary and secondary) modeling guidance and presentations from the AERMOD Implementation Workgroup summarizing an ongoing NO₂ and SO₂ modeling study. Completing the second day of the conference, there was a review of new and emerging models/techniques for future consideration under Appendix W to address long-range transport and chemistry. The Tenth Conference on Air Quality Modeling concluded with a full day of public presentation and oral comments. A transcript of the proceedings and a copy of all written comments can be found in Docket ID No. EPA-HQ-OAR-2012-0056.

Summary of the Public Comments

This Summary of Public Comments document package contains a summary of the public comments filed in the Docket (EPA-HQ-OAR-2012-0056) for the 10th Conference on Air Quality Modeling. The main portion of this document is divided into seven topical areas that mimics the order of presentation and discussion during the conference proceedings. The seven topical areas are as follows: Model Clearinghouse and Procedural Comments; Comments on Development of Schedule to Address Comments and Implement Model Changes; Comments Related to AERMOD; Fugitive Dust Comments; Comments Related to CALPUFF; NAAQS Compliance Demonstration Comments; and, Emerging Models and Techniques Comments.

A brief summary of each of the individual comment submissions are provided in Attachment A. A bulleted summary of the public (non-EPA) presentations delivered during the three days of the conference are provided in Attachment B. The brief comment summaries and bulleted presentation summaries are solely for general reference and are not intended to supersede the actual comments submitted to the Docket or the presentation material and transcripts from the 10th Conference on Air Quality Modeling. For additional clarity, Internet links to the main conference website, the conference Docket, and the conference presentations and transcripts are provided in Attachment C.

Finally, a Modeling Action Items and Prioritization Summary Table is provided in Attachment D. This summary table outlines the EPA's near-term action items and long-term goals with respect to updates and modifications to the regulatory models (AERMOD and CALPUFF) and the *Guideline* that are necessary to address specific issues identified with these models, with current and future NAAQS compliance demonstrations, and with emerging models and techniques.

2.0 Model Clearinghouse and Procedural Comments

2.1 General Stakeholder Involvement

Numerous commenters (UARG, EEANC, SC, API, BP, AISI, NMA, NEDA, FI) make a case for greater involvement with EPA to ensure that the best tools are used in implementing the Clean Air Act. Furthermore, they recommend that EPA give tools developed by industry groups, and provided to EPA, the same consideration given to tools developed by EPA; this is particularly true if those models improve accuracy for regulatory purposes. The commenters recommend that EPA more frequently consult/work with stakeholders (including the scientific community) to promote a community approach to model development and acceptance that supports continual improvement in modeling science/data and timely model acceptance for use in the regulatory arena. Some commenters indicate that the stakeholder community is prepared to assist EPA by providing useful information on model evaluation/improvement, and such efforts could involve considerable investment in resources by stakeholders.

More specifically, commenters (including UARG, SC, API) recommend that EPA engage not only the regional, state and local agencies, but also the private sector, including consultants and industry, to achieve goals of improving the performance of both preferred and alternative models and for updating Appendix W. EPA should provide a clear path forward for approving model improvements that come from the modeling community, (e.g., AECOM recommendations on low wind speed, the SHARP and AERMINUTEplus processors for simulating sub-hourly meteorology in AERMOD). Also, the private sector should be invited to participate in the yearly State/local Modelers' Workshops, in addition to the Modeling Conference. Regional Chemistry Models (CMAQ, CAMx, and others) should also have a larger role in the EPA Air Modeling Conferences; while there is an annual CMAS conference, it does not provide a formal mechanism for public review and comment.

Another, more general option (API) for engagement is a workgroup process to involve and expand stakeholder and scientific input, similar to the planning conferences. This could also include support for model development and application from industry associations. EPA should continue increasing their communications and collaborations with the many groups studying modeling issues and include the wider community in planning, model development and evaluation, and analysis and review of results. Collaboration among EPA, Stakeholders and Researchers could include some or all of the following actions/activities: (1) EPA's consideration of comments from the 10th Modeling Conference and development of a research plan/schedule for addressing modeling issues; (2) communication and coordination within EPA (e.g., OAQPS and ORD), and external communication and collaboration with stakeholders such as industries, state agencies and consulting companies who must use the models, and with national and international scientists who are working on improving models; (3) EPA OAQPS's continued use of a technical work group to suggest technical solutions and provide technical review of new models and model revisions; (4) industry association provision of various technical resources and expertise for workgroup efforts that could be targeted toward fundamental program development, or alternatively at source-specific applications.

An even broader approach suggested in part by a number of commenters (EEANC, BP, AISI, NMA NEDA) involves a spirit of collaboration with stakeholders, independent of any

specific project. A panel of recognized experts (evenly split between state agencies, universities, public and industry) could be appointed to address modeling issues. The panel could: (1) provide short term research objectives along with measurable performance milestones; (2) provide feedback to EPA management regarding research needs; (3) help develop methods of reducing the time required to implement changes in the Modeling Guideline (Appendix W); (4) provide peer review of Model Clearinghouse actions; (5) provide technical peer review on changes to guideline models; (6) provide and publish determinations that demonstrate model accuracy is sufficient to meet the current policy needs; (7) address modeling issues and suggest changes to improve the accuracy of models used in NAAQS implementation; (8) help to develop a transparent process that solicits available expertise to refine air dispersion modeling and allows for public notice and comment rulemaking; (9) work with EPA, in advance of implementation guidance or changes to the modeling system, to exchange information and expertise that can avoid unintended or unforeseen consequences of EPA modeling tools and guidance.

2.2 Expanded Access to the Model Clearinghouse

Regarding the model clearinghouse, some commenters (EEANC, BP, NEDA) recommend that EPA re-invent and/or adopt another means of communicating technical developments to modelers on a regular basis. Toward this end, EPA should encourage and accept stakeholder input during efforts to improve the model clearinghouse process, contents and information; this will help reduce the likelihood of errors and deficiencies and the imposition of overly burdensome requirements in the resulting policies and guidance. Commenters expressed concern that the Model Clearinghouse process does not allow technical input by the affected parties (e.g., permit applicant). Typically, the permitting authority states their opinion and asks for Clearinghouse approval and no other involvement is allowed. Because more controversy is expected, the process needs to change and suggestions at the 10 Modeling Conference related to model acceptance criteria should be considered. Also, OAQPS needs to create a more dynamic tool in the near term for modelers to communicate to iron out problems and develop solutions that take advantage of technological innovations in the field. EPA should change the model clearinghouse process to allow the regulated community to bring questions and proposals directly to OAQPS if the states and the regions deny them; an approach whereby the affected parties are able to provide comment along with the permitting authority's correspondence to the Clearinghouse is also endorsed. This approach would provide a more open platform than monthly conference calls for encouraging States and regional EPA officials' participation and make existing models better by submitting them for discussion and resolution of issues in "real time." OAQPS should also establish a regulatory mechanism akin to the quarterly publication of NSPS/MACT, then post at an Internet website case-specific modeling issues and decisions. If necessary, the existing technical modeling stakeholder committee and/or a regional EPA modeling committee could be tasked with monthly modeling conference calls to "peer-review" and/or prioritize issues brought to the committee's attention.

Since modeling "determinations" by the model clearinghouse tend to memorialize case-specific resolutions, a commenter (NEDA) notes that such resolutions need not establish "precedent" for other modeling decisions or be cast so broadly to be of "national significance," as is the case with postings on the Model Clearinghouse. Instead the mechanism would provide a resource for modelers and regulators to exchange information. Resolutions, even temporary fixes and future rulemakings and shared data or Notices of Data Availability, also could be posted for

the modeling community, which presently seems to be unusually dependent on word of mouth for what is permissible, possibly permissible, and might happen in the future. Historical model clearinghouse guidance should be revisited, and state/local agencies should be given the ability to apply flexibility and judgment in consideration of source-specific circumstances.

2.3 Public Access to Model Evaluation Databases

Commenters (EEANC, API) indicate that the modeling community should have easy access to all field and laboratory model evaluation data bases used by the EPA to develop and evaluate models. EPA should keep this information on a devoted server and include adequate metadata. All the dispersion field results should be placed in a single data archive for easy public access.

2.4 Requirements of “Data Quality Act”

Finally, commenters (Koogler, FI) noted that information disseminated by EPA Conferences on Air Quality Modeling does not comply with EPA guidelines for compliance with the Data Quality Act. Revisions that lack model evaluation support, run contrary to long standing regulatory policy and guidance, and produce demonstrably erroneous results are often without the opportunity for independent peer review or public comment. Stakeholder input, including independent peer review, is often ignored or not otherwise integrated into final decision-making on data dissemination. In other instances, known data quality errors are consistently ignored. EPA should review its procedures for prioritizing, determining and disseminating information through the Conferences on Air Quality Monitoring process to ensure that data disseminated from these meetings are in compliance with EPA Guidance and the Data Quality Act. EPA should examine when and how stakeholder input is integrated into decision-making, how data are prioritized for review and revision, and how proposed changes to air models are validated before data dissemination.

2.5 Modeling Guidelines and Guideline Models Update Process

A variety of commenters (including UARG, EPRI, SC, DE, BP, NMA, Koogler, FI, and AF&PA) address issues concerning changes to the modeling guideline and/or revisions to guideline models and their application. Generally, they argue that such changes/revisions should lead to the best available models and modeling methods in Appendix W through a systematic and expeditious process. In their view, such a process has not been consistently followed and many aspects of the process of updating Appendix W are deficient. The current version, issued in 2005, of Appendix W is thought to be out of date with respect to both (1) the existence of known, but uncorrected, errors in the computer codes of the preferred models, and (2) the guidance needed to address the new and more stringent National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) increments that have been promulgated since 2005. The process of verifying reported errors in the preferred model codes needs to be accelerated, and known errors in the model codes must be corrected as soon as possible.

When it is necessary to add a model or modeling method to Appendix W (e.g., the “Modeling Guideline”), or to make revisions to the models and modeling methods currently in the Guideline that result in changes to modeled concentrations, each commenter made a case for one or more of the following steps. The steps should be taken by EPA as part of a public notice

and rulemaking process before a significant change can be made to the Modeling Guideline, or to Guideline-referenced models and modeling techniques. The steps include: (1) formally propose any change to the Guideline models/modeling methods in the Federal Register; (2) explain the basis for such proposed change, including documentation on the satisfactory performance of any new model or modified model, especially for the conditions to which it is to be applied; (3) consider a peer review mechanism as part of this comment process that evaluates the scientific principles, implementation of the principles into the model, and verification of any changes (peer review should include EPA ORD, academia and stakeholders); (4) give the States, regulated entities, modeling community, and the public a meaningful opportunity to comment on the proposed change(s); and (5) review and respond to any significant comments received during the notice-and-comment rulemaking, and as a result of any peer review. One commenter (BP) suggested that EPA develop a multi-step process over the next two years that facilitates changes to Appendix W, and incorporates the changes by reference without having to update Appendix W in its entirety. In conclusion, it was argued that EPA must assure that the performance of Guideline models is unbiased and does not lead to over predictions that force unnecessary action to address problems that aren't present in the real world. Modeling required by EPA should be transparent and open, facilitating engagement and collaboration with the modeling community. The turnaround time for evaluating changes to all guideline models, when those changes appear to better represent the current state of science, should be improved.

2.6 Ad-hoc Guidance, Clarification Memos, and Clearinghouse Activities

Commenters (DE, BP, NMA, Koogler, FI, AF&PA) also recommended that EPA propose implementation guidance/rulemaking at the same time new NAAQS are proposed through a notice and comment process that allows for stakeholder input, and necessitates an EPA response to those comments. It is postured that current regulatory practices consistently rely on untested models with hastily developed ad hoc agency “guidance”, including “clarification memoranda”, the Modeling Clearinghouse, internal memoranda to the EPA Regional Air Division Directors, general guidance memoranda, implementation guides, and draft/revised user’s guides. This ad hoc guidance has the effect of making promulgated standards significantly more stringent without formal rulemaking and is inconsistent with the Clean Air Act and basic principles of administrative law, relies on clearly unacceptable alternatives to notice-and comment rulemaking, and lacks any form of outside peer review, instead of encouraging and accepting stakeholder review and input. Moreover, repeated application of model algorithms beyond the scopes of their evaluated and recognized applicability and capability are simply not “good science”. Such EPA guidance was developed over the past two years to address a variety of previously unrecognized and/or underappreciated consequences of the new NAAQS. Even so, the most recent of such memos contain ambiguities, logical inconsistencies, unscientific recommendations and superfluous requirements, some of which are also contrary to the Appendix W modeling guidance. As a result of changes to the model, preprocessors and guidance, model performance must be reevaluated before use in demonstrating compliance with the SO₂ NAAQS. Furthermore, EPA should provide appropriate notice, and an opportunity for comment, prior to finalizing the rule requirement to use ambient air quality modeling for any approach, including a “hybrid” approach, to establish nonattainment areas. Overall, a deliberate rulemaking approach that seeks formal public input would be a more appropriate means for establishing modeling requirements that are firmly grounded in fundamental scientific principles.

Finally, as noted by one commenter (Koogler), the Model Clearinghouse should be revised in its content and its method of review and approval of updates to meet the demands of a shift to using modeling as a “hybrid” approach (i.e., monitoring to determine NAAQS status with modeling as an indicator). Also, EPA should not issue modeling guidance as non-binding if it intends to later treat that guidance as binding; there is a necessity for such guidance and related documentation in the Clearinghouse to undergo the rigors of proposed rules and the rulemaking process.

3.0 Comments on Development of Schedule to Address Comments and Implement Model Changes

Several commenters (Hunton & Williams for NAAQS Implementation Coalition, American Petroleum Institute, BP America, National Environmental Development Association’s Clean Air Project, Duke Energy, Camille Sears) recommended that EPA identify and develop a prioritized listing of all modeling deficiencies/issues, model fixes, and modeling studies that were identified as a result of the 10th Modeling Conference. A plan for near-term, mid-term and long-term focus should be developed (with outside peer review) that details specific Agency projects, budgets, timetables, completion dates, and methods to address these issues. Some commenters indicated a willingness to work with the Agency to appropriately address the issues.

EPA should discuss the plan with the modeling community, solicit input from stakeholders on the list of projects and the project priority, and publish the plan for public comment. During this planning and vetting process, EPA should provide interim solutions for situations where there is not an appropriate model at this time, and enhance case-by-case support to State and Local agencies on what models and protocols to use. At the end of this process, time to implement the modeling changes should be allowed, prior to requiring that sources demonstrate compliance with new NAAQS.

Following are general timetables and specific issues/projects that were suggested by individual commenters; Duke Energy and Camille Sears did not individually suggest detailed timetables

3.1 Hunton and Williams for NAAQS Implementation Coalition

1. Near-Term – Solutions for modeling problems that have already been developed and provided to EPA on which actions can be taken at least on an interim basis.
 - a. AERMOD overstates ambient impact of fugitive particulate emissions – use a preprocessing step that would reduce emission factors for fugitive sources of PM which parallel the EPA-approved approach to modeling fugitive emissions with CMAQ; similar fixes are also applicable to fugitive emissions of SO₂ and NO₂. (see references)
 - b. AERMOD substantially over-predicts at low wind speeds – adjust “critical wind speed” and minimum hourly averaged sigma (see reference)
 - c. AERMOD does not model buoyant line sources – use BLP for final plume rise and model sources in AERMOD as volume sources.
 - d. AERMOD can be improved for NO₂ concentration estimates – implement ARM2 for predicting the ratio of NO₂ to NO_x as a more refined Tier 3 method.

- e. Updates to CALPUFF (version 6) provided to EPA improves the chemistry and other upgrades that produce significantly improved performance for NO₂ over the default FLAG chemistry options.
 - f. Improve implementation of newer NAAQS by clarifying or changing EPA policy
 - i. EPA should issue guidance reminding Regions/States that the use of monitoring data, particularly for existing sources, may be appropriate in characterizing source impacts.
 - ii. Provide guidance for prediction of ambient concentrations based on treatment of emissions from existing sources and determination of background concentrations. It is unrealistic to assume that all modeled point sources operate continuously at their maximum permitted or enforceable emission rate; modeling with actual emission should be considered if they are available. Variability of emissions should be considered and maximum allowed emissions should not be set at the level of the actual emissions, e.g., steel industry. Also, emphasize use of background concentrations based on monitors near sources and paired in time with relevant meteorological conditions.
 - iii. Less conservative levels should be used for SILs. They should be based on the percentile values on which compliance with the NO₂ and SO₂ NAAQS are judged, not the highest predicted impact.
2. Mid-Term – issues that require rulemaking over the next year or two; there is no need to wait for the next modeling conference.
- a. Include both industry-developed model modifications, as well as EPA modifications including changes involving AERMINUTE, BPIP and AERSURFACE.
 - b. Consider AERMINUTEPlus developed by EPRI which is currently undergoing testing.
 - c. Establish SILs to define when a source’s impact is sufficiently small to eliminate the need for a comprehensive air quality analysis.
 - d. Provide interim solutions for situations where there is not an appropriate model at this time and provide a plan for developing appropriate models, e.g., hourly NO₂ impacts of proposed sources could be limited to annual estimates based on BACT for NO_x, monitoring to insure compliance with the 1-hour NAAQS, and a plan to end “unforeseen difficulties”.
3. Long-Term – issues that require new research.
- a. A model to estimate the contribution of an individual source to ambient concentrations of PM_{2.5} and ozone with the required complex chemistry and meteorology.
 - b. The impact of fugitive PM_{2.5} emissions.
 - c. Performance re-evaluation of preferred models, e.g., AERMOD with newer modifications and for 1-hour concentrations in a probabilistic form consistent with new NAAQS. This may be accompanied by the need for new databases with respect to near-field impacts, impacts in complex terrain and low wind speed conditions.
 - d. Characterization of uncertainty in modeled concentrations and treatment of uncertainty in demonstrating NAAQS compliance. This is particularly important in multi-model applications such as those associated with the secondary NO₂ and SO₂ NAAQS.

Generally develop and demonstrate modeling tools that provide realistic and relatively certain predictions as new NAAQS are developed.

3.2 American Petroleum Institute

Key recommendations for EPA action are summarized below for implementation periods characterized as Short-Term (0 – 1 years), Mid-Term (1 – 3 years) or Long-Term (3+ years).

1. AERMOD NO₂ Plume Chemistry –
 - a. (ST) Issue guidance allowing use of Ambient Ratio Method 2 (ARM2) as a Tier 2 method.
 - b. (ST) Continue collaborating with the API on improvements to the PVMRM (a Tier 3 method). Make the AERMOD PVMRM formulas (e.g., relative dispersion) consistent with the original formulations by Hanrahan.
 - c. (MT) Evaluate other more sophisticated NO₂ plume chemistry models such as SCICHEM and RPM; adopt those plume chemistry models if the more complete chemical mechanisms provide significantly better accuracy than AERMOD/PVMRM.
 - d. (LT) Consider new NO₂ field experiments involving shorter stacks, source emissions sampling, and ground level sampling where ozone, NO and NO₂ are measured.
2. AERMOD Over-predictions in Stable Low Wind Conditions
 - a. (ST) Resolve the stable low wind problem with AERMOD by means of science-based revisions to the boundary layer and dispersion formulas. Specific technical recommendations are listed in the attached report and are a combination of recommendations from the Paine et al. (2010) report plus more recent analyses.
 - b. (ST) Change the critical wind speed in the AERMOD formula for deriving u^* in very stable conditions, thus increasing u^* as well as turbulent speeds and the derived mixing depth during low wind conditions.
 - c. (ST) Increase the “minimum σ_v and σ_w ” so as to avoid very low values which lead to unrealistic over-predictions of concentrations.
 - d. (ST) Modify the weighting factors in the AERMOD low wind method of averaging the meander (pancake) and coherent plumes. The meander (pancake) component should receive a larger weighting than at present.
 - e. (MT) Change the wind and temperature profiling methods in AERMOD so as to assure smoother profiles in conditions when the input wind observation height is above or near the mixing height at night.
 - f. (LT) Explore better use of sub-hourly (2 min average) meteorological data available from the NWS airport sites.
3. CALPUFF Regulatory Model
 - a. (ST) Adopt the current version of CALPUFF with improved chemistry (e.g., v 6.42) as the regulatory version.
4. AERMOD GEP Stack Height Formula and Building Downwash Modeling
 - a. (ST) Return to the previous practice of allowing “Equivalent Building Dimensions” (EBDs) for open lattice and porous structures and allow CFD models to contribute to the decision process.
 - b. (MT) Evaluate the accuracy of plume downwash conditions for short stacks and light wind speeds using the AGA and other relevant databases; vertical profiles of meteorology in stable conditions should also be reviewed.

5. AERMOD Extrapolation of Airport Wind Observations to Other Sites
 - a. (ST) Return to the previous 3 km radius method for estimating surface roughness length z_0 around a site. The recent change to a 1 km radius is too small.
 - b. (LT) Use resistance relations suggested by Blackadar and Zilitinkevich to more realistically develop wind profiles at the modeled site.
 6. Use of Observed Emissions and Monitored Concentrations
 - a. (ST) EPA should issue a reminder to the Regional offices and the states regarding the availability of the option in Section 10.2.2 of Appendix W for use of monitoring in lieu of modeling when there are no suitable models for use in NSR permitting.
 - b. (ST) SO₂ area designations should be made primarily using monitoring data as opposed to using model-predicted concentration estimates.
 7. Regional Chemistry Models (CMAQ, CAMx, and others)
 - a. (MT) Regional chemistry models should have a larger role in the EPA Air Modeling Conferences. While there is an annual CMAS conference, it does not provide a formal mechanism for public review and comment
 8. Background Concentrations
 - a. (ST) The background concentrations should conform to the averaging times (e.g., one hour, one day, annual) and the spatial domain (e.g., 10 km, 100 km, 500 km) of the scenario being modeled.
 - b. (LT) Methods should be devised for use in defining and determining background concentrations in areas with many sources at local and mesoscale distances to void problems such as double-counting in modeling for compliance determinations.
 9. Model Evaluation and Data Bases
 - a. (ST) The modeling community should have easy access to all field and laboratory data bases used by the EPA to develop and evaluate models. EPA should keep this information on a devoted server and include adequate metadata.
 10. Collaboration among EPA, Stakeholders and Researchers
 - a. (ST) EPA should consider the comments from the 10th Modeling Conference and develop a research plan and schedule for addressing modeling issues.
 - b. (ST) There should be communication and coordination within EPA (e.g., OAQPS and ORD), and external communication and collaboration with stakeholders such as industries, state agencies and consulting companies who must use the models, and with national and international scientists who are working on improving models.
- (ST) EPA OAQPS should continue to use a technical work group to suggest technical solutions and provide technical review of new models and model revisions.

3.3 BP America

An EPA plan should address the recommendations provided below.

1. Use of Air Quality Models in a Regulatory Setting (ongoing activity over the next 0-2 years) – EPA should get input from stakeholders and publish its determination that demonstrates model accuracy is sufficient to meet the current policy needs. If EPA concludes that model accuracy does not provide a tool for policy use, then alternative approaches that could be used for meeting current policy needs include coupling modeling and monitoring and use of modeling in more of a relative mode as in the case

- of PM and ozone modeling, or to base compliance with the NAAQS using a combination of BACT and ambient monitoring as allowed under Section 10 of the Guideline
2. Determination of Model Accuracy – EPA Model Evaluations (ongoing activity over the next 0-2 years) – EPA should re-examine the previous AERMOD evaluations for a 1-hour period and determine what limitations exist in the current model evaluations that need further analysis; model accuracy should be tested and conclusions reached regarding sub-categories such as stack height, downwash, and meteorological conditions (including low wind speeds).
 3. Low Wind Speeds (short term high priority to address over the next year) – EPA should review the API low wind speed modifications to AERMOD and suggest modifications to address deficiencies, then subject model revisions to peer review and public comment; until review and revisions to AERMOD are completed, EPA should revert to the previous definition of calm wind speed (<1 m/s = calm).
 4. NO₂ 1-hour Modeling (short term high priority to address over the next year) – EPA should review and implement the NO₂ Ambient Ratio Method 2 and corrections to AERMOD PVMRM that API has identified; evaluate other NO₂ models beyond AERMOD PVMRM and OLM such as SCICHEM.
 5. Overarching Procedural Concerns (ongoing activity over the next 0-2 years) – EPA should develop a process that facilitates changes to Appendix W. When changes are required, EPA needs to publish draft changes, accept comments, respond to comments in a final document, and incorporate the changes by reference without having to update the entire Appendix W.
 6. EPA also needs to develop a peer review process. Such a process needs to evaluate the scientific principles, implementation of the principles into the model and evaluate the verification of any changes. Peer review must include EPA ORD, academia and other stakeholders. In addition, EPA must adequately address the concerns raised by any peer review group.
 7. EPA should change the model clearinghouse process to allow the regulated community to bring questions and proposals directly to OAQPS if the states and the regions deny them.
 8. AQRV Analysis (short term high priority to address over the next year) – EPA should incorporate the new version of CALPUFF that API had developed which includes both corrections to errors in the existing gas-phase chemistry module, as well as incorporation of new science modules for inorganic and organic aerosols and aqueous-phase chemistry into the Guideline. Related steps include:
 - a. Add a post-processing step to recalculate inorganic aerosol equilibrium at receptor locations to address lack of treatment of ammonia limitation for multiple or overlapping puffs.
 - b. Add an upper limit for particulate nitrate formation that is based on the amount of ammonia available in the background in CALPUFF to prevent the output of particulate ammonium nitrate concentrations that are physically unrealistic and when CALPUFF does not conserve mass of ammonia (as is the case in the current model).
 - c. Incorporate into the Guideline CALPUFF with the improved RIVAD chemistry.
 9. Portable Sources (short term high priority to address over the next year) – EPA needs to revise the February 2012 memo regarding modeling of temporary sources. BP has outlined an approach that can be used to address impacts or sources that do not remain at a fixed location for a 3-year period.

3.4 The National Environmental Development Association's Clean Air Project

High priority, near-term (3 months) refinement of EPA's preferred dispersion Models

1. Allow use of AERMINUTE permissively but do not mandate its use.
 - a. Allow sources to use available air monitoring data to pair monitored values and hourly emissions.
 - b. By waiving the use of AERMINUTE, incentivize partnerships between state air authorities and sources for the collection of real time meteorological data.
2. Aggressively prioritize refinements to AERMOD for modeling building downwash for low wind speeds and cases with large or long buildings.
 - a. Approve approaches for accurately modeling buoyant plumes from line/volume sources.
 - b. Allow the use of post construction monitoring at receptors with high predicted impacts to allow construction of new sources and provide technical input for model refinements. If necessary, back up monitoring with permit conditions if certain values are exceeded.
3. Prioritize refinements to dispersion models for low wind speeds. In the interim, establish or set a lower wind speed threshold of 1 meter per second.
4. Allow a set ground level 1st layer mixing height at 68 meters (minimum) pending completion of technical work to confirm a lower mixing height is real and suitable for use.
5. Recognize and use the form of each NAAQS to determine the modeled design value. Just as EPA allows modeling of the 8th high for NO₂ (98th percentile), and 4th high for SO₂ (99th percentile), modeling for PM_{2.5} should evaluate the 8th high (98th percentile).
6. Approve modelers' use of the American Petroleum Institute's corrections to AERMOD PVMRM for NO₂, the NO₂ Ambient Ratio Method 2, the low wind modifications to AERMOD, and the new version of CALPUFF with updated chemistry.
7. Give careful consideration to avoiding double-counting impacts in modeling and background. In particular, background should be determined on an event basis.

4.0 Comments Related to AERMOD

4.1 Low Wind Speeds

Since EPA is advocating the use of computer models to determine nonattainment for sources, several commenters (NIC, DE, AF&PA) note that EPA must provide accurate, stable modeling tools and guidance for industry during periods of significant capital investments to meet new regulatory requirements. EPA must also require improved model performance to ensure that the control measures required of sources are appropriate without being excessive. However, it is argued that AERMOD significantly over predicts SO₂ concentrations, especially at low wind speeds, and thus the current models are not reliable enough to be used as the basis for classifying an area as nonattainment. An analysis by one commenter (DE) shows the model predicts that receptors located in the vicinity of the monitors would not attain the one-hour SO₂ standard, while the actual on-site monitors show that the facility is complying with the standard. EPA should make needed changes to update the regulatory modeling system by addressing well-characterized bugs and systematic performance issues, prioritize refinements to dispersion

models especially those for low wind speeds, and then establish a stable modeling platform for consistent use during implementation of new regulatory programs.

Commenters (NIC, UARG, EPRI, EEANC, OPC, API, BP, AISI, WMA, ACW, BGNA, PE, AF&PA, NDDH) indicate that a performance re-evaluation of preferred models, e.g., AERMOD, with newer modifications and for 1-hour concentrations in a probabilistic form consistent with new NAAQS is necessary; this may be accompanied by the need for new databases with respect to near-field impacts, impacts in complex terrain, and low wind speed conditions. Model performance evaluations should focus on the highest (upper quantile) predictions, and need not include distribution where observations have fallen to less than minimum detectable values. Topics such as treatment of low wind speeds, terrain height variations, AERMINUTE, downwash effects, actual emission rates, national consistency in selection of model input data, application of AERSURFACE with land cover data bases, and the basis for determining roughness length (AERMET) all require further attention by EPA, as well as the opportunity for public input. EPA should re-examine the previous AERMOD evaluations for a 1-hour period and determine what limitations exist in the current model evaluations that need further analysis; model accuracy should be tested and conclusions reached regarding sub-categories such as stack height, downwash, and meteorological conditions (including low wind speeds). Commenters (NIC, UARG) urge that both industry-developed model modifications, as well as EPA modifications, should be considered in improvements to AERMOD, including changes involving AERMINUTEplus, BPIP and AERSURFACE. One commenter (Sears) notes though that contrary to comment by some industry representatives, AERMOD's evaluation analyses do include a number of site-specific meteorological data sets that incorporate low wind speed conditions.

A number of examples are given by commenters (NIC, UARG, EPRI, EEANC, OPC, API, BP, AISI, NMA, NEDA, AF&PA, FI) regarding a perceived lack of evaluation and consequence analysis for changes to AERMOD after it was formally promulgated. Inclusion of low wind speeds (<1 mps) which result in higher concentrations, especially with AERMOD and low level sources is most frequently addressed. It is claimed that AERMOD's tendency to overestimate concentrations at low wind speeds is exacerbated by implementation of AERMET and AERMINUTE. There has not been sufficient justification and verification regarding the validity of the resulting estimates. AERMINUTE was implemented with access to many Automated Surface Observing System (ASOS) stations that have sonic anemometer instrumentation with a near-zero starting wind speed threshold; this change has not received public review and comment. In general, EPA should review low wind speed modifications to AERMOD to better simulate transport and dispersion that are proposed by various commenters and suggest modifications to address deficiencies; model revisions should then be subjected to peer review and public comment. For example, EPA is urged to act expeditiously to (1) adopt the fix developed by AECOM for AERMOD under low wind speed conditions, (2) adopt recommendations made by Paine & Heinold, (3) approve modelers' use of API's corrections to the low wind modifications to make AERMOD's predictions more accurate, and/or (4) consider EPRI's approach (SHARP) to run with AERMOD that allows the model to simulate low wind conditions more accurately and has undergone evaluation on two low wind speed databases. Generally, there should be a thorough review and attention to all associated model formulation issues. Until review and revisions to AERMOD are completed and tested to more accurately

simulate transport and dispersion under low wind speed conditions, many commenters recommend that AERMOD results for low wind speeds (<1 mps) are not valid and should not be included in model results (as is currently the case for “calm” conditions) until these AERMOD revisions are implemented and tested. For the interim, EPA should revert to the previous definition of calm wind speed (<1 mps = calm); EPA should also allow a set ground level 1st layer mixing height at 68 meters (minimum) pending completion of technical work to confirm a lower mixing height is real and suitable for use. Furthermore, the use of AERMINUTE should be allowed permissively, but its use should not be mandated; by waiving the use of AERMINUTE, incentives for partnerships between state air authorities and sources for the collection of real time meteorological data can be pursued.

Other specific recommendations to deal with AERMOD over-predictions in stable low wind conditions include: (1) address API/UARG technical recommendations on AERSURFACE changes that have effectively reduced the surface roughness and consequently changed the wind profile in stable conditions, resulting in higher concentrations; (2) resolve the stable low wind problem with AERMOD by means of science-based revisions to the boundary layer and dispersion formulas (specific technical recommendations are listed in an attached report and are a combination of recommendations from the Paine et al. (2010) report plus more recent analyses); (3) change the critical wind speed in the AERMOD formula for deriving u^* in very stable conditions, thus increasing u^* as well as turbulent speeds and the derived mixing depth during low wind conditions; (4) increase the “minimum σ_v and σ_w ” so as to avoid very low values which lead to unrealistic over-predictions of concentrations; (5) modify the weighting factors in the AERMOD low wind method of averaging the meander (pancake) and coherent plumes to receive a larger weighting than at present; (6) change the wind and temperature profiling methods in AERMOD so as to assure smoother profiles in conditions when the input wind observation height is above or near the mixing height at night; (7) explore better use of sub-hourly (2 min average) meteorological data available from the NWS airport sites; (8) incorporate urban canopy formulas in AERMOD for wind and turbulence profiles in urban dispersion conditions; and (9) treat industrial facilities with substantial “fugitive heat” releases as urban areas.

Commenters (API, NDDH) also suggest that, for AERMOD (AERMET) modeling, surface characteristics for the primary source location should be used, rather than the meteorological data (wind measurement) site. EPA has provided no substantive justification, nor side-by-side performance tests, on why use of surface characteristics for the primary source location isn't preferable. A return to the previous 3 km radius method for estimating surface roughness length z_0 around a site is justified, since the recent change to a 1 km radius is too small; use of resistance relations suggested by Blackadar and Zilitinkevich to more realistically develop wind profiles at the modeled site is appropriate.

Another commenter (EEANC) argues that models use a one-hour time increment that is inappropriate for a one-hour standard. Too much weight is given to the rare times when the wind direction lines up with a particular receptor; the variation of wind direction within the hour is not accounted for in the meteorological data used in the modeling and therefore biases the results when compared to a one hour standard. AERMOD might be modified to more easily identify meteorological conditions and model details which would promote broader understanding of

sensitivities and case-specific model attributes. A suggestion by another commenter (AEPSC) for dealing with 1-hour issues is to use short term meteorological data in the model itself and integrate these shorter increments into a one hour value.

4.2 Treatment of Downwash

Several commenters (EEANC, OPC, API, A&WMA, FI, Exponent, Coulter) note that EPA has modified the AERMOD code to consider potential downwash effects for stack heights that equal or exceed the EPA GEP formula height. This code modification seems to represent a revision to the algorithms within the model and appears to overturn 25 years of regulatory policy and guidance with respect to modeling the emissions from stacks whose heights equal or exceed the Good Engineering Practice (GEP) formula height; emissions from stacks whose heights exceed the GEP formula height are now subject to the calculation of aerodynamic downwash in any Appendix W guideline model. One commenter (Exponent) further pointed out that the changes made to AERMOD are an extrapolation of the PRIME algorithm beyond the range of data used in its development. There has been no opportunity for public comment and no justification or consequence analysis has been provided. Until EPA provides a justification and consequence, the change to downwash procedures should be removed from the regulatory version of AERMOD and there should be a return to the previous practice of allowing (1) “Equivalent Building Dimensions” (EBDs) for open lattice and porous structures and (2) use of CFD models to contribute to the decision process. An independent peer review and evaluation should be conducted for stacks above formula height; the evaluations should be bundled with the independent review and evaluation of the effective length parameter in BPIPFRM. Ultimately, public peer review and comment should be allowed for this model change.

Several commenters (AISI, API, NMA, A&WMA, NEDA) note that changes made to the downwash code with AERMOD version 11059 lead to significant increases in predicted concentrations for light winds (<1 mps) and for unique building (wide/long) shapes with short stacks. EPA has presented no data to justify the technical basis for the specific algorithms used above GEP formula height or a consequence analysis of changes, especially for long buildings where the effects are greatest; also, the changes did not undergo public review or comment. As a result, the commenters indicate that: (1) the PRIME downwash algorithm for light winds (< 1 mps) and excess heat releases should be limited until profiles of wind, temperature and turbulence during periods of light winds and stable conditions are improved; (2) the accuracy of plume downwash conditions for short stacks and light wind speeds should be evaluated using the AGA, and other relevant databases and vertical profiles of meteorology in stable conditions should also be reviewed; (3) EPA should aggressively prioritize refinements to AERMOD for modeling building downwash for low wind speeds and cases with large or long buildings; (4) any new model changes such as effective building dimensions should be subject to a transparent public review process with independent scientific review and evaluation prior to its use in regulatory applications; (5) EPA should consider proposed threshold wind speeds for downwash effects to minimize AERMOD over-prediction of building downwash for certain geometries and wind speeds; (6) while the known problems with AERMOD for long buildings are being addressed, EPA should allow Section 3.2 Petitions (use of alternative models) to address the problem with AERMOD for very wide buildings, such as aluminum reduction facilities; (7) EPA should approve approaches for accurately modeling buoyant plumes from line/volume sources; and (8) EPA should approve the use of post construction monitoring at receptors with high

predicted impacts to allow construction of new sources, provide technical input for model refinements, and if necessary, back up monitoring with permit conditions if certain values are exceeded.

On commenter (A&WMA) suggests that, since EBD may be the only alternative to obtaining accurate concentration estimates for some building configurations, a method is needed to streamline the process for using EBDs. Some things that would help streamline this process are: (1) clear guidelines on how to conduct an EBD study; (2) interaction with the ultimate decision makers at EPA in the protocol development and approval process; (3) actual EPA approval of the EBD protocol prior to conducting the study; (4) cooperative interaction with EPA during the EBD study and preliminary report phase where results are reviewed and if necessary changes made to the EBD testing method prior to issuance of a final report; (5) a timely review and approval process; and (6) some assurance that once a final report is issued, the EBD values will be approved for use. Two optional methods whereby this streamlined process could be developed for EBD include: (1) form an Industry/EPA work group tasked with developing guidance for conducting EBD evaluations; this guidance could then be published like that for determining GEP stack heights and could include a checklist reviewed by EPA to ensure that all studies are conducted in a consistent manner; or (2) wait for the next EBD protocol to be submitted to the EPA Model Clearinghouse for review and comment; once the protocol is completed and approved, it could be used as a template for future EBD studies.

4.3 Modeling Domain Limitation

Several commenters (EPRI, API, WMA, ACW, BGNA, PE) note that EPA considers 50 km as the appropriate distance for the applicability of a steady-state model without a clear scientific basis. Commenters claim that analyses have been conducted demonstrating that a more reasonable distance limit for steady-state models used for hourly applications, such as those required by the one-hour NO₂ and SO₂ NAAQS, is 20 km. The use of a steady-state model beyond 20 km can result in unrealistically high modeled concentrations and therefore is not recommended; it is highly likely that multiple hours of transport are required and as such, the typical hour-by-hour changes in the transport winds and dispersion conditions lead to distortions in steady-state model predictions. Inter-model comparisons reveal the expected over-prediction for a steady-state vs. a non-steady-state model, which are clearly evident for receptor distances exceeding 20 km.

Commenters recommend that, unless meteorological conditions are persistent (similar wind speed and direction) in succeeding hours, model-predicted concentrations at receptors beyond the one-hour travel distance should not be accepted as meaningful. AERMOD should be modified to delete such concentrations from the output, or at least provide a notification to the user to disregard such results in interpreting the model output. EPRI has developed additional code that provides warnings on predictions for transport exceeding one hour; the information in this file will be useful for determining general information for the plume transport from each source to the receptor with the highest hourly concentration.

More importantly, commenters (EPRI, NDDH, Koogler) point out that for cumulative modeling involving other sources, it is presumed that an inventory of sources out to the applicable modeling distance (50 km) must be obtained; the use of an overly large distance for

the applicability of a steady-state model is expected to generally result in a misrepresentation of the source-to-receptor transport and dispersion, as well as an over-prediction tendency for the worst-case concentration. This is another reason for limiting the application of AERMOD to distances of 20 kilometers or less; that is, AERMOD should be used only when all nearby sources are located within 20 kilometers of the subject or primary source. If nearby sources (which must be included in the cumulative analysis) are located more than 20 kilometers from the primary source, the steady-state AERMOD model will not be adequate, and CALPUFF (or possibly similar dynamic model) should be used instead. Similarly, there are limitations to AERMOD in areas of complex terrain and in areas where there is a significant land/water interface. Due to the steady-state transport limitation of AERMOD, there is a tendency to over-prediction of impact at mid-range and long-range target receptors. As a consequence, commenters (EPRI, API) suggest that EPA plan for use of a Lagrangian puff model like CALPUFF/SCIPUFF at distances less than 50km, and at all distances within the next few years.

4.4 AERMOD Update Process

Several of the commenters (UARG, EPRI, SC, DE) noted, specifically with regard to changes in AERMOD, model updates and policy decisions that EPA has not offered the public a chance to review and comment, nor allowed for peer review. This is true since the time that AERMOD was promulgated, even though such developments have significantly changed the model's predictions for various conditions and applications. These developments include: meteorological inputs to AERMOD (e.g., the performance of AERMOD with the AERMINUTE processor) and the treatment of GEP stack height and downwash (e.g., the change to AERMOD in MCB #4 that alters the PRIME downwash algorithms). Because of the potential impact on the regulated community and the wealth of external technical experience available, EPA must reconsider the entire AERMOD system (AERMOD, preprocessors and modeling guidance), including AERMAP, AERSURFACE, AERMET and AERMINUTE. It is noted that modeling systems for CALPUFF must be treated in a comparable way, and the above public notice and rulemaking process needs to be followed for all modeling systems. Also, the model version relied upon by the State and EPA must remain valid for clearly defined time periods or on the basis of some predictable measure that provides the regulated community assurance of the valid application of a model and its results, e.g. revision to AERMOD downwash.

4.5 Buoyant Line Sources

Commenters (NIC, AISI) note that AERMOD does not model buoyant line sources. As a result, they recommend that BLP be used for final plume rise on an hourly basis and that sources be modeled as volume sources in AERMOD.

5.0 Fugitive Dust Comments

5.1 Treatment of Emissions and Modeling for Surface Mines

Commenters (NIC, NMA, AISI) expressed concern that EPA emission factors and models like AERMOD overstate the short-term ambient impacts of fugitive particulate emissions, especially those from surface mines. This can be resolved by using a preprocessing step that reduces emission factors for fugitive sources of PM that parallels the EPA-approved approach to modeling fugitive emissions with CMAQ; similar fixes are also applicable to

fugitive emissions of SO₂ and NO₂. A number of source modeling related issues/findings are identified: (1) AERMOD is designed to predict steady state emissions from stacks, and has not proven capable of accurately predicting contributions to ambient concentrations from the fugitive, mobile, and variable sources; (2) significant work has been done to assess the underlying technical problems contributing to the over-prediction bias for non-stack sources in AERMOD that are driven by multiple layers of conservative assumptions, including uncertainties associated with fugitive emissions or other non-stack sources and unique dispersion characteristics and depletion/removal features associated with these sources; (3) the over-prediction bias can be reduced by use of actual hourly emissions or reasonable worst case emissions rates in their absence, actual meteorological data instead of worst case assumptions, and actual monitored background concentrations; (4) plausible receptor locations should be used where the public has reasonable access and can stay stationary for the entire period associated with an ambient standard, rather than including transportation corridors; and (5) use of ambient monitoring is the only way to reliably measure the ambient impact of surface mine fugitive sources.

To improve model performance, two commenters (NMA, AISI) recommend that EPA implement several readily available revisions that address emissions preprocessing related to near-source plume-depletion mechanisms and conservative source configuration properties. These include: (1) considering the concept of “transportable fractions” of fugitive dust as a function of ground cover bordering the source of the fugitive dust in AERMOD applications; (2) applying a 50% reduction for haul road and for pits, as well as a 50% reduction for other fugitive particulate emissions from mining operations to account for plume depletion mechanisms and inadequate treatment of plume dynamics by AERMOD; (3) applying a preprocessing reduction of 75% for fugitive particulate emissions within the confines of the pit to account for AERMOD’s improper representation of pit retention; and (4) improving how AERMOD treats haul roads, slag pits, and material handling by how the source is represented in the model input using techniques described in attached materials. Field test data should subsequently be obtained to confirm the magnitude of the reduction factor.

In addition, several commenters (WMA, ACW, BGNA, PE) note that EPA guidance for intermittent sources, e.g., blasting activities at surface mines, is vague and overly conservative and that States have adopted various interpretations. AERMOD, which assumes continuous and constant emissions over a one-hour time span, is not capable of validly modeling the nearly instantaneous blasting source; in its regulatory form it is not an appropriate methodology, as ground-level concentrations are generally over-predicted. Field studies that are well-designed are required to better define blasting emissions and dispersion, the results of which could be used to better analyze the assessment of blasting impacts. A probability approach to quantifying blasting impacts would be appropriate, rather than determining the maximum possible impact given blasting on some or all hours of the year. EPA should provide definitive guidance for modeling this type of source that is based on a realistic evaluation of the likelihood that an intermittent source will threaten the standards, and should be supported by sound science; see example relative to probability-based approaches. This approach would permit EPA to avoid the necessity for extensive modeling analyses, and would also prevent the need for unnecessary source modifications that result from overly conservative impact estimates.

5.2 Relevance to CAA, Section 234

Commenters (NMA, WMA, ACW, BGNA) indicated that the application of currently-approved models to fugitive particulate emissions from surface mining operations, as well as to the 1-hour NO₂ and SO₂ standards, is of concern. EPA's assessment of these operations must begin with a longstanding congressional mandate (i.e., CAA Section 234). That section of the CAA indicates that there may be unacceptable performance of EPA models and emission factors when applied to fugitive particulate emissions from surface mining operations on a short term basis, and it establishes alternative regulatory approaches when EPA's models and emission factors result in excessive and unacceptable levels of over-prediction. In addition, AP-42 notes that haul road emission factors should be used with caution and awareness of their likely limitations. To date, no satisfactory revisions have been made to models or emission factors. Yet current regulatory practice has required the modeling of fugitive emissions on a short term basis from surface mining operations in almost every state except Wyoming.

These commenters also state that a memorandum of agreement indicates that ISC3 will not be used for regulatory application involving surface coal mines, and that monitoring in lieu of modeling is acceptable for assessing coal mining-related impacts in the Powder River Basin. Replacement of ISC3 with AERMOD doesn't rectify this. EPA must re-visit the statutory prohibition/mandate before either EPA or the States require future modeling of PM₁₀ and PM_{2.5} emissions from surface mining operations on a short-term basis. In addition, one commenter (BGNA) notes, concerning unacceptable performance of EPA models, that even though Section 234 specifically addresses surface coal mines, the factors and modeling algorithms that are uncertain for coal mining operations are equally uncertain for other types of surface mining activities; therefore, there is no scientific basis for these air models to treat hardrock surface mining different from surface coal mining. Until emission factors and modeling methods can be shown to provide accurate predictions, EPA has to adhere to the statutory prohibition that prevents it from relying on dispersion models for particulate impacts associated with surface coal mining activities.

6.0 Comments Related to CALPUFF

6.1 Adoption of Improvements to CALPUFF

Many Commenters (NIC, UARG, APS, SRP, Tri-State, West, API, BP, NDDH, NEDA, and FI) indicate that the EPA-recommended version of CALPUFF should always be the most technically advanced. As a result, they believe that EPA should replace out-dated CALPUFF 5.8 with the scientifically superior version of CALPUFF (e.g., v 6.42). Updates/upgrades to CALPUFF (version 6) provided to EPA improve the chemistry and produce significantly better performance for NO₂ over the default FLAG chemistry options. The new chemistry module has been proposed, tested and evaluated; studies demonstrate that CALPUFF 6.4 has superior predictive capability when compared to CALPUFF 5.8's over prediction of nitrates. In addition, CALPUFF Version 6.4 has been found to provide equivalent results to the regulatory version (5.8) when the same options and data are used. The new version (6.4) is "backward compatible" with the regulatory version when run with the same inputs and data, if the new chemistry option is turned off and the bug-fixes are applied in CALPUFF 5.8. Supporting documentation on the relative performance of subject versions of CALPUFF is provided by commenters. Due to the

demonstrated superiority of the chemistry in CALPUFF 6.4, its more accurate predictions of particulate nitrate formation, and its wide acceptance in the scientific community, EPA should encourage modeling demonstrations using CALPUFF 6.4 for NO_x emission reductions.

In any case, these commenters believe that CALPUFF documentation needs to stay current with the recommended version of the model. CALPUFF should be upgraded to correct all known bug fixes and other minor updates should be implemented immediately as released in model change bulletins (or users should be allowed to implement bug fixes themselves) without any testing requirement. EPA should implement the well documented enhancements that have been developed since the 9th Modeling Conference, following the timely opportunity for public comment and participation. To save time, testing to support new versions should be based on third party as well as EPA evaluations. More specifically, for AQRV analyses, EPA should incorporate the new version of CALPUFF which includes both corrections to errors in the existing gas-phase chemistry module, as well as incorporation of new science modules for inorganic and organic aerosols and aqueous-phase chemistry into the Guideline. Related steps include: (1) adding a post-processing step to recalculate inorganic aerosol equilibrium at receptor locations to address lack of treatment of ammonia limitation for multiple or overlapping puffs; (2) adding an upper limit for particulate nitrate formation that is based on the amount of ammonia available in the background in CALPUFF to prevent the output of particulate ammonium nitrate concentrations that are physically unrealistic and when CALPUFF does not conserve mass of ammonia (as is the case in the current model); and (3) incorporating into the Guideline CALPUFF with the improved RIVAD chemistry. In addition, other improvements to CALPUFF's chemistry modules developed by stakeholders should be considered; materials documenting these improvements have been provided, but EPA has not acted upon them.

6.2 Relationship of CALPUFF v6.4 to BART Rule

With regard to the BART rule, while EPA endorsed CALPUFF as the best modeling tool available in 2005, commenters (Tri-State, APS) indicate that EPA specifically recognized that the model was less than perfect. EPA committed in the 2005 BART rule to evaluate “newer” approaches, but has not acted on the matter in the following seven years. It is clear from the BART rule that each analysis should be based on the “best application [currently] available” to predict visibility impacts; the best application and information “currently available” is now the new, more refined version CALPUFF 6.42b. EPA should adopt enhancements to the regulatory version of CALPUFF (specifically CALPUFF 6.42) in implementing the Regional Haze Rule relative to BART as expeditiously as possible, particularly as applicable to NO_x emission reductions. EPA should review and approve MCBs E, F, and G and conduct its own review of the tests/evaluations of the new version of the CALPUFF model as soon as possible before final BART determinations are made later this year. This updated version of CALPUFF has already been placed in the public domain and additional tests have been completed and reported at the 10th Modeling Conference. As needed, EPA should conduct its own tests and evaluations of the new version of the CALPUFF model as soon as possible, before final BART determinations are made. If those tests duplicate findings described at the Tenth Modeling Conference, then EPA should move expeditiously to designate CALPUFF 6.4 as the regulatory version of the model for BART determinations. Such an approach is consistent with the process EPA has used for recent changes to the AERMOD model.

Commenters (Tri-State, APS, SRP, West) indicate that EPA's 2005 BART Guidelines acknowledged the need for CALPUFF 5.8 updates, since the regulatory-approved CALPUFF version 5.8 may overestimate the amount of nitrate produced from point source NO_x emissions, and chemistry modules in CALPUFF 5.8 are less advanced than more recent atmospheric chemistry simulations. Comparisons of field measurements of sulfates and nitrates with corresponding values predicted by CALPUFF 5.8 indicate that the model over predicts particulate nitrate formation by as much as a factor of three to four under wintertime conditions. Work has been done to improve the model's chemistry module and reduce the over-prediction. Comparisons with the two versions of the model show conflicting results on benefits of additional control technology to improving visibility in Class I areas; CALPUFF 6.4 showed no perceptible improvement. In addition, predicted sulfate and nitrate concentrations obtained by applying the two versions of the model were compared with actual measured values obtained at the Bridger Wilderness Area site and the Pinedale site. For the two model configurations, the results for sulfates were very similar, which was expected because the improvements to the CALPUFF chemistry were anticipated to have the most impact on nitrate predictions. The EPA-approved CALPUFF version was found to over-predict nitrates by a factor of two to three.

6.3 Application of Appendix W, Section 3.2 to CALPUFF v6.4

In conclusion, commenters (APS, West) recommend that EPA move expeditiously to either designate CALPUFF 6.42b as the regulatory version of the model for BART determinations, or in the interim, under Section 3.2 of Appendix W, allow EPA Regional Administrators to approve use of CALPUFF 6.4b as an alternative model on a case-by-case basis in all proposed applications. Such an approach is consistent with the process EPA has used for recent changes to the AERMOD model. The new chemistry, as well as the entirety of CALPUFF version 6.4.2 can be accepted for BART determinations, since Section 3.2 is designed to allow use of important model enhancements or alternative models in a timely way on a case by case basis, without the 3 to 5 year wait for formal rulemaking. Appendix W Section 3.2.2 indicates that an alternative model is acceptable if "a preferred air quality model is not appropriate for the particular application." In this case, CALPUFF 5.8 chemistry, especially for formation of winter nitrate, appears to be inapplicable because the MESOPUFF II formulation is based upon field testing with ambient temperatures of 50°F and higher. It is evident from the chemistry mechanisms that the nitrate equilibrium is highly sensitive to temperature and is most critical in conditions for which there are no observations for the MESOPUFF II formulation. The weight of evidence of the new evaluation information provided here and the clear limitations of the chemistry in CALPUFF 5.8 makes it imperative for EPA to allow immediate use of CALPUFF 6.42b for nitrate chemistry. Additional industry-supported improved models and modeling techniques, such as SCICHEM, SHARP and EMVAP tools, are under development and will be shared with EPA soon.

6.4 Application of CALPUFF to Nearby Sources

Several commenters (NDDH, BGNA, AEPSC, NMA) suggest that the Gaussian model formulation (e.g., AERMOD) that has been used for many years for near-field modeling may not be appropriate for all modeling of short term standards, such as those for SO₂, NO₂, and possibly CO. This is particularly true where varied and extensive complex terrain exists in an area of multiple sources, and this terrain extends from the sources to the location of receptors where design concentrations are expected. Non-steady state models, such as a Lagrangian puff model

like CALPUFF, are theoretically more appropriate for such applications, particularly when paired with meteorological models and their superior handling of atmospheric behavior in generating realistic input meteorology (e.g., three-dimensional wind fields). In contrast, AERMOD uses only meteorological data and surface characteristics from one site. CALPUFF's handling of nearby sources (farther than 20 kilometers) is thus thought to be superior to AERMOD's, and similar overall performance of CALPUFF should make it a preferred alternative in such cases involving nearby sources. EPA should acknowledge the potential applicability of alternative models for appropriate situations and consider making a replacement with a Lagrangian puff formulation, e.g., CALPUFF/SCIPUFF, as the preferred model for modeling of 1-hour standards, and work more diligently to review the updates being made to CALPUFF or SCIPUFF, as they may have a place in one hour modeling. Such a change (e.g., from AERMOD to CALPUFF for nearby sources) will require notice and comment rulemaking, along with the time to upgrade the existing models or develop a new model that would incorporate all of the necessary technical changes to significantly improve abilities to model the new 1-hour standards. EPA should begin moving down this path to allow the use of a superior model formulation for future SIP development and permit modeling.

More specifically, one commenter (Koogler) stated that CALPUFF should be an approved alternative model without the need for the justification required by Section 3.2, Appendix W, 40 CFR 51, rather than AERMOD, in multi-source situations (including those for which the impact of multiple sources are calculated to determine "background"). For consistency with AERMOD, another commenter (NDDH) suggests that the dispersion setting used with CALPUFF (MDISP) should be Option 2, turbulence-based dispersion, rather than the currently recommended PG dispersion. CALPUFF even provides an implementation of the turbulence dispersion which makes it equivalent to the AERMOD dispersion. Also, EPA should test use of MDISP=2, micrometeorological variables or turbulence dispersion, in CALPUFF and approve its use where it is shown to be superior.

Another commenter (NDDH) suggests that it may be advantageous to replace the "AERMOD near field" and "CALPUFF far field" scheme with a single dynamic model capable of covering all distances from 0 to 300 kilometers (or more). The SCIPUFF model may be an acceptable alternative to CALPUFF. It would appear that both CALPUFF and SCIPUFF could effectively serve as a single tool, even in their current iterations.

6.5 Individual Source Impacts on PM_{2.5} and Ozone

In addition to the comments on CALPUFF, commenters (AF&PA, NIC, NDDH) recommended that EPA develop PM_{2.5} guidance that can be practically implemented, e.g., adopt a reasonable approach to estimate impacts of secondary PM_{2.5} that appropriately reflect spatial and temporal impacts relative to primary PM_{2.5}. Also, a priority long-term development effort is needed for a model to estimate the contribution of an individual source to ambient concentrations of PM_{2.5} and ozone with the required complex chemistry and meteorology.

7.0 NAAQS Compliance Demonstration Comments

7.1 NAAQS Compliance Demonstration General Comments

Several commenters (NIC, UARG, EEANC, SC, AISI, NMA, NEDA, AF&PA) indicate that EPA should develop and demonstrate modeling tools that support realistic predictions as new NAAQS are developed. It is inappropriate to use computer models to implement the CAA where modeling does not yield the best information.

Concern has been expressed (EEANC SC AISI NMA) that models are increasingly being given deference over measurements from ambient monitors for attainment designations; measurements should be the gold standard, and modeling used to inform those measurements. Continuing to apply models with existing but outdated guidance is inappropriate. EPA should perform an overall re-evaluation of the Agency's policies and procedures that drive its determinations regarding the application of regulatory modeling; modeling should not be used to determine nonattainment areas, or any other regulatory obligation, until AERMOD is validated with measured values. Then, EPA should revise Appendix W and establish modeling guidelines that allow for flexibility and more realistic assumptions in all modeling applications, and assure that guidelines allow the use of the most accurate and up to date models and techniques available. For example, EPA's proposal to use modeling to designate attainment is different from past practice. Where AERMOD has been applied in New York modeling, results indicate large one-hour impacts. However, the extensive monitor network (current and retired monitors) does not show any NAAQS exceedances. This type of modeling should not be used to determine attainment designations.

Several commenters (NIC, AISI, NEDA, AF&PA) note that the models and modeling approaches set forth in Appendix W are inadequate for implementing EPA's newer and most stringent NAAQS; they fail to realistically predict relevant concentrations of covered pollutants in ambient air. In many circumstances, modeled concentrations that spur regulatory attention are, in fact, unrealistically high and lead to unreasonably conservative outcomes. There will be significant difficulty in permitting new or expanded sources as a result of these inadequate tools and guidance for addressing the implementation of new NAAQS. The requirements for states to model thousands of sources using flawed tools will result in mandates for unnecessary controls on existing sources and, in some cases, make continued operation infeasible. In addition, EPA should recognize and use the form of each NAAQS to determine the modeled design value. Just as EPA allows modeling of the 8th high for NO₂ (98th percentile), and 4th high for SO₂ (99th percentile), modeling for PM_{2.5} should evaluate the 8th high (98th percentile). Also, EPA should reconsider the policy that considers NAAQS effective for PSD permitting purposes immediately upon issuance, and instead institute a minimum 1-year transition period before new NAAQS would be considered applicable. Implementation guidance should be developed at the same time, and such guidance subjected to a notice and comment process that allows for stakeholder input.

7.2 Ambient Air

Commenters (NMA, AISI, AF&PA) recommend that EPA should align expectations for modeled ambient air receptors with realistic expectations of general public exposure. Most important is the determination of the ambient air boundary to make a reasonable determination in

cases where human exposure is unlikely. EPA should adopt more plausible assumptions about receptor locations where the public has reasonable access and can stay stationary for the entire period associated with an ambient standard, e.g., don't include rights-of-way or transportation corridors such as public roads and railroads that transect facility property.

7.3 Background Concentrations

Several commenters (NIC, AEPSC, API, NEDA) emphasize use of enhanced background calculation procedures where the necessary data exist. Background concentrations should be based on monitors near sources, paired in time with relevant meteorological conditions, and should conform to the averaging times (e.g., one hour, one day, annual) and the spatial domain (e.g., 10 km, 100 km, 500 km) of the scenario being modeled. Some commenters (WMA, ACW, BGNA, PE) also indicate that current guidance based on use of the 98th or 99th percentile monitored background values are unrealistically conservative. Guidance is needed for pairing model-predicted concentrations with monitored concentrations in-time to obtain a realistic projection of whether or not a potential exceedance is likely, and to eliminate double counting of impacts from modeled sources and those impacts represented in background monitoring data, particularly in areas with many sources at local and mesoscale distances. Where representative regional monitoring data exist, there should be no requirement to model regional sources whose impacts can reasonably be presumed to be reflected in the monitoring data.

Commenters (FI, Koogler) claim that EPA's recommendation for deriving NO₂ and SO₂ background concentrations is unnecessarily stringent and unscientific; there is a need for an improved method to account for background concentrations that better address the cause and effect relationships that exist between the actual hour-by-hour meteorological conditions that produce both the predicted impacts of the modeled sources and the actual measured background concentrations. To obtain the most appropriate background concentration for the target area, consideration should be given to using a "frequency of occurrence" approach, rather than the uniform background concentration typically used in AERMOD.

One commenter (AF&PA) suggests EPA's interim guidance for PM_{2.5} screening analyses is impractical, and unreasonably overestimates the design concentration relative to the NAAQS, since it inherently assumes that the day with multi-year average maximum model impact is coincident with the day of the 98th percentile background concentration. The "Paired Sums" approach should be allowed to account for background PM_{2.5} in the calculation. Case studies are provided following current EPA guidance to assess PM_{2.5} impacts using prescribed screening techniques and compared with a "Paired Sums" approach; most sources cannot demonstrate compliance with the PM_{2.5} NAAQS under current EPA guidance despite being well controlled.

7.4 Significant Impact Levels for revised 1-hour NO₂/SO₂ and PM_{2.5} NAAQS

Several commenters (NIC, AISI, AF&PA, OPC) have expressed concern about the conservative nature of SILs for pollutants with new NAAQS. They argue that less conservative levels should be used for SILs that are based on the percentile values on which compliance with the NO₂, SO₂ and PM_{2.5} NAAQS are judged, not the highest predicted impact. SILs should be established to define when a source's impact is sufficiently small to eliminate the need for a comprehensive air quality analysis.

Overly conservative SILs and conservative modeling assumptions can lead to large SIAs and, even relatively small maintenance and construction projects, can trigger permitting requirements. However, guidance on SIAs is not clear and help has not been provided to relevant State efforts. EPA's interim guidance for PM_{2.5} screening analyses for PM_{2.5} is impractical, since measured background PM_{2.5} concentrations, except for designated nonattainment areas, are consistently below the current NAAQS by a small margin. Adequate tools and guidance for sources to quantify PM_{2.5} emissions, including off-site emissions, and to model ambient impacts for the 1-hour NAAQS are needed.

7.5 1-hour NO₂/SO₂ NAAQS

7.5.1 1-hour NO₂/SO₂ NAAQS General Comments

Several commenters (API, SC, DE, AEPSC) note that the promulgation of more stringent NAAQS and requirements for 1-hour modeling, including the proposed use of modeling for SO₂ area designations have resulted in the need for improved modeling methods and evaluation. AERMOD has many flaws that come out when the new 1-hour SO₂ and NO₂ Standards are analyzed. AERMOD has not been thoroughly evaluated for performance in simulating the maximum daily 1-hour concentration at the 99th percentiles (or 98th for NO₂), especially for low wind speed cases that are the most impacted situations. Prescribing emission limits for such a stringent standard from the results of an unproven model could result in significant and unnecessary costs and burdens. If EPA finalizes these modeling requirements for SIP submittals, it should allow States the discretion to use modeling and analysis tools to help demonstrate situations where sources have a low probability of violating the standard, rather than prescribe overly conservative models that lead to unnecessarily stringent controls. Furthermore, it is thought inappropriate to use AERMOD in its current form as the primary tool for determining attainment or non-attainment with the current one-hour SO₂ NAAQS. It is argued that the model has demonstrated a high probability of over predicting actual ground level SO₂ concentrations; this excessive conservatism will impose burdensome and unnecessary requirements on the regulated community that are not necessary for attainment of the standard or to protect public health. There were a number of good suggestions made as to ways to "fix" AERMOD, including a statistical method to formulate the emissions input data, use of short term meteorological data, and improvements to methods of converting NO_x to NO₂ in the model. While these improvements should be made to the preferred model, a far more significant change may be needed to be truly able to model the 1-hour. Additional modeling studies, model revisions, and guidance are needed.

On the other hand, one commenter (Sears) offers the opinion that, in virtually all cases, air dispersion modeling should be used to determine one-hour SO₂ impacts from coal-fired power plants and other major SO₂ emission sources; modeling should be applied in all situations except where source-specific SO₂ monitoring exists and the monitor is properly located to capture maximum facility impacts. All NO₂, PM_{2.5}, and SO₂ NAAQS and PSD increment compliance verification analyses should be performed with air dispersion modeling, such as running AERMOD in a manner consistent with the Guideline on Air Quality Models. Another commenter (NIC) suggests that characterization of uncertainty in modeled concentrations and treatment of uncertainty in demonstrating NAAQS compliance is particularly important in multi-model applications such as those associated with the secondary NO₂ and SO₂ NAAQS.

Another commenter (EEANC) suggests that rather than classify large portions of the country as unclassifiable, EPA should classify those areas that are not obviously in non-attainment as unclassifiable/attainment, particularly where there is no monitoring evidence that there is a widespread attainment problem with the 1-hour SO₂ NAAQS. Also, this commenter thought it necessary to develop guidance for a probabilistic emission limit, e.g., use of the 90th percentile actual emission rate and the 90th percentile predicted concentration to represent the “ambient” concentration at the 99th percentile level. The potential to establish this kind of limit and to be able to enforce it is particularly intriguing for electric generating units that have continuous emissions monitoring systems in place.

7.5.2 1-hour NO₂ – Refined Tier 2 and Tier 3 Methods, ARM2 Implementation, and Field Studies

Several commenters (NIC, AEPSC, API, BP, AISI, NEDA, AF&PA) recommend that AERMOD be reviewed and improved for NO₂ concentration estimates by implementing ARM2 for predicting the ratio of NO₂ to NO_x, as a more refined Tier 2 or Tier 3 method. Also, improvements to the PVMRM (as a Tier 3 method) should be pursued; at a minimum, the AERMOD PVMRM formulas (e.g., relative dispersion) should be made consistent with the original formulations by Hanrahan and approved for use. Other more sophisticated NO₂ plume chemistry models such as RPM and SCICHEM should be evaluated; those plume chemistry models should be adopted if the more complete chemical mechanisms provide significantly better accuracy than AERMOD/PVMRM. Once Tier 3 NO₂ modeling techniques are updated, a streamlined approval process should be enabled at the state/local level for facilities applying sector/source-specific data. Also, new NO₂ field experiments involving shorter stacks, source emissions sampling, and ground level sampling where ozone, NO and NO₂ are measured should all be considered.

7.5.3 1-hour NO₂ – NO₂ to NO_x Ambient Equilibrium Ratios and In-stack Emissions Ratios

Several commenters (AF&PA, OPC, FI) note that the NO₂ to NO_x ratio recommended by EPA is highly restrictive and conservative. Data provided for the 10th Modeling Conference should be reviewed and revisions to 1-hour NO₂ NAAQS analyses (Tier 2) considered to better accommodate variations in the ambient ratio; it is also recommend that EPA allow in-stack NO₂/NO_x ratios that are significantly lower (e.g., 20%) than the EPA default value of 50% (examples are provided). Furthermore, there is a lack of clarity regarding the acceptance criteria for deriving and using both source-specific in-stack NO₂/NO_x emission rate ratios and a site-specific NO₂/NO_x ambient equilibrium ratio, and when it is necessary to use “default” ratios of 0.5 and 0.9, respectively, as AERMOD model input. There is also a lack of clarity regarding acceptance criteria for selecting and utilizing background O₃ and NO₂ ambient air quality monitoring sites and data, when utilizing the Plume Volume Molar Ratio Method (PVMRM) algorithm in AERMOD to calculate the total concentrations attributable to the modeled sources plus the background concentrations.

7.5.4 1-hour SO₂ – Use of Variable Emissions and EMVAP Implementation

Several commenters (NIC, UARG, EPRI, AF&PA, BP) recommend that EPA develop guidance for prediction of ambient concentrations based on treatment of actual emissions from

existing sources. It is unrealistic to assume that all modeled point sources operate continuously at their maximum permitted or enforceable emission rate; use of allowable emission rates at all times in AERMOD results in over-predictions. At a minimum, EPA should commit to development of modeling tools and implementation guidance that simulates actual emissions profiles, rather than the conservative assumption that all sources emit simultaneously and continuously at the maximum allowable rate; examples are provided. Development of an emissions variability processor should be made a priority to account for substantial differences in actual and allowable emissions. In the end, EPA should consider adopting a tiered approach -- the use of constant allowable emission rates with a more refined approach that accounts for inherent variability in emission rates; Tier 2 -- a conservative approach to estimating actual emissions; Tier 3 -- actual hourly emissions for model input.

More specifically, several commenters (EPRI, EEANC, SC, AEPSC, AISI, NMA) note that Appendix W stipulates that for sources subject to emission limitations, the short-term modeling should use allowable emission rates, design capacity, and assume continuous operation. However, for a modeling vs. monitoring study summarized at the 10th Modeling Conference, it is shown that use of allowable emission rates at all times in AERMOD results in over-predictions for retrospective applications, and leads to overly conservative estimates of future impacts when used in prospective applications. Any retrospective modeling of a source that is meant to estimate past impacts from the source (and other nearby sources) should use actual observed emissions, with actual meteorology and actual stack parameters. Any deviation from this approach leads to a misrepresentation of past conditions. For prospective modeling of potential future impacts from a point source, rather than “potential to emit”, a statistical approach to formulate the emissions input data, since the emission standard is statistical in nature, that implements a newly developed tool known as the Emissions Variability Processor (EMVAP) for AERMOD is recommended. Incorporation of emissions variability in any analysis of existing sources, particularly for electrical generating units that have extensive hourly records of emissions, by incorporating some sort of statistical emissions input would be appropriate; examples of other source types that can demonstrate compliance with the 1-hour average SO₂ NAAQS with “typical”, rather than allowable, emissions operations are also provided. Ways to incorporate EMVAP for treating source emissions uncertainties and intermittent sources should be considered in implementing a variable emission rate limit. For example, AZ examples for multipoint rollback are available for enforceable permit limits based upon a probabilistic emissions model; States should have the discretion to use tools such as the Emissions Variability Processor with less restrictive emission limits that still achieve the NAAQS goals.

On the other hand, another commenter (Sears) notes that where actual emissions are used for nonattainment SIP modeling, a condition must be added to the facility permit requiring that emissions must not be greater than the level used in the modeling analysis. Also, actual emissions cannot be modeled using full load stack parameters; stack gas exit velocity and temperature is reduced under less than full load conditions, affecting plume rise and resulting modeled impacts. Any AERMOD modeling using actual emission levels must use corresponding actual stack gas exit velocity and temperature.

Finally, one commenter (BP) notes that EPA needs to revise the February 2012 memo regarding modeling of temporary sources. An approach is outlined that can be used to address impacts of sources that do not remain at a fixed location for a 3-year period.

7.6 PM_{2.5} NAAQS

Commenters (AISI, FI, APFA) express concern about significant over-prediction for particulate emissions and other pollutants, particularly when applied to complex facilities with multiple non-stack sources and irregular emission rates. Those over-predictions may prevent or hinder the development and construction of projects that in actuality would not have unacceptable ambient air quality impacts. Models used to implement the NAAQS must be improved to address such flaws prior to NAAQS implementation. Issues that have been identified as a problem and also have viable technical solutions include: fugitive particulate matter modeling; un-validated revisions to AERMOD that include over-predictions for low wind speed periods; the use of reasonable operating scenarios as inputs; and downwash algorithm anomalies; a presumption that secondary formation of PM_{2.5} from precursors occurs at the same time and location that primary pollutants have their greatest impact. Another issue is the small margins that exist between the NAAQS and the background concentrations that will greatly magnify the adverse consequences of the tendency of AERMOD to over predict air quality impacts. Generally, there is a need for PM_{2.5} modeling and implementation guidance that can be practically implemented, for example use of the 98th percentile design concentration consistent with the form of the standard; such guidance requires sufficient time for effective review and comment.

7.7 Monitoring in Lieu of Modeling

Several commenters (NIC, UARG, EEANC, API) recommend that when regulators, or regulated entities, have ambient measurements of pollutant concentrations, recorded by an EPA-approved monitor at an EPA-approved location, those data -- not model predictions -- should be relied upon in determining the attainment status of areas and for other purposes. In particular, SO₂ area designations should be made primarily using monitoring data, as opposed to using model-predicted concentration estimates. Guidance should “account for and consider the existing monitoring networks that are specifically designed to determine SO₂ impacts from dominant sources”. In situations where an assessment determines that the monitoring network is adequate, then monitoring alone should be used to determine the attainment status of the area. When monitoring data from approved monitors are not yet available, regulators and regulated sources should be given a reasonable opportunity to collect needed monitored data in lieu of requiring them to rely on modeling predictions of the ambient impacts of existing sources.

Commenters (NIC, API, BP, AISI, NMA, NEDA, AF&PA, FI) provide additional details on how to enable permitting authorities to rely upon representative ambient monitoring results in lieu of, or as a supplement to, modeling results for decision-making. More specifically, EPA should issue a reminder to the Regional offices and the states regarding the availability of the option in Section 10.2.2 of Appendix W for use of monitoring in lieu of modeling when there are no suitable models or when modeling is less acceptable than monitoring to demonstrate compliance with the 1-hour average NO₂ and SO₂ NAAQS; see various examples given at the 10th modeling conference. As indicated in Section 10, if EPA concludes that model accuracy

does not provide a tool for policy use, then alternative approaches that could be used for meeting current policy needs include coupling modeling and monitoring and use of modeling in more of a relative mode (as in the case of PM and ozone modeling), or to base compliance with the NAAQS using a combination of BACT and ambient monitoring. State/local permitting authorities should be allowed to rely upon representative ambient monitoring data and emissions trends, to make decisions that reflect actual air quality conditions and impacts. For surface mine sources, EPA should authorize the use of monitoring data to demonstrate compliance with short-term PM₁₀, PM_{2.5}, SO₂ and NO₂ NAAQS, just as it has for use of SO₂ monitoring for “sources that may not be conducive to modeling”. EPA should reconsider its policy requiring PM_{2.5} modeling analyses for maximum modeled concentrations instead of more refined estimates of the design value; guidance must provide more flexible and refined approaches that enable the use of available monitoring data to make reasonable estimates of cumulative impacts. Finally, for proposed new sources or major modifications of existing sources, permits should include conditions that address how monitoring would be done and what happens if exceedances of standards are monitored.

On the other hand, another commenter (Sears) argues that air dispersion modeling should be the preferred method for determining one-hour SO₂ impacts. In order to ensure consistency in how air impacts are determined, both existing sources and newly permitted sources should be assessed using the same methods. If existing sources are allowed to use monitoring, which are generally not “well-placed” for measuring the maximum ambient air impacts from existing sources, this results in a lower standard of compliance verification than that being used for new permit applicants.

One commenter (EEANC) is concerned with an increasing quantity of issues that must be addressed and the resulting increase in the time necessary to prepare regulatory analyses. Prior to the latest revised NAAQS limits, air quality modeling had evolved into a pretty much standardized methodology that could be routinely prepared for the modeling protocol submittal and approved without much controversy. However, outside organizations are now running models that can project values exceeding the NAAQS limits and then demanding a response. The model clearinghouse will become embroiled in controversy when one modeling group makes a series of assumptions that result in predictions that contradict another modeling analysis. There are so many parameterizations, configurations and other tweaks that all are perfectly acceptable but lead to different results that controversy is the inevitable outcome. This is further justification for reliance on a robust monitoring network to determine attainment.

8.0 Emerging Models and Techniques Comments

8.1 Mesoscale Model Interface Program (MMIF) Comments

Commenters (EEANC, API) indicate that 3-D prognostic meteorological models for inputs to dispersion models are a useful modeling approach, particularly when coupled with a shorter time step for one-hour source assessments. However, until EPA has shown that the model field agrees well with measured wind fields, this approach may not be appropriate; see the Eastern Lake Ontario Meteorological Study. Test runs with AERMOD and CALPUFF must be completed, documented and made available for public comment to show that meteorological

models provide comparable performance compared to standard inputs, before adoption of these techniques can go forward.

8.2 Single Source PM_{2.5} and Ozone Modeling

One commenter (Sears) specifically supports the use of single-source PM_{2.5} and ozone photochemical grid modeling for impact analyses and compliance demonstrations for major emission sources; comments on this same issue were provided at the 9th Modeling Conference and EPA responded in an affirmative manner relative to the Sierra Club Petition. State and Local agencies should be required to consult with the Regional meteorologists on a case-by-case basis for determining the best models to use for assessing such single-source impacts. Also, it is noted, with regard to Draft PM_{2.5} Permit Modeling Guidance, that further details/clarification are needed on various scenarios and on how they protect the PM_{2.5} PSD increments, not just compliance with the PM_{2.5} NAAQS.

Attachment A

Summary of 10th Conference on Air Quality Modeling Comment Submissions

A brief and bulleted summary of the comments formally submitted to Docket of the 10th Conference on Air Quality Modeling are presented in this Attachment. This summary information is for general reference only and is not intended to supersede the actual comments submitted to the Docket. An Internet link to the conference Docket containing all of the comment submissions as well as the conference presentations and transcripts are listed in Attachment C.

NAAQS Implementation Coalition (*Prepared by Hunton & Williams*)

1. Overview
 - a. The models and modeling approaches set forth in Appendix W are inadequate for implementing EPA's newer and most stringent NAAQS; they fail to realistically predict relevant concentrations of covered pollutants in ambient air. In many circumstances, modeled concentrations that spur regulatory attention are, in fact, unrealistically high.
 - b. EPA should identify modeling issues for near-term, mid-term and long-term focus, and develop/share with the public a plan detailing the Agency's anticipated dates and methods to address these issues (Coalition members would like to work with the Agency to appropriately address these issues).
2. Near-Term – Solutions for modeling problems that have already been developed and provided to EPA on which actions can be taken at least on an interim basis.
 - a. AERMOD overstates ambient impact of fugitive particulate emissions – use a preprocessing step that would reduce emission factors for fugitive sources of PM which parallel the EPA-approved approach to modeling fugitive emissions with CMAQ; similar fixes are also applicable to fugitive emissions of SO₂ and NO₂. (see references)
 - b. AERMOD substantially over-predicts at low wind speeds – adjust “critical wind speed” and minimum hourly averaged sigma (see reference)
 - c. AERMOD does not model buoyant line sources – use BLP for final plume rise and model sources in AERMOD as volume sources.
 - d. AERMOD can be improved for NO₂ concentration estimates – implement ARM2 for predicting the ratio of NO₂ to NO_x as a more refined Tier 3 method.
 - e. Updates to CALPUFF (version 6) provided to EPA improves the chemistry and other upgrades that produce significantly improved performance for NO₂ over the default FLAG chemistry options.
 - f. Improve implementation of newer NAAQS by clarifying or changing EPA policy
 - i. EPA should issue guidance reminding Regions/States that the use of monitoring data, particularly for existing sources, may be appropriate in characterizing source impacts.
 - ii. Provide guidance for prediction of ambient concentrations based on treatment of emissions from existing sources and determination of background concentrations. It is unrealistic to assume that all modeled point sources operate continuously at their maximum permitted or enforceable emission rate; modeling with actual

emission should be considered if they are available. Variability of emissions should be considered and maximum allowed emissions should not be set at the level of the actual emissions, e.g., steel industry. Also, emphasize use of background concentrations based on monitors near sources and paired in time with relevant meteorological conditions.

- iii. Less conservative levels should be used for SILs. They should be based on the percentile values on which compliance with the NO₂ and SO₂ NAAQS are judged, not the highest predicted impact.
3. Mid-Term – issues that require rulemaking over the next year or two; there is no need to wait for the next modeling conference.
 - a. Include both industry-developed model modifications, as well as EPA modifications including changes involving AERMINUTE, BPIP and AERSURFACE.
 - b. Consider AERMINUTEplus developed by EPRI which is currently undergoing testing.
 - c. Establish SILs to define when a source’s impact is sufficiently small to eliminate the need for a comprehensive air quality analysis.
 - d. Provide interim solutions for situations where there is not an appropriate model at this time and provide a plan for developing appropriate models, e.g., hourly NO₂ impacts of proposed sources could be limited to annual estimates based on BACT for NO_x, monitoring to insure compliance with the 1-hour NAAQS, and a plan to end “unforeseen difficulties”.
4. Long-Term – issues that require new research.
 - a. A model to estimate the contribution of an individual source to ambient concentrations of PM_{2.5} and ozone with the required complex chemistry and meteorology.
 - b. The impact of fugitive PM_{2.5} emissions.
 - c. Performance re-evaluation of preferred models, e.g., AERMOD with newer modifications and for 1-hour concentrations in a probabilistic form consistent with new NAAQS. This may be accompanied by the need for new databases with respect to near-field impacts, impacts in complex terrain and low wind speed conditions.
 - d. Characterization of uncertainty in modeled concentrations and treatment of uncertainty in demonstrating NAAQS compliance. This is particularly important in multi-model applications such as those associated with the secondary NO₂ and SO₂ NAAQS.
 - e. Generally develop and demonstrate modeling tools that provide realistic and relatively certain predictions as new NAAQS are developed.

Utility Air Regulation Group (*Prepared by Hunton & Williams*)

1. Overview
 - a. Because modeling may play a role in so many CAA programs, it is vital that EPA include in Appendix W the best available models and modeling methods. EPA should take steps to ensure that improvements to *Guideline* models/methods are made systematically and expeditiously.
 - b. EPA does not now consistently follow the best approaches for determining what models and modeling methods should be included in its *Modeling Guideline*, or for making revisions to *Guideline* models and modeling methods.
 - c. EPA should continue to involve all stakeholders in helping to ensure that the best modeling tools are used in implementing the CAA.
2. Role of Models and modeling methods in CAA Implementation –
 - a. It is inappropriate to use computer models to implement the CAA where modeling does not yield the best information.
 - b. When regulators or regulated entities have at hand ambient measurements of pollutant concentrations, recorded by an EPA-approved monitor at an EPA-approved location, those data -- not model predictions – should be relied upon in determining the attainment status of areas and for other purposes.
 - c. In addition, when monitoring data from approved monitors are not yet available, regulators and regulated sources should be given a reasonable opportunity to collect needed monitored data in lieu of requiring them to rely on modeling predictions of the ambient impacts of existing sources.
3. Notice-and-comment rulemaking requirements for revising Guideline models/methods –
 - a. When it is necessary to add a model or modeling method to its *Modeling Guideline*, or to make revisions to the models and modeling methods currently in its *Guideline*, EPA must first conduct notice-and-comment rulemaking on those actions. No significant change should be made to the *Modeling Guideline* or to *Guideline*-referenced models and modeling techniques without EPA’s first (1) proposing any such change to the *Guideline* models/modeling methods; (2) explaining the basis for such proposed change, including documentation on how well any new model or modified model will perform for the conditions to which it would be applied; (3) giving the public a meaningful opportunity for comment on any proposed change; and (4) reviewing and responding to any significant comments that it receives during the notice-and-comment rulemaking.
 - b. These general rulemaking requirements also apply to “clarification memoranda” concerning meteorological inputs to AERMOD and the treatment of GEP stack height and downwash when using AERMOD.
4. Following rules for including and revising models in the Guideline –
 - a. EPA should give tools developed by others, e.g., UARG and other industry groups and provided to EPA, that improve the accuracy of the models used for regulatory purposes the same consideration that it gives to tools developed by EPA.
 - b. EPA is urged to act expeditiously to adopt the fix developed by AECOM for AERMOD under low wind speed conditions, and to adopt the other recommendations made by Paine & Heinold to make AERMOD’s predictions under these conditions more accurate.

- c. In addition, the development and evaluation of improvements to CALPUFF's chemistry modules by West Associates and EPRI should be considered by EPA. Materials documenting these improvements have been provided, but the Agency has not acted on them.
- d. Additional industry-supported improved models and modeling techniques, such as the EPRI-sponsored SCICHEM, SHARP and EMVAP tools, are under development and will be shared with EPA soon.
- 5. Evaluation of models and modeling techniques for inclusion in the modeling guideline
 - a. Before a model can be approved for use, its performance must be evaluated and determined to be satisfactory.
 - b. Not only must such an evaluation be conducted, but the conditions under which the model's use is approved must be consistent with those under which its performance is evaluated, e.g., actual emissions or background concentrations.
- 6. Working with industry stakeholders –
EPA should work with stakeholders to promote a community approach to model development and acceptance that champions the use of best science, supports continual improvement in modeling science and data, and timely model acceptance for use in the regulatory arena, opening yearly state/local modeling meeting to all stakeholders.
- 7. Comments by AECOM –
 - a. Low Wind Speed – Evaluation and consequence analysis for AERMOD did not include low wind speeds, which result in higher concentrations, especially with AERMOD and low level sources. AERMINUTE makes it possible to utilize newer data with more frequent low wind speeds; this change has not received public review and comment. Likewise, changes to AERSURFACE have also been made with resulting higher concentrations. An API/UARG sponsored study has shown problems with low wind speed and AERSURFACE effects; a set of technical recommendations on AERSURFACE and treatment of low wind speed has been provided. There should be a thorough review and attention to all associated model formulation issues.
 - b. Model Emissions Input Data – Use of allowable emission rates at all times in AERMOD results in over-predictions. EPA should consider adopting a tiered approach. For example, Tier 1 -- the use of constant allowable emission rates with a more refined approach that accounts for inherent variability in emission rates; Tier 2 - - a conservative approach to estimating actual emissions; Tier 3 -- actual hourly emissions for model input.
 - c. Model Updates and Policy Decisions – changes to AERMOD have been conducted without public review and comment, or peer review. EPA needs to provide the public with information regarding the change that would result from the model update and to develop a process by which the public could provide input and comment; a list of changes made without review for AERMOD and CALPUFF is provided.
 - d. Collaboration with the user community – It is desirable to involve and expand stakeholder and scientific input, similar to the planning conferences, into the future through a continued workgroup process. EPA needs to more frequently consult with and consider the advice of stakeholders, including the scientific community, into the future. The stakeholder community is prepared to assist EPA by providing useful information on model evaluation/improvement. These efforts could involve considerable investment in resources by stakeholders.

Electric Power Research Institute

1. Refinements for low wind speed modeling with AERMOD –
After AERMOD was promulgated, much higher predictions in comparison to other models such as ISC were experienced where wind speeds less than 1 mps were available; these concentrations often control the outcome of the modeling analysis. The peak concentrations are especially noticeable for low-level sources, which were not tested extensively during the AERMOD evaluation process. Since the time that AERMOD was promulgated, EPA has not offered the public a chance to review and comment on changes to AERMOD, even though developments since its promulgation have significantly changed the model's predictions for light winds. Developments include:
 - a. implementation of AERMINUTE with access to many Automated Surface Observing System (ASOS) stations that have sonic anemometer instrumentation with a near-zero starting wind speed threshold;
 - b. introduction of AERSURFACE which has effectively reduced the surface roughness and consequent changes to the wind profile in stable conditions without adequate testing;
 - c. EPRI has developed an approach (SHARP) to run with AERMOD that allows the model to simulate low-wind conditions more accurately; the technique was presented at the 10th Modeling Conference and has undergone evaluation on two low-wind speed databases; after completion of evaluation. SHARP will be publicly released.
2. Distance applicability for steady-state Gaussian dispersion modeling –
 - a. EPA considers 50 km as the appropriate distance for the applicability of a steady-state model without a clear scientific basis.
 - b. More importantly, for cumulative modeling involving other sources, it is presumed that an inventory of sources out to the applicable modeling distance (50 km) must be obtained; the use of an overly large distance for the applicability of a steady-state model is expected to generally result in a misrepresentation of the source-to-receptor transport and dispersion, as well as an over-prediction tendency for the worst-case concentration.
 - c. EPRI has conducted analysis that demonstrated that a more reasonable distance limit for steady-state models used for hourly applications, such as those required by the one-hour NO₂ and SO₂ NAAQS, is 20 km. The use of a steady-state model beyond 20 km can result in unrealistically high modeled concentrations and therefore is not recommended. Beyond a distance of 20 km, it is highly likely that multiple hours of transport are required and as such, the typical hour-by-hour changes in the transport winds and dispersion conditions lead to distortions in steady-state model predictions. The inter-model comparisons reveal the expected over-prediction for a steady-state vs. a non-steady-state model, which are clearly evident for receptor distances exceeding 20 km.
 - d. EPRI has developed additional code (that does not interact with the dispersion modeling of AERMOD) that provides warnings for receptor-hour combinations that lead to predictions for transport exceeding one hour. The information in this file will be useful for determining general information for the plume transport from each source to the receptor with the highest hourly concentration. EPRI anticipates a release of this added code as a public beta before the end of July 2012 and will provide appropriate documentation and software.

3. Modeling Variable Emissions –
 - a. Appendix W stipulates that for sources subject to emission limitations, the short-term modeling should use allowable emission rates, design capacity, and assume continuous operation. For a modeling vs. monitoring study summarized at the 10th Modeling Conference, it was shown that use of allowable emission rates at all times in AERMOD results in over-predictions for retrospective applications, and leads to overly conservative estimates of future impacts when used in prospective applications.
 - b. Any retrospective modeling of a source that is meant to estimate past impacts from the source (and other nearby sources) should use actual observed emissions, with actual meteorology and actual stack parameters. Any deviation from this approach leads to a misrepresentation of past conditions.
 - c. For prospective modeling of potential future impacts from a point source, EPRI recommends the use of a three-tier approach implementing a newly developed tool known as the Emissions Variability Processor (EMVAP) for AERMOD. EPRI is continuing to test EMVAP, and anticipates a release of this tool as a public beta before the end of July 2012. Consistent with such a public release, EPRI will provide appropriate documentation and software.

Environmental Energy Alliance of New York, LLC

1. Models use a one-hour time increment that is inappropriate to use for a one-hour standard. Too much weight is given to the rare times when the wind direction lines up with a particular receptor; the variation of wind direction within the hour is not accounted for in the meteorological data used in the modeling and therefore biases the results when compared to a one hour standard.
2. Gridded meteorological analyses are a useful modeling approach, particularly when coupled with a shorter time step for one-hour source assessments. However, Until EPA has shown that the model field agrees well with measured wind fields, this approach may not be appropriate; see the Eastern Lake Ontario Meteorological Study.
3. It is necessary to develop guidance for a probabilistic emission limit, e.g., use of the 90th percentile actual emission rate and the 90th percentile predicted concentration to represent the “ambient” concentration at the 99th percentile level. The potential to establish this kind of limit and to be able to enforce it is particularly intriguing for electric generating units that have continuous emissions monitoring systems in place.
4. Rather than classify large portions of the country as unclassifiable, EPA should classify those areas that are not obviously in non-attainment as unclassifiable/attainment, particularly where there is no monitoring evidence that there is a widespread attainment problem with the 1-hour SO₂ NAAQS.
5. EPA’s proposal to use modeling to designate attainment is different than past practice. Where AERMOD has been applied in New York modeling results indicate large one-hour impacts. However, the extensive monitor network (current and retired monitors) does not show any NAAQS exceedances. This type of modeling should be used to determine attainment designations.
6. NYSDEC previously recommended that guidance should “account for and consider the existing monitoring networks that are specifically designed to determine SO₂ impacts from dominant sources”. In situations where an assessment determines that the monitoring network is adequate, then monitoring alone should be used to determine the attainment status of the area. That recommendation should be followed.
7. An over-arching issue has been the ever increasing quantity of issues that must be addressed and the resulting increase in the time necessary to prepare regulatory analyses. Prior to the latest revised NAAQS limits air quality modeling had evolved into a pretty much standardized methodology that could be routinely prepared for the modeling protocol submittal and approved without much controversy. This is undergoing significant change. Outside organizations are running the models that can project values exceeding the NAAQS limits and then demanding a response. The model clearinghouse will become embroiled in controversy when one modeling group makes a series of assumptions that result in predictions that contradict another modeling analysis. There are so many parameterizations, configurations and other tweaks that all are perfectly acceptable but lead to different results that controversy is the inevitable outcome. This is further justification for reliance on a robust monitoring network to determine attainment.
8. The Model Clearinghouse process does not allow technical input by the affected parties (e.g., permit applicant). Typically, the permitting authority states their opinion and asks for Clearinghouse approval and no other involvement is allowed. Because more controversy is expected the process needs to change. The Alliance endorses an approach

whereby the affected parties are able to provide comment along with the permitting authority's correspondence to the Clearinghouse.

9. Incorporation of emissions variability in any analysis of existing sources, particularly for electrical generating units that have extensive hourly records of emissions, by incorporating some sort of statistical emissions input would be appropriate; further development of the Emissions Variability Processor is appropriate.
10. Low wind speed corrections, proposed by AECOM, should be implemented because wind speed is a critical factor in the elevated one hour concentration predictions.
11. The change to downwash procedures should be removed from the regulatory version of AERMOD until independent peer review, consequence analyses, and evaluations are conducted for stacks above formula height; these evaluations should be bundled with the independent review and evaluation of the effective length parameter in BPIPFRM.
12. All the dispersion field results should be placed in a single data archive for easy public access. Also suggestions at the 10 Modeling Conference related to model acceptance criteria should be considered in meeting concerns that the model clearinghouse is going to have to address more controversial issues.
13. EPA should continue increasing their communications and collaborations with the many groups studying modeling issues and include the wider community in planning, model development and evaluation, and analysis and review of results.
14. AERMOD should be modified to more easily identify meteorological conditions and model details which would promote broader understanding of sensitivities and case-specific model attributes.

Southern Company

1. Overview – Models are increasingly being given greater deference than measurements from ambient monitors; measurements should be the gold standard, and modeling used to inform those measurements. Continuing to apply models with existing but outdated guidance is inappropriate. EPA should revise Appendix W and establish modeling guidelines that allow for flexibility and more realistic assumptions in all modeling applications, and assure that its guidelines allow the use of the most accurate and up to date models and techniques available.
2. The SO₂ NAAQS – AERMOD has not been thoroughly evaluated for performance in simulating the maximum daily 1-hour concentration at the 99th percentiles (or 98th for NO₂), especially for low wind speed cases that are the most impacted situations. Prescribing emission limits for such a stringent standard from the results of an unproven model could result in significant and unnecessary costs and burdens. If EPA finalizes these modeling requirements for SIP submittals, it should allow States the discretion to use modeling and analysis tools to help demonstrate situations where sources have a low probability of violating the standard, rather than prescribe overly conservative models that lead to unnecessarily stringent controls. For example, rather than “potential to emit”, States should have the discretion to use tools such as the Emissions Variability Processor with less restrictive emission limits that still achieve the NAAQS goals.
3. Making Modifications to Preferred Models – Model modifications that result in changes to modeled concentrations, must go through notice and comment rulemaking before being implemented in preferred models. Specifically, the change to AERMOD in MCB #4 that alters the PRIME downwash algorithms requires public notice and comment. Similarly, the performance of AERMOD with the AERMINUTE processor needs to be evaluated; EPA must consider the entire AERMOD system, including AERMAP, AERSURFACE, AERMET and AERMINUTE. Modeling systems for CALPUFF and AERMOD must be treated in a comparable way. Once an evaluation is complete, the model changes should be submitted for public notice and comment.
4. EPA Should Engage the Modeling Community – EPA should engage not only the regional, state and local agencies, but also the private sector, including consultants and industry, to achieve goals of improving the performance of both preferred and alternative models and for updating Appendix W. EPA should provide a clear path forward for approving model improvements that come from the modeling community, (e.g., AECOM recommendations on low wind speed, the SHARP and AERMINUTEplus processors for simulating sub-hourly meteorology in AERMOD). The private sector should be invited to participate in the Modelers’ Workshops, in addition to the Modeling Conference.
5. Conclusions – EPA must assure that the performance of Guideline models is unbiased and does not lead to gross over predictions that forces unnecessary actions to address problems that aren’t present in the real world. EPA must perform a model performance evaluation for modifications and submit those for public notice and comment. EPA modeling should be transparent and open, and engage and seek collaboration with the modeling community.

American Electric Power Service Corporation

1. Determining Background for 1-hour Modeling – The method presented at the 10th Modeling Conference is an improved method for determining background air quality levels for use in modeling analyses from areas with few monitors and those monitors have unrealistic background readings, where short term meteorological data are available. See attachment.
2. Model Issues for 1-hour Modeling – AERMOD has many flaws that come out when the new 1-hour SO₂ and NO₂ Standards are analyzed. There were a number of good suggestions made as to ways to “fix” AERMOD, including a statistical method to formulate the emissions input data, use of short term meteorological data, and improvements to methods of converting NO_x to NO₂ in the model. While these improvements should be made to the preferred model, a far more significant change may be needed to be truly able to model the 1-hour. The Gaussian model formulation that we have used for many years for near field modeling may not be appropriate for modeling of short term standards for SO₂, NO₂, and possibly CO and should be replaced by a model that uses a lagrangian puff formulation e.g., CALPUFF/SCIPUFF. USEPA must work more diligently to review the updates being made to CALPUFF. An updated CALPUFF or SCIPUFF may have a place in one hour modeling due to their superior handling of atmospheric behavior when paired with either their given meteorological model or prognostic meteorological models such as MM5 or WRF. Such a change requires notice and comment rulemaking, along with the time to upgrade the existing models or develop a new model that would incorporate all of the necessary technical changes to significantly improve our abilities to model the new 1-hour standards. USEPA should begin moving down this path to allow the use of a superior model formulation for future SIP development and permit modeling.
3. In conclusion, the issues that EPA should address include:
 - a. Allowing the use of enhanced background determination procedures where the necessary data exists
 - b. Use a statistical method to formulate the emissions input data since the emission standard is statistical in nature.
 - c. Use short term meteorological data in the model itself and integrate these shorter increments into a one hour value
 - d. Improve the methods of converting NO_x to NO₂ in the model
 - e. Improve the turnaround time for evaluating changes to ALL guideline models when those changes appear to better represent the current state of the science
 - f. Consider making a lagrangian puff type model the preferred model for modeling of 1-hour standards

Duke Energy Company

1. Since EPA believes that computer models can determine nonattainment for sources, EPA must also require improved model performance to ensure that the control measures required of sources are appropriate without being excessive. AERMOD significantly over predicts SO₂ concentrations and thus the current models are not reliable enough to be used as the basis for classifying an area as nonattainment. An extensive analysis (attached) by IDEM showed that overall modeled design values were more than 3 times those observed at monitors and showed over prediction of the model at regulatorily relevant levels of the standard, especially during periods of low wind speed and unstable conditions. In short, the model predicts that receptors located in the vicinity of the monitors would not attain the one-hour SO₂ standard, while the actual on site monitors show that the facility is complying with the standard. Due to changes to the model, preprocessors and guidance model performance must be reevaluated before their use in demonstrating compliance with the SO₂ NAAQS using modeling. New guidance documents should be subject to public notice and comment and EPA then response to those comments.
2. EPA should develop a prioritized listing of all modeling studies and model fixes it has received as a result of the 10th Modeling Conference, i.e., allowing sources to use actual hourly emissions instead of overly conservative maximum allowance emissions, and using a smaller and more representative modeling domain, 20km versus EPA's stated 50km domain. The EPA should solicit input from stakeholders on the list of projects and the project priority, and then allow the time needed to implement such changes prior to requiring sources demonstrate compliance with the new NAAQS.
3. It is not appropriate to use AERMOD in its current form as the primary tool for determining attainment or non-attainment with the current one-hour SO₂ NAAQS. The model has demonstrated a high probability of over predicting actual ground level SO₂ concentrations. This excessive conservatism will impose burdensome and un-necessary requirements on the regulated community that are not necessary for attainment of the standard or to protect public health. Additional modeling studies, model revisions, and guidance are needed. Because of the potential impact on the regulated community and the wealth of technical experience outside of EPA, changes to AERMOD, its preprocessor and modeling guidance should be subject to a public notice and comment process.

Arizona Public Service Company

1. EPA should replace out-dated CALPUFF 5.8 with the scientifically superior CALPUFF 6.4 for BART determinations. APS endorses (and incorporates by reference) comments being submitted to the docket by the Utility Air Regulatory Group (“UARG”) and the Electric Power Research Institute (“EPRI”) on both the CALPUFF and AERMOD models. APS also supports the comments submitted by WEST Associates on the CALPUFF model.
2. Supporting documentation on the relative performance of subject versions of CALPUFF is also provided. CALPUFF Version 6.4 has been found to provide equivalent results to the regulatory version when the same options and data are used. The new version is “backward compatible” with the regulatory version when run with the same inputs and data, if the new chemistry option is turned off and the bug-fixes are applied in CALPUFF 5.8. Predicted sulfate and nitrate concentrations obtained by applying the two versions of the model were compared with actual measured values obtained at the Bridger Wilderness Area site and the Pinedale site. For the two model configurations, the results for sulfates were very similar, which was expected because the improvements to the CALPUFF chemistry were anticipated to have the most impact on nitrate predictions. The EPA-approved CALPUFF version was found to over-predict nitrates by a factor of two to three.
3. Appendix W Section 3.2.2 indicates that an alternative model is acceptable if “a preferred air quality model is not appropriate for the particular application.” In this case, CALPUFF 5.8 chemistry, especially for formation of winter nitrate, appears to be inapplicable because the MESOPUFF II formulation is based upon field testing with ambient temperatures of 50°F and higher. It is evident from the chemistry mechanisms that the nitrate equilibrium is highly sensitive to temperature and is most critical in conditions for which there are no observations for the MESOPUFF II formulation. The weight of evidence of the new evaluation information provided here and the clear limitations of the chemistry in CALPUFF 5.8 makes it imperative for EPA to allow immediate use of CALPUFF 6.42b for nitrate chemistry.
4. While EPA endorsed CALPUFF as the best modeling tool available in 2005, EPA specifically recognized that the model was less than perfect. EPA committed in the 2005 BART rule to evaluate “newer” approaches, but has not acted on the matter in the following seven years. It clear from the BART rule that each analysis should be based on the “best application [currently] available” to predict visibility impacts; the best application and information “currently available” is now the new, more refined version CALPUFF 6.42b. EPA should review and approve MCBs E, F, and G and conduct its own review of the tests/evaluations of the new version of the CALPUFF model as soon as possible before final BART determinations are made later this year. If those tests duplicate findings described at the Tenth Modeling Conference, EPA should move expeditiously to either designate CALPUFF 6.42b as the regulatory version of the model for BART determinations, or allow its use as an alternate model in all proposed applications. Such an approach is consistent with the process EPA has used for recent changes to the AERMOD model.

Salt River Project Agricultural Improvement and Power District

CALPUFF has evolved continuously since its initial introduction, but EPA's model approval process has not kept pace with the developmental process. Comparisons with field measurements have found that CALPUFF 5.8 over-predicts particulate nitrate formation by a factor of 3 to 4. Work has been done to improve the model's chemistry module and reduce the over-prediction; as a result CALPUFF 6.4 has been released. Comparisons with the two versions of the model show conflicting results on benefits of additional control technology to improving visibility in Class I areas; CALPUFF 6.4 showed no perceptible improvement. EPA should move expeditiously in evaluating and adopting these enhancements as the regulatory version of CALPUFF. In the interim EPA Regional Administrators, may approve use of CALPUFF 6.4b as an alternative on a case-by-case basis.

Tri-State Generation and Transmission Association, Inc.

1. EPA should adopt enhancements to the regulatory version of CALPUFF (specifically CALPUFF 6.42) in implementing the Regional Haze Rule relative to BART as expeditiously as possible, particularly as applicable to NO_x emission reductions. This updated version of CALPUFF has already been placed in the public domain and additional tests have been completed and reported at the 10th Modeling Conference. As needed, EPA should quickly conduct its own tests and evaluations.
2. Various studies have concluded that the current version CALPUFF 5.8 over-predicts particulate nitrate formation by a factor of 3 to 4 under wintertime conditions. EPA has recognized that the model may overstate the visibility effects of an individual source.

Oglethorpe Power Corporation

1. AERMOD Low Wind Speed Issue – AERMOD's tendency to overestimate concentrations at low winds speed is exacerbated by implementation of AERMET and AERMINUTE. There has not been sufficient justification and verification regarding the validity of the resulting estimates. EPA should consider modifying u^* and σ_v as recommended at the 10th Modeling Conference.
2. Development of Off-Site Emission Inventories for the 1-hour SO₂ and NO₂ NAAQS – Interim SILs for the SO₂ and NO₂ NAAQS are very stringent, inconsistent with other historical SILs, and can lead to large SIAs; guidance on SIAs is not clear and help has not been provided to relevant State efforts. EPA should provide detailed guidance on off-site emission inventories for use in modeling analyses for the 1-hour NAAQS.
3. Reconsideration of the Ambient Ratio Method (ARM) Value to be used in 1-hour NO₂ NAAQS Analysis – The relevant ratio is highly restrictive and conservative. EPA should review data as provided for the 10th Modeling Conference and provide a revised ARM method for Tier 2 for 1-hour NO₂ NAAQS analyses.
4. AERMOD Version 11059 Model (and subsequent Versions) Changes Related to Building Downwash – EPA has modified the AERMOD code to consider potential downwash effects for stack heights that equal or exceed the EPA GEP formula height. This code modification seems to represent a revision to the algorithms within the model. There was no opportunity for public comment and no justification or consequence analysis has been provided. EPA should provide a justification and consequence analysis for this change to the AERMOD model. Public peer review and comment should be allowed for this model change.

West Associates

1. EPA's 2005 BART Guidelines acknowledged the need for CALPUFF 5.8 updates, since the regulatory approved CALPUFF version 5.8 may overestimate the amount of nitrate produced from point source NO_x emissions and chemistry modules in CALPUFF 5.8 are less advanced than more recent atmospheric chemistry simulations. Comparisons of field measurements of sulfates and nitrates with corresponding values predicted by CALPUFF 5.8 indicate that the model over predicts particulate nitrate formation by as much as a factor of three to four under wintertime conditions.
2. Studies demonstrate that CALPUFF 6.4 has superior predictive capability. A new chemistry module to reduce CALPUFF 5.8's over prediction of nitrates has been proposed, tested and evaluated; additional tests recommended by EPA have been completed (supporting documentation is provided).
3. EPA should conduct its own tests/evaluations of the new version of the CALPUFF model as soon as possible, before final BART determinations are made, then move expeditiously to designate CALPUFF 6.4 as the regulatory version of the model for BART determinations. Such an approach is consistent with the process EPA has used for recent changes to the AERMOD model.
4. Due to the demonstrated superiority of the chemistry in CALPUFF 6.4, its more accurate predictions of particulate nitrate formation, and its wide acceptance in the scientific community, EPA should encourage modeling demonstrations using CALPUFF 6.4 for NO_x emission reductions. This new chemistry, as well as the entirety of CALPUFF version 6.4.2 can be accepted for BART determinations under Section 3.2 of Appendix W; this section is designed to allow use of important model enhancements or alternative models in a timely way on a case by case basis, without the 3 to 5 year wait for formal rulemaking.

American Petroleum Institute

The promulgation of more stringent NAAQS and requirements for 1-hour modeling, including the proposed use of modeling for SO₂ area designations have resulted in the need for improved modeling methods and evaluation. Key recommendations for EPA action are summarized below for implementation periods characterized as Short-Term (0 – 1 years), Mid-Term (1 – 3 years) or Long-Term (3+ years). EPA should develop a research plan and schedule for addressing these modeling issues. This plan should be shared and discussed with the modeling community.

1. AERMOD NO₂ Plume Chemistry –
 - a. (ST) Issue guidance allowing use of Ambient Ratio Method 2 (ARM2) as a Tier 2 method.
 - b. (ST) Continue collaborating with the API on improvements to the PVMRM (a Tier 3 method). Make the AERMOD PVMRM formulas (e.g., relative dispersion) consistent with the original formulations by Hanrahan.
 - c. (MT) Evaluate other more sophisticated NO₂ plume chemistry models such as SCICHEM and RPM; adopt those plume chemistry models if the more complete chemical mechanisms provide significantly better accuracy than AERMOD/PVMRM.
 - d. (LT) Consider new NO₂ field experiments involving shorter stacks, source emissions sampling, and ground level sampling where ozone, NO and NO₂ are measured.
2. AERMOD Over-predictions in Stable Low Wind Conditions
 - a. (ST) Resolve the stable low wind problem with AERMOD by means of science-based revisions to the boundary layer and dispersion formulas. Specific technical recommendations are listed in the attached report and are a combination of recommendations from the Paine et al. (2010) report plus more recent analyses.
 - b. (ST) Change the critical wind speed in the AERMOD formula for deriving u* in very stable conditions, thus increasing u* as well as turbulent speeds and the derived mixing depth during low wind conditions.
 - c. (ST) Increase the “minimum σ_v and σ_w ” so as to avoid very low values which lead to unrealistic over-predictions of concentrations.
 - d. (ST) Modify the weighting factors in the AERMOD low wind method of averaging the meander (pancake) and coherent plumes. The meander (pancake) component should receive a larger weighting than at present.
 - e. (MT) Change the wind and temperature profiling methods in AERMOD so as to assure smoother profiles in conditions when the input wind observation height is above or near the mixing height at night.
 - f. (LT) Explore better use of sub-hourly (2 min average) meteorological data available from the NWS airport sites.
3. CALPUFF Regulatory Model
 - a. (ST) Adopt the current version of CALPUFF with improved chemistry (e.g., v 6.42) as the regulatory version.
4. AERMOD GEP Stack Height Formula and Building Downwash Modeling
 - a. (ST) Return to the previous practice of allowing “Equivalent Building Dimensions” (EBDs) for open lattice and porous structures and allow CFD models to contribute to the decision process.
 - b. (MT) Evaluate the accuracy of plume downwash conditions for short stacks and light wind speeds using the AGA and other relevant databases; vertical profiles of meteorology in stable conditions should also be reviewed.

5. AERMOD Extrapolation of Airport Wind Observations to Other Sites
 - a. (ST) Return to the previous 3 km radius method for estimating surface roughness length z_0 around a site. The recent change to a 1 km radius is too small.
 - b. (LT) Use resistance relations suggested by Blackadar and Zilitinkevich to more realistically develop wind profiles at the modeled site.
6. Use of Observed Emissions and Monitored Concentrations
 - a. (ST) EPA should issue a reminder to the Regional offices and the states regarding the availability of the option in Section 10.2.2 of Appendix W for use of monitoring in lieu of modeling when there are no suitable models for use in NSR permitting.
 - b. (ST) SO₂ area designations should be made primarily using monitoring data as opposed to using model-predicted concentration estimates.
7. Regional Chemistry Models (CMAQ, CAMx, and others)
 - a. (MT) Regional chemistry models should have a larger role in the EPA Air Modeling Conferences. While there is an annual CMAS conference, it does not provide a formal mechanism for public review and comment
8. Background Concentrations
 - a. (ST) The background concentrations should conform to the averaging times (e.g., one hour, one day, annual) and the spatial domain (e.g., 10 km, 100 km, 500 km) of the scenario being modeled.
 - b. (LT) Methods should be devised for use in defining and determining background concentrations in areas with many sources at local and mesoscale distances to void problems such as double-counting in modeling for compliance determinations.
9. Model Evaluation and Data Bases
 - a. (ST) The modeling community should have easy access to all field and laboratory data bases used by the EPA to develop and evaluate models. EPA should keep this information on a devoted server and include adequate metadata.
10. Collaboration among EPA, Stakeholders and Researchers
 - a. (ST) EPA should consider the comments from the 10th Modeling Conference and develop a research plan and schedule for addressing modeling issues.
 - b. (ST) There should be communication and coordination within EPA (e.g., OAQPS and ORD), and external communication and collaboration with stakeholders such as industries, state agencies and consulting companies who must use the models, and with national and international scientists who are working on improving models.
 - c. (ST) EPA OAQPS should continue to use a technical work group to suggest technical solutions and provide technical review of new models and model revisions.

In addition, the attached technical assessment makes recommendations on:

1. Urban dispersion methodology in AERMOD – incorporate urban canopy formulas for wind and turbulence profiles.
2. Straight-line assumption in AERMOD – reconsider and reduce the distance limits for AERMOD and other straight-line Gaussian plume models
3. Use of CALPUFF at distances less than 50km – plan for adopting a Lagrangian puff model, like CALPUFF or SCIPUFF, at all distances within the next few years.
4. Use of 3D prognostic meteorological models for inputs to dispersion models – make no major change such as adoption of MMIF until test runs with AERMOD and CALPUFF are completed, documented and made available for public comment to show that meteorological models provide comparable performance compared to standard inputs.

BP America, Inc.

1. Overview -- These comments identify issues with the current Guideline process, as well as attempt to provide suggestions to help address related issues. More detailed technical comments are provided in attachments.
2. EPA should offer a formal mechanism for the modeling community, including the states and the regulated community, to comment or provide peer review on the models and modeling methods. The current process that EPA uses including the Modeling Clearinghouse, internal memorandums to the EPA Regional Air Division Directors, and general guidance memorandums to issue modeling guidance precludes public input and lacks any form of outside peer review.
3. EPA should develop a spirit of collaboration with stakeholders independent of any specific project. In addition, a panel of recognized experts (evenly split between state agencies, universities, public and industry) should be appointed to address modeling issues. The panel should
 - a. provide short term research objectives along with measurable performance milestones
 - b. provide feedback to EPA management regarding research needs
 - c. help develop methods of reducing the time required to implement changes in the Modeling Guideline (Appendix W)
 - d. provide peer review of Model Clearinghouse actions
 - e. provide technical peer review on changes to guideline models
4. EPA should take comments regarding modeling deficiencies and develop a research work plan. This work plan should be developed by EPA with outside peer review. The plan needs to include a timetable for research milestones and a budget. The plan should be published for public comment and should address the recommendations provided below.
 - a. Use of Air Quality Models in a Regulatory Setting (ongoing activity over the next 0-2 years) -- EPA should get input from stakeholders and publish its determination that demonstrates model accuracy is sufficient to meet the current policy needs. If EPA concludes that model accuracy does not provide a tool for policy use, then alternative approaches that could be used for meeting current policy needs include coupling modeling and monitoring and use of modeling in more of a relative mode as in the case of PM and ozone modeling, or to base compliance with the NAAQS using a combination of BACT and ambient monitoring as allowed under Section 10 of the Guideline
 - b. Determination of Model Accuracy – EPA Model Evaluations (ongoing activity over the next 0-2 years) -- EPA should re-examine the previous AERMOD evaluations for a 1-hour period and determine what limitations exist in the current model evaluations that need further analysis; model accuracy should be tested and conclusions reached regarding sub-categories such as stack height, downwash, and meteorological conditions (including low wind speeds).
 - c. Low Wind Speeds (short term high priority to address over the next year) -- EPA should review the API low wind speed modifications to AERMOD and suggest modifications to address deficiencies, then subject model revisions to peer review and public comment; until review and revisions to AERMOD are completed, EPA should revert to the previous definition of calm wind speed (<1 m/s = calm).
 - c. NO₂ 1-hour Modeling (short term high priority to address over the next year) – EPA should review and implement the NO₂ Ambient Ratio Method 2 and corrections to

- AERMOD PVMRM that API has identified; evaluate other NO₂ models beyond AERMOD PVMRM and OLM such as SCICHEM.
- d. Overarching Procedural Concerns (ongoing activity over the next 0-2 years) – EPA should develop a process that facilitates changes to Appendix W. When changes are required, EPA needs to publish draft changes, accept comments, respond to comments in a final document, and incorporate the changes by reference without having to update the entire Appendix W.
 - e. EPA also needs to develop a peer review process. Such a process needs to evaluate the scientific principles, implementation of the principles into the model and evaluate the verification of any changes. Peer review must include EPA ORD, academia and other stakeholders. In addition, EPA must adequately address the concerns raised by any peer review group.
 - f. EPA should change the model clearinghouse process to allow the regulated community to bring questions and proposals directly to OAQPS if the states and the regions deny them.
 - g. AQRV Analysis (short term high priority to address over the next year) – EPA should incorporate the new version of CALPUFF that API had developed which includes both corrections to errors in the existing gas-phase chemistry module, as well as incorporation of new science modules for inorganic and organic aerosols and aqueous-phase chemistry into the Guideline. Related steps include:
 - i. Add a post-processing step to recalculate inorganic aerosol equilibrium at receptor locations to address lack of treatment of ammonia limitation for multiple or overlapping puffs.
 - ii. Add an upper limit for particulate nitrate formation that is based on the amount of ammonia available in the background in CALPUFF to prevent the output of particulate ammonium nitrate concentrations that are physically unrealistic and when CALPUFF does not conserve mass of ammonia (as is the case in the current model).
 - iii. Incorporate into the Guideline CALPUFF with the improved RIVAD chemistry.
 - h. Portable Sources (short term high priority to address over the next year) – EPA needs to revise the February 2012 memo regarding modeling of temporary sources. BP has outlined an approach that can be used to address impacts or sources that do not remain at a fixed location for a 3-year period.

American Iron and Steel Institute

1. Overview
 - a. There will be significant difficulty in permitting new or expanded sources as a result of inadequate tools and guidance for addressing the implementation of new NAAQS. The requirements for states to model thousands of sources using flawed tools will result in mandates for unnecessary controls on existing sources and, in some cases, make continued operation infeasible.
 - b. Significant over-prediction continues for particulate emissions and other pollutants, particularly when applied to the complex facilities with multiple non-stack sources with irregular emission rates operated by AISI members.
 - c. Models used to implement the NAAQS must be improved to address these flaws prior to NAAQS implementation. There are several issues discussed below that need to be addressed. Issues that have been identified as a problem and also have viable technical solutions include: fugitive particulate matter modeling; AERMOD over-predictions for low wind speed periods; the use of reasonable operating scenarios as inputs; and downwash algorithm anomalies. Technical details of some issues are provided in attachments to AISI comments.
 - d. In addition, EPA should establish a process to formally address these modeling issues and make significant changes to improve the accuracy of models used in NAAQS implementation. One option is to continue to utilize the Technical Workgroup that the agency formed to plan for and prepare the agenda for the conference.
2. AERMOD was designed to predict steady state emissions from stacks, and has not proven capable of accurately predicting contributions to ambient concentrations from the fugitive, mobile, and variable sources operated by AISI members.
3. Significant work has been done to assess the underlying technical problems contributing to the over-prediction bias for non-stack sources in AERMOD, including uncertainties associated with fugitive emissions or other non-stack sources and unique dispersion characteristics and depletion/removal features associated with these sources. Use of ambient monitoring is the only way to reliably measure the ambient impact of these sources.
4. Appendix procedures drive over-prediction bias with multiple layers of conservative assumptions. To reduce the over-prediction bias: (1) use actual hourly emissions, or reasonable worst case emissions rates in their absence; (2) actual meteorological data, instead of worst case assumptions; (3) actual monitored background concentrations.
5. Use more plausible receptor locations where the public has reasonable access and can stay stationary for the entire period associated with an ambient standard, e.g., don't include transportation corridors.
6. Address the low wind speed problem associated with use of AERMOD and AERMINUTE, and limit use for regulatory purposes until resolved.
7. Limit use of the PRIME downwash algorithm for light winds (< 1 mps) and excess heat releases until improved; refine profiles of wind, temperature and turbulence during periods of light winds and stable conditions.
8. Apply a pre-processed adjustment (e.g., 50%) to particulate emissions from roadways and pits to compensate for inadequate treatment of plume dynamics by AERMOD.
9. Consider treatment of industrial facilities with substantial "fugitive heat" releases as urban areas.

10. Adjust AERMOD for buoyant volume sources by separately calculating hourly plume rise and then using the volume source feature.
11. Improve how AERMOD treats haul roads, slag pits, and material handling by how the source is represented in the model input using techniques described in the attachment.
12. AERMOD should not presume that secondary formation of PM_{2.5} from precursors occurs at the same time and location that primary pollutants have their greatest impact. Refinement and testing against field data are necessary before models like AERMOD can be appropriately used.
13. The use of ARM2 should be considered to better accommodate variation of the ambient NO₂ to NO_x ratio with the NO_x concentration.
14. Modeling should not be used to determine nonattainment areas or any other regulatory obligation until AERMOD is validated with measured values.
15. Ways to incorporate EMVAP in taking into account source emissions uncertainties and intermittent sources should be considered in implementing a variable emission rate limit.
16. The use of monitoring in lieu of modeling should be clarified to enhance its use in characterizing source impacts.
17. Use less conservative levels for SILs that are consistent with percentile values on which NAAQS are based.
18. Implement a transparent process that solicits the broad expertise available to refine air dispersion modeling and allows for public notice and comment rulemaking.

National Mining Association

1. Overview. EPA should perform an overall re-evaluation of the Agency's policies and procedures that drive its determinations regarding the application of regulatory modeling. Current regulatory practices consistently rely on untested models with hastily developed, ad hoc agency "guidance". Modeling requirements that rely on a proliferation of guidance in the form of clarification memoranda, implementation guides, and draft/revised user's guides which have the effect of making promulgated standards significantly more stringent without formal rulemaking is inconsistent with the Clean Air Act and basic principles of administrative law. Moreover, repeated application of model algorithms beyond the scopes of their evaluated and recognized applicability and capability are simply not "good science". A deliberate rulemaking approach that seeks formal public input would be a more appropriate means for establishing modeling requirements that are firmly grounded in fundamental scientific principles. The application of currently-approved models to fugitive particulate emissions from surface mining operations as well as to the 1-hour NO_2 and SO_2 standards is of concern. For fugitive particulate emissions from surface mining operations, EPA's assessment must begin with a longstanding congressional mandate that establishes certain alternative regulatory approaches when EPA's models and emission factors result in excessive and unacceptable levels of over-prediction. EPA must implement some of the readily available revisions that can improve model performance. EPA should also consider accepting CALPUFF for near-field application with complex terrain, such as that frequently encountered in industry mining operations.
2. EPA's approach for modeling fugitive particulate emissions falls short of satisfying the Agency's guiding principles for best scientific analysis, rule of law, and transparency.
 - a. EPA's emissions factors and models over-predict short-term ambient impacts of fugitive PM_{10} emissions from surface coal mines.
 - b. EPA's reliance on guidance documents to make significant alterations to modeling requirements circumvents the notice-and-comment rulemaking prescribed by law.
 - c. EPA's Model Clearinghouse and its issuance of "clarification memoranda are clearly unacceptable alternatives to notice-and comment rulemaking.
3. Unacceptable performance of EPA's models and emission factors when applied to fugitive particulate emissions and dust is well known and documented.
 - a. A memorandum of agreement indicates that ISC3 will not be used for regulatory application involving surface coal mines and that monitoring in lieu of modeling is acceptable.
 - b. EPA must re-visit the statutory prohibition and mandate before either EPA or the States require future modeling of PM_{10} and $\text{PM}_{2.5}$ emission from surface mining operations. The fact that ISC3 has been replaced by the AERMOD model does not render sections 234 of the CAA as either irrelevant or no longer applicable.
4. Revisions are readily available to account for AERMOD deficiencies (see Cowherd paper).
 - a. Improved AERMOD predictions at low wind speeds – EPA should implement changes to AERMET/AERMOD that reduces prediction of unrealistically high ambient impacts during low wind speeds.
 - b. Emissions preprocessing to address near-source plume-depletion mechanisms and conservative source configuration properties – (1) EPA should consider the concept

- of “transportable fractions of fugitive dust as a function of ground cover bordering the source of the fugitive dust in AERMOD applications, and (2) EPA should apply a 50% reduction for haul road emissions outside the confines of the quarry pit, as well as a 50% reduction for other fugitive particulate emissions from mining operations to account for plume depletion mechanisms. Field test data should subsequently be obtained to confirm the magnitude of the reduction factor.
- c. Emission preprocessing to account for AERMOD’s improper representation of pit retention – EPA should apply a preprocessing reduction of 75% for fugitive particulate emissions within the confines of the pit.
 - d. Application of probabilistic approach to account for the intermittent nature of emissions from smelters – EPA should adopt presented methods for sources with intermittent emissions and adopt this approach for any modeling that may be required at smelters; AZ examples for multipoint rollback are available for enforceable permit limits based upon a probabilistic emissions model.
 - e. Use CALPUFF for near-field modeling in complex terrain – EPA should consider approving CALPUFF as a superior model because of its ability to handle three-dimensional wind fields that more accurately reflects actual conditions.
 - f. Monitoring in lieu of modeling – EPA has endorsed use of SO₂ monitoring for “sources that may not be as conducive to modeling as are larger SO₂ sources”, so for such sources at surface mines, e.g., nonroad engines of various types, EPA should authorize the use of monitoring data to demonstrate compliance with short-term PM₁₀, PM_{2.5}, SO₂ and NO₂ NAAQS.
 - g. Definition of ambient air – EPA should adopt more plausible assumptions about receptor locations where the public has reasonable access and can stay stationary for the entire period associated with an ambient standard.
 - h. AERMOD over-prediction of building downwash for certain geometries and wind speeds – EPA should consider proposed threshold wind speeds for downwash effects.
 - i. EPA should adopt a technical work group to support model development and application – EPA should include industry associations to provide various technical resources and expertise for workgroup efforts that could be targeted toward fundamental program development or alternatively at source-specific application.

Wyoming Mining Association – supports comments from National Mining Association

1. Unacceptable performance of EPA models and emission factors when applied to fugitive particulate emissions
 - a. The over-predictive nature of current EPA models with respect to modeling fugitive dust emissions from surface mining operations on a short term basis has been identified as an on-going issue critical to the coal mining industry, e.g. Sec. 234 of the CAA.
 - b. A Memorandum of Agreement (MOA) allows WY to conduct monitoring in lieu of modeling for assessing coal mining-related impacts in the Powder River Basin. In addition, AP-42 notes that haul road emission factors should be used with caution and awareness of their likely limitations.
 - c. No other actions relative to Sec. 234 can be found, and EPA has failed to satisfy the Congressional mandate. Yet current regulatory practice has required the modeling of fugitive emissions on a short term basis from surface mining operations in almost every state except Wyoming. Replacement of ISC3 with AERMOD doesn't rectify this.
 - d. EPA must re-visit the statutory prohibition and mandate before either EPA or the States require future modeling of PM₁₀ emissions from surface mining operations on a short-term basis.
2. AERMOD predictions for low wind speeds – EPA should immediately initiate AERMOD revisions to better simulate transport and dispersion under low wind speed conditions; until such revisions are completed and tested, AERMOD results for low wind speeds (less than 1.0 m/s) should not be included in model results (as is currently the case for “calm” conditions).
3. Distance limitation to AERMOD validity – EPA considers AERMOD results to be applicable to a distance of 50 km; however, it has been shown that, for most circumstances, a steady state model is only applicable to 20 km or less. Unless meteorological conditions are persistent (similar wind speed and direction) in succeeding hours, model-predicted concentrations at receptors beyond the one-hour travel distance should not be accepted as meaningful. AERMOD should be modified to delete such concentrations from the output, or at least provide a notification to the user to disregard such results in interpreting the model output.
4. Intermittent sources – EPA guidance for intermittent sources, e.g., blasting activities at surface mines, is vague and overly conservative and States have adopted various interpretations. EPA should provide definitive guidance that is based on a realistic evaluation of the likelihood that an intermittent source will threaten the standards; see example relative to probability-based approaches.
5. Background concentrations – current guidance based on use of the 98th or 99th percentile monitored background values are unrealistically conservative. EPA should approve a method of pairing model-predicted concentrations with monitored concentrations that are paired in-time. Also, more appropriate guidance is required to eliminate double counting of impacts from modeled sources and those impacts represented in background monitoring data.

Alpha Coal West, Inc. – exact duplicate of comments from Wyoming Mining Association

Barrick Gold of North America, Inc. – supports comments from National Mining Association

1. These comments largely duplicate those from Wyoming Mining Association and Alpha Coal West, Inc., either by paraphrasing similar reference materials or by an exact copy on topics such as low wind speeds, AERMOD distance limitation, and background concentrations.
2. Concerning unacceptable performance of EPA models, it is noted that even though Section 234 specifically addresses surface coal mines, the factors and modeling algorithms that are uncertain for coal mining operations are equally uncertain for other types of surface mining activities; therefore, there is no scientific basis for these air models to treat hardrock surface mining different from surface coal mining.
3. Concerning complex terrain and alternative models, it is noted that AERMOD may not be an appropriate model, where varied and extensive complex terrain exists in the area of multiple sources and this terrain extends from the sources to the location of receptors where design concentrations are expected. Non-steady state models such as CALPUFF are theoretically more appropriate for such applications, particularly where mesoscale forecast models and their use in generating realistic input meteorology to CALPUFF make it a preferred alternative to AERMOD. EPA should acknowledge the potential applicability of alternative models for appropriate situations.

Peabody Energy

1. EPA models and emissions factors applied to fugitive particulate matter emissions – Section 234 specified that EPA make revisions to eliminate over-prediction. To date, no satisfactory revisions have been made. Until emission factors and modeling methods can be shown to provide accurate predictions, EPA has to adhere to the statutory prohibition that prevents it from relying on dispersion models for particulate impacts associated with surface coal mining activities.
2. AERMOD predictions for low wind speeds – EPA should introduce AERMOD revisions to more accurately simulate transport and dispersion under low wind speed conditions. Current AERMOD predictions for low wind speed (less than 1.0 mps) are not valid and should not be included in model results (which unfortunately is presently the case for "calm" conditions) until these AERMOD revisions are implemented and tested.
3. AERMOD distance limitation – Currently, EPA considers AERMOD results to be applicable to a 50km distance; however, it has been shown that applicability should be limited to 20km or less under most circumstances. Model-predicted concentrations at receptors beyond the one-hour travel distance should not be accepted as meaningful unless meteorological conditions are persistent (similar wind speed and direction) in succeeding hours. As such, AERMOD should be changed to remove these concentrations from the output, or provide a notification to the user to disregard these results in interpreting the model output.
4. Intermittent sources – The approach to modeling intermittent sources, e.g. blasting activities, should be based on a realistic evaluation of the likelihood that an intermittent source will threaten the standards, and should be supported by sound science. This would permit EPA to avoid the necessity for extensive modeling analyses. It would also prevent the need for unnecessary source modifications that result from overly conservative impact estimates.
5. Blasting impacts – AERMOD, which assumes continuous and constant emissions over a one-hour time span, is not capable of validly modeling the nearly instantaneous source that is blasting. The application of AERMOD in its regulatory form is not an appropriate methodology for assessing blasting impacts, as ground-level concentrations are generally over-predicted. Field studies that are well-designed are required to better define blasting emissions and dispersion, the results of which could be used to better analyze the assessment of blasting impacts. A probability approach to quantifying blasting impacts would be appropriate, rather than determining the maximum possible impact given blasting on some or all hours of the year.
6. Background concentrations – Current guidance on the use of background data is unrealistically conservative. Highest monitored background or 98th/99th percentile values usage causes an unreasonable limitation to allowable source impacts. Pairing of model-predicted concentrations with monitored concentrations in time provides a means to obtain a realistic projection of whether or not a potential exceedance is likely. EPA should immediately approve this method of accounting for background concentrations in all situations where representative background data exist. Additionally, more appropriate direction is required to eliminate double counting of impacts from modeled sources and those impacts represented in background monitoring data. Where representative regional monitoring data exist, there should be no requirement to model regional sources whose impacts can reasonably be presumed to be reflected in the monitoring data.

The National Environmental Development Association's Clean Air Project

1. General Comments
 - a. Refinements of Appendix W models are critical, as are improved “modules for processing inputs” into the models.
 - b. Weather and timing elements are so critical to model predictions that collection of site-specific meteorological data can make or break a model outcome where use of regionally collected airport data once may have been sufficient.
 - c. Proposed priorities for EPA model refinements in 2 below and related policy priorities are respectively listed in 3 and 4 below.
2. High priority, near-term (3 months) refinement of EPA's preferred dispersion Models
 - a. Allow use of AERMINUTE permissively but do not mandate its use
 - i. Allow sources to use available air monitoring data to pair monitored values and hourly emissions.
 - ii. By waiving the use of AERMINUTE, incentivize partnerships between state air authorities and sources for the collection of real time meteorological data.
 - b. Aggressively prioritize refinements to AERMOD for modeling building downwash for low wind speeds and cases with large or long buildings. The currently mandated.
 - i. Approve approaches for accurately modeling buoyant plumes from line/volume sources.
 - ii. Allow the use of post construction monitoring at receptors with high predicted impacts to allow construction of new sources and provide technical input for model refinements. If necessary, back up monitoring with permit conditions if certain values are exceeded.
 - c. Prioritize refinements to dispersion models for low wind speeds. In the interim, establish or set a lower wind speed threshold of 1 meter per second.
 - d. Allow a set ground level 1st layer mixing height at 68 meters (minimum) pending completion of technical work to confirm a lower mixing height is real and suitable for use.
 - e. Recognize and use the form of each NAAQS to determine the modeled design value. Just as EPA allows modeling of the 8th high for NO₂ (98th percentile), and 4th high for SO₂ (99th percentile), modeling for PM_{2.5} should evaluate the 8th high (98th percentile).
 - f. Approve modelers' use of the American Petroleum Institute's corrections to AERMOD PVMRM for NO₂, the NO₂ Ambient Ratio Method 2, the low wind modifications to AERMOD, and the new version of CALPUFF with updated chemistry.
 - g. Give careful consideration to avoiding double-counting impacts in modeling and background. In particular, background should be determined on an event basis.
3. Communicate to EPA Regional and State modelers and permit authorities as soon as possible that Section 10 of Appendix W allows use of monitoring when a suitable model is not available or when modeling is less acceptable than monitoring, as indicated in Section 10 of Appendix W to Part 51.
 - a. See various examples given at the modeling conference.
 - b. It is noted that for proposed new sources or major modifications of existing sources, permits would include conditions that address how monitoring would be done and what happens if exceedances of standards are monitored.

4. Re-Invent the Model Clearinghouse and/or Adopt Another Means of Communicating Technical Developments to Modelers on a Regular Basis.
 - a. EPA needs a process to incorporate changes by reference without update to the entire Appendix W. EPA should publish the draft changes, accept comments, and respond to comments in the final document. EPA also needs some sort of peer review process that includes EPA ORD, academia, industry, and other stakeholders to evaluate scientific principles, implement the principles in the model, and evaluate the changes.
 - b. Regarding the Model Clearinghouse OAQPS needs to create a more dynamic tool in the near term for modelers to communicate to iron out problems and develop solutions that takes advantage of technological innovations in the field. This tool also would provide a more open platform than monthly conference calls for encouraging States and regional EPA officials' participation making existing models better by submitting for discussion and resolution modeling issues in "real time." OAQPS should establish a regulatory mechanism akin to the quarterly publication of NSPS/MACT, then post at an Internet website case-specific modeling issues and decisions. If necessary, the existing technical modeling stakeholder committee and/or a regional EPA modeling committee could be tasked with monthly modeling conference calls to "peer-review"/prioritize issues brought to the committee's attention.
 - c. Importantly, since the modeling "determinations" will memorialize case-specific resolutions, the resolutions need not establish "precedent" for other modeling decisions or be cast so broadly to be of "national significance," as is the case with postings on the Model Clearinghouse. Instead the mechanism would provide a resource for modelers and regulators to exchange information. Resolutions, even temporary fixes and future rulemakings and shared data or Notices of Data Availability, also could be posted for the modeling community, which presently seems to be unusually dependent on word of mouth for what is permissible, possibly permissible, and might happen in the future.

American Forest & Paper Association

1. Challenges from EPA's modeling guidance – Pulp and paper operations are subject to numerous federal emissions regulations that establish standards for pollutants (e.g., NO₂, PM_{2.5}, and SO₂) regulated under NAAQS. Because of the low SILs associated with the new NAAQS and current conservative modeling assumptions, even relatively small maintenance and construction projects, can trigger permitting requirements.
2. EPA's implementation procedures for recent NAAQS
 - a. Implementation policies specific to dispersion modeling lead to unreasonably conservative outcomes as a result of technical limitations in regulatory modeling.
 - b. EPA has adopted the practice of issuing "clarification memoranda" without the benefit of public notice and comment.
 - c. EPA has not provided adequate tools and guidance for sources to quantify PM_{2.5} emissions and to model ambient impacts. Screening tools for PM_{2.5} compliance demonstrations require a modeled design concentration that is very conservative.
 - d. A minimum 1-year transition period is appropriate before new NAAQS are applicable. Implementation guidance should be developed at the same time, and such guidance subjected to a notice and comment process that allows for stakeholder input.
3. Need to develop practical implementation guidance using suitable modeling techniques for current and future PM_{2.5} NAAQS.
 - a. EPA's interim guidance for PM_{2.5} screening analyses for PM_{2.5} is impractical since
 - i. measured background PM_{2.5} concentrations, except for designated nonattainment areas, are consistently below the current NAAQS by a small margin.
 - ii. it inherently assumes that the day with multi-year average maximum model impact is coincident with the day of the 98th percentile background concentration, unreasonably overestimating the design concentration relative to the NAAQS.
 - b. Case studies are provided following current EPA guidance to assess PM_{2.5} impacts using prescribed screening techniques and compared with a "Paired Sums" approach; most sources cannot demonstrate compliance with the PM_{2.5} NAAQS under current EPA guidance despite being well controlled.
 - c. EPA should reconsider its policy requiring PM_{2.5} modeling analyses for maximum modeled concentration instead of more refined estimates of the design value. Guidance must provide more flexible and refined approaches that enable the use of available monitoring data to make reasonable estimates of cumulative impacts.
4. EPA must provide accurate, stable modeling tools and guidance for industry during periods of significant capital investments to meet new regulatory requirements.
 - a. An example shows a significant increase in the modeled design concentration results from implementation of the AERMINUTE meteorological data preprocessor.
 - b. EPA should make needed changes to update the regulatory modeling system by addressing well-characterized bugs and systematic performance issues (i.e., low wind speed performance), then establish a stable modeling platform for consistent use during implementation of new regulatory programs.
5. Pulp and paper mills can demonstrate compliance with the 1-hour average SO₂ NAAQS when "typical" operations are considered.
6. Streamlined approval of Tier 3 NO₂ analyses should be available. EPA should allow in-stack NO₂/NO_x ratios which are significantly lower, e.g. 20%, than the EPA default value of 50%; examples are provided.

7. Implementation guidance and modeling tools that account for emissions variability, instead of assuming that all emission units operate simultaneously and continuously at the maximum allowable emission rate should be developed; examples are provided.
 - a. Development of an emissions variability processor should be made a priority to account for substantial differences in actual and allowable emissions to avoid overestimation of model impacts.
 - b. Until such modeling tools are in place, EPA should enable state/local permitting authorities to rely upon representative ambient monitoring data and emissions trends, to make decisions that reflect actual air quality conditions and impacts.
 - c. The stringency of the current NAAQS and screening nature of available modeling techniques compel EPA to reconsider other aspects of modeling policy guidance. Most important is the determination of the ambient air boundary to make a reasonable determination in cases where human exposure is unlikely, which includes rights-of-way such as public roads and railroads that transect facility property.
8. Conclusion
 - a. Several areas of concern for which current EPA guidance implements unreasonable and impractical policies that cumulatively overestimate modeled impacts are identified. EPA should adopt priorities to improve modeling tools and guidance.
 - i. Reconsider the policy that considers NAAQS effective for PSD permitting purposes immediately upon issuance, and instead institute a minimum 1-year transition period before new NAAQS would be considered applicable.
 - ii. Propose implementation guidance/rulemaking at the same time new NAAQS are proposed through a notice and comment process that allows for stakeholder input.
 - iii. Implement identified improvements to AERMOD (e.g., resolve the low wind speed bias), AERMET, AERMINUTE, and AERSURFACE as soon as possible.
 - iv. Update Tier 3 NO₂ modeling techniques and enable a streamlined approval process at the state/local level for facilities applying sector/source-specific data.
 - v. Develop PM_{2.5} guidance that can be practically implemented:
 - Use 98th percentile design concentration consistent with form of the standard.
 - Allow the “Paired Sums” approach to account for background PM_{2.5} in the calculation of the 98th percentile design concentration.
 - Adopt a reasonable approach to estimate impacts of secondary PM_{2.5} that appropriately reflect spatial and temporal impacts relative to primary PM_{2.5}.
 - vi. Revisit historical model clearinghouse guidance and enable state/local agencies to apply flexibility and judgment in consideration of source-specific circumstances.
 - vii. Align expectations for modeled ambient air receptors with realistic expectations of general public exposure.
 - viii. Commit to development of modeling tools and implementation guidance that simulates actual emissions profiles, rather than the conservative assumption that all sources emit simultaneously and continuously at the maximum allowable rate.
 - ix. Enable permitting authorities to rely upon representative ambient monitoring results in lieu of, or as a supplement to, modeling results for decision-making.
 - b. EPA should continue to engage industrial stakeholders in advance of issuing implementation guidance or changes to the modeling system to allow for exchange of information and expertise that can avoid unintended or unforeseen consequences of EPA modeling tools and guidance.

The Fertilizer Institute

1. Model Clearinghouse Status and Update Process
 - a. EPA should encourage and accept stakeholder input during efforts to improve the model clearinghouse process, contents and information; this will help reduce the likelihood of errors and deficiencies and the imposition of overly burdensome requirements in the resulting policies and guidance.
 - b. Information disseminated by EPA Conferences on Air Quality Modeling does not comply with EPA guidelines for compliance with the Data Quality Act. Revisions that lack model evaluation support, run contrary to long standing regulatory policy and guidance, and produce demonstrably erroneous results are often without the opportunity for independent peer review or public comment. Stakeholder input, including independent peer review, is often ignored or not otherwise integrated into final decision-making on data dissemination. In other instances, known data quality errors are consistently ignored by EPA.
 - c. EPA should review its procedures for prioritizing, determining and disseminating information through the Conferences on Air Quality Monitoring process to ensure that data disseminated from these meetings are in compliance with EPA Guidance and the Data Quality Act. EPA should examine when and how stakeholder input is integrated into decision-making, how data are prioritized for review and revision, and how proposed changes to air models are validated before data dissemination.
2. Appendix W of EPA Permit and Modeling Guidance and Clarification Memoranda
 - a. Many aspects of the process of updating Appendix W and its contents are deficient. The current version, issued in 2005, is now very out of date with respect to both the existence of known, but uncorrected, errors in the computer codes of the preferred models, and the guidance needed to address the new and more stringent National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) increments that have been promulgated since 2005. The process of verifying reported errors in the preferred model codes needs to be accelerated, and known errors in the model codes must be corrected as soon as possible.
 - b. Numerous model revisions and Clarification Memos have been issued by EPA without the opportunity for public comment and any stakeholder input or participation. EPA should encourage and accept stakeholder review and input during the development and implementation of all model revisions and Clarification Memos.
3. Currently preferred air quality models – AERMOD
 - a. Building downwash – 25 years of regulatory policy and guidance were overturned with respect to modeling the emissions from stacks whose heights equal or exceed the Good Engineering Practice (GEP) formula height by indicating that emissions from stacks whose heights exceed the GEP formula height were subject to the calculation of aerodynamic downwash in any Appendix W guideline model.
 - b. Low wind speeds – The incorporation of AERMINUTE into AERMET radically changed the manner in which AERMOD treats wind speeds. These changes were made in the absence of any model validation using measured data or demonstration that AERMOD is capable of producing valid air pollutant concentrations during wind speed condition below 1.0 mps. The previous AERMOD system model code should be restored immediately in which a minimum wind speed of 1.0 m/s was used in all its dispersion calculations. In addition, future changes to AERMINUTE, AERMET

- and AERMOD that involve wind speeds below 1.0 m/s should not be made until they are supported by appropriate model performance evaluation(s) and have been subject to public comment and participation.
4. Currently preferred air quality models – CALPUFF
 - a. CALPUFF should be upgraded to correct all known bugs.
 - b. EPA must implement the well documented enhancements that have been developed since the 9th Modeling Conference, following the timely opportunity for public comment and participation.
 5. PM_{2.5} modeling issues
 - a. Un-validated revisions to AERMOD will certainly result in predicted PM_{2.5} concentrations that are erroneously large. As such, those over-predictions will prevent or hinder the development and construction of projects that otherwise and in actuality would not have unacceptable ambient air quality impacts.
 - b. In the case of PM_{2.5}, the small margins that exist between the NAAQS and the background concentrations will greatly magnify the adverse consequences of the tendency of AERMOD to over predict air quality impacts. PM_{2.5} modeling guidance to address these extremely challenging issues will have insufficient time for effective review and comment.
 6. 1-hour NO₂/SO₂ Modeling
 - a. EPA guidance, e.g., “Clarification Memos”, was developed over the past two years to address a variety of previously unrecognized and/or underappreciated consequences of the new NAAQS. Even so, the most recent of such memos contain ambiguities, logical inconsistencies, unscientific recommendations and superfluous requirements, some of which are also contrary to the Appendix W modeling guidance.
 - b. There is a lack of clarity regarding the acceptance criteria for deriving and using both source-specific in-stack NO₂/NO_x emission rate ratios and a site-specific NO₂/NO_x ambient equilibrium ratio, and when it is necessary to use their “default” ratios of 0.5 and 0.9, respectively, as AERMOD model input. There is also a lack of clarity regarding acceptance criteria for selecting and utilizing background ozone (O₃) and NO₂ ambient air quality monitoring sites and data, when utilizing the Plume Volume Molar Ratio Method (PVMRM) algorithm in AERMOD to calculate the total concentrations attributable to the modeled sources plus the background concentrations.
 - c. EPA’s recommendation for deriving NO₂ and SO₂ background concentrations is unnecessarily stringent and unscientific; the cause and effect relationships that exist between the actual hour-by-hour meteorological conditions that produce both the predicted impacts of the modeled sources and the actual measured background concentrations.
 - d. EPA should allow and encourage the appropriate use of concurrent 1-hour average modeled and measured concentrations to demonstrate compliance with the 1-hour average NO₂ and SO₂ NAAQS.

Koogler and Associates, Inc. – supports comments of the Fertilizer Institute

1. General Comments
 - a. The Model Clearinghouse must be revised in its content and its method of review and approval of updates to meet the demands of a shift to using modeling as a “hybrid” approach (i.e., monitoring to determine NAAQS status with modeling as an indicator).
 - b. EPA should not issue modeling guidance as non-binding if it intends to later treat that guidance as binding; there is a necessity for such guidance and related documentation in the Clearinghouse to undergo the rigors of proposed rules and the rulemaking process.
 - c. EPA should provide appropriate notice, and an opportunity for comment, prior to finalizing the rule requirement to use ambient air quality modeling for any approach, including a “hybrid” approach, to establish nonattainment areas.
 - d. The model version relied upon by the State and EPA must remain valid for clearly defined time periods or on the basis of some predictable measure that provides the regulated community assurance of the valid application of a model and its results, e.g. revision to AERMOD downwash.
2. Model Selection
 - a. CALPUFF should be an approved alternative model without the need for the justification required by Section 3.2, Appendix W, 40 CFR 51, rather than AERMOD, in multi-source situations (including those in which the impact of multiple sources are calculated to determine “background”).
 - b. There are limitations to AERMOD in areas of complex terrain, in areas where there is a significant land/water interface, and at distances greater than 20km.
 - c. Due to the steady-state transport limitation of AERMOD, there is a tendency to over-prediction of impact at mid-range and long-range target receptors.
3. Background concentration
 - a. There is a need for an improved method to account for SO₂ background concentrations.
 - b. To obtain the most appropriate background concentration for the target area, consideration should be given to using a “frequency of occurrence” approach (see example provided), rather than the uniform background concentration typically used in AERMOD.

Coulter Air Quality Services

EPA’s New Stack Downwash Policy Lacks Proper Demonstration and is Ill-posed – The change is aerodynamic downwash policy reflected in MCB#4 for AERMOD, is technically flawed, is inconsistent with EPA policy for good engineering stack height, is a subversion of the spirit and letter of the Administrative Procedures Act of 1946, and should have been subjected to public notice and comment procedures.

Camille Sears

1. Single-source ozone and PM_{2.5} modeling should be used in permit applications for major emission sources
 - a. USEPA should develop a time-table for model development for single-source ozone and PM_{2.5} impacts, which includes opportunities for public input and comments. In the interim, USEPA should provide enhanced case-by-case support to State and Local agencies on what models and protocols to use.
 - b. Comments on this same issue were provided at the 9th Modeling Conference and EPA responded in an affirmative manner relative to the Sierra Club Petition.
 - c. Opportunity for public comments on two Environ reports (WA #4-06) should be provided.
 - d. With respect to ozone, single-source ozone impact analyses, using photochemical grid modeling, should be required for major NO_x and VOC emission sources.
 - e. State and Local agencies should be required to consult with the Regional meteorologists on this issue and they must work with USEPA on a case-by-case basis for determining the best models to use for assessing single-source impacts from major NO_x and VOC emitting facilities.
 - f. With regard to Draft PM_{2.5} Permit Modeling Guidance, further development is needed to provide additional details on how the four scenarios will also protect the PM_{2.5} PSD increments, not just compliance with the PM_{2.5} NAAQS; clarification of the four individual scenarios is also desirable.
2. Air dispersion modeling should be the preferred method for determining one-hour SO₂ impacts
 - a. In virtually all cases air dispersion modeling should be used to determine one-hour SO₂ impacts from coal-fired power plants and other major SO₂ emission sources; modeling should be applied in all situations except where source-specific SO₂ monitoring exists and the monitor is properly located to capture maximum facility impacts. All NO₂, PM_{2.5}, and SO₂ NAAQS and PSD increment compliance verification analyses are performed with air dispersion modeling, such as running AERMOD in a manner consistent with the Guideline on Air Quality Models. In order to ensure consistency in how air impacts are determined, both existing sources and newly permitted sources should be assessed using the same methods. If existing sources are allowed to use monitoring, which are generally not “well-placed” for measuring the maximum ambient air impacts from existing sources, this results in a lower standard of compliance verification than that being used for new permit applicants.
 - b. It should be noted that contrary to comment by some industry representatives, AERMOD’s evaluation analyses include a number of site-specific meteorological data sets that incorporate low wind speed conditions.
 - c. Concerning the use of actual emissions for nonattainment SIP modeling, a condition must be added to the facility’s permit requiring that emissions must not be greater than the level used in the modeling analysis. Also, actual emissions cannot be modeled using full load stack parameters; stack gas exit velocity and temperature is reduced under less than full load conditions, affecting plume rise and resulting modeled impacts. Any AERMOD modeling using actual emission levels must use corresponding actual stack gas exit velocity and temperature.

North Dakota Department of Health

1. Application of AERMOD should be limited to distances of 20 kilometers or less. That is, AERMOD should be used only when all nearby sources are located within 20 kilometers of the subject or primary source. If nearby sources (which must be included in the cumulative analysis) are located more than 20 kilometers from the primary source, the steady-state AERMOD model will not be adequate, and CALPUFF (or possibly similar dynamic model) should be used instead.
2. If nearby-source impacts are important in an analysis, CALPUFF's handling of nearby sources is superior to AERMOD's, and similar overall performance of CALPUFF should make it preferred in such a case involving nearby sources. AERMOD's handling of nearby sources (farther than 20 kilometers) is inferior to CALPUFF's capability. AERMOD uses only meteorological data and surface characteristics from one site, whereas CALPUFF uses spatially gridded data based on meteorological data and surface characteristics from many locations.
3. The EPA-recommended version of CALPUFF should always be the most technically advanced version (currently Version 6.4). To save time, testing to support new versions should be based on third party as well as EPA evaluations. Bug fixes and other minor updates should be implemented immediately as released in model change bulletins (or users should be allowed to implement bug fixes themselves) without any testing requirement. CALPUFF documentation needs to stay current with the recommended version of the model.
4. It may be advantageous to replace the "AERMOD near field" and "CALPUFF far field" scheme with a single dynamic model capable of covering all distances from 0 to 300 kilometers (or more). The SCIPUFF model may be an acceptable alternative to CALPUFF. It would appear that both CALPUFF and SCIPUFF could effectively serve as a single tool, even in their current iterations.
5. A priority for EPA and IWAQM is development/approval of models for single-source ozone and secondary PM_{2.5}.
6. For consistency with AERMOD, the dispersion setting used with CALPUFF (MDISP) should be Option 2, turbulence-based dispersion, rather than the currently recommended PG dispersion. CALPUFF even provides an implementation of the turbulence dispersion which makes it equivalent to the AERMOD dispersion.
7. EPA should test use of MDISP=2, micrometeorological variables or turbulence dispersion, in CALPUFF and approve its use where it is shown to be superior.
8. For AERMOD (AERMET) modeling, surface characteristics for the primary source location should be used, rather than the meteorological data (wind measurement) site. EPA has provided no substantive justification, nor side-by-side performance test results, on why use of surface characteristics for the primary source location is not preferable.
9. Topics such as treatment of terrain height variations, AERMINUTE, downwash effects, actual emission rates, national consistency in selection of model input data, in-stack conversion ratios for NO_x to NO₂, application of AERSURFACE with land cover data bases, the basis for determining roughness length (AERMET) all require further attention by EPA, as well as the opportunity for public input.
10. Model performance evaluations should focus on the highest (upper quantile) predictions, and need not include distribution where observations have fallen to less than minimum detectable values.

Air & Waste Management Association, AB-3 Committee on Meteorology, includes Exponent, Inc.

1. Changes made to the downwash code with AERMOD version 11059 lead to significant increases in predicted concentrations for wide buildings. The changes did not undergo public review or comment. The EPA has presented no data to justify the technical basis for the specific algorithms used above GEP formula height, especially for long buildings where the effects are greatest. The EPA did not release a consequence analysis of changes. As a result:
 - a. The change to building downwash procedures introduced in AERMOD version 11059 should be removed from the regulatory version of AERMOD until independent peer review, consequence analyses, and model evaluations are conducted.
 - b. Any new model changes such as the effective building length introduced at the 10th Conference should be subject to a transparent public review process with independent scientific review and evaluation prior to its use in regulatory applications.
 - c. While the known problems with AERMOD for long buildings are being addressed, EPA should allow Section 3.2 Petitions (use of alternative models) to address the problem with AERMOD for very wide buildings, such as aluminum reduction facilities.
2. Since EBD may be the only alternative to obtaining accurate concentration estimates for some building configurations, a method is needed to streamline the process for using EBDs. Some things that would help streamline this process are:
 - a. Clear guidelines on how to conduct an EBD study;
 - b. Interaction with the ultimate decision makers at EPA in the protocol development and approval process;
 - c. Actual EPA approval of the EBD protocol prior to conducting the study;
 - d. Cooperative interaction with EPA during the EBD study and preliminary report phase where results are reviewed and if necessary changes made to the EBD testing method prior to issuance of a final report;
 - e. A timely review and approval process; and
 - d. Some assurance that once a final report is issued, the EBD values will be approved for use.
3. There are a couple optional methods whereby this streamlined process could be developed for EBD.
 - a. Form an Industry/EPA work group tasked with developing guidance for conducting EBD evaluations. This guidance could then be published like those published for determining GEP stack heights (EPA, 1985). The guidance would include a checklist that could be reviewed by EPA to ensure that all studies are conducted in a consistent manner.
 - b. Wait for the next EBD protocol to be submitted to EPA. At this time, the EPA Model Clearinghouse could get involved and review and comment on the protocol. Once this protocol is completed and approved, it could be used as a template for future EBD studies. Also, once the report is submitted and approved it could also be used as a report template for future studies.

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Attachment B

Summary of 10th Conference on Air Quality Modeling Individual Presentations

The summary of individual presentations in this Attachment are (1) largely excised from conference presentation materials and (2) supplemented where necessary by information from the conference transcripts. Internet links to both the conference presentations and transcripts are listed in Attachment C. Presentations by U.S. EPA staff that are of informative or status nature are not summarized in this documentation package but are available via the provided Internet links; including those by Wayland, Fox, Bridgers, Brode, Thurman, Patulski, Baker, Snyder, Kelly, and Anderson (USFS).

AERMOD Applications Development

Ron Petersen -- CPP Inc.

- Background to use of equivalent building dimensions (EBDs) in AERMOD
 - Equivalent Building Dimensions” (EBDs) are the dimensions (height, width, length and location) that are input into AERMOD (or ISC) in place of BPIP dimensions to more accurately predict building wake effects.
- Summary of AERMOD Modeling Conducted to Support the Assessment of Alcoa Davenport Works EBD Study
 - Compared wind tunnel observations with AERMOD predictions
 - Results used to provide additional justification regarding concerns about large roughness
 - Problems with analysis
 - Appears EPA used model speed at reference height – should use simulated full scale speeds versus height
 - EPA used roughness length input for dispersion calculations: should use measured turbulence profiles in wind tunnel
 - Assumed stable conditions: neutral simulated
 - Used combination of model and full scale inputs: should use model values appropriately scaled to full scale
 - Not enough data collected during wind tunnel testing to do a valid comparison
 - Attachment B conclusions flawed – here is where collaboration would have been useful
- Path Forward
 - Option 1:
 - Create an Industry/EPA work group to develop a guideline for conducting EBD evaluations; then publish guideline much like the EPA Fluid Modeling Guideline
 - Option 2:
 - Wait for next EBD protocol submitted to EPA with EPA Clearinghouse review and comment on protocol
 - Collaboration as needed during the review process and approve final protocol – not done in that past

- Conduct the study in a collaborative fashion with near real-time feedback and make adjustments as needed
- Use final protocol as a template for future studies

Bob Paine – AECOM for API and UARG

- Concerns noted by EPA and the modeling community on AERMOD low wind speed applications
 - Brode USEPA 2007 Modeling Workshop from AERMOD Implementation Workgroup Highlights
 - “Mandatory work: Light winds. Revise AERMOD’s treatment of light winds to avoid unrealistically high concentrations”
 - Reported at USEPA’s 9th Modeling Conference - Air & Waste Management Association Comments
 - Many investigators report that the worst-case AERMOD impacts occur for very low wind speeds at night, especially for low-level sources
 - AERMOD has limited evaluation for these conditions very few hours with wind speed < 1 m/s
- Findings and Recommendations
 - API provided results, code, and modeler’s archive to EPA for review 2 years ago
 - We encouraged EPA to add our code changes as a beta option to an AERMET/AERMOD release:
 - Set minimum sigma-v = 0.4 m/s instead of 0.2 m/s
 - Use alternative u* formulation for both single-level and 2-level approaches
 - Low u* has other implications – results in very low mechanical mixing heights which leads to extremely low plume spreading for releases above the mixing height

Randy Robinson – EPA Region 5

- Haul Road Workgroup Concerns
 - Modeled impacts substantial
 - Sources difficult to characterize
 - Lack of state-to-state consistency
- Recommendations
 - Volume source
 - A volume source characterization is recommended for all haul roads, except for cases where ambient air receptors are within the volume’s exclusion zone
 - Rationale: Volume source contains meander algorithm, and limited study using Cordero Rojo Mine measured data supports volume source use over area source
 - Area source
 - Recommended for cases where ambient receptors are located within source dimensions

- Length – length of roadway; Width – $VW + 6m$ for single lane : Road width + 6m for two-lane; Top of plume height – $1.7 \times$ vehicle height; Release height – $0.5 \times$ top of plume height; Sigma Z - top of plume / 2.1
- Future efforts
 - Encourage more field studies examining initial plume dimensions, including the impact of vehicle speed
 - Point source modeling has some potential benefits, such as the ability to consider the influence of facility structures near roadways, and the workgroup supports further study of this approach
 - New line source work may eventually replace need to model fugitive roadway dust as either volume or area source

Chatten Cowherd – MRI Global

- Modeling concerns for fugitive sources in the iron, steel and mining industries
 - Emission factors
 - Particle size distributions
 - Source representation
 - PM_{10} and $PM_{2.5}$ depletion issues
- Recommendations to improve accuracy
 - Air dispersion models are not currently accurate enough to meet regulatory challenges – especially for fugitive, area, volume, and low-stack sources that are prevalent in the iron, steel and mining industry
 - Steps to improve accuracy should include
 - Incorporate the emission deposition pre-processing step into the standard modeling protocol
 - Adopt an emissions pre-processing step (similar to CMAQ area-wide fugitive dust modeling)
 - Develop a set of emission reduction factors that offset AERMOD modeling deficiencies, based on the distinguishing characteristics of roadways and other source categories and the near-source dispersion environment
 - Adjust the model to address wind speed-dependent emissions to avoid positive bias for fugitive and volume/area sources during low wind speed events
 - Re-examine the applicability of AP-42 emission factors and particle size distributions and adjust as necessary

Currently Preferred AQ Models -- CALPUFF

Gale Hoffnagle -- TRC Companies, Inc.

- CALPUFF 5.8 modeling system status and availability
 - TRC maintains the EPA approved code for free use by the public
 - TRC provides the CALPOST version 6.221 which supports the Federal Land Manager's FLAG assessments and the BART process
 - EPA has not yet approved the bug fixes for Version 5.8 submitted in 2005. Model Change Bulletins E and F
 - EPA's work to date on CALPUFF is meant to confine it's use (April 2008 memo) and to sponsor one study which uses CALPUFF as a long range transport model
- CALPUFF 6.4
 - Several studies have demonstrated that version 5.8 significantly overestimates sulfate and nitrate production and thus visibility impacts
 - CALPUFF Version 6.4 incorporates more sophisticated handling of the atmospheric chemistry of sulfate and nitrate formation. This leads to more accurate reproduction of both particulate formation and visibility impact calculations
 - RIVAD ozone chemical mechanism
 - ISORROPIA inorganic gas particle equilibrium
 - RADM for aqueous phase transformation
 - Secondary organic aerosol formation from CalTech
 - TRC urges EPA to consider version 6.4 for application to these assessments
 - Version 6.4 is "backward compatible" with Version 5.8
 - Version 6.4 will provide much more accurate determinations of sulfate and nitrate production and thus, much more accurate determinations of visibility impact and BART determinations
 - TRC urges EPA to consider version 6.4 for application to these assessments

PM_{2.5} Modeling

Ryan Gesser – American Forest & Paper Association

- Challenges to the pulp & paper industry on PM_{2.5} modeling methods
 - Like many industrial sectors, integrated pulp & paper mills find it difficult to demonstrate compliance with applicable NAAQS following current EPA modeling guidance resulting in numerous consequences...
 - New projects cannot move forward until modeling issues are resolved
 - Existing operations without projects may be required to evaluate controls if NAAQS evaluation is required as part of operating permit renewals
 - "Better than BACT/MACT" levels of control may be necessary to demonstrate compliance, which may require...
 - ...significant capital investments in new or upgraded controls
 - ..."on-paper" reductions to permit limits
 - ...reduced fuels/operational flexibility

- Observations/Comments
 - AF&PA is concerned that current EPA guidance is overly conservative and cannot be practically implemented
 - AF&PA appreciates efforts to ...
 - ...develop best practices for fugitive source modeling
 - ...identify and correct systematic deficiencies in model performance
 - AF&PA eagerly anticipates draft PM_{2.5} guidance and appreciates opportunity to comment
 - Sound, unbiased estimates of impacts, including background and secondary formation
 - Temporal consistency of background concentrations
 - Spatial consistency of secondary impacts
 - AF&PA promotes reasonable, practical implementation of new standards and modeling guidance
 - Critical application of EPA guidance in practice to provide stability during regulatory implementation periods
 - Revisit traditional approaches (ambient air, variable emissions)

1-hour NO₂/SO₂ Modeling

Bob Paine, AECOM

- Emissions Variability Processor (EMVAP)
 - Large variation possible over the course of a year
 - Intermittent sources (e.g., emergency backup engines or bypass stacks) present modeling challenges
 - For these sources, assuming fixed peak 1-hour emissions on a continuous basis will result in unrealistic modeled results
 - Better approach is to assume a prescribed distribution of emission rates
 - EMVAP (Emissions Variability Processor) uses this information to develop alternative ways to indicate modeled compliance using a range of emission rates instead of just one value
- Conclusions and status
 - EMVAP is currently operational for EPRI beta testing and consideration of implementation approaches
 - Evaluation against field data shows expected results: critical predictions are somewhat higher than those from actual emissions and lower than those from peak emissions
 - Further development and testing is currently underway by EPRI
- Additional factors
 - There will be a need to determine how an emissions distribution is assigned to a new source and how this is put into an enforceable regulation; this requires public comment
 - A change in Appendix W and in Tables 8.1 and 8.2 will be required
 - Multiple sources with variable emissions will have to be addressed

Mark Podrez – RTP Env. Assoc. Inc

- Ambient Ratio Method (ARM) for 1-hour NO₂ NAAQS analyses
 - ARM was originally developed for annual NO₂ modeling, using annual ambient NO₂/NO_X ratios for all monitoring sites in 1987-1989
 - EPA has cited two recent studies to support the current recommendation of a fixed ARM ratio of 0.80 for 1-hour analyses
 - However, both of these studies, as well as other monitoring data evaluations, demonstrate that variable ratios are observed as a function of distance/time from the source. This indicates that the current fixed-value ARM method may be overly conservative for 1- hour NO₂ analyses, especially when nearby “fence-line” concentrations are the controlling impact.
 - A variable ratio ARM method (“ARM2”) could be less conservative than current fixed 0.8 ARM guidance, yet more conservative than refined Tier 3 methods.
 - Current fixed ratio ARM is not very useful for 1-hour modeling; ARM2 could fill a gap in Tier 2 and 3 techniques.
 - If a variable ratio 1-hour ARM2 is based on a large enough data set of 1-hour ambient monitoring data, it would implicitly address the range of entrainment, mixing, and conversion processes that are occurring over a wide range of total NO_X concentrations.
- Conclusions
 - ARM2 is more conservative than PVMRM and OLM at low and mid-range NO₂ concentrations. At the higher NO₂ concentrations in the test data sets, ARM2 compares well to the best performing Tier 3 method.
 - ARM2 fills the gap between current fixed-ratio 1-hour ARM guidance and the more refined Tier 3 methods. EPA should adopt a revised ARM2 method for 1-hour NO₂ analyses via an updated guidance memorandum.
 - Additional test data sets with elevated NO₂ impacts at or above the NAAQS, and with better source data, are needed to evaluate the various conversion methods.

Steven Hanna -- Hanna Consultants

- NO₂ modeling - PVMRM and OLM evaluation using a new data set
 - Identify existing dataset that could be used to evaluate AERMOD and the PVMRM and OLM options for predicting 1-hour NO₂ concentrations
 - Evaluate:
 - AERMOD predictions of NO_X
 - OLM and PVMRM predictions of NO₂/NO_X ratio
 - AERMOD/PVMRM and AERMOD/OLM predictions of NO₂ concentrations
- Conclusions
 - PVMRM is doing well at predicting the NO₂/NO_X ratio (minimal bias, with most ratios from 0.2 to 0.4).
 - OLM has a general 70 % over prediction tendency for the NO₂/NO_X ratio.
 - Both AERMOD/OLM and AERMOD/PVMRM over predict the high end NO₂ concentrations by about a factor of two (OLM by more) (But this may be caused by the fact that AERMOD over predicts the high end NO_X concentrations).
 - There was little skill (correlations) evident in both

- To be robust, many data sets should be used in a model evaluation so that a multitude of conditions, source data, etc. can be included.
- This evaluation using the Wainwright data set should be considered an additional piece of information to supplement the limited number of data sets used by EPA to date to evaluate the PVMRM and OLM options in AERMOD for predicting 1-hour NO₂.
- A detailed field experiment is needed.

Dan Dix – All4

- Collection of in-stack NO₂/NO_x ratio information
 - The collection of in-stack NO₂/NO_x data for use in AERMOD's OLM and PVMRM option has become more important since the promulgation of the new 1-hour NO₂ NAAQS.
 - Many facilities are currently collecting NO_x data using CEMs
 - CEMs collecting NO_x data use the *Chemiluminescence* method which also measures NO and NO₂.
 - Conclusions and considerations
 - Cost effective and simple (less invasive) way to collect in-stack NO₂/NO_x information for use modeling NO₂ using AERMOD's OLM or PVMRM options.
 - It was easier and more cost effective to install a temporary datalogger than set up NO₂ readings in their current DAHS and PLC Systems.
 - A Campbell Scientific CR1000 data logger was hooked up to unused ports on the 42i and programmed to take 1 minute readings of NO, NO₂, and NO_x.
 - Many facilities currently operate NO_x CEMs under a variety of programs.
 - DAHS systems could also be set up to collect this information.
 - If no NO_x CEMs is in place this data can also be collected during NO_x testing.
 - Protocol Considerations
 - Statistical Analysis
 - QA/QC

Emerging Models / Techniques

Ralph E. Morris -- ENVIRON International Corporation

- Conclusions of long range tracer model intercomparison and evaluation study
 - GP80 Tracer Field Experiment
 - Using different valid CALMET configurations, the maximum CALPUFF concentrations vary by factor of 3
 - Since less option, less variation using MMIF
 - CALPUFF "SLUG" near-field option needed to reproduce "good" model performance on 600 km arc from 1998 EPA study
 - SRL75 Tracer Field Experiment
 - Fitted Gaussian plume evaluation approach can be flawed

- CAPTEX Tracer Field Experiment
 - RMAX1/RMAX2 = 100/200 (EPA-FLM recommendation) produces best WS/WD but worst CALPUFF tracer
 - CALPUFF/MMIF performs better than CALPUFF/CALMET for CTEX3 but worst for CTEX5
 - CTEX3: CAMx & SCIPUFF perform best followed by CALPUFF & FLEXPART with HYSPLIT & CALGRID worst
 - CTEX5: CAMx/HYSPLIT performs best followed by SCIPUFF/FLEXPART with CALPUFF/CALGRID worst
- ETEX Tracer Field Experiment
 - CAMx, HYSPLIT & SCIPUFF perform best
 - FLEXPART & CALPUFF perform worst

Public Presentations

Pietro Catizone, A&WMA AB-3 Meteorology Committee – Introductory Comments

(Comments left over from the 9th Modeling Conference)

- Clearinghouse turnaround and input
 - Traditionally, the Model Clearinghouse process does not allow technical input by the affected parties (e.g., permit applicant)
 - Typically, the permitting authority states their opinion and asks for Clearinghouse approval; no other involvement allowed
 - AB-3 recommends that the affected parties be able to provide comment along with the permitting authority's correspondence to the Clearinghouse; involvement would result in quick and faster resolution of the issues with a common consensus
- Status and timeline of modeling Guidance – SO₂ and PM_{2.5}
 - Issuance of modeling Guidance has been lengthy and the lack of final guidance can affect the viability of project schedules
 - SO₂ draft guidance out since September 22, 2011, final guidance is forthcoming?
 - Secondary PM_{2.5} guidance expected for some time, but not yet available!
 - Collaborative efforts might help to expedite process – how can groups like AB-3 get involved and help?
- What is the availability of the long range transport data base for model evaluation? Is it publicly available?

Lloyd L. Schulman -- Building Downwash Modeling with AERMOD (A&WMA AB-3)

- AERMOD status
 - Changes made to the downwash code with AERMOD version 11059 lead to significant, but unverified, increases in predicted concentrations for wide buildings
 - Even without the code change, documented over-predictions exist for very wide buildings

- Change described in MCB #4 (2-28-2011) states: “*Subroutine WAKFLG was modified to no longer ignore potential downwash effects for stack heights that equal or exceed the EPA formula height. The determination of whether building downwash effects apply is based on the criterion implemented within the PRIME downwash algorithm.*”
- Previous policy was to only model downwash effects for stacks less than GEP formula height
- AERMOD downwash change:
 - Change was made to eliminate discontinuities for stacks straddling the GEP formula height
 - The change will be justified by a pending clarification memorandum
 - No consequence analyses provided by EPA
 - No public comment or review of this significant change to the model
 - There is downwash at formula height for most buildings, but does PRIME model it correctly?
 - PRIME algorithm was developed using data from buildings with W/H <4.4 and sub-GEP stacks
 - Over-prediction already demonstrated for very wide buildings – unrealistically long projected lengths from BPIPFRM
 - Allowing downwash for stacks greater than formula height will exacerbate this problem.
 - Proposed definition of an effective building length is a step in the right direction but needs further testing and confirmation
- Conclusions and recommendations
 - Change to downwash procedures in AERMOD are significant
 - Predicted building influences are inconsistent with theoretical estimates and wind tunnel studies
 - No public peer review or comment on these changes; a clarification memo is not sufficient
 - The change to downwash procedures should be removed from the regulatory version of AERMOD until independent peer review, consequence analyses, and evaluations are conducted for stacks above formula height
 - These evaluations should be bundled with the independent review and evaluation of the effective length parameter in BPIPFRM

Joseph S. Scire -- Assessment of EPA’s ETEX Evaluation Study (A&WMA AB-3)

- Evaluation Conclusions:
 - EPA-ENVIRON study on the ETEX-1 model evaluation contains flaws which significantly affect model conclusions regarding CALPUFF and which model performs best
 - Errors in model setup
 - Inappropriate model configuration settings
 - Inadequate coarse resolution (36-km) MM5 data
 - Alternative CALPUFF configuration with EPA met data significantly improves performance

- Simulation with higher resolution MM5 data produces CALPUFF model performance comparable with the best performing group of models
- Review of modeling conducted by EPA during 2008-2012 is late in the process due to previous lack of access to datasets.
- *Recommendation: Full and timely access to all model evaluation data be provided to the entire modeling community*
 - Evaluation process would benefit from direct involvement of model developers in the evaluation of their models
 - Configuration mistakes and errors more likely to be caught and corrected

Joseph S. Scire -- New Developments and Evaluations of the CALPUFF Model (A&WMA AB-3)

- Overview of Changes:
 - CALPUFF v6.42b chemical module updates
 - ISORROPIA II (v2.1) used for nitric acid/nitrate aerosol partition
 - ISORROPIA used in Eulerian models such as CMAQ and CAMx
 - Aqueous-phase chemical transformation (adapted from RADM cloud module in CMAQ/SCICHEM)
 - Oxidation of SO₂ in cloud water and rain water
 - V6.42b couples CALPUFF with MM5/WRF liquid water content
 - Tracks location of plume and overlap with cloud layer
 - New RIVAD module tracks depleted O₃ and H₂O₂ in each puff
 - Anthropogenic secondary organic aerosol (SOA) formation
 - (from CalTech SOA routines implemented in CMAQ-MADRID)
- Summary:
 - CALPUFF v6.42b includes significant improvements in the treatment of chemical reactions
 - ISORROPIA II model for inorganic gas-particle equilibrium as in
 - CMAQ
 - Revised gas phase chemical transformation module for SO₂
 - conversion to sulfate and NO_x conversion to nitric acid and nitrate
 - Aqueous phase oxidation and wet scavenging module adapted from
 - the RADM cloud implementation in CMAQ/SCICHEM, with access to
 - 3D cloud water fields from MM5/WRF
 - New option for anthropogenic secondary organic aerosol (SOA)
 - formation based on the CalTech SOA routines implemented in CMAQ-MADRID
 - SWWYTAF evaluations with enhanced resolution MM5 meteorological data demonstrates significant improvement in performance over the default FLAG--(2010) chemistry options
 - Large over prediction of average observed nitrate concentrations with the older chemistry mechanism is reduced or eliminated with new chemistry
 - Cumberland plume simulations indicate O₃ depletion improves the modeled sulfate transformation rate, and both RIVAD module options improve modeled NO_x transformation at large distances

- Conclusions
 - New chemistry modules in v6.42b use well-established algorithms referenced in
 - the referred literature and almost universally accepted in the modeling community as better science
 - CALPUFF v6.42b is backwardly compatible with v5.8 (after bug fixes are introduced to v5.8).
 - CALPUFF should be adopted as a replacement for v5.8 to allow access to 7 years of optional model improvements, including the new chemistry.
 - Because v6.42b is equivalent to v5.8 when run in the same mode, v6.42b is an equivalent model.
 - New chemistry can and should be accepted under Section 3.2 of Appendix W
 - Section 3.2 is designed to allow use of important model enhancements in a timely way on a case-by-case basis, without the 3-5 year wait for formal rulemaking
 - BART rule indicates CALPUFF is acceptable but also allows for alternative models
 - EPA should approve v6.42b on case-by-case basis for use in BART applications

Andy Berger – West Associates

- Specific enhancements to the regulatory version of CALPUFF need to be adopted for BART determinations and reasonable progress work.
- The 2005 BART rule indicates that the simplified chemistry in the CALPUFF model tends to magnify the actual visibility effects of a source and, in the next review of the modeling guideline on air quality models, EPA will evaluate these and other newer approaches. At the 9th (2008) modeling conference API recommended a new chemistry model to reduce CALPUFF over prediction of nitrates. In November 2010, based on successful completion of tests and evaluations, CALPUFF Version 6.4 with new chemistry and code fixes was placed in the public domain.
- EPA should conduct its own test and evaluation of CALPUFF Version 6.4, before final best-available retrofit technology determinations are made later this year under a consent decree. If findings for Version 6.4 are duplicated, EPA should move expeditiously to designate CALPUFF 6.42b as the regulatory version of the model for BART determinations, at least on a case-by-case basis. This approach is consistent with the process EPA used with recent changes to the AERMOD model.

Steve Hanna – Hannah Consultants for API

- To improve the use of models, it is necessary to
 - Continue to develop and improve modeling science by conducting additional model evaluations that consider a variety of source characteristics and atmospheric conditions, e.g., low-level sources, low wind speed conditions
 - Improve guidance on modeling use and model inputs
 - Guidance should undergo peer review/public comment prior to issuance
 - Balance need for standardization and consistency against ability to use the best model for the source/conditions
 - More realistic inputs mean more realistic results

- Help policy makers, model users, and those evaluating model results better understand the limitations and uncertainties of modeling tools
- Provide for better use of well-sited air quality monitoring
- Previous Modeling Conference comments still appropriate
 - Need for complete documentation and guidance
 - All codes should be in public domain
 - All documentation needs to be brought up to date and made publicly available
 - General need for more EPA guidance, workshops, and training for the modeling community
 - Encourage development and use of science-based models through evaluation efforts and enhanced public involvement
- PM_{2.5} and SO₂ NAAQS Guidance
 - EPA should provide a minimum of 60 days for comments on PM_{2.5} Modeling Guidance
 - Complete final SO₂ NAAQS implementation guidance and an implementation rule that provides for:
 - Use of monitoring data as the preferred method for attainment determinations.
 - Non-attainment SIPs should:
 - Use modeling recognizing accuracy limitations
 - Use weight of evidence assessments (other data and analyses to supplement modeling)
 - Use actual emissions, not potential to emit
- AERMOD
 - Low winds - over predictions in low winds during stable conditions are now found and possible fixes to the AERMOD low wind parameterizations have been suggested by several groups. EPA should implement the results of the API/UARG Low Wind Speed Project.
 - Urban dispersion - The AERMOD modules rely on PRIME, which is intended for downwash scenarios with only a few buildings. For urban areas with several blocks of many buildings, a new urban dispersion module is needed and there are several well-tested urban dispersion modules that are available and that have been evaluated with data from recent large new urban tracer data bases. The EPA AMAG is developing an urban dispersion model system that could be directly implemented in AERMOD.
 - NO₂ chemistry - is not adequately accounted for in AERMOD via PVMRM or OLM. Outside groups have suggested improved chemical formulations, including those in SCICHEM, ADMS, and RPM2. These should be tested. The ARM2 method is a revised ambient ratio approach based on extensive observations, and should be implemented as an interim approach. It is essential that a new comprehensive NO_x plume field experiment be carried out and used for model testing.

- Use of airport met observations for sites many km away - Methods should be developed to better extrapolate the airport observations to the local site. Various improved extrapolation methods are available that better account for the differences in surface roughness wind speed at the reference height. Prognostic meteorological models may also be useful for extrapolation, after testing.
- The straight-line assumption in AERMOD - The 50 km assumption is much beyond the travel distance in one hour for most wind speeds encountered. EPA should either better justify the current arbitrary 50 km limit or provide guidance for reducing the distance limits during lighter winds. It may be necessary to use a Lagrangian puff model (CALPUFF or SCIPUFF) at distances beyond where the straight-line assumption breaks down.
- Use of realistic emissions - The use of maximum allowable emissions all year in modeling is not realistic and is overly conservative. If observed emissions are not available, it may be appropriate to allow a Monte Carlo random value that provides agreement with the known average and scatter of emissions. For multiple sources, the correlation of emissions between sources should be considered.
- CALPUFF
 - The 50 km minimum distance limit should be reduced, since puff models are scientifically valid at much shorter distances. CALPUFF may need some modifications, though, to assure that it provides similar predictions to AERMOD at the overlap distances.
 - Several other high-quality widely-used Lagrangian puff and particle models are available in the U.S. (e.g., SCIPUFF and LODI) and abroad (e.g., RIMPUFF and Flexpart). Some were recently evaluated by EPA using long-range field data, found to provide similar results to CALPUFF, and should be considered by the EPA.
 - The chemistry in the current version of CALPUFF and similar models should be (and is being) improved to account for more chemicals, for non-linear reactions, and for heterogeneous conversions (such as gas to particle). Improved CALPUFF chemistry that has been carefully tested with field data should be incorporated into the regulatory version of CALPUFF.
- Regional chemistry models (CMAQ and CAMx)
 - Regulatory applications of CMAQ and CAMx should take a more prominent role in the present conference
 - We encourage the current EPA effort to incorporate the SCICHEM plume-in-grid model in CMAQ to more realistically treat a large point source plume.
- Prognostic meteorological models
 - We are pleased that the EPA is investigating linking their dispersion models with the outputs of prognostic meteorological models.
 - The EPA testing of the Mesoscale Interface (MMIF) program, which provides an interface between the met model outputs and the required dispersion model inputs is a good first step.

- Uncertainties - Many studies find that the use of the met models does not necessarily improve the dispersion model predictions.
 - Met models have inherent uncertainty themselves.
 - No major changes in the use of met models should be made until extensive testing is done over a wide range of scenarios, in order to demonstrate that the changes produce improved or at least similar performance compared to current methods (such as use of single met sites in AERMOD or diagnostic met models in CALPUFF).
- Background concentrations
 - If a local monitor is used to establish background, double-counting the contribution of sources can be avoided by using more than one monitor and adding background determined from the lowest monitored concentration each hour in a paired in time procedure with the modeled concentrations.
 - The background should conform to the averaging times and the spatial domain of the scenario being modeled.
- Model evaluation and data bases
 - The EPA model evaluation methods are inconsistent and rely too much on the Quantile-Quantile (Q-Q) plots. No estimates of statistical significance are given.
 - The EPA should revisit their model evaluation method derived 15 years ago and included in an ASTM guideline. These are similar to the Hanna and Chang BOOT model evaluation methodology, which determines whether differences between performance measures are significant for two different models.
 - There is a need for the EPA to put all of their dispersion field data sets into a single data archive for easy public access.
 - The Chang and Hanna suggestions of model acceptance criteria should be considered, since they have been tested using many field experiments and are in wide use.
 - Separate criteria are suggested for performance measures such as FB and NMSE for rural and urban areas.
 - Additional OAQPS-specific acceptance criteria could be developed for measures such as “2nd-high” and for routine sampling networks (i.e., not research-grade). Together with significance tests, the model acceptance criteria allow quantitative comparisons of models.
- Recommendations
 - The NO₂ Modeling Guidance Tier 2 methods should include ARM2.
 - PVMRM has some deficiencies that need to be corrected and evaluated with field data.
 - EPA should implement the results of the API/UARG Low Wind Speed project.
 - The regulatory version of CALPUFF should be the improved chemistry version.
 - The Hanna and Chang BOOT model evaluation methodology should be considered in addition to QQ plots.
 - Well-placed monitors should be used for SO₂ NAAQS attainment determinations.
 - If SO₂ SIP modeling is needed, it should use actual emissions, not potential emissions.

- EPA/OAQPS should continue increasing their communications and collaborations with the many groups studying modeling issues and include the wider community in planning, model development and evaluation, and analysis and review of results.

Ryan Gesser – American Forest & Paper Association

- Like many industrial sectors, pulp & paper mills find it difficult to demonstrate compliance with applicable NAAQS following current EPA modeling guidance
- American Forest & Paper Association (AF&PA) analyses suggest AIWG study may overstate pulp & paper industry impacts
- AF&PA appreciates efforts to...
 - improve upon Tier 3 NO₂ models
 - identify and correct systematic deficiencies in model performance
- AF&PA promotes reasonable, practical implementation of new standards and modeling guidance
 - Critical application of EPA guidance in practice to provide stability during regulatory implementation periods
 - Revisit traditional approaches (ambient air, variable emissions)
 - Streamlined approval of Tier 3 approaches

Bob Paine – AECOM for Electric Power Research Institute

- Need for a sub-hourly AERMOD capability?
 - Hourly AERMOD predictions for low wind speeds overstate impacts from coherent plume and sub-hourly meteorological data is now routinely available from both on-site met and 1-minute ASOS
 - In low winds, winds can go in several directions during an hour, resulting in multiple concentration “lobes”
- Conclusions on development and evaluation of AERMINUTEPlus and Sub-Hourly AERMOD (SHARP*)
 - Sub-hourly AERMOD capability has been developed and limited evaluation has been done on two databases
 - Stable, light wind database clearly shows need to correct AERMOD over predictions for hourly averaged data – consistent with other research
 - AERMOD hourly predictions perform much better in unstable conditions, but some cases with scattered winds could benefit from sub-hourly modeling
 - Hourly predicted plume footprint “too tight”, especially in stable conditions
 - 5-min sub-hourly plume footprint “too loose”
 - Best sub-hourly averaging time might be ~10 minutes
 - Further testing is recommended

Bob Paine – AECOM for Electric Power Research Institute

- Limitations of steady-state 1-hour dispersion models
 - Plumes are assumed to travel to infinite distances within 1-hour (“lighthouse beam” effect)
 - Each hour, the previous hour’s emissions are replaced and forgotten

- Worst-case conditions, especially associated with low winds, are persisted to impossible distances
- Currently, though, US EPA considers these models to be applicable to a rather arbitrary distance of 50 km
- This study tried to more carefully quantify a reasonable distance for applicability of these models (such as AERMOD or ISC)
- Conclusions on concentration comparison: Steady-state vs. non-steady-state models
 - ISC/CALPUFF concentration ratios are close to 1 within 5 km and within a factor of 2 within 20 km
 - Beyond 20 km, there are some directions where this ratio can significantly exceed 2 – higher differences may be possible for real terrain applications
 - 20-30 km is the extent a single hour's travel for most of the hours
 - Even after 4-5 hours, more than half of air parcels followed with a 10-m wind are still on the 50-km modeling domain
 - Results suggest that a 20-km limit seems more appropriate for steady-state model (e.g., AERMOD) applicability rather than the current limit of 50 km
 - AERMOD should provide information to users regarding hourly plume travel time
 - We are working on providing this information in an enhanced version of AERMOD to be provided to EPA

Bob Paine – AECOM for Electric Power Research Institute

- This presentation is a report on Model Evaluation of AERMOD at a Monitoring Network in North Dakota for a unique data base.
- AERMOD performance improves with the use of actual hourly emissions. For NAAQS compliance modeling for existing sources, actual hourly emissions are recommended to obtain the most accurate AERMOD results.
- Additionally, the assumption of flat terrain for areas of gentle slope (slope <2%) improves AERMOD performance and should be allowed.
- This was clearly demonstrated with the case of low winds and low mechanical mixing heights. In that case, the use of actual terrain with a 1% slope resulted in counter-intuitive results at some distant location because of plume intersection with the terrain.

Allen Dittenhoefer -- Enviroplan Consulting

- Comments on a procedure for modeling buoyant line sources with AERMOD
- Until EPA develops a buoyant line source algorithm in AERMOD, a two-step hybrid modeling scheme has been proposed involving the application of two Guideline dispersion models (BLP and AERMOD)
- This procedure can treat enhanced plume rise from multiple buoyant line sources, but is more time- and resource-intensive (e.g., requires two meteorological data preprocessors – RAMMET for BLP and AERMET for AERMOD)

Qiguo Jing -- Breeze, Trinity Consultants

- Comments on dispersion of buoyant emissions from a low level urban source; No specific recommendations
- Findings
 - AERMOD provides an adequate description of concentrations associated with a buoyant release from the low level source during the daytime.
 - AERMOD underestimates concentrations during the night when turbulence is generated by wind shear. A simple modification and onsite meteorology can improve its performance.

Bob Paine – AECOM

- Conclusions for non-BLP alternative for buoyant volume sources
 - AERMOD needs procedure to accommodate buoyant volume sources
 - BLP approach has many source limitations
 - Proposed approach avoids these limitations and uses AERMOD meteorological profiles to characterize plume rise without change to the model except for additional debug printout
- Comments on building downwash in light winds; no specific recommendations
 - Unexpected AERMOD results for buoyant stacks with heights close to building heights
 - Many recent AERMOD runs indicate predictions of design concentrations for buoyant point sources due to building downwash in stable, nearly calm conditions.
 - This is contrary to expectations, since building wake expected to be weak, and plume rise high
 - AERMOD evaluations show that modeling issues likely include buoyant volume sources and downwash under low wind speeds; even with annual average emissions, AERMOD design SO₂ concentrations were several times higher than observations at 2 regional monitors

George Schewe -- Trinity Consultants

- Sensitivity of AERMOD to AERMINUTE-generated meteorology; demonstration of the differences in maximum concentration estimates between AERMET and AERMINUTE-AERMET data sets for various source types.
- No specific recommendations.

Sergio Guerra -- Wenck Associates, Inc.

- Sensitivity analysis concerning effects of met data processing (using AERMINUTE) in AERMOD concentrations.
- Concerned with threshold wind speeds.
- Recommendation to EPA that the one knot threshold should be rethought and that a two knot threshold would be more appropriate until the low wind speed issues in AERMOD are fixed.

Dana Wood – BP

- AQRVs - CALPUFF
 - Industry has provided critical comments over the past 12 years regarding:
 - The basic formulation, accuracy and lack of model evaluation of MESOPUFF II chemistry in CALPUFF
 - Model estimates of secondary SO₄ and NO₄ have not been evaluated against monitoring data.
 - API has further developed a new chemistry mechanism that addresses many of the past comments
 - As a result of industry comments and providing EPA with a revised model, nothing has changed regarding how visual range impacts are estimated through modeling –
 - Regulatory modeling is still based on MESOPUFF II chemistry and impacts are not consistent with monitoring data
 - In a regulatory setting, using models that contain better science can be a difficult process. To mitigate bias toward over estimating actual impacts, models should be used in a relative manner
- Recommendations and conclusions
 - Modeling issues and challenges are substantial and models need to be improved
 - There is a pressing need for independent peer review of EPA development
 - EPA needs to publish a research plan to identify pressing modeling issues – OAQPS and ORD need to develop a plan with stakeholder input and comment
 - Better evaluation tools and databases are needed

Nicole Downey -- Earth System Sciences, LLC

- NO₂ model performance for Empire Abo
 - In spite of the uncertainties in emission data, NO_x model performance is underestimated by almost a factor of two
 - If NO₂ is evaluated using NO_x pairing, NO₂ model performance is over stated by more than a factor of two – implies that matching NO₂ conversion with NO_x dispersion overstates NO₂ formation (compensating errors)
 - If NO₂ is compared to monitoring data independent of time, NO₂ over predicts by a factor of two (compensating errors)
 - EPA's analysis should be publicly available and described (i.e. what emission inventory was used, which ozone monitor, etc...)
- Conclusions and recommendations
 - Code review of AERMOD PVMRM has formulation problems (Hanna presentation)
 - Conversion of NO into NO₂ overstates NO₂ conversion (Empire Abo analysis)
 - There is an urgent need for EPA to develop refined NO₂ modeling procedures and databases for evaluation
 - Until refined techniques occur, EPA should adopt ARM2

Cindy Langworthy – UARG

- Since EPA, States, and industries must rely on models for implementing some provisions of the CAA, it is important that the underlying regulatory models and related modeling tools and any changes to these regulatory models and modeling tools be fully tested and consistently evaluated before EPA accepts their use for regulatory purpose.
- For regulatory purposes, the model should run with actual emissions rather than with combinations of inputs that have not actually occurred and are unlikely to occur in the real world.
- Background concentrations should be taken into account when the model is evaluated and monitored air- quality values should be the benchmark against which models are evaluated.
- Concentrations measured by an EPA-approved monitor and an EPA-approved site should be relied upon and preference given, rather than to concentrations predicted by a model.
- Improvements to EPA’s guideline models should be made expeditiously but only under the framework provided by the CAA.
- Significant changes to the modeling guideline and the models it references must allow for the public to have a meaningful opportunity to comment. This public comment must precede finalization of modification to EPA’s models; documentation on how well the modified models will perform must be available for review. This procedure was not used for the addition of AERMET to AERMOD, or for how GEP stack height limits are modeled within AERMOD. This procedure applied to both the model code and to changes to the tools used in conjunction with those models to characterize source emissions and meteorology.
- EPA should simplify, expedite and make more transparent the procedures followed when those outside EPA suggest changes they believe should be made to EPA developed models, e.g., low wind speed conditions. A better program for considering changes on a timely basis is needed, e.g. responses to high priority concerns identified by industry; this is particularly true for improvements to CALPUFF.
- The annual EPA/State/local modeler’s meeting should be expanded to allow consistent, meaningful participation by all stakeholders. To assure real opportunities for public comment at these and other meetings, EPA should make sure that key documents on modeling policy are released well ahead of time, e.g., PM modeling guidance.
- EPA should become more agile and open in its approaches for improving models and modeling tools by working more closely with industry to insure that the best modeling tools and procedures are used in all regulatory proceedings.

Mark Bennett – CH2M Hill for Rio Tinto

- Summary
 - Stringency of new limits, forms of the standard and high background concentrations make dispersion modeling compliance demonstrations challenging for all three of these NAAQS
 - Requires improved performance of AERMOD and expedited addressing of known deficiencies
 - Specific Issues
 - Low Wind Speed Algorithm Issues with Respect to Low-Level Sources
 - AERMINUTE will result in more low wind speeds

- Buoyant Line Sources
 - Pit Retention
 - Impacts of Frequent Updates to AERMOD by EPA
- Conclusion
 - As EPA prepares new NAAQS, coordination with stakeholders, including the regulated community, is necessary to identify real-world compliance issues
 - Rio Tinto appreciates EPA's increased collaborative efforts with the regulated community, and pledges its support of these and future collaborative approaches
 - EPA has a responsibility to provide tools that accurately evaluate impacts in order to avoid unnecessary barriers to beneficial economically growth

Stephen Mueller -- Tennessee Valley Authority

- Issue: Does temporal resolution of meteorological data influence modeling outcomes for 1-hour SO₂ levels?
- Conclusions
 - Time-scale of input meteorology does not always reduce simulated 99th percentile 1-hour values.
 - AERMOD over-estimated max. daily 1-hour SO₂ by 80% on average when non-modeled source influences can be neglected. Is it time for a new modeling paradigm, i.e., non steady-state plumes?
 - Increase in plume meander due to sub-hourly winds can be offset by an increase in hours modeled with very low wind speeds increasing the number of hours when the steady-state plume assumption is least valid.
 - As the switch from hourly to sub-hourly meteorological data was implemented, meander in the wind field was increased, but a lot of hours where the wind is very light were introduced. So actually there is a swap of one problem for another now that there are more hours under the sub-hourly processing when the steady state model assumption is less valid
 - EPA should consider offering alternatives to a steady state modeling approach for near field plume impact evaluations.

Steve Gossett – Eastman Chemical Company & Bob Paine -- AECOM

Discussion of field study to support attainment demonstration and the importance of meteorological data. No specific recommendations.

Ashley Jones – Trinity Consultants

- Case study for an aluminum plant with challenges for the 1-hour SO₂ NAAQS
 - Focus on raising stack height is no longer a likely solution
 - Evaluating what SO₂ rate it takes to achieve modeled compliance, while considering that add-on SO₂ controls for pot lines are not common
 - Modeling uses BLP model for roof vents and AERMOD for all other sources
- Summary
 - Determining a modeled solution is still an on-going process as is the case with many trying to comply with the SO₂ 1-hour NAAQS. In this situation finding a solution has been made even more difficult with the recent change in the WAKFLAG routine.

- Will any relief come from the pending downwash guidance to achieve modeled compliance?
- The facility is initiating a field study to better understand the plant's monitored impacts versus the modeled impacts.

Anand Yegnan – ERM

- Experiences and challenges of 1-hour SO₂ compliance demonstration and designations modeling
 - Significantly greater nonattainment than current situation based on monitoring, due to conservative approach (modeling) plus conservative inputs (potential emissions) plus conservative background
 - 1-hour modeling results tend to point directly at individual facilities, not to regional scale emissions (e.g. ozone, PM_{2.5})
 - Modeled non-attainment tends to be limited to small geographic areas “hot spots”
 - Potential for “pseudo” nonattainment areas
- Findings
 - Some simple solutions
 - Low wind speeds: Limit dilution speed to 1.0 m/s
 - Background: Seasonal/hour approach is helpful; should use average (per Appendix W 8.2.2b):
 - Specifically for SO₂ 1-hour modeling:
 - Always include sensitivity analyses; allow time for consideration of case-by-case model sensitivity
 - Always pay close attention to meteorological conditions and model “details” associated with high concentrations
 - Allow for use of actual emissions:
 - in the form of a distribution (e.g. max monthly for each month)
 - Monte Carlo simulations where data are available
 - Modify AERMOD to more easily identify met conditions and model details; Promote broader understanding of sensitivities and case-specific model attributes

Anand Yegnan – ERM

Experience with CALPUFF 6.4, modeling for 1-hour NO₂ and SO₂ compliance in Baltimore, and using MM5 data for local scale modeling. No specific recommendations.

- Evaluations of CALPUFF 6.4
 - CALPUFF has been used as a tool to help understand source and source sector contributions to N loading; compare and contrast with CMAQ
 - New chemistry included in v. 6.4 holds promise in terms of improving predictions of N loading
 - Work-in-Progress includes evaluations of CALPUFF predictions compared to aerosol and gas concentrations, and wet deposition, measured at CASTNET, IMPROVE, and NADP measurement stations
- Experience with modeling for 1-hour NO₂ and SO₂ compliance in Baltimore;
 - OLMGROUP appears to produce better patterns of NO₂/NO_x ratios than PVMRM
 - Evaluation suggests use of 0.1 in-stack ratio for all sources

- Problems with AERMINUTE processing; DNR currently recommending use of pre-ASOS meteorological data
- Baltimore analysis points out shortcomings of AERMOD application at this scale; transport times are an issue... possible future application of CALPUFF
- Evaluating improvements in treating “urban core” plume
- Using MM5 data for local scale modeling
 - PPRP has used MM5 data to extract local winds for near field analyses in a number of cases;
 - Evaluations of extracted winds compared to tall towers (primarily at nuclear stations) and profilers are encouraging;
 - Initiating evaluations of beta version of MMIF
 - Use of MM5 (and WRF) holds promise for improving local scale meteorology, particularly in situations where airports are somewhat remote

Eladio Knipping -- Electric Power Research Institute

SCICHEM development update. No specific recommendations.

- A new SCICHEM version is forthcoming in a few months; The model will be free, open-source and public-domain
- A prior version SCICHEM has been described in previous presentations at this conference; this version has some of but not all the future enhancement
- This presentation provides an update on the status of SCICHEM development
- In the 2000s, EPRI embedded the SCICHEM model into the EPA CMAQ model as a plume-in-grid module for sub-grid treatment of industrial plumes
- This PiG version of SCICHEM is known by the name “Advanced Plume Treatment” or APT, i.e. CMAQ-APT
- A version of CMAQ-APT was publicly released via the CMAS Center based on CMAQ4.6 and sectional MADRID aerosol Treatment
- As derivative products of SCICHEM may be developed, EPRI will remain the “custodian” of the “core” SCICHEM model
- SCIPUFF and SCICHEM are being reconciled and at the end of this reconciliation, there will be only one standalone model; however, the two names will remain in order to emphasize whether chemistry is “on” or “off”
- The SCIPUFF/SCICHEM equivalency may be thought of as: SCIPUFF is SCICHEM with chemistry “off” and SCICHEM is SCIPUFF with chemistry “on”

Steven Hanna – Hanna Consultants on research supported by Defense Threat Reduction Agency

- Comparison of CALPUFF and SCIPUFF with tracer gas observations at two mesoscale field experiments – No specific recommendations
 - Good performance at DP26; FAC 2 under predictions at OLAD for CALPUFF and SCIPUFF
 - The two models’ performance is about the same for the two mesoscale tracer experiments (DP26 and OLAD)
 - No significant difference (at 95 % level) between most performance measures for CALPUFF and SCIPUFF
 - Similar performance even when both use the CALMET diagnostic wind models

- Caveat – both models have changed somewhat since this study was done in 2002

Steven Hanna – Hanna Consultants on research supported by Defense Threat Reduction Agency

- Evaluations of prognostic meteorological models with field observations, with focus on meteorological variables used in dispersion models – No specific recommendations
 - Wind speed (WS) RMS error has a minimum (inherent uncertainty) of about 1 m/s, large biases occasionally happen, especially at night
 - Wind direction RMS error is typically 20 to 60° but is clearly proportional to 1/WS
 - Mixing depth has $\pm 20\%$ error day, $\pm 100\%$ night
 - dT/dz in capping inversion underestimated by models
 - Obs TKE agrees within a factor of two with model simulations during the day. At night, TKE agreement is not so good
 - These results are in general agreement with the Seaman 2000 review paper

David Long -- American Electric Power Service Corporation

- A proposed method to screen source impacts on potential background monitors using the ASOS surface 1-minute dataset – No specific recommendations
 - The use of the 6405 Dataset to source the meteorology for doing this type of exclusion analysis is viable.
 - Transit times up to 12 hours should be considered to maximize the capture of source impacts on 1-hour monitored values
 - If we are considering upwind sources with a long transit time, the angle between average wind direction and source direction should be increased to 30 degrees in order to allow for plume meander over a longer transit time
 - A Step 4 analysis option should be available in the event there are hours that do not conform to the normal behaviors.
 - If there are a large number of sources in similar directions, consideration should be given to grouping the sources instead of using individual sources.
 - While performed for 1-hour SO₂, this technique should work equally well for any pollutant with a 1-hour averaging time and possibly other short term averaging times

Tony Colombari – Trinity Consultants

- Top five conventional and unconventional ways to meet the NAAQS – No specific recommendations
 - 5. Recharacterize ambient air as not
 - 4. Reevaluate met and/or monitoring data
 - 3. Building changes
 - 2. Pursue alternative models/switches
 - 1. Stratify impacts

Justin Walters – Southern Company

- With short-term standards that approach values that are closer to background concentrations, the models require a level of accuracy and precision beyond their current capability. Models are increasingly being given greater deference than ambient measurements. Continuing to apply models with existing but outdated guidance is inappropriate (e.g. SO₂ NAAQS SIP submissions).
- EPA must assure that the performance of its guideline models is unbiased and does not lead to gross over predictions that could force costly and unnecessary actions to be taken. Performance evaluation for model modifications and submittal for public notice and comment are essential.
 - EPA needs to evaluate the performance of AERMOD for the entire AERMOD system, including AERMAP, AERSURFACE, AERMET, AERMINUTE, etc. Changes to the system should be demonstrated to result in improved model performance for a wide range of meteorological conditions, particularly low wind speed and stable conditions. Only when the evaluation is complete, should model changes be submitted for public notice and comment.
 - Model modifications that result in changes to model concentrations must go through notice and comment rule-making before being implemented as preferred models. As a result, the recent change in AERMOD that is noted in MCB#4 that alters the PRIME downwash algorithms to apply to stacks that are greater than or equal to the GEP formula height relegates the model to a non-preferred status
 - AERMOD has not been thoroughly evaluated for performance in simulating the maximum daily one-hour concentration at the 99th percentile in the case of NO₂.
 - EPA should give states discretion to use modeling and analysis tools to help demonstrate situations where sources have a low probability of violating the standard; e.g., states should have discretion to allow sources to demonstrate through application of the emissions variability processor (MVEP).

EPA should engage the private sector, e.g. consultants and industry, and provide a clear path forward for approving tools and model improvements that come from the modeling community; this applies to improvements in the performance of both preferred and alternative models. Invitation for the private sector to participate in annual regional/state/local modelers meetings would be a positive step.

Attachment C

Presentations, Transcripts, and Docket Links

A list of relevant Internet links for the 10th Conference on Air Quality Modeling presentations, transcripts, and Docket are listed below.

Conference Website:

<http://www.epa.gov/ttn/scram/10thmodconf.htm>

Conference Presentations:

<http://www.epa.gov/ttn/scram/10thmodconfpres.htm>

Conference Transcripts:

Day 1 – http://www.epa.gov/ttn/scram/10thmodconf/2012_Tenth_Modeling_Conference-Transcripts_03-13-2012.pdf

Day 2 – http://www.epa.gov/ttn/scram/10thmodconf/2012_Tenth_Modeling_Conference-Transcripts_03-14-2012.pdf

Day 3 – http://www.epa.gov/ttn/scram/10thmodconf/2012_Tenth_Modeling_Conference-Transcripts_03-15-2012.pdf

Conference Docket: *(includes formal comment submissions)*

<http://www.regulations.gov/#!docketDetail;dct=FR%252BPR%252BN%252BO%252BSR;pp=10;po=0;D=EPA-HQ-OAR-2012-0056>

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Attachment D

Modeling Action Items and Prioritization Summary Table

The summary table outlining the EPA’s near-term action items and long-term goals with respect to updates and modifications to the regulatory models (AERMOD and CALPUFF) and the *Guideline* that are necessary to address specific issues indentified with these models, with current and future NAAQS compliance demonstrations, and with emerging models and techniques will eventually be included in the Summary of Comments document package. This summary table has often been referred to as the “Matrix” or some variant in various meetings and engagements with the modeling community since the 10th Conference on Air Quality Models. The Summary of Comments document package will be appropriately updated, noticed, and reposted on SCRAM once the summary table is available and incorporated into the document.

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