Docket A-99-05
Item V-C-01

SUMMARY OF PUBLIC COMMENTS AND EPA RESPONSES

7TH CONFERENCE ON AIR QUALITY MODELING

WASHINGTON, D.C.

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Air Quality Modeling Group
Emissions, Monitoring and Analysis Division
Office of Air Quality Planning & Standards
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ACRONYMS

ADMS	Atmospheric Dispersion Modeling System
AQRV	Air Quality Related Value
ASOS	Automated Surface Observing Stations
CRADA	Cooperative Research and Development Agreement
ETA	an operational mesoscale meteorological model run by the NWS/NCEP. The model derives its name through the use of a vertical coordinate system (Eta),[a] which tends to follow constant pressure surfaces near the ground. http://www.emc.ncep.noaa.gov/mmb/mesoscale.html
FLAG	Federal Land Managers AQRV Work Group
FLM	Federal Land Manager
FSL	Forecasting Systems Laboratory
GEP	Good Engineering Practice
HUSWO	Hourly US Weather Observations
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
MM5	mesoscale meteorological model originally developed by Penn State University and now supported by NCAR. http://www.ncar.ucar.edu/ncar/mmm.html
NAAQS	National Ambient Air Quality Standard(s)
NAD	North American Datum
NCAR	National Center for Atmospheric Research http://www.ncar.ucar.edu/ncar/index.html
NCDC	National Climatic Data Center
NCEP	National Centers for Environmental Prediction. http://www.ncep.noaa.gov/
NSR	New Source Review
NWS	National Weather Service
PVMRM	Plume Volume Molar Ratio Method
PSD	Prevention of Significant Deterioration
RUC	Rapid Update Cycle, an operational mesoscale meteorological model run by NWS/NCEP. The RUC employs components of the NCAR/Penn State MM5 mesoscale model and uses a sigma-based vertical coordinate system, which tends to be terrain following near the ground. http://maps.fsl.noaa.gov/
SIP	State Implementation Plan
SDTS	Spatial Data Transfer Standard, an ANSI standard developed by the United States Geological Survey to transfer earth-referenced spatial data between dissimilar computer systems with the potential for no information loss. It is a transfer standard that embraces the philosophy of self-contained transfers, i.e. spatial data, attribute, georeferencing, data quality report, data dictionary, and other supporting metadata are all included in the transfer. SDTS is neutral, modular, growth-oriented, extensible, and flexible--all the characteristics of an "open systems" standard. http://mcmcweb.er.usgs.gov/sdts.
SRDT	Solar Radiation/Delta-T
USGS	United States Geological Survey
UTM	Universal Transverse Mercator

[a]Mesinger, F., 1984: A blocking technique for representation of mountains in atmospheric models. *Rev. Meteor. Aeronaut.*, 44, 195-202.

1. INTRODUCTION

This document contains a summary of (1) those public comments filed in Docket A-99-05 in response to a notice of proposed rulemaking (65 **FR**: 21506) to revise Appendix W to 40 CFR Part 51 (the *Guideline on Air Quality Models*, hereafter *Guideline*) and (2) comments received at the 7th Conference on Air Quality Modeling (65 **FR**: 32180). The document also contains Agency responses to the comments, and should be read in conjunction with the preamble to the *Federal Register* notice in order to better understand the overall organization.

Background

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

The 6th Conference on Air Quality Modeling was held in Washington, D.C. on August 9-10, 1995. As required by Section 320 of the Clean Air Act, these conferences take place approximately every three years to standardize modeling procedures. The 6th conference featured presentations in several key modeling areas. One presentation, by the American Meteorological Society (AMS)/EPA Regulatory Model Improvement Committee (AERMIC), covered developing an enhanced Gaussian dispersion model with boundary layer parameterization: AERMOD. Another presentation, by IWAQM, covered long range transport modeling: CALPUFF. Also, EPRI presented recent research efforts to better define and characterize dispersion around buildings (downwash effects). These efforts were part of a program called PRIME, and PRIME was included within ISC3 (ISC-PRIME). The presentations were followed by a critical review/discussion and public comment on all three modeling systems. To the extent possible, the main concerns expressed at the 6th Conference were addressed in refinements included in our April 21, 2000 *Federal Register* notice, which allowed a 90-day comment period extending to July 20, 2000 (65 **FR** (78): 21506).

On May 19, 2000 EPA announced the 7th Conference on Air Quality Modeling (65 **FR** 32180) to be held on June 28 and 29, 2000 in Washington, D.C. The purpose of the 7th Conference was to provide a forum for public review and comment[1] on the April 2000 proposed revisions to the *Guideline*, which included:

! adoption of CALPUFF in appendix A, as proposed, for assessing long range transport of pollutants and their impacts on Federal Class I areas;

! removal of the Climatological Dispersion Model (CDM), RAM and the Urban Airshed Model (UAM) from appendix A;

[1]The public comment period was extended to August 21, 2000.

! simplification of complex terrain screening techniques;

! revision of the section Model Input Data to reflect our October 1997 settlement with the Utility Air Regulatory Group regarding specification of emissions from background sources;

! updating information in appendix W and reorganizing its structure; and

! transfer of appendix B and appendix C to our website.

The April 2000 proposal also included (1) adopting AERMOD[2] to replace the Industrial Source Complex (ISC3) model in many assessments that now use it, (2) revising ISC3 by incorporating a new downwash algorithm (PRIME) and renaming the model ISC-PRIME, and (3) updating the Emissions Dispersion Modeling System (EDMS) by incorporating improved emissions and dispersion modules.

In addition to the oral comments that were transcribed at the 7th Conference, we received 35 sets of written comments. Regarding AERMOD, public comment solidly expressed the desire to integrate aerodynamic downwash into AERMOD. (i.e., not to require two models for some analyses). As a result of AERMIC's (the American Meteorological Society (AMS)/ EPA Regulatory Model Improvement Committee) efforts to revise AERMOD, incorporating the PRIME algorithm and making a few other incidental modifications, we believe the new model estimates merit another public examination of performance results. Also, since the April 2000 proposal, the Federal Aviation Administration decided to configure EDMS3.1 to incorporate the AERMOD dispersion model, and results of its performance with AERMOD only recently became available. Consequently, AERMOD and EDMS4.0, as well as other conforming changes for the *Guideline*, are being reconsidered in a Supplemental Notice of Proposed Rulemaking (SNPR) that will be published in the *Federal Register* at a later time. Accordingly, specific public comments regarding AERMOD and EDMS, and EPA responses, are deferred to a companion document that will be released when the SNPR is issued.

Note that since AERMOD is being deferred to the SNPR, the proposed merger of the *Guideline's* section 4 and 5 will also be deferred to a *Guideline* revision in which AERMOD is adopted. Our responses in this document reference sections of the "non-merged" (original) *Guideline* structure, which corresponds with the final promulgation supported by this document. Therefore, as you read comments (which reference the sections from the proposed "merged" Guideline structure), references to specific sections in corresponding responses may be off by one).

Summary of the Public Comments

All comments presented at the Seventh Conference and received in Docket A-99-05 are available for review at the Air & Radiation Docket (6102T), Room B-102, U.S. Environmental Protection Agency, 1301 Constitution Ave., SW, Washington, D.C. 20004.

[2] AMS/EPA Regulatory MODel

The summary of comments and EPA responses is organized according to the specific models and modeling topics identified above, along with others. First, comments on CALPUFF for both long-range transport on Class I areas and for case-by-case applications to complex wind situations are considered. Second, comments on other modeling systems are addressed. Next, comments on meteorological data topics and miscellaneous topics (public comments not explicitly solicited) are compiled and discussed. Finally, the issue of timing and implementation of revisions to the *Guideline* are considered. In most sections, comments are further partitioned by specific topic areas.

In all cases an effort is made to address the comments in the context of six questions identified in the *Federal Register* notice. This is particularly true for CALPUFF and markedly less so for the other models and topics due to the focus and volume of comments provided. The six questions are:

- What is the scientific merit of the models presented?
- What is their accuracy?
- What should be the regulatory use of individual models for specific applications?
- What implementation issues are apparent and what additional guidance is needed?
- What are the resource requirements of modeling systems presented?
- What additional information or analyses are needed?

In some instances, summarizing the comments themselves requires some interpretation and in many cases it is necessary to paraphrase or substantially condense the comments. In those situations, every effort is made to capture the substance and intent of the commenter. Following the comment summary on each topic, the EPA response and a conclusion (where appropriate) is provided.

For convenience, the list of commenters (Appendix A to this document) contains all commenters, regardless of topic. In this document, specific comments are cited as, e.g., "Several commenters (IV-D-18; IV-D-24; IV-D-25; IV-D-30; transcript) ". In this case, comments are attributed to written comments submitted by IV-D-18, IV-D-24, IV-D-25 and IV-D-30, but may as well be attributed to oral comments given by one or more of these commenters and captured in the official transcripts for the 7th Conference. Note also that a few individuals gave oral statements at the 7th Conference but didn't submit written comments. If/when a substantial comment was offered that was not captured as a written submission to the docket (i.e., the comment came directly from the 7th conference proceedings), the citation "(*transcript*)" is used.

2.0 CALPUFF

2.1 Background

In the *Federal Register* notice, EPA recommended the CALPUFF modeling system for refined use in modeling long-range transport and dispersion to characterize reasonably attributable impacts from one or a few sources for PSD Class I impacts. CALPUFF would be added to Appendix A of the *Guideline.* It was also proposed that CALPUFF be used for all downwind distances for those applications involving complex wind regimes, with case-by-case justification. Comments were sought on the use of CALPUFF for these applications. For related uses of meteorological information, comment was similarly sought on use of prognostic mesoscale meteorological models and the length of record for meteorological data.

2.2 Have the scientific merit and the accuracy of CALPUFF been established and documented?

Summary of comments: General scientific merit of CALPUFF

Several commenters (IV-D-18; IV-D-24; IV-D-25; IV-D-30; transcript) offered that CALPUFF is a state-of-the-practice simulation tool that should serve as a flexible and robust system for both near and long-range dispersion. The modeling system is the result of many contributors that have funded improvements based on individual needs. CALPUFF is considered a significant advancement whose scientific merit is established (IV-D-18; IV-D-24) that provides the ability to simulate a number of important local effects, and explicitly treats virtually all of the important physical processes affecting transport, diffusion, deposition, plume rise, downwash and linear chemical transformations.

IV-D-30 agrees with *Guideline* paragraph 8.3.3.2(k) which defines CALMET as the meteorological processor for CALPUFF.

EPA Response:

The general consensus seems to be that the scientific merit of the CALPUFF modeling system has been established. As will be discussed later in this section, a few commenters noted that the mechanisms used in the CALPUFF's chemical transformations are simplistic. Specific concern was expressed about the sulfate and aqueous phase chemistry algorithms, which affect Air Quality Related Values (AQRV). As chronicled on the FLAG website (see p. 2-12), these procedures and criteria have been published and received review and comment. However, our current action addresses the suitability of CALPUFF for PSD increment consumption and for complex wind situations (with case-by-case approval), not AQRV analyses. EPA therefore doesn't believe that any limitations in CALPUFF's treatment of chemical transformation compromise its usefulness to calculating PSD increment consumption in long range applications.

Summary of Comments: Accuracy of CALPUFF for Long Range Transport

IV-D-18 believes model performance comparisons and testing is certainly adequate to recommend use in the 50 - 200km range. IV-D-16 and IV-D-30 believe CALPUFF is well tested against available databases and models for long-range transport, and that the performance is acceptable out to 200km, but beyond 200km more testing is needed to confirm that recent puff splitting options are working as anticipated. IV-D-16 claimed that, even with CALPUFF's puff splitting option invoked, vertical shearing effects may not be sufficiently characterized, thereby underestimating the plume footprint and overestimating ground-level concentration maxima. IV-D-25 reported they have tested and used CALPUFF out to 300km and found acceptable performance.

IV-D-17 suggested more testing is needed over a broader range of conditions, and mentions several tracer field studies (LROD, Dipole Pride 26, OLAD) that could be used to further test CALPUFF's performance for mesoscale distances.

EPA Response:

EPA agrees with commenters who generally believe that the CALPUFF modeling system has adequate accuracy for use in long range transport modeling assessments, at least out to 200km. EPA believes that current evaluation results suggest acceptable results can be achieved out to 300km, although as some commenters note, individual circumstances must be carefully evaluated, particularly for greater distances within the range for which it is being approved. Recent enhancements, e.g., new puff-splitting options, likely will extend the system's ability to treat transport and dispersion well beyond 300km. In our guidance (e.g., in the Appendix A summary description for CALPUFF), we say that CALPUFF is reliable in long range transport applications from 50km to *several hundred kilometers* so as not to prescribe a *bright line* for the limit of applicability. Future performance comparisons for transport beyond 300km are likely to extend the applicability and use of the modeling system, and we intend to watch for such evaluations very diligently. In an effort to keep the public abreast with the latest findings, EPA requests that evaluation results of the CALPUFF modeling system be sent to us (SCRAM webmaster) in an electronic format suitable for distribution, or that citations be provided for copyrighted material. EPA will post this information on its website for review and assessment.

Summary of Comments: Accuracy of CALPUFF for Complex Winds

IV-D-04; IV-D-17; IV-D-18; IV-D-24 and IV-D-30 suggest more evaluations of CALPUFF are needed for potential complex-wind situations envisioned, and that EPA should develop a plan of development for CALPUFF to expand its applicability to encompass short-range to long-range applications. IV-D-14 and IV-D-30 mentioned that theoretically CALPUFF can perform for most envisioned complex wind situations, but asked if testing and improvements are needed for marine and shoreline boundary layers, fumigation, and stagnation events.

IV-D-30 recommended that CALPUFF be considered as a refined recommended model for complex wind situations, while still requesting more evaluations be performed.

EPA Response:

EPA concludes that the commenters agree with EPA's proposal to promote use of

CALPUFF for complex winds with prior approval by the permitting agency. EPA interprets the comments received as basically saying that CALPUFF has been demonstrated to perform as well as, or better than, other short-range plume dispersion models for a few cases involving complex winds, several with wind fields that are dominated by terrain effects. This is encouraging and EPA agrees that more testing of CALPUFF is desirable prior to accepting its results in all the cases involving complex wind situations. EPA presently does not have results for stagnation, fumigation, land-water circulations, and terrain impaction. EPA will post on its website citations to investigations for any cases involving complex winds as they become available, to build a knowledge base from which determinations can be made on the use of CALPUFF for various complex wind situations.

2.3 Are the proposed regulatory uses of CALPUFF for specific applications appropriate and reasonable?

Summary of Comments: Regulatory use of CALPUFF for Long Range Transport (PSD/NSR)

There appears to be a consensus (IV-D-16; IV-D-18; IV-D-25; IV-D-30; transcript) that CALPUFF is well-tested against available databases and models for long-range transport, and that EPA can recommend use of CALPUFF out to 200km. IV-D-16 and IV-D-30 believe more testing is needed to recommend use beyond 200km, whereas IV-D-25 reported they have tested and used CALPUFF out to 300km and found acceptable performance. IV-D-17 suggests more justification is needed to define distance limits on use of CALPUFF. IV-D-31 and IV-D-32 believe it is premature to recommend CALPUFF as a refined model for estimating Class I impacts, and that the model should receive a "conditional" recommendation for use (IV-D-32).

EPA Response:

EPA concludes that although improvements might be made, CALPUFF is suitable for regulatory use for long range transport. For several reasons, EPA has decided to not state a maximum transport distance for the use of the CALPUFF modeling system. Although a modeling system may work well out to some distance, it does not follow that it will always work well to such distances. This is especially true for the modeling situations where use of CALPUFF is most likely to be considered. As with other models, incorporation of new scientific advances into CALPUFF is an evolving process. Recognizing that the capabilities of the model to reliably estimate transport for increasingly greater distances are likely to improve, we have elected not to set a maximum transport limit on CALPUFF. Rather, we say in our guidance (e.g., in the Appendix A summary description for CALPUFF) that CALPUFF is reliable in long range transport applications from 50km to several hundred kilometers, subject to expert judgment considering individual circumstances.

Summary of Comments: Regulatory use of CALPUFF for Complex Winds

IV-D-30 believes that CALPUFF has been shown to be applicable as a refined model for complex wind situations, calms, stagnation, complex terrain flows, inversion breakup, that suitable performance evaluations have been completed (and more are on the way). IV-D-18 recommended CALPUFF also be mentioned for use in *Guideline* subsection 8.3.4 for calms. IV-D-07 recommended CALPUFF be listed as an optional model for complex terrain in *Guideline* paragraph 4.2.2(d). IV-D-18 and IV-D-30 recommended removal of WYNDvalley in *Guideline* paragraph 7.2.8(d). The endorsement to treat CALPUFF as a refined model for regulatory use by IV-D-30 comes in parallel with their call for more evaluations in a variety of situations.

EPA Response:

EPA is encouraged that at least one commenter was willing to accept CALPUFF as a refined model for complex wind situations; however, EPA agrees with the other comment that suggested it is premature to formally propose CALPUFF as a refined model for complex winds. EPA believes its proposal to endorse acceptance of the use of CALPUFF for complex wind situations on a case-by-case basis strikes the correct balance between the limited (but very successful) studies in which CALPUFF has been employed for complex wind situations, and the need for more testing before accepting CALPUFF as a refined model for all situations involving complex wind conditions. This will support consideration of new field study comparisons, as they become available, which may allow approval for use of CALPUFF for a particular situation being considered. EPA believes (as was mentioned in the comments received) that generally CALPUFF can adequately handle these situations. Hence, EPA intends to proceed as proposed and encourage the use of CALPUFF for complex wind situations (as it obviously has the scientific basis for more appropriately addressing these situations than standard plume models); however, EPA will require approval to be obtained prior to accepting CALPUFF for complex wind situations. Basically, this will ensure that a protocol is agreed to between the parties involved, and that all are willing to accept the results as binding. EPA agrees with the comment that, as experience is gained, acceptance will become clear and those cases that are problematic will be better identified. EPA has removed WYNDvalley as comments suggested, and EPA will insure that use of CALPUFF is mentioned for all the complex winds cases listed in *Guideline* subsection 8.2.8, i.e., inhomogeneous local winds, inversion breakup fumigation, shoreline fumigation, and stagnation).

Summary of Comments: Definition of CALPUFF/CALMET Options

There is a general consensus that the users will need more information so that they can better tailor the model options for specific applications (IV-D-09; IV-D-18; IV-D-30; IV-D-32), and that most of the suggested studies should be conducted. As examples where more guidance is anticipated as being needed: compare benefits of alternatives between options and sensitivity on results of alternative options (e.g., terrain options and use of sub-grid terrain impacts), provide filling procedures for missing meteorological data (UA, Doppler, site specific), tradeoffs in accounting for terrain effects in developing wind fields between diagnostic and mesoscale meteorological modeling, considerations when blending observations with mesoscale meteorological data, and recommendations for location and number of surface and upper-air observation sites for different applications.

IV-D-18 sees a need for a CALPUFF/CALMET regulatory model protocol (model parameter settings) so users trained in MPRM and ISC3 will have a smooth and effective transition into using the CALPUFF/CALMET modeling system. At a minimum, they see a need for guidance on what methods to use in order of preference based on actual testing of the performance of the different available options. IV-D-24 suggested that States and local agencies share information on protocols developed.

IV-D-18 believes user's guides for CALPUFF are sufficient for typical user, well written, and very clear, whereas IV-D-30 believes user's guides need to provide more information and be made consistent with recommended defaults.

IV-D-18 warns that the recommended option settings in the user's guides and in the distributed code should agree.

IV-D-10 recommended that option selections be passed between programs, so that all option selections are documented at each stage of processing.

EPA Response:

As explained in the notice of proposed rulemaking, EPA believes the proposed default CALPUFF option settings are reasonable and necessary to establish at least a starting place for regulatory application. When sufficient experience has been attained, whereby it has become obvious what settings should be employed for best results for certain situations, EPA will promulgate expanded guidance after notice and opportunity for public review and comment. The *Guideline* provides flexibility in tailoring option settings for particular applications and EPA will publish interim guidance as it becomes available. EPA agrees that users should endeavor to document options selections and share information as protocols are developed.

EPA anticipated when it proposed the use of the CALPUFF modeling system that there would be a call for guidance that would aid in tailoring the system's application for specific situations. Because of EPA's experiences in applying the model and discussions we have had with other users, EPA concluded that attempting to "cookbook" the option settings was premature, problematic, and counter-productive and commenters have provided no evidence to the contrary. CALPUFF is a sophisticated, flexible system which can be applied in a variety of situations. There is not widespread experience in its use, although its capabilities are apparent. It was for this very reason that EPA has resisted attempts to dictate the options settings, or to dictate all the implementation steps. EPA believes that given the lack of widespread experience in the use of this modeling system, its application should remain flexible so that as experience is gained, and system improvements are introduced, the application of the system and the setting of the options should remain flexible.

Summary of Comments: CALPUFF Meteorological Data Requirements

In EPA's proposal, it was suggested that 5 years of analysis would be required if only NWS data were processed, but that less than 5 years of analysis would be needed if mesoscale meteorological data were used in the processing. It was also proposed, that use of site specific observations should not be required, but might be explored as part of the protocol development.

With respect to CALPUFF modeling requirements; IV-D-24 and IV-D-30 endorse the idea

of accepting less than 5-years of analysis; however; IV-D-24 and IV-D-25 cautioned that year-to-year variability in the modeled impacts argue for use of more than one year for analysis. IV-D-18 believes a study is needed to justify the need for 5 years of analysis, as mesoscale impacts may not show that much year-to-year variability.

With respect to CALMET data needs; IV-D-07 and IV-D-24 recommended making use of NWS observations an option (rather than a requirement) when developing wind fields where site specific data or mesoscale meteorological data are available. IV-D-30 approves of making collection of site specific meteorological data optional, *Guideline* paragraph 8.3(d), when developing wind fields for CALPUFF.

IV-D-08 requested more guidance on the data needs for CALPUFF for complex terrain. They view current guidance as severely limiting use of NWS data if Doppler and site specific data are collected at different locations. The commenter was also concerned about the existence of "criteria on how similar the two sites need to be" to combine the data for model input.

EPA Response:

Processing 5 years of NWS data was seen by most as feasible, but difficult (things could be made easier). EPA's proposal of using less than 5 years of analysis was endorsed, but with caution, as large year-to-year variations have been seen. In general the comments were receptive to EPA's proposal to not force all applications of the CALPUFF modeling system to require a full 5-years of analysis if they would employ mesoscale meteorological data in the processing. EPA has revised *Guideline* paragraph 9.3(c) to address quality assurance of MM-type meteorological data. EPA has reconsidered the issue of length of record and revised paragraph 9.3.1.2(d) to allow at least three (3) years of meteorological data for driving CALMET. EPA sought to strike a balance between the need for a sufficiently robust meteorological record to ensure results of reliable integrity, while maintaining administrative and computational burdens at a practical level. In consultation with the Regional Offices, we therefore have agreed to allow use of less than five, but at least three, years of assimilated mesoscale meteorological data. More than 3 years may lead to the objectionable computations burdens noted here, whereas less than 3 provides insufficient variation in meteorological conditions to capture the range of possible concentrations. EPA has clarified in paragraph 9.3.3.1(a) that the recommendation of blending NWS data with mesoscale meteorological data was with the assumption that the NWS were appropriate and relevant for the analysis. Regarding the use of CALPUFF in complex terrain, EPA has suggested that use of site specific data can improve the integrity of a diagnostic analysis for input to CALMET. Though CALPUFF is sophisticated enough to do a credible job of accommodating different data types in the domain, users are reminded that professional judgement should always be used in setting up runs and in interpreting results.

Summary of Comments: CALPUFF Screen

IV-D-10 recommended development of a CALPUFF Screen. IV-D-16 and IV-D-30 believe use of maximum impacts found on rings of receptors about the source in the CALPUFF screen is an overly conservative procedure and should be modified to require only receptors in the Class I areas of interest. Such a procedure may show a maximum impact 180° opposite to the direction of the PSD Class I area that is to be protected, especially for cases in which the surface

meteorological station observes a high frequency of calm winds.

IV-D-28 recommended terrain heights be defined for each receptor ring to be representative of Class I areas of interest.

EPA Response:

The public comments involved FLAG's recommendations for applying CALPUFF to assess long range transport impacts, which we did not solicit. The commenters did not furnish data or analyses to support the claimed association of maximum ground level impacts 180° from any particular Class I areas with the procedure recommended by FLAG. The recommendation to place receptors on 180° rings, and to have the receptor heights defined for each receptor ring to be those representative of the Class I areas of interest, is supported by published studies. We have, in fact, seen preliminary analyses for a number of sources and actual Class I area which indicate that restricting the arc of influence for a source's impacts to ±90° or even ±45° either side of the Class I boundary does not result in any more regulatory approvals.[3] The recommended CALPUFF screening procedure uses simplistic single-station meteorological data that do not make precise impact location meaningful. Instead, the magnitude of the screening estimate continues to determine whether a refined analysis is needed. We continue to believe that rings of receptors encompassing the source are needed in order to assure conservatism (higher impacts predicted than likely). EPA will allow the permitting agency to decide whether it will accept the CALPUFF screening results as proposed, and in that decision process will defer to the permitting agency to decide on the details of how the CALPUFF Screen is to be implemented. EPA does not believe that sufficient testing has been accomplished to confidently conclude (1) whether the results are consistently conservative, and (2) how best to recommend the routine implementation details.

2.4 Do significant implementation issues remain or is additional guidance needed in choosing between models (niche definition for CALPUFF)?

Summary of Comments: Can CALPUFF be used anywhere?

With the advent of CALPUFF; IV-D-17 requested that EPA better justify use of plume models out to 50km (better than saying "this is the way we have always done it"). IV-D-17 sees an overlap between Models-3/CMAQ and CALPUFF use, and requested guidance on when one model is preferred over another. IV-D-10 asked EPA to clarify distance ranges where CALPUFF is applicable, with more updated references to dispersion studies than those supplied in the *Guideline*. IV-D-13 asks for additional guidance on when CALPUFF can be used in near-field applications.

IV-D-28 proposed that CALPUFF be recommended for Class I impacts at all distances, with

[3]Bennett, M.J, M.E. Yansura, I.G. Hornyik, J.M. Nall, D.G. Caniparoli and C.G. Ashmore, 2002. Evaluation of the CALPUFF Long-range Transport Screening Technique by Comparison to Refined CALPUFF Results for Several Power Plants in Both the Eastern and Western United States. Proceedings of the Air & Waste Management Association's 95th Annual Conference, June 23-27, 2002; Baltimore, MD. Paper #43454.

no case-by-case approval required), and that use of CALPUFF for complex winds be approved by the "PSD delegated authority"(see also Who Approves Use of CALPUFF, p.3-8). IV-D-30 suggested a new *Guideline* section be added that recommends CALPUFF as a refined model for calms and stagnation conditions (they suggested Bull Run tracer field data for testing).

IV-D-30 believes that *Guideline* paragraph 6.2.1(e) (case-by-case application of CALPUFF for analysis of reasonably attributable haze impairment) is at odds with the requirements of paragraph 6.2.3(a) (CALPUFF recommended for long range transport analyses); and that *Guideline* subsection 10.2.1 (requiring a protocol for every PSD/NSR permit application where the issue of using CALPUFF can be raised and approved) obviates the need for the alternative model acceptance criteria specified in paragraph 3/2/2(e).

Regarding use of CALPUFF and to extend the kinds of source situations that can be treated for complex wind situations involving transport distances that are less than 50km; IV-D-04; IV-D-06; IV-D-07; IV-D-10; IV-D-15; IV-D-18; IV-D-21; IV-D-24; IV-D-28, and IV-D-30 requested that PRIME be added to CALPUFF. IV-D-30 recommended CALPUFF with PRIME be evaluated.

EPA Response:

There is a common thread that many commenters appear ready to accept use of CALPUFF for both short-range and long-range transport. We have tried to explain when and how CALPUFF is to be used in regulatory applications. EPA believes its proposal to endorse acceptance of the use of CALPUFF for complex wind situations on a case-by-case basis strikes the correct balance between the limited (but successful) studies in which CALPUFF has been employed for complex wind situations, and the need for more testing before accepting CALPUFF as a refined model for all situations. While there will always be calls for "cookbook" (prescribed) procedures, trying to remove expert judgement in other cases does not serve the public interests of promoting good modeling practices. The Regions and States have ample experience to properly review modeling protocols for special circumstances, and EPA believes they will be able to properly judge when use of CALPUFF is appropriate.

Regarding the perceived discrepancy in guidance presented in *Guideline* paragraph 6.2.1(e) (case-by-case application of CALPUFF for analysis of reasonably attributable haze impairment) vs. the requirements of paragraph 6.2.3(a) (CALPUFF is recommended for long range transport analyses), we have clarified in Guideline paragraph 6.2.3(a) that "CALPUFF ... may be applied when assessment is needed of reasonably attributable haze impairment or atmospheric deposition due to one or a small group of sources."

Regarding the comment regarding guidance presented in *Guideline* section 3 vs. 10, commenter IV-D-30 correctly points out that, per paragraph 11.2.1(a), "each PSD/NSR permit application is proceeded (*sic*) by a protocol." However, this recommendation for a protocol speaks to the process of identification of the model to be used and the manner of its application, while the criteria specified in paragraph 3.2.2(e) focus on the factors that EPA considers in determining whether to approve the use of an alternative model. Thus both discussions serve a useful purpose in guiding potential users and are neither redundant or in conflict.

It is EPA's understanding that Earth Tech has installed PRIME in CALPUFF, and that they have evaluated the algorithm with a few data sets. It is Earth Tech's intention to have PRIME available as an option in the code that is released in support of this action.

Summary of Comments: Who Approves Use of CALPUFF?

IV-D-08 questioned why EPA Regional Offices should be involved in each and every use of CALPUFF for complex winds. IV-D-30 recommended CALPUFF as a refined model for "complex winds", which obviates the issue of obtaining case-by-case approval. IV-D-06; IV-D-07; IV-D-15; IV-D-18; IV-D-21; IV-D-24, and IV-D-28 recommended that States with delegated PSD authority be allowed to approve use of CALPUFF for complex wind situations, rather than requiring EPA Regional Office approval.

EPA Response:

When the PSD program is delegated by the Region to a State, the State has the authority to review and approve model protocols as envisioned in EPA's proposal for acceptance of CALPUFF for case-by-case usage for complex wind situations. For those areas where the Region has not delegated the PSD program, then the Region will provide the review of model protocols. Provisions are in place for consultation between the Regions and States (and ultimately, if needed, EPA headquarters) to assist each other during such reviews. Thus, in using CALPUFF on a case-by-case basis in complex wind situations, it is envisioned that the reviewing authority will continue to administer their PSD program in a manner that is consistent with their respective delegation agreements or SIPs and consult with their regional offices as appropriate.

Summary of Comments: CALPUFF/CALMET/CALPOST System Capabilities

A number of comments were received that offered ways in which the CALMET/CALPUFF modeling system could be enhanced and improved (IV-D-7; IV-D-10; IV-D-18; IV-D-30).

With respect to the modeling system in general, these suggestions included: recommend the CALMET/CALPUFF system be modified to allow processing without the need to break a year up into sub-intervals; recommend that nested grids be incorporated into the modeling system; recommended providing 3-dimensional time varying output from all models suitable for data visualization, and foster development of visualization tools like CALDESK; and recommend adding ensemble simulation capabilities; recommend submitting the entire modeling system for an independent code audit, to ensure there are no coding errors.

Some of the comments were specific to CALMET, CALPUFF, and CALPOST. For CALMET these included: upgrade surface energy calculations to include precipitation history effects, upgrade processing to provide a more generalized treatment of thermal wind effects, add ACARS profile processing capability; expand mesoscale meteorological formats to include ARCS, HOTMAC, NCEP/ETA, RUC, allow turbulence profiles (observations or mesoscale model output) to be input at more than one location, and allow relative humidity to be processed from mesoscale model output (which would allow variations with height). For CALPUFF, it was recommended a source group be added to allow tracking of impacts from a select group of

sources. For CALPOST it was recommended that it be modified to allow processing of all species at one time for all effects (i.e., concentration, deposition, visibility).

EPA Response:

EPA welcomes the various timely and helpful suggestions offered that if implemented would simplify the processing steps of the CALPUFF modeling system, although they are generally not critical to operating the system or to its accuracy. We currently have committed resources to implement a few of these proposals, and will endeavor to continue to promote efforts to generally make the system more user friendly. The emphasis will be on (1) amplifying the available guidance information, (2) expanding the data formats for meteorological input data, and (3) making the code more robust to various choices in compilers. Additional updates to improve use of the modeling system may be made as resources allow.

2.5 Are there serious resource constraints imposed by the CALPUFF system?

Summary of Comments: Resources for CALMET Processing - This is Not Easy!

IV-D-18 and IV-D-25 believe the resource requirements are manageable, however, there appears to be a general consensus that processing of the meteorological input data for CALPUFF is a resource intensive task that EPA should simplify and make more manageable (IV-D-02; IV-D-04; IV-D-09; IV-D-16; IV-D-18; IV-D-24; IV-D-30). Suggestions included: EPA or FLMs generate needed mesoscale meteorological and other data sets for distribution (IV-D-18; IV-D-09; IV-D-16; IV-D-30) and standardizing to a fixed 5-year period (IV-D-24; IV-D-30). IV-D-30 mentioned that more packaged mesoscale meteorological data sets are needed beyond the 1990 MM4 data set.

IV-D-16 and IV-D-30 suggested using CALPUFF with ISC3 meteorological data in a screening mode, until FLMs have established for public use meteorological and emissions input data files for the various anticipated applications.

IV-D-02; IV-D-18 and IV-D-30 recommended that EPA take "ownership" of the CALPUFF modeling system and provide a point of contact for technical help. IV-D-19 and discussion comments during the Meteorological Panel at the conference recommended that EPA study ETA and RUC data's suitability and feasibility for routine use in regulatory assessments. During the floor discussions, a commenter viewed all the flexibility (various mesoscale meteorological fields, data processing options) as stressful to State regulatory agencies, claiming that the "playing field is not level", and that the situation is similar to before the *Guideline* defined which model was preferred for various uses.

EPA Response:

Experience to date has shown, and comments received appear to express consensus, that a skilled staff with experience with CALMET can perform the required processing steps. However, these same commenters strongly encouraged EPA to find and promote a simplification to the CALMET meteorological processing steps. Thus although there is nothing that precludes

the immediate use of CALMET, there is every sense that EPA should endeavor to simplify the process. In the interim, however, EPA does not believe that it is technically appropriate or justifiable to use screening level (ISC-like) meteorological data , since to do so would eliminate the advantages of the greater sophistication that CALMET offers. EPA will endeavor to provide technical assistance, and will endeavor to provide useful tips and suggestions via our website. Pending availability of resources, EPA will develop descriptions that will ease use of the three existing mesoscale meteorological data sets that EPA has in hand.

2.6 What additional analyses or information are needed?

Summary of Comments: Conditional Recommendation of CALPUFF for Assessment of Air Quality Related Values (AQRVs)

IV-D-31 and IV-D-32 questioned whether CALPUFF is sufficiently accurate or tested for application to AQRVs. IV-D-31 reported on the comparison results for the Mt. Zirkel study, where differences of a factor of 2 were seen in comparisons of modeled and observed concentration values for both primary and secondary species. They do not trust CALPUFF to provide the correct directional changes in visibility as a consequence of changes in emissions. IV-D-32 recognizes that CALPUFF is needed and useful, but believes it is premature to recommend general use of the modeling system without further testing, evaluation and guidance. For AQRVs, as an example of existing uncertainties, they reported that CALPUFF modeling results were sensitive to the background specifications for the Southwest Wyoming Technical Air Forum study, whereas the modeling results for the Mt. Zirkel study were relatively insensitive to the background specifications.

IV-D-32 suggested that CALPUFF is needed, but further evaluations, sensitivity testing, and user guidance is needed prior to recommending CALPUFF. To assist in oversight of these tests and evaluations, they recommended the formation of a review panel formed of EPA, state agencies, and industry. They recommended "conditional" approval of CALPUFF, so that there can be flexibility in its application, and so there can be substantial modifications to procedures and algorithms as testing and sensitivity tests reveal the need. They proposed that a review panel ("a cooperative stakeholder peer review committee") be established to provide oversight and to direct additional studies and analyses. As model improvements are made, there should be a formal peer review process before recommending use of the improvements and changes to the procedures. They list seven (7) items for committee oversight: (1) evaluation of the model in the manner it is to be applied, (2) develop technical guidance for producing accurate wind fields, (3) testing and evaluation of chemical transformation formulations, (4) guidance on determination of background ammonia levels, (5) evaluation of modeling partial inventories and then recombining them, (6) sensitivity studies of the model when applied in the anticipated regulatory mode, and (7) peer review of the visual range procedures.

EPA Response:

The uncertainty in the CALPUFF concentration values cited in these comments is typical of that seen for local-scale modeling, where simulation results have been used successfully for regulatory impact assessments for over 20 years. The difference in the sensitivity to the

background specifications for the Southwest Wyoming Technical Air Forum study versus for the Mt. Zirkel study should be expected and is reasonable given the differences in the situations being modeled. For Mt. Zirkel, the local sources dominate the impacts seen, whereas for the other study, the local sources were a small additional increment superimposed on a larger background. EPA concludes that although there are modeling uncertainties, these uncertainties are no more difficult to deal with than are currently dealt with in regulatory assessments involving short-range dispersion modeling and regional-scale grid modeling.

The Clean Air Act Amendments of 1977 (and subsequent amendments) gave Federal Land Managers an affirmative responsibility to protect the natural and cultural resources, or "air quality related values" (AQRVs), of designated national parks and wilderness areas from the adverse impacts of air pollution. Individually, the FLMs have developed different approaches to identifying AQRVs and defining adverse impacts in Class I areas. In April 1997, air resource managers representing USFS, NPS, and FWS initiated an interagency workgroup known as FLAG (Federal Land Managers AQRV Work Group). The objective of FLAG is to "achieve greater consistency in the procedures each agency uses in identifying and evaluating AQRVs." As part of this collaborative effort, FLAG members have worked together to: define sensitive AQRVs, identify the critical loads (or levels) and the criteria that define adverse impacts, and standardize the methods and procedures for conducting AQRV analyses. The results of these deliberations are available in the FLAG Phase I Report, which can be obtained at: http://www.aqd.nps.gov/ard/flagfree/index.htm. During the public review of the FLAG Phase I Report, questions were raised concerning whether the concentration estimates available from CALPUFF were sufficient for identifying adverse impacts in Class I areas. In the response to these concerns, the FLMs affirmed that they were aware of the strengths and limitations of the CALPUFF modeling system, and were satisfied that this modeling system can successfully be used for assessing Class I impacts.

EPA does not believe it would be useful to form a special cooperative stakeholder peer review committee. The *Guideline* specifically recommends that applicants consider developing modeling protocols for refined modeling, but has avoided making protocols mandatory for routine application of approved modeling systems (see *Guideline* paragraphs 3.0(b), 6.2.3(b), and 10.2.1(a), as proposed). CALPUFF is a relatively new modeling system, and EPA has repeatedly encouraged applicants to use modeling protocols for CALPUFF modeling, while everyone gains experience in use of this system. EPA has successfully used modeling protocols for over 20 years to insure that all review authorities approve of planned modeling activities. EPA believes applicants are aware of how to construct modeling protocols, and when they are beneficial to employ.

Summary of Comments: Visibility

IV-D-16 believes the 5% threshold recommended by the FLMs is excessively conservative for determination of a visibility impact. They propose that EPA should either adopt a 10% threshold for significance and a 20% threshold for a perceptibility limit for all PSD sources, or EPA should allow line-of-sight averaged concentration values to be used in visibility impact assessments. IV-D-32 recommended the visual range determination using concentration values at specific sites (rather than an average over the line-of-sight) be evaluated and subjected to peer review.

IV-D-16 believes that since relative humidity (RH) values are higher at the surface in the early morning hours, and since CALPOST does not consider the variation of RH with height, EPA should exclude the hours from dusk to dawn from visibility impact assessments.

IV-D-16 believes that assuming 90% RH for the visibility screening calculations is arbitrarily high. IV-D-32 is concerned about using the Tang RH corrections at various temperatures, since they believe the data it summarizes were all collected at 25C.

IV-D-16 recommended that background visual range should reflect current transport conditions (instead of the FLM-recommended "clean" 90% best background visual range), and be set to be consistent with the meteorological conditions used in the model simulation. They recommended use of concurrent IMPROVE visibility data to accomplish this. IV-D-32 sees a need for more guidance on the specification of background levels of ammonia.

EPA Response:

Most of the comments pertain to a policy and procedural framework established by the FLMs to promote consistency in fulfilling their responsibilities to protect AQRVs. The FLMs determine the AQRVs themselves, they established the procedures for assessing AQRVs, and the significance levels are set by the FLMs. The FLMs have "an affirmative responsibility to protect [AQRVs]".[4] We did not solicit public comments on such policies and procedures that involve CALPUFF's application. We defer to the FLMs in defining the relevant AQRVs of interest and the procedures to employ to assess whether there is an adverse impact. When CALPUFF is used for a visibility impact assessment, this would be for a Class I AQRV assessment, and the reviewing authorities are the FLMs responsible for the management and protection of the resources for the particular Class I areas involved. The Federal Land Managers' Air Quality Related Values Work Group (FLAG) was formed in 1997 to provide a more consistent approach for FLMs to evaluate air pollution effects on their resources. To assist permit applicants, the FLMs have provided specific procedures for performing such analyses as may be required. Included in these instructions are the significance thresholds for possibly adverse impacts, and the methodologies for computing a visibility impact. The comments summarized above pertain to tentative FLAG procedures outlined in the IWAQM Phase 2 report[5] which are not a subject of today's action. To the extent that they were addressed in the responses to comments developed by the FLMs in the FLAG Phase I report, we refer commenters to that document. The IWAQM Phase 2 report specifically directed attention to the FLAG activities and stated that the latest information on procedures and methodologies were substantially revised by FLAG through their deliberations, and the FLAG Phase I report provides the current recommendations for visibility impact assessment, including worked examples employing the CALPUFF modeling system. Concerns expressed by commenters about the FLAG procedures should thus be directed to the FLAG report as they are beyond the scope of this action.

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[4]Clean Air Act §165(d)

[5]Environmental Protection Agency, 1998. Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long-Range Transport Impacts. EPA Publication No. EPA-454/R-98-019.

Summary of Comments: CALPUFF Chemistry

IV-D-16 believes the chemistry algorithms within CALPUFF are out of date (underpredicts sulfate production), and that the aqueous phase chemistry algorithms recently installed in a version of CALPUFF are too new and untested to be trusted for AQRV applications. They recommended a comprehensive evaluation of CALPUFF chemistry options. IV-D-17 and IV-D-32 recommended that EPA evaluate CALPUFF's ability to properly characterize visibility and first-order chemistry effects. IV-D-18 noted that CALPUFF's chemistry is highly parameterized, and looks to be in need of updating.

IV-D-21 and IV-D-24 recommended that the version of CALPUFF that contains aqueous phase chemistry be released for use, as the current version underpredicts sulfate impacts. IV-D-28 recommended the version of CALPUFF with aqueous phase chemical mechanisms be evaluated and, if it proves successful, released for routine use.

IV-D-32 recommended an evaluation be conducted of the ability of EarthTech newly developed software that combines results and corrects the chemistry.

EPA Response:

EPA recognizes that more sophisticated chemical treatments are available in grid modeling constructs whose design emphasis is on the chemistry of complex mixtures. EPA also agrees that the chemical mechanisms in CALPUFF should continue to be updated and refined as information and resources permit. However, there may be limits imposed by the puff modeling construct which are different from those applicable to grid modeling constructs, and so modifying the CALPUFF chemical formulations is not a trivial exercise. As information and resources are available, EPA will endeavor to improve the CALPUFF chemical mechanism. However, the instant question is whether the existing chemical mechanism is acceptable for its intended uses. EPA believes that it has been adequately demonstrated that the limitations of the CALPUFF chemistry do not preclude EPA from recommending use of CALPUFF for long range transport assessments of PSD increment consumption (see p. 2-1).

CONCLUSIONS

EPA concludes that the technical basis of the CALPUFF modeling system is sound and provides substantial capabilities to not only address long range transport, but to address transport and dispersion effects in some complex wind situations. The noted scientific weaknesses in the model are the lack of advanced (e.g., PRIME) algorithms for treatment of building wake effects, and a simplistic characterization of sulfate and nitrate chemistry. However, EPA believes that the evaluation results available are sufficient to endorse the regulatory use of CALPUFF as a refined model for long range transport, and with prior approval, as a refined model for complex wind situations. Future performance comparisons for transport beyond 300km, and for various complex wind situations, are likely to extend the applicability and use of the modeling system. EPA will post on its website citations to performance evaluation investigations involving CALPUFF, as they become available, to build a knowledge base from which determinations can be made on the use of CALPUFF for various situations.

EPA has removed WYNDvalley as commenters suggested, and EPA will insure that use of CALPUFF is mentioned for all the cases listed in *Guideline* subsection 7.2.8.

Some commenters desired to avoid the proposed requirement for a protocol and prior approval for the use of CALPUFF for complex wind situations. However, given the lack of extensive evaluation results for these situations, and the lack of widespread experience with this modeling system, EPA believes its proposal on how CALPUFF can be used for complex wind situations is appropriate and reasonable.

Requiring 5 years of analysis, when only NWS data are available, was considered necessary (although likely difficult) in order to address possible year-to-year variations. Allowance of less than 5 years of analysis when mesoscale meteorological data are employed was endorsed, but some commenters were concerned if too few years are processed, as their experiences when using CALPUFF revealed large year-to-year variations in modeled long range transport impacts. In order to provide a reasonable degree of flexibility while continuing to ensure a sufficiently robust analysis., EPA has revised the *Guideline* to allow use of a minimum of three (3) years of mesoscale meteorological data to drive CALMET. EPA will has clarified in *Guideline* subsection 9.3 that the requirement to blend NWS data with mesoscale meteorological data is predicated on the assumption that the available NWS data are relevant and appropriate for the assessment being performed.

The CALPUFF screening procedure as proposed in the IWAQM Phase 2 report was considered by some to be too conservative, and by others as needing to have minor implementation details resolved. The proposal to endorse its use, but not require its use, appears warranted. The EPA anticipates that as experience is gained, the CALPUFF screening technique will see frequent use, and the implementation details will be resolved to the satisfaction of the applicants and the reviewing authorities.

Long range transport and complex wind situations, are not trivial modeling problems. All commenters were aware that to address these situations requires more information (terrain heights, land use, time and space variations in meteorological conditions) than is typical of standard plume models. Processing the data is seen to be a necessary but demanding task. The complexity of these situations requires a selection of options to provide the flexibility to tailor the model to specific situations. Understanding the nuance between various options is seen to be a necessary but demanding task. EPA was urged to provide a substantial and sustained effort to simplify data processing steps, to publish technical guidance on the trade-offs between the various options, to provide guidance on implementation issues, and to provide technical assistance to users.

EPA has placed emphasis on: 1) amplifying the available guidance information, 2) expanding the data formats for meteorological input data, and 3) making the code more robust to various choices in compilers. When sufficient experience has been attained, whereby it has become obvious what settings should be employed for best results for certain situations, EPA will publish this guidance on its website. Indeed, if EPA considers that any such settings are controversial for regulatory applications, and would warrant public review, a proposal will be published in the *Federal Register*. In the mean time, EPA will publish guidance as it becomes available to assist users in tailoring CALPUFF for application. Pending availability of resources,

EPA will develop descriptions that will ease use of the three existing mesoscale meteorological data sets that EPA has in hand.

3.0 OTHER MODELING SYSTEMS

3.1 Background

The *Federal Register* notice addressed a number of other model-specific issues. The *Guideline* subsections on ozone and particulate matter were enhanced to better reflect modeling approaches that are currently state-of-the-science. A screening technique for NO_2 was enhanced and CAL3QHCR was specifically mentioned for use on a case-by-case basis.

Reference to the Urban Airshed Model (UAM-IV) was removed from the revised *Guideline* subsection 5.2.1 and deleted from Appendix A since it is no longer the recommended photochemical model for attainment demonstrations for ozone; it will frequently be necessary to consider the regional scale for such demonstrations and, since the last revision to Appendix W, newer models have become available. Similar actions were taken for CDM as applied to particulates and RAM for particulates and CO.

Comment was requested on the need to integrate ozone and fine particle impacts (i.e., the "one atmosphere" approach) for regional scale assessments. The question was asked, “Are modeling tools and air program policies sufficiently developed to provide guidance on an integrated approach at this time?” Models-3 and REMSAD were identified as potential tools for regional scale assessments and to replace ROM and RADM. Comments on whether specific validated tools have been sufficiently developed to calculate the impacts of individual point sources on ozone and PM-2.5 precursor pollutants were also requested. EPA asked if there were any models that can be recommended for source-specific ozone and PM-2.5 assessments. Also, a proposal for revising how *Guideline* Appendix B addresses alternative models and criteria for use of alternative models were identified and comment sought.

3.2 Specific modeling systems

<u>Summary of Comments</u>: UAM-IV

Several commenters (IV-D-4; IV-D-17; IV-D-30) supported the removal of UAM-IV from Appendix A as a recommended model for ozone since it no longer represents the state-of-science. Removal of reference to ROM and RADM for regional-scale applications was also supported.

Other commenters (IV-D-23; IV-D-24; NRC) opposed the removal of UAM-IV, primarily because they felt that CMAQ, as a replacement that EPA will pursue over time, is not sufficiently tested and needs to be better understood. Also, one of these commenters felt that EPA did not provide a reasonable basis for removal of UAM-IV, did not consider adverse effects of the change, and wanted related programmatic assurances about how EPA’s “weight of evidence” concept is used. Ultimately, there was concern about adverse effects on ozone attainment and control strategy demonstrations.

EPA Response:

EPA's proposal to remove UAM-IV from Appendix A as a recommended model for ozone and to remove reference to ROM and RADM for regional scale applications were supported by some commenters who understood that these models were no longer state-of-the-science. Those who objected to removal of UAM-IV were concerned that Models-3/CMAQ, as a replacement for UAM-IV that EPA is likely to pursue, was not sufficiently tested. What EPA was attempting to communicate in its proposal was that UAM-IV is obsolete in light of the other more recent modeling approaches that have become available, and should therefore no longer by considered a recommended model. The use of Models-3/CMAQ is optional and was identified as only one example of the models that are appropriate in simulating the highly complex ozone formation and transport processes. As EPA has stated previously, the choice of model to be used is at the discretion of the control agency(ies) with jurisdiction for the model application. Alternately, criteria for using models not in Appendix A are delineated in revised wording that had been proposed for Section 3.2.2 of Appendix W; those who commented on revisions to Section 3.2.2. were generally supportive of that wording. Concern about use of "weight of evidence" is misplaced since its purpose is to make the decision process more robust and allow for the use of additional technical information on a case-by-case basis. In fact, under weight of evidence, determinations were made based on all information presented by the States and available to EPA. Model results for control measures were included. EPA's decisions were further strengthened by States' commitments to check progress toward attainment and to adopt additional measures, if the anticipated progress was not made. In the end, any proposed regulatory decision based on the use of a weight of evidence will ultimately be subject to public comment. The regulatory process should resolve concern with emission reductions as reflected in ozone attainment and control strategy demonstrations.

Summary of Comments: Models-3/CMAQ & REMSAD

Although Models-3/CMAQ and REMSAD are not proposed as recommended models for inclusion in Appendix A, a number of commenters (IV-D-4; IV-D-10; IV-D-16; IV-D-17; IV-D-24; IV-D-30; IV-D-33) took exception to encouraging the use of these models for ozone and/or PM-2.5 applications at this time. The commenters thought that these models have too many limitations, require additional analysis, and have not been evaluated sufficiently to be advocated or endorsed. There is a need, they said, to not only conduct operational, diagnostic, mechanistic and probabilistic evaluations, but also to establish the ability of these models to correctly predict changes in air quality associated with emission reduction scenarios for the new ozone and PM NAAQS. In general, there was a feeling that modeling tools for these new NAAQS are insufficiently developed and EPA is urged to pursue this deficiency as a high priority; no specific models for ozone and PM-2.5 should be identified at this time, since criteria for Appendix A status has not been satisfied by any model. Analyses for these pollutants should be done on a case-by-case basis with the choice of alternative models. Integrating ozone and PM-2.5 analyses is thought to be a good approach, but only after suitable models are evaluated and tested for the purpose. This level of knowledge for Models-3/CMAQ and REMSAD have not yet been achieved. One commenter also believed that the technical ability to conduct source specific assessments for ozone and PM-2.5 is unclear.

EPA Response:

EPA generally agrees with the desirability of further testing and evaluation of Models-3/CMAQ and REMSAD for use in ozone and PM-2.5 applications. The same is true of all similar regional scale models. However, these models have been successfully subjected to peer scientific reviews and are currently undergoing performance evaluations that will extend over several years as data bases become more extensive and complete for both ozone and PM-2.5. The utility of these models is being tested and demonstrated by EPA and by "ground-breaking" users such as the Western Regional Air Partnership. Also, the commenters misinterpreted the wording changes that had been proposed: Models-3/CMAQ is identified as only one example of the models that are appropriate in simulating the highly complex ozone/PM-2.5 formation and transport processes. It is clear that the model to be used remains within the judgment of the control agency(ies) with jurisdiction for the model application. Alternately, criteria for using models not in Appendix A are clearly delineated in revised wording that had been proposed for subsection 3.2.2 of Appendix W. As examples, Models-3/CMAQ and REMSAD do not exclude the use of other models. Consideration of the use of other models on a case-by-case basis is acceptable, but as two of the best documented and widely available modeling systems for which there has been substantial interest, Models-3/CMAQ and REMSAD are appropriately identified as potential models for use. Commenters did not indicate other models that should be identified for this purpose.

Comments on integrating analyses of ozone and PM-2.5 were supportive and comments on source-specific analyses were cautionary. It is clear that further work on estimating the impact of individual sources is desirable, thereby supporting the Appendix W proposal that individual source impacts should be considered on a case-by-case basis.

Summary of Comments: OLM

A number of commenters (IV-D-7; IV-D-9; IV-D-10; IV-D-11; IV-D-24; IV-D-32) supported the identification of OLM as an accepted technique for modeling NO_2 and encouraged evaluation of the Plume Volume Molar Ratio Method (PVMRM). They noted that procedures for dealing with multi-plume cases need to be identified.

One commenter (IV-D-24) wants expanded flexibility of multiple sources and suggested that EPA clarify its position on the use of OLM per its recommendation in Clearinghouse Memorandum #107. The commenter is of the understanding that our guidance recommends only modeling one plume at a time for OLM, which tends to result in higher ratios of NO_2 / NO_x, and hence more conservatism than when NO_x plumes are combined.

EPA Response:

Commenters were generally supportive of allowing the ozone limiting method (OLM) as a screening approach for NO_2 in Appendix W. Regarding PVMRM, while commenters encouraged its evaluation, it is evident that this model has not been standardized and is not in a form for distribution in the public domain. Testing of this model has been limited and it needs to be considered for a greater variety of NOx sources. No further action is appropriate on PVMRM at this time.

Regarding the comment about combining plumes, we have no guidance *per se* that addresses

the combination or separation of NO_x plumes when applying OLM. Rather, as with most decisions of this kind, we encourage professional judgement. As conveyed in Clearinghouse Memo #107 (which the commenter cites), if stationary NO_x sources are distinguishable, we would recommend that they be simulated individually. If, on the other hand, NO_x sources are indistinguishable, they may be combined.

Summary of Comments: Appendix B

Two commenters (IV-D-4; IV-D-10) specifically endorsed EPA's proposal to remove Appendix B from its position in Appendix W and place this list of alternative model summaries on the SCRAM website. Semi-annual, rather than annual updates to the list (posted as Alternative Models on the website) were suggested. The inclusion of CAMx in the list and the movement of the air quality checklist (Appendix C) to the SCRAM website were also supported. A third commenter (IV-D-7) did not want MESOPUFF (redundant with CALPUFF) removed from Alternative Models unless other redundant alternative models were also removed.

One commenter (IV-D-5) did not support the removal of Appendix B to the SCRAM website. The commenter argued that inclusion in Appendix W provides the only basis for public review of alternative models and little is saved by relegating this list to a website; openness and flexibility in the selection of models would be adversely affected. The commenter also believes that Appendix B status is an necessary interim step to a model's ultimate candidacy for adoption in Appendix A, and that removal of Appendix B creates a "pothole in the road to Appendix A". If EPA proceeds with its proposal to locate and maintain the Alternative Models on the website, then *Guideline* paragraph 3.2.2 (b) should identify which alternative models have been subject to public comment. The commenter questions the meaningfulness of the statement in *Guideline* Section 3.2.2(b) that there is no unique status associated with being in Appendix B, and suggests that it be removed.

EPA Response:

As explained in greater detail below, EPA is transferring Appendix B to facilitate easy maintenance and revision of this list of alternative models which do not have a regulatory standing and need not be codified. Comments were generally supportive of removing Appendix B from Appendix W and maintaining it as a PDF file on EPA's SCRAM Internet website. Updates will be provided as new models with appropriate summaries are submitted to EPA, rather than on a fixed schedule, thereby providing the greatest amount of responsiveness. Similarly, the air quality checklist will be available on the website as a PDF file. At the request of the developer, EPA will remove MESOPUFF from Appendix B, contrary to the desires of one commenter, since its function is now replaced by CALPUFF.

The comment by IV-D-05 opposing movement of Appendix B to the Internet website appears not to recognize that use, and manner of use, of models for regulatory applications subject to notice and public comment on a case-by-case basis. Thus generic review of all models as part of the public review process for proposed inclusion or reference in Appendix W does not uniquely add greater openness and flexibility, since use of any alternative (case-be-case) model would ordinarily be subject to public review for independent regulatory applications anyway. EPA has clarified in the designated area on its modeling website that new models added to the list are not necessarily the subject of review upon their addition. However, it should

be noted that the models identified in this proposal (i.e., ADMS, SCIPUFF, OBODM, CAMx, and UAMV) have been subjected to notice and public comment as part of this proposal to include them in the list of alternative models, and thus do not suffer from the potential limitation identified by the commenter.

Furthermore, it appears that commenter IV-D-05 has incorrectly presumed that a model's ultimate adoption in Appendix A must be preceded by an existence in Appendix B. Simply stated, inclusion of a model in Appendix B has never been a prerequisite, or a necessary or sufficient condition, for subsequent inclusion in Appendix A. Whether or not Appendix B exists as it has in the past (published as part of Appendix W), or managed as a list of alternative models posted on our modeling website, has no bearing whatsoever on a model's candidacy or suitability for adoption as a preferred/recommended technique in Appendix A. In fact, no model currently listed in Appendix A has ever previously been listed in Appendix B.

As we stated in the preamble to the notice of proposed rulemaking for this action Appendix B of the Guideline was created solely for the convenience of those seeking information about alternatives to the models adopted in Appendix A. The models described in Appendix B may or may not have been the subject of performance evaluations and their inclusion in Appendix B does not confer special status or EPA sanction on their use. Conversely, the fact that a model has not been listed in Appendix B carries no implication that its performance or acceptability for use is any poorer than Appendix B listed models. Whether or not a model is listed, potential users will be subject to the same requirements, i.e., to demonstrate that the model performs acceptably for its intended regulatory application. Because production and maintenance of Appendix B information in the CFR presents a substantial administrative burden for EPA and is not updated frequently enough to provide current information to potential users, we are moving the Appendix B repository of alternative model summary descriptions to our Internet SCRAM website. This action offers the advantages of easier and less expensive maintenance, as well as more frequent updating, and is thus more likely to contain a comprehensive description of alternative models which have been brought to our attention.

Regarding alternative models, *Guideline* Section 3.2.2(b) includes this caveat: "... inclusion there does not confer any unique status relative to other alternative models that are being or will be developed in the future." Commenter IV-D-05 writes, "The statement in Appendix W at the end of Section 3.2.2 (b) that inclusion in Appendix B "does not infer any unique status" on Appendix B models apparently only intends to convey assurance that no exclusive eligibility is implied by providing a list of alternative models in Appendix B. That is, <u>other</u> alternative models an applicant may wish to use, models that are not in Appendix B, will also be considered." The commenter then suggests that the caveat be deleted and replaced by the following: "However, Appendix B is not an exhaustive list of all models that might be approved for use as alternative models on a case-by-case basis." In fact, our caveat - as correctly interpreted by commenter - is in place to support the very position held by an alternative model developer. The suggested replacement language is thus unnecessary because the caveat says just this, as it is. It is clear from the caveat that the list of alternative models is not exhaustive, and that the potential approved use of an alternative model if regardless of whether it is "listed" or not.

<u>Summary of Comments</u>: ADMS & SCIPUFF

A number of commenters (IV-D-5; IV-D-12; IV-D-17; IV-D-22; IV-D-27) suggested that ADMS be included as a recommended model in Appendix A of the *Guideline*. They claimed that the model is widely used in Europe, is based on the latest science, has been peer reviewed, and is equal in statistical performance to AERMOD when compared to measured ambient concentrations. It was their opinion that restricting use of the model because it is proprietary is at odds with use of best modeling science: EPA should be more open and less prescriptive in its modeling requirements. One commenter noted that the source codes of some consultant's proprietary versions of ISC3 have not been published by EPA. To the contrary, another commenter (unidentified at the7th modeling conference) expressed the opinion that the source code for ADMS needed to be in the public domain before it could be included in Appendix W.

One of these commenters (IV-D-17) also suggested that SCIPUFF should be considered for Appendix A since it has been peer reviewed, is as accurate as AERMOD, and has equivalent application abilities. A better rationale should be provided for selecting CALPUFF over SCIPUFF.

EPA Response:

Commenters on ADMS, speaking largely from the perspective of European interests, argued that proprietary limitations on the availability of ADMS should not preclude it from having equal status with AERMOD and that it should be recommended in Appendix A. However, as specified in paragraph 3.1.1(c)(vi), air quality models used in U.S. regulatory programs must be in the public domain at reasonable cost. The purposes of these requirements are twofold: first, the model code must be available for public review and evaluation so that the basis for State and EPA proposed decisions relying on model results may be fully evaluated. Second, there must be a core set of models which are generally available to all potential users such that cost of acquisition is not an impediment. These criteria have been in place in U.S. regulatory programs since the inception of the *Guideline*. Until the joint issues of availability and cost are addressed by the authors of ADMS, it is most appropriately listed as an alternative model for use on a case-by-case basis regardless of how widely it is used in Europe. As with all other alternative models, even if the model is justified on a case-by-case basis, users will have to make the model available for public review and comment for specific applications.

All models in Appendix A of the *Guideline* are publically available (especially ISC3). Regarding alternate versions developed by consultants, EPA is aware that these entities have developed proprietary preprocessors or user interfaces to make the models easier to use, but the essential code remains in the public domain. It should be remembered that alternate versions of models recommended in Appendix A must be shown to be equivalent and subject to public comment when used in regulatory applications.

SCIPUFF has not gone through the same extensive testing and regulatory evaluation as has CALPUFF, nor has it been as widely used as CALPUFF for regulatory applications. As has been done by CALPUFF's developers, a commitment to support public availability of SCIPUFF would have to be made by its supporter before it could be considered for adoption in Appendix A.

Developers of ADMS nor SCIPUFF have not provided information that would assist EPA in assessing the potential conflicts which can arise with multiple models for the same application.

Moreover, part of the inquiry in determining whether to recommend or adopt a model for regulatory purposes is whether it fulfills a particular identified technical need in the suite of refined dispersion models and EPA has not identified in the materials supplied by commenters a basis for making such a determination.

Summary of Comments: General Modeling Issues

One commenter (IV-D-14) said that the OCD model should be used for complex terrain near shorelines. It was thought that this model is not less conservative than AERMOD.

One commenter (IV-D-15) said that ISC3LT should continue to be allowed for PM-10 and NO_2 in surface mining applications.

One commenter (IV-D-17) argued that there was no need for BLP in Appendix A since ISC3 and BLP can both model line sources.

One commenter (IV-D-11) indicated that there was a need for scaling factors for CTSCREEN for 8-hr and quarterly averaging times.

One commenter (IV-D-9) indicated the general need for an individual model that addresses impacts from non-GEP stacks in terrain above stack top height within 50km of the source.

EPA Response:

OCD has not specifically been evaluated for a complex terrain application. Nor has it been proposed for inclusion in Appendix A for such an application. It is essentially a flat terrain model applicable for shoreline environments. Considerable testing and evaluation would be required before the model could be proposed for use with complex terrain. It should also be noted that OCD doesn't have the capability to treat complex winds (e.g., sea breeze effects) as does CALPUFF.

The use of ISC3LT for surface mining applications has previously been negotiated and approved, and therefore meets grandfathering provisions for such applications. Even though ISC3LT was proposed for withdrawal and curtailment, that proposal does not affect grandfathered agreements.

BLP was specifically developed for aluminum reduction plants and other industrial facilities with buoyant line source applications. Although ISC3 can be used to approximate such applications, it is doubtful that it can do so better than a model developed and evaluated for that specific purpose.

The CTSCREEN screening factors for 1, 3, and 24-hour averages are adequate. Factors for 8-hour and quarterly averages are unique to specific pollutants and not generally applicable. If a specific need should be identified, a case-specific application can be developed.

There were no comments on (1) proposals to remove CDM and RAM from Appendix A, (2) reference to applications of CDM or RAM for particulate matter and CO, or (3) use of CAL3QHC for CO on a case-by-case basis.

CONCLUSIONS

Removal of UAM-IV from Appendix A for urban ozone applications and removal of reference to ROM and RADM for regional scale applications should be implemented to reflect the current state-of-science. Similarly, identification of Models-3/CMAQ and REMSAD as example modeling systems that have been evaluated and peer reviewed for regional scale applications is also justified provided this is not done in a way that precludes the use of other models. EPA never intended that identification of these models would be exclusionary. Also, It is clear that integrating ozone and PM-2.5 analyses is desirable when possible, and that individual source impacts may be considered on a case-by-case basis but that further work is necessary to refine such techniques.

The removal of Appendix B and Appendix C from Appendix W and placement of equivalent counterparts on EPA's SCRAM Internet website is justified. Appendix B will thus continue to comprise a list of alternative model summaries, but in a manner which can be updated as new models in the proper format are submitted, and not on the restrictive schedule that has existed in the past. Given the current status of ADMS and SCIPUFF, as well as OBODM, CAMx and UAMV, all should be included in the Alternative Models list at this time. If developers address proprietary and availability issues and consider issues of multiple models for a single application, selection of these models for inclusion in Appendix A of the *Guideline* can be considered at a later time.

EPA's proposal to reference OLM and CAL3QHC for use in specific circumstances is justified, as is removal of RAM and CDM from Appendix A. There is insufficient justification or information for EPA action on issues for OCD, ISC3LT, BLP, SCREEN, and CTSCREEN.

Criteria for use of alternative models (*Guideline* subsection 3.2.2) did not receive substantial comment and should be implemented as proposed.

4.0 METEOROLOGICAL DATA ISSUES

4.1 Background

The *Federal Register* notice proposed a number of editorial changes related to the use of meteorological data. In particular, comments were sought on the meaning of "site specific" and on use of surface meteorological data derived from the NWS's Automated Surface Observing System (ASOS). More specifically, comment was invited on whether the policy of modeling with the most recent 5 years of NWS meteorological data should include ASOS data and whether the period of record must be the most recent 5 years, regardless of whether it contains ASOS data. Similarly, EPA asked whether the policy to model with the most recent full year of meteorological data (i.e., *Guideline* subsection 10.2.3.4) should include/exclude ASOS data.

4.2 Meteorological Data & Processing Issues

Summary of Comments: ASOS and length of meteorological record

Several commenters (IV-D-04; IV-D-10; IV-D-24; IV-D-30; IV-D-32) viewed ASOS data as inferior to observer-based pre-ASOS data, and argued against wording that would require use of the "most recent 5-years of data". One commenter (IV-D-11) added that cloud cover is an essential input to modeling. In contrast, IV-D-07 and IV-D-25 mentioned opposition to blanket recommendations against the use of ASOS data.

One commenter (IV-D-11) said that use of the most recent period of meteorological data does not have to include consecutive years. They also argued that *Guideline paragraph* 7.2.1.1 (c) should be revised to recommend that less than 12 months of data should not be used for a refined analysis. Commenters IV-D-07 and IV-D-11 disagree with *Guideline* paragraph 7.2.1.1(c) because it assumes that the meteorological conditions resulting in the highest concentration will occur in the shorter data collection period. Forcing use of the highest first high concentration as a design value for comparison to the NAAQS , they argue, is tantamount to implementing a new NAAQS. One recommended that the paragraph be expanded to address other kinds of data encountered in an analysis, e.g., data that do not meet QA requirements or that may be only marginally spatially representative.

One commenter (IV-D-4) indicated the need to modify Appendix W to allow case-by-case decisions on the length of meteorological data record (i.e., *Guideline* paragraph 8.3.1.2 (c)) for sources with 1-year of site specific data and for use of new models with different data requirements.

One commenter (IV-D-30) indicated support for use of the term "representative" rather than "site specific" in reference to meteorological data.

EPA Response:

The majority of commenters who addressed the topic of ASOS data and requirements for using 5 years of National Weather Service data felt that the ASOS data were inferior for use with

Gaussian models; however not all commenters agreed. The commenters were concerned with requiring the most recent 5 years of such data when older, pre-ASOS, data , which is thought to be more appropriate, are available for use. Nevertheless, ASOS data are now the meteorological data typically available from the NWS. ASOS data are also the official record of the NWS; however, cloud cover observations at the level of detail previously available for higher level clouds are not provided. To deal with the issue of whether to use new ASOS data or pre-ASOS data, a footnote should be added to paragraph 8.3.1.2(a) of Appendix W to indicate that, where the latest 5 years of data include ASOS data (now the typical situation), discretion should be used; where judgment indicates ASOS data are inadequate for cloud cover, the most recent 5 years of pre-ASOS data may be considered for use.

Allowance of other-than consecutive years of meteorological data record is partially addressed and accomodated in revised guidance for use of mesoscale data for driving CALMET (i.e., *Guideline* paragraph 9.3.1.1(d)). Regarding contention with *Guideline* paragraph 8.2.1.1(c) and its prescription of H1H as the design concentration, we appreciate the technical issue raised by the commenters. While the commenters didn't offer any specific suggested revisions that would resolve the issue, we would point out that this matter was explored in a technical paper by EPA staff.[6] For both hypothetical sources across the 17 years analyzed (partial years were not analyzed), in far less than half the cases, the H1H concentrations was less than the highest H2H concentration for the period. Therefore, as often as not, the modeled H2H concentration is higher than the H1H concentration for the period. There is therefore no guarantee that the H1H for annual periods will be greater than the corresponding H2H. Our longstanding policy to require the H1H is easy to implement consistently, and affords some measure of reasonable conservatism in the absence of complete data. The paragraph will be retained, as written.

Specific comments on the length of meteorological record for, and use of, prognostic mesoscale meteorological models are discussed in Section 2.3 of this comment summary.

On the issue of site specific data, one commenter expressed a preference for "representative" rather than "site specific" terminology. However, no commenter addressed the use of the term "site specific" or associated definitions as used in the proposed revisions. Since there were no other comments on this terminology and for the reasons discussed in the proposal, we have replaced the term "on-site" with"site specific". In Guideline subsection 7.2.1.1, as well as in subsection 8.3, EPA has stressed *representativeness* as the guiding principle in judging suitability for meteorological data. In the revision proposed, EPA added to that emphasis in these subsections. Material emphasizing the concept of *representativeness* is also included in the recent update to the meteorological monitoring guidance[7] (see Section 3 of this guidance document).

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[6]Peterson, W.H and J.S. Irwin, 1984. Climatological Variability in Maximum Concentrations.. 4th Joint Conference on Applications of Air Pollution Meteorology; 16-19 October 1984; Portland, OR. pp. 99 - 102

[7]Environmental Protection Agency, 2000. Meteorological Monitoring Guidance for Regulatory Modeling Applications. EPA Publication No. EPA-454/R-99-005. Office of Air Quality Planning & Standards, Research Triangle Park, NC. (PB 2001-103606) (www.epa.gov/scram001/)

Summary of Comments: Updates to Meteorological Processors

Several commenters (IV-D-04; IV-D-06; IV-D-11,IV-D-13; IV-D-14; IV-D-15; IV-D-18; IV-D-21; IV-D-24; IV-D-30) mentioned specific enhancements that could be made to the meteorological processors. These included: update all processors to allow processing of all the various formats of meteorological data available from the National Climatic Data Center (NCDC); modify PCRAMMET nighttime rural Z_i values to avoid unrealistically low values (IV-D-14); modify MPRM to allow better error handling, be more user friendly, and to accept new or emerging data formats archived by NWS, e.g. ISHD, TD3280, and METAR for surface data (IV-D-6; IV-D-18; IV-D-30).

EPA Response:

As requested by the commenters, the meteorological data processors (i.e., MPRM and CALMET) have been updated to allow processing of meteorological data formats from NCDC necessary to support associated air quality models. **MPRM now supports the following formats:**

- CD-144 Card Deck 144 WBAN observations (80 characters per record)
- SCRAM Compressed format WBAN data (28 characters per record)
- SAMSON Solar and Meteorological data (1961-90); CD-ROM
- HUSWO Hourly U.S. Weather Observations (1990-95); CD-ROM
- INSWO International Surface Weather Observations (1982-97); CD-ROM
- TD-3505 Integrated Surface Hourly Data (ISHD); available from NCDC

Other Data Archives:
- TD-3240 Hourly precipitation data; available from NCDC
- TD-9689 Twice per day (morning and afternoon) mixing heights

CALMET has the following options for the input of meteorological data:

Hourly surface meteorological data:
- CD-144
- SAMSON
- HUSWO

- DATSAV3
- METAR

The first three formats are read directly by SMERGE. The last two formats are converted to one of the allowed 3 formats by preprocessing programs that are available from Earth Tech as part of the CALPUFF modeling package. There are processors to allow the use of ASOS data in CALMET. For example, there is a processor to convert DATSAV3 data into the CD144 format, which is one of the formats allowed in SMERGE. The DATSAV3 data has sufficient information on clouds to work after the conversion to ASOS. Another option is to use the METAR formatted data, which will convert ASOS data into the proper format.

Upper air data:
- TD-6201
- FSL format (1946-1992 and 1994-1997 CDs available from NCDC)
- FSL format (available from the FSL website)

Precipitation data:
- TD-3240

Hourly (or 3-hourly) gridded 3-D meteorological data:
- 1990 MM4 USEPA dataset (available from the NCDC; an extraction program is included)

- 1992 and 1996 MM5 datasets (available from the NPS; an extraction program is included)

- MM5 binary output; Earth Tech provides a program called CALMM5 to convert Version 2 and Version 3 MM5 output into the 3D.DAT and 2D.DAT files readable by CALMET.

- RAMS binary output; Earth Tech provides a program called CALRAMS to convert RAMS Version 4.3 output into the 3D.DAT and 2D.DAT files readable by CALMET.

- Eta *grib* file output (available from NCEP); Earth Tech provides a program called CALETA to convert Eta grib formatted output into the 3D.DAT and 2D.DAT files readable by CALMET.

With regard to MPRM, several enhancements have meed made to make the preprocessor more user-friendly. MPRM has a new user interface allows one to extract, audit, merge, and create files (for use in modeling) using a single set of input instructions ("single pass processing"). The old STAGE1N2 and STAGE3 executables have been replaced with a single executable (MPRM). As before, MPRM prompts the user for the name of the input command file. Also, options supporting free format and a user specified format have been added to extraction processing. In particular, the issue associated with Z_i values has been known for some time. The use of expert judgment on a case-by-case basis is the best approach since a permanent fix such as that requested in the comments is difficult to justify for a broad range of possible conditions.

Summary of Comments: Updates for Meteorological Guidance Documentation

Several commenters (IV-D-15; IV-D-17; IV-D-21; IV-D-28; IV-D-30) mentioned updates for the meteorological program guidance to reflect CALPUFF needs. These included: adding a warning on representativeness of meteorological data collected within slope flows; discuss that data collected within 10km of a site is likely representative in flat terrain (distance for acceptability reduces in hilly terrain); mention that when redundant data are used to substitute for missing values, the filled period should not be counted as missing; update the guidance on specification of surface roughness lengths and consider a cited report[8]; and update the discussions on the treatment of missing data to include both surface and upper-air observations,

[8]Hanna, S.R and R.E Britter, 2000. The effect of roughness obstacles on flow and dispersion at industrial facilities. To be published by AIChE/CCPS, 345 East 47th Street, New York, NY 10017.

given data needs for CALPUFF.

EPA Response:

Meteorological monitoring guidance is being updated in response to issues identified by the commenters. The revised guidance will be released at the same time as, or prior to, promulgation of revisions to Appendix W.

Summary of Comments: Treatment of Missing Data

A commenter (IV-D-30) urged EPA to provide further guidance on treatment of missing data. While treatment of a single hour is straight-forward, it is unclear how blocks of 2, 3, 5, 10, or 20 or more consecutive hours should be treated.

EPA Response:

A subjective procedure for filling blocks of missing hours - generally 10 or less - is described in a July 1992 note posted on our website:
http://www.epa.gov/scram001/surface/missdata.txt

Ideally, the interpolation scheme is most reasonable for filling one missing hour at a time. Professional judgement should always be used in the assessing the reliability of filling more than a few hours at a time. The *Meteorological Monitoring Guidance for Regulatory Modeling Applications* specifically states that "... isolated one-hour gaps should be filled with estimates based on persistence or linear interpolation. Application specific procedures should be used to for filling longer gaps; guidance for developing such procedures is provided in Section 6.8.1." The guidance, as written, is intended to provide flexibility to the reviewing authority in dealing with missing data; more prescriptive guidance would only tie the hands of the reviewing authority.

CONCLUSIONS

Due to limitations of ASOS data for use with standard dispersion models, a footnote should be added to paragraph 8.3.1.2(a) of Appendix W that indicates that where the latest 5 years of data includes ASOS data (now the typical situation) discretion should be used; where judgment indicates ASOS data are inadequate for cloud cover observations, the most recent 5 years of pre-ASOS data that is observer-based may be used.

The terminology for “site-specific” should be implemented as proposed since there was a lack of negative comment. The prevailing concept is, as commenters recognize, *representativeness*, and this is emphasized in EPA’s guidance. Other comments, e.g., on length of record, do not require further action.

The meteorological data processors (i.e., MPRM and CALMET) have been updated to allow processing of meteorological data formats from the National Climatic Data Center necessary to operate associated air quality models; the meteorological monitoring guidance is also being updated. The revised guidance and code will be released at the same time as, or prior to, promulgation of revisions to Appendix W. No further updates to MPRM are necessary at this time.

5.0 MISCELLANEOUS

Summary of Comments: Miscellaneous Comments on Appendix W

One commenter (IV-D-10) said that reference to STAR (STability ARray) should not be removed because LONGZ is an alternative model in Appendix B that uses STAR.

One commenter (IV-D-17) believed that EPA should provide justification supported by data for assuming that a wind speed of 1 m/s be used for lighter wind speeds that are greater than the response threshold of the instrument.

One commenter (IV-D-11) requested a clarification of language in *Guideline* paragraph 8.2.2 (b) on use of monitoring data in determining background concentrations.

One commenter (IV-D-11) requested a description of how the *Guideline* is applicable to unique conditions in Alaska and Hawaii. Another commenter (IV-D-28) indicated that PCRAMMET should be tested to insure that it is working properly for latitudes above the arctic circle.

One commenter (IV-D-32) requested that EPA provide clarification guidance on the minimum distance to which the PGT dispersion curves can be calculated. Another commenter (IV-D-17) suggested that guidance on determination of stability should be left to user's judgment and that the stability section in the *Guideline* should be updated. A third commenter (IV-D-30) suggested that in *Guideline* paragraph 8.3.3.2(h) use of turbulence be recommended rather than mentioned as an option.

One commenter (IV-D-02) suggested that *Guideline* Section 9 be updated to reflect the fact that model uncertainty is an area of increasing importance. Another commenter (IV-D-17) requested guidance on conditions under which a recommended model is unreliable. A suggestion that modeling be done by highly competent individuals with a broad range of experience, by itself, does not satisfy this need.

Commenters (IV-D-2; IV-D-7; IV-D-32) indicated that EPA should address State requirements that receptors be located to the nearest 1-meter or else an unreasonable number of receptors (thousands) may be required. A minimum receptor spacing as a function of downwind distance should be provided. Another commenter (IV-D-11) suggested that grid spacing be set to coincide with DEM data points.

One commenter (IV-D-30) suggested specific edits for *Guideline* subsection 8.3 (citations to voluntary standards); correct title to reference 98; and some suggested text for subsection 9.3.2.1 (and corresponding summary section) on suitability of using gridded meteorological data

One commenter (IV-D-05) suggested that work by European authors should be reflected in the *Guideline*, e.g., in its Section 4 or 9, or in the Bibliography).

EPA Response:

The STAR meteorological data processor was originally identified for models recommended in Appendix A that provide long term average concentration estimates. It is proposed that those models be removed from Appendix W. LONGZ is a screening model that is seldom used. Thus, there is no need to continue to reference STAR.

The issue of assuming 1 m/s for certain light wind conditions has previously been subjected to public review and comment in previous updates to the *Guideline*, and the commenter provided no evidence or data to suggest that this assumption os unreasonable.

A number of clarifications were requested on use of background, applications for Alaska and Hawaii, use of PCRAMMET, downwind distances for PGT curves, stability determination, use of turbulence, uncertainty and reliability. These topics have also previously been subjected to public comment and the commenters' requests were not specific enough for EPA to evaluate them and frame a response.

Regarding restrictions to State options on selection of receptor sites, this issue and an appropriate level of subjective judgment has previously been subjected to public comment. There is no basis for change or reopening the issue at this time.

Regarding the addition of the new references, we have added a reference to the *Guideline*'s Bibliography.[9]

Summary of Comments: Broadening the Use of Models and Guidance

Commenters (IV-D-17; IV-D-32) said that models recommended in Appendix A should be peer reviewed for journal articles and that peer review groups should review changes to models.

One commenter (IV-D-4) said that Appendix W should apply to both criteria and non-criteria pollutant issues to avoid conflicting analyses; this would include applications for BIF (Boiler and Industrial Furnace) rules, RCRA (Resource Conservation and Recovery Act), environmental justice, cumulative exposure, and AQRVs.

A number of commenters (IV-D-5; IV-D-16; IV-D-22; IV-D-33) claimed that Appendix W is vague, inflexible and cannot respond to exceptional circumstances and modeling advances. The scope of "off the shelf" models is not adequate to deal with all situations. Development of additional tools should be encouraged to provide greater support for SIP and NSR processes. There must be an open climate and greater flexibility on use of a broader range alternative models and for development of a variety of new, scientifically credible models. EPA must be willing to consider models from outside the agency and act expeditiously to allow use of alternative techniques; the status of alternative models should be clearly indicated on the

[9]Hunt, J.C.R., R.G. Holroyd, D.J. Carruthers, A.G. Robins, D.D. Apsley, F.B. Smith and D.J. Thompson, 1990. Developments in Modeling Air Pollution for Regulatory Uses. In Proceedings of the 18th NATO/CCMS International Technical Meeting on Air Pollution Modeling and its Application, Vancouver, Canada. Also in Air Pollution Modeling and its Application VIII (1991). H. van Dop and D.G. Steyn, eds. Plenum Press, New York, NY. pp. 17-59

SCRAM website. Reasonable standards for designating models recommended in Appendix A and more opportunities for including newly developed models are needed. This would not lead to inconsistency. In addition, minimum standards for simple problems and a manual of worked examples are needed. Another commenter (IV-D-17) said that EPA should define what is meant by "better performance" in criteria for justifying use of an alternative model.

One commenter (IV-D-5) argued that a requirement in *Guideline* paragraph 3.1.1(c)(vi) for preferred modeling techniques that "the model cannot be proprietary" poses legal and financial risk to developers, thus creating barriers to trade and innovation which should be removed. Software developed by other-than-U.S. taxpayers has been discouraged. The requirement that the model not be proprietary should be replaced with a requirement that the model "must be disclosed for review"; however, the source code need not be published. Another commenter (IV-D-17) supported the idea that source code need not be published for alternative models and asked for a definition of reasonable cost.

Commenters (IV-D-16; IV-D-33) are concerned with use of informal guidance, e.g., NSR Manual[10], for modeling applications. They emphasize that public notice and comment are necessary for draft documents such as the NSR Manual to be binding on NSR permit applicants. Where flexibility is to be used, it must be clearly indicated and supported. They supported the revised criteria for use of alternative models in subsection 3.2

Commenters (IV-D-5; IV-D-16; transcript) indicated that to facilitate the use of alternative models, there is a need for a list of cases for which alternative models have been accepted that is placed on the SCRAM website. If such a list includes many instances of EPA's approved use of the alternative models, that will demonstrate EPA's commitment to the development and use of a broader range of such models.

EPA Response:

EPA generally agrees that Appendix A models should be peer reviewed. CALPUFF, identified for inclusion by the proposed rulemaking has been peer reviewed. However, there is not a uniform standard in the scientific community as to whether a journal article, a peer review group, or some other review mechanism satisfies criteria for scientific peer review. EPA is not in a position to dictate the exact form of peer review to others submitting models. CALPUFF has been submitted to both journal and group peer reviews. It continues to be EPA's policy that models recommended in Appendix A have been subjected to public comment and peer scientific review through participation of the American Meteorological Society and the Air and Waste Management Association in modeling conferences required by the Clean Air Act.

Because the provisions in the Clean Air Act calling for EPA to specify models to be used pertain to PSD and to demonstrations of attainment for State implementation plans, Appendix W is intended for use in assessing criteria pollutants. In practice the models and procedures contained in Appendix W are often used in assessments of ambient concentrations of noncriteria pollutants , or air toxics, applications as well. Whether this should be required as a matter of

[10]Environmental Protection Agency, 1990. New Source Review Workshop Manual: Prevention of Significant Deterioration and Nonattainment Area Permitting (Draft). Available @: www.epa.gov/ttn/nsr/

regulation is beyond the scope of our current action, however.

A number of the commenters argued that Appendix W is inflexible and doesn't reflect modeling advances, or argued for acceptance of proprietary models, e.g., ADMS However, the weight of scientific opinion has been that a proprietary model is one that is not available for review and testing by all members of the scientific, regulatory, and regulated communities, that access is restricted by sequestering the source computer code and releasing only an executable version. When the source code is unavailable, it is impossible to review the detailed physical, chemical, and numerical approximations made in the model or to check for coding errors. The purposes of seeking the best scientific basis for modeling and requiring model transparency also differ somewhat in that in addition to enabling scientific review and verification of the code, transparency also is needed for EPA to meet its obligation to provide the public with adequate information to demonstrate that EPA's decisions are reasonable and adequately supported by applicable law, available information, and sound science. Finally, as discussed above (p. 3-6), we believe that it is important that regulatory models be available to all users at a reasonable cost. Users are not precluded from applying more expensive models, but must meet other requirements applicable to the use of alternative models.

EPA's desire to include new models with better scientific basis for a broader range of conditions and regulatory applications is stated in Section 3 of Appendix W and is evidenced by the models included in this proposal which were at least partially developed outside the Agency. Revised criteria for use of alternative models were included in this proposal and received few comments; those comments were favorable.

Contrary to the position expressed by the commenter, the October 1990 draft NSR manual is not mandatory for all model users and, for States with SIP-approved programs, it does not dictate their program implementation to them. In some cases, we refer to what is generally regarded as common practice merely in order to give readers some indication of how other users have applied models in particular circumstances.

Although there is not a comprehensive list of models that have been used in permit applications, the Model Clearinghouse Information Storage and Retrieval System (MCISRS), which is publicly available on the SCRAM Internet website, already identifies situations where alternative models have been used. Information on other cases are available from individual EPA Regional Offices. Producing a complete historical listing retrocatively would be resource intensive and not germane to the present purpose of revising the *Guideline*.

Summary of Comments: Miscellaneous

One commenter (IV-D-19) recommended an annual budget of $1 million for continuous regulatory model development and support. Another commenter (IV-D-9) suggested that EPA staff, rather than contractors, should provide direct support and training for models.

One commenter (IV-D-17) offered to join with EPA and other stakeholders to work cooperatively on meeting needs for alternative models. A CRADA was suggested for working with industry.

One commenter (IV-D-32) requested that EPA form a committee involving NCDC and

stakeholders to improve support by NCDC to the air quality modeling community. Another commenter (IV-D-19) noted NWS plans to use a sonic anemometer for determination of the horizontal wind, and recommended that EPA discuss with NWS the addition of a vertical sensor (and possibly other instruments) to provide data and output valuable for air quality modeling.

One commenter (IV-D-14) indicated that EPA should provide firm guidance on what sources should be considered in increment analysis when they are located in different political jurisdictions. Another commenter (IV-D-30) stated that the guidance documents on use of weight of evidence for O3/PM-2.5 attainment demonstrations is a positive development and should be finalized when reviews are completed. This commenter (IV-D-30) also recommended changing policy with respect to GEP stack height credit and modeling GEP stack heights. The commenter points out that the wake effects can extend above the present cap. Another commenter (transcript) has seen cases where newly constructed, non-emitting structures have acerbated a downwash situation and would like EPA to require the review of the construction of new buildings in excess of 40% of the shortest neighboring stack height.

One commenter (IV-D-2) wanted EPA to address the appropriateness of commercial front ends for its SCRAM Internet website programs by recommending and making them available through the SCRAM website.

EPA Response:

This set of comments represent general views of a number of commenters and not directly related to the Appendix W proposal. Views about distribution of resources are helpful but not necessarily within EPA's discretion, given other demands and constraints. EPA is always willing to work with stakeholders on models and typically has one or more ongoing activities. EPA has ongoing conversations with services from NCDC concerning specific meteorological data products. NOAA's "pay as you go" requirements for products and services generally satisfy most customer needs at a nominal cost. Specialty requests for unique instrumentation and data sources will undoubtedly result in substantial costs for users. EPA is continuing to develop the guidance on ozone and PM-2.5, subject to the status of new National Ambient Air Quality Standards for these pollutants. However guidance on NSR/PSD and good engineering practice stack heights is subject to separate regulatory requirements and are not within the scope of Appendix W or our current action. Commercial "front ends" (user interfaces) to models can be made available from developers at their discretion, but since they do not affect the source code or model performance, EPA does not require their disclosure.

CONCLUSIONS

This set of comments represents a variety of independent views. In most cases they are on topics not specifically addressed as part of this regulatory proposal and/or attempt to address issues that had previously been subjected to public comment. As a result there is no basis for change or reopening these issues at this time. No immediate action is appropriate.

Nevertheless, EPA is always open to new techniques and is working with outside groups in development of such new techniques, as evidenced by models included in the regulatory action proposed. New modeling techniques will continue to be considered as peer reviewed and nonproprietary models are made publicly available.

6.0 TIMING

6.1 Background

The *Federal Register* notice proposed to consider AERMOD, ISC-PRIME, and CALPUFF as recommended techniques for their intended applications (as specified in the *Guideline)* starting one year after the final rule is issued, and that the models be used in their regulatory default modes. The models could be used in the interim (i.e., as soon as the final rule is issued). Comment was invited on the reasonableness of the timing of this implementation schedule.

6.2 Timing for Implementing New Models

Summary of Comments:

Several commenters (IV-D-6; IV-D-8; IV-D-13; IV-D-24) believed that State permitting authorities should be allowed to apply CALPUFF sooner than the proposed period of 1 year. Suggestions ranged from as soon as possible to six months after promulgation. A primary reason for this concern is "model shopping" during the transition period in order to minimize concentration estimates.

EPA Response:

The purpose for extending the period by which users should begin applying CALPUFF is an acknowledgment that most users will not have established the requisite data bases and procedures to begin using CALPUFF for up to a year following its adoption. It should be noted that EPA's action allows but does not require interim use of models prior to the 1-year deadline. A version of CALPUFF is in fact already being used on such a basis and is consistent with the general views of commenters. Consequently, we agree with commenters that there is no need to extend the deadline for those who have the necessary data bases in less than one year from promulgation.

CONCLUSIONS

EPA's decision to allow but not require interim use of models prior to the 1-year deadline is reasonable. This action neither interferes with those who want to use the models immediately, nor with those who need a longer time to collect the necessary data bases. However, it does provide a deadline by which the new models must be used, consistent with the desire of all those who commented on this topic.

Appendix A

List of commenters who submitted in writing to Docket A-99-05 or otherwise offered comments related to the 7th Conference on Air Quality Modeling, June 28-29, 2000, Washington, DC.

LIST OF COMMENTERS WHO SUBMITTED TO DOCKET A-99-05

Docket Item No.	Commenter
IV-D-01	John A. Roth Wisconsin Department of Natural Resources
IV-D-02	Raymond P. Berube Department of Energy, Office of Environmental Policy & Guidance
IV-D-01	Calvin Ku Missouri Department of Natural Resources
IV-D-04	Jeffrey A. Saitas Texas Natural Resource Conservation Commission
IV-D-05	Regina A. Loughran, Esq. Ladas & Parry
IV-D-06	Christopher M. Howard Alabama Department of Environmental Management
IV-D-07	Tom Chapple Alaska Department of Environmental Conservation (see also IV-D 20)
IV-D-08	Alan Dresser New Jersey Department of Environmental Protection
IV-D-09	Merrilee Carlson NMC Environmental Group
IV-D-10	James F. Yohn, Alan J. Krol, & James W. Keating (w/ attachment) BP AMOCO
IV-D-11	Richard Sprott Utah Department of Environmental Quality
IV-D-12	Gill Hunter Innogy Environment
IV-D-13	Susan S.G. Wierman Mid-Atlantic Regional Air Management Association
IV-D-14	Robert P. LaBelle Department of Interior, Minerals Management Service

IV-D-15 Ken Rairigh
Wyoming Department of Environmental Quality

IV-D-16 Andrea Bear Field, Esq.
Hunton & Williams for the Utility Air Regulatory Group

IV-D-17 Howard Feldman
American Petroleum Institute
w/ 2 attachments:
Technical Comments by Air Modeling Task Force
Comparison of AERMOD, ISC3 and ADMS Model Performance with Five Data Sets. S. Hanna *et al.* AWMA paper, June 2000

IV-D-18 Jeffrey C. Weil
University of Colorado, Cooperative Institute for Research in Environmental Sciences
AMS - CMAAP (Chair)
w/ 2 attachments:
AMS Comments on AERMOD, P. Hanrahan;
Comments on the CALPUFF Dispersion Model, W. Dabberdt

IV-D-19 Richard H. Schulze & D. Bruce Turner
Trinity Consultants

IV-D-20 Tom Chapple
Alaska Department of Environmental Conservation
(see also IV-D-07)

IV-D-21 Ken Rairigh
Wyoming Department of Environmental Quality
(see also IV-D-15)

IV-D-22 Martin Tasker
ICI Eutech Engineering Solutions

IV-D-23 Mark Sullivan
University of Maryland for 1000 Friends of Maryland

IV-D-24 Patrick Hanrahan
State & Territorial Air Pollution Program Administrators /Association of Local Air Pollution Control Officials

IV-D-25 Jeffrey L. Burgess
North Dakota Division of Air Quality

IV-D-26 David Carruthers
Cambridge Environmental Research Consultants Ltd.

IV-D-27	Roy Lewis AstraZeneca
IV-D-28	Dan Johnson WESTAR
IV-D-29	Larry L. Simmons Energy & Environmental Mgmt., Inc.
IV-D-30	George J. Schewe (w/ attachment) Air & Waste Management Association - AB-3 Committee
IV-D-31	William Hochheiser Department of Energy, Oil & Gas Environmental Research
IV-D-32	Jeffrey Panek (w/ attachment) Gas Technology Institute
IV-D-33	Pamela Faggert Dominion General
IV-D-34	Jason Maranche Allegheny County Health Department
IV-D-35	Jeffrey A. Tarde Johns Manville International, Inc.