

Expert Panel #1 – Treatment of Low Wind Conditions

Panelists:

- **Mr. Rick Gillam** is an environmental engineer working with EPA Region 4 in Atlanta, Georgia. He has been with Region 4 for 27 years, including 19 years of experience in air modeling. He currently serves at the Region 4 Air Modeling Team Leader working with four other Region 4 modeling staff to manage air modeling projects in the region, including PSD/NSR modeling, SIP attainment modeling, Outer Continental Shelf (OCS) permit modeling, ozone and PM_{2.5} photochemical modeling, regional haze modeling, air toxics, and wildland fire smoke modeling. Rick has a B.S. in Mechanical Engineering from Ohio University.
- **Mr. Bob Paine** is a Certified Consulting Meteorologist who has worked at AECOM for 44 years. Bob has a long history working with EPA in the development of many approved regulatory models, including OCD, RTDM, CTDMPLUS and AERMOD. Bob was a member of the AERMIC committee that helped design AERMOD. Bob has continued to contribute to AERMOD development on many topics and has specifically engaged EPA on low wind improvements to AERMOD since 2009.
- **Dr. Akula Venkatram** is a Professor of Mechanical Engineering at the University of California, Riverside, California, USA. His research is focused on the development and the application of models for the transport and dispersion of air pollutants over urban and regional scales. Previously, he held positions as the Vice President of Air Sciences at ENSR Consulting and Engineering and the Head of Model Development at the Ontario Ministry of the Environment. Dr. Venkatram was a member of the team that developed AERMOD and was a principal contributor to the RLINE model. Dr. Venkatram received a B.S. degree in mechanical engineering from the Indian Institute of Technology and a Ph.D. degree in mechanical engineering from Purdue University.

Charge Questions:

- 1) With the 2017 revisions of the *Guideline on Air Quality Models*, the regulatory ADJ_U* option and the ALPHA LOW_WIND options (*i.e.*, minimum wind speed, sigma-v, and maximum meander factor) were added. Please comment on your experience with the ADJ_U* option in modeling situations involving light wind, stable conditions.
- 2) Please also comment on the EPA's strategy and the benefits for providing LOW_WIND components as ALPHA options for testing and evaluation purposes. If applicable, share your experiences with testing and evaluations of the ALPHA LOW_WIND options.
- 3) Do you have additional recommendations for further adjustments or options to address potential overpredict biases in the model during light wind, stable conditions? For example, model performance can be addressed by changes to the processing of meteorology (AERMET) or the treatment of sources via modification to the dispersion curves (AERMOD). Where do you feel that model improvements efforts should be most focused?
- 4) For assessing model performance during light wind, stable conditions periods, are the existing databases adequate for investigating further model improvements? Are there additional or new dataset needed, and what would be the key features of these datasets?

Expert Panel #2 – Overwater Modeling

Panelists:

- **Dr. Bart Brashers** did a post-doc with the EPA group developing CMAQ from 1998-2001, working on dry deposition. He returned to Seattle and has been with the same group for 18 years, though there have been four different names on the door - most recently ENVIRON and now Ramboll. He runs WRF, supports MMIF, and has done model inter-comparisons both onshore and offshore.
- **Mrs. Holli Ensiz** is a physical scientist, with emphasis on air quality, with the Bureau of Ocean Energy Management (BOEM) Headquarters Region in Northern Virginia. Since the mission of BOEM is to manage development of U.S. Outer Continental Shelf (OCS) energy and mineral resources in an environmentally and economically responsible way, Holli conducts air studies regarding impacts assessments of OCS oil and gas activities on air quality, including emissions inventory and modeling studies. She is also assisting with drafting BOEM's Air Rule. Before working in headquarters, Holli worked in BOEM's Gulf of Mexico Region in New Orleans for 14 years in a similar position.
- **Dr. Jay McAlpine** is a boundary layer meteorologist and Regional Modeling Contact at EPA Region 10 in Seattle and a member of EPA's overwater dispersion modeling workgroup. He holds a Ph.D. in Atmospheric Science from the University of Nevada, Reno / Desert Research Institute and a B.S. in Atmospheric Science from the University of Washington. Jay has 18 years of experience in air quality modeling, working in air quality consulting and modeling research prior to joining the EPA.
- **Dr. Akula Venkatram** is a Professor of Mechanical Engineering at the University of California, Riverside, California, USA. His research is focused on the development and the application of models for the transport and dispersion of air pollutants over urban and regional scales. Previously, he held positions as the Vice President of Air Sciences at ENSR Consulting and Engineering and the Head of Model Development at the Ontario Ministry of the Environment. Dr. Venkatram was a member of the team that developed AERMOD and was a principal contributor to the RLINE model. Dr. Venkatram received a B.S. degree in mechanical engineering from the Indian Institute of Technology and a Ph.D. in mechanical engineering from Purdue University

Charge Questions:

- 1) Currently, the Offshore and Coastal Dispersion (OCD) model is the EPA's preferred model for offshore and coastal modeling applications. The EPA is considering the eventual replacement of OCD with AERMOD. However, AERMOD does not contain key modules required for offshore and coastal modeling such as required input parameters for marine-based meteorology, treatment for coastal fumigation, or offshore platform downwash from elevated and porous (lattice) structures.

Please share your thoughts regarding EPA's efforts to replace OCD with AERMOD. What elements of the current science within the OCD model are in most need for improvement beyond just being incorporated into AERMOD as is?

- 2) In your opinion, what is the most immediate need or what should be the EPA's highest development priority with regard to addressing overwater and coastal modeling issues (*e.g.*, shoreline fumigation, elevated platform downwash, defining a regulatory method for processing and use of marine-based meteorology for offshore modeling)?
- 3) Do you envision priorities related to overwater/coastal modeling issues to shift in the near future (5 years) that could require the EPA to reprioritize development efforts to address overwater modeling issues? If so, what shifts do you foresee will take place and what do you believe are or will be the drivers for those shifts (*e.g.*, economic such as more or less offshore drilling, advancements in scientific research that would increase offshore drilling or simplify offshore/coastal modeling issues)?

Expert Panel #3 – Mobile Source Modeling

Panelists:

- **Dr. David Heist** has been a Research Scientist in EPA's Office of Research and Development for 16 years. He earned a Ph.D. in Mechanical Engineering from Cornell University in fluid dynamics. David performs wind tunnel experiments on flow and dispersion at EPA's Fluid Modeling Facility and works to further develop the agency's dispersion models.
- **Dr. Michelle G. Snyder** is an atmospheric scientist at Wood Environment & Infrastructure Solutions LLC and has worked for UNC's Institute for the Environment, and EPA's Office of Research and Development. She specializes in atmospheric dispersion, numerical model development, and air quality data analysis. She was one of the main developers of the R-LINE model, a Gaussian dispersion model for roadway sources.
- **Mr. Christopher Voigt** is a Senior Environmental Engineer with the Virginia Department of Transportation Environmental Division. He has served in a number of roles with the American Association of State Highway and Transportation Officials (AASHTO), where he is currently the Vice-Chair of the CES Air Quality, Climate Change and Energy Subcommittee.

Charge Questions:

- 1) AERMOD version 19191 includes two new source types based on ORD's R-LINE model. The RLINE source is a BETA option that brings a new dispersion formulation into AERMOD. The RLINEXT is an ALPHA option based on the RLINE source, but also includes algorithms for depressed roadways and solid barriers and an ALPHA URBAN option to account for urban meteorology.

Please share your thoughts and opinions on EPA's addition of the RLINE sources to AERMOD. In particular, which of the ALPHA options should EPA focus their development efforts for improving the RLINE options in AERMOD for regulatory purposes?

- 2) Please discuss what is the most important development area with regard to the treatment of mobile sources in the AERMOD model that the EPA has not already identified or discussed?
- 3) Do you envision priorities related to mobile source modeling issues changing in the near future (5 years)? If so, what shifts do you foresee will take place and what do you believe are or will be the drivers for those shifts?

Expert Panel #4 – Building Downwash

Panelists:

- **Dr. Ron Petersen** is currently the President of Petersen Research and Consulting. After 35 years at CPP, Inc., he retired in late 2018 where he was a Principal and one of the three founders. He was the Principal Investigator on the PRIME2 research project that lead to improved equations for building wake turbulence and wind speed. The new PRIME2 equations are included as ALPHA options in AERMOD version 19191. He is a Certified Consulting Meteorologist with over 35 years' experience in modeling atmospheric dispersion using numerical and wind tunnel modeling methods. Dr. Petersen has been an active member of the A&WMA APM committee for over 35 years and is currently the Chairman of the PRIME2 sub-committee.
- **Dr. Steven G. Perry** is a Research Physical Scientist with the USEPA's Office of Research and Development in RTP, NC. Dr. Perry received his Ph.D. in Meteorology from the Pennsylvania State University and has over 34 years of experience developing many of the Agency's regulatory dispersion models including AERMOD, CTDMPLUS and AgDRIFT. He is a senior scientist and co-lead at the EPA's Fluid Modeling Facility which houses the Agency's Meteorological Wind Tunnel that is used for flow and dispersion studies in support of regulatory model development and specialized homeland security applications.
- **Dr. K. Max Zhang** is a professor at Sibley School of Mechanical and Aerospace Engineering, Cornell University. He received his Ph.D. in Mechanical Engineering from UC-Davis. Dr. Zhang's research areas reside on the nexus of energy and environmental system engineering, and currently focus on dispersion modeling, passive mitigation of air pollution, renewable energy planning, and sustainable heating solutions in cold climate. Dr. Zhang was a visiting scientist to then USEPA Atmospheric Modeling Division in 2000 and 2002-2003.

Charge Questions:

- 1) AERMOD version 19191 includes ALPHA options that represent formulation changes in the PRIME downwash algorithm. Two sets of options are available, one set which incorporates changes recommended by the EPA's Office of Research and Development (ORD) and the other recommended by the PRIME2 subcommittee of the Air & Waste Management Association (AWMA). An additional change was made to the BPIPPRM building processor in the way the effective building dimensions are determined for rectangular buildings when oriented at an angle to the wind flow. The updates to BPIPPRM were released in a draft version BPIPPRM (19191_DRFT) to facilitate the testing and evaluation of the ALPHA options in AERMOD.

Please comment on the EPA's collaborative activities and this approach to incorporate options into AERMOD to make them available to the user and scientific communities for testing and evaluation. Do you have any specific comments or thoughts regarding the updates to AERMOD version 19191 based on the work by ORD and by AWMA?
- 2) With regard to improving and refining AERMOD's treatment of building downwash, in your expert opinion, what should be the EPA's highest development priority (*e.g.*, effective building parameters/BPIPPRM for simple and/or complex building configurations, elongated buildings, corner vortex issues, streamlined structures, porous structures, elevated platforms)?
- 3) With regard to improving AERMOD's treatment of downwash, should the EPA focus its energy on continuing to improve and maintain the PRIME algorithm or replace PRIME altogether? In other words, do you consider that PRIME is now based on science that is out-of-date? Based on your response, please share any insights you have on the direction the EPA should consider in the near-term and longer-term for improving AERMOD's treatment of building downwash.

Expert Panel #5 – Prognostic Meteorology

Panelists:

- **Mrs. Ashley Mohr** is an Environmental Scientist in the EPA Region 6 Office in Dallas, Texas. She joined EPA in 2010 and currently works in the Air Permits Section, where she serves as the Region 6 contact on air permit modeling. As the Region's air permit modeler, she coordinates activities related to the Region's oversight and review of ambient air analyses conducted in support of state-issued New Source Review permits. She is also the lead for reviewing ambient air analyses submitted by permit applicants to EPA Region 6 in support of EPA-issued construction permit applications. Ashley also serves as the EPA Region 6 state coordinator for the Arkansas air permitting program. Ashley has a M.S. in Atmospheric Science and B.S. in Meteorology, both from North Carolina State University.
- **Mr. Bret Anderson** is a Physical Scientist with the USDA Forest Service. Previously, he was the Lead Regional Modeler for EPA Region 7 and started with the Nebraska Department of Environmental Quality. His technical experience is in permit modeling, meteorological and photochemical modeling, long range transport modeling and smoke transport modeling. Mr. Anderson is a graduate of the University of Nebraska-Lincoln with a B.S. in Geography and has an M.S. in computer information systems from Bellevue University.
- **Dr. Bart Brashers** did a post-doc with the EPA developing CMAQ from 1998-2001, primarily working on dry deposition. He returned to Seattle and has been with the same group for 18 years, though there have been four different names on the door - most recently ENVIRON and now Ramboll. He runs WRF at multiple scales and regions, supports and updates the MMIF tool under the guidance of EPA, and has done significant work on model development and evaluation.

Charge Questions:

- 1) The option to use prognostic meteorological data in dispersion modeling applications was intended to open a door for modeling sources in challenging meteorological situations. For example, sources that are in complex terrain or sources with missing representative data.

With respect to allowing the use of prognostic meteorological data under the *Guideline*, what has been the most significant advantage or improvement to meteorological data inputs?
- 2) Three-dimensional meteorological modeling has a different set of challenges when compared to compiling an observational dataset, be it either on-site monitoring or National Weather Service. Knowing there would be growing pains with a new option, what has been the most challenging aspect as it relates to the use of prognostic meteorological data in dispersion modeling applications?
- 3) Moving forward, advancements in computational ability and our understanding of the atmosphere will continue to grow. Thus, the ability of three-dimensional models to simulate atmospheric conditions at meso- and microscales will also improve. Outside of higher resolution datasets, what sort of improvements do you expect or would you like to see in the implementation of prognostic data in dispersion modeling applications?

Expert Panel #6 – Near-field and Long-range Model Evaluation Criteria

Panelists:

- **Mr. Bret Anderson** is a Physical Scientist with the USDA Forest Service. Previously, he was the Lead Regional Modeler for EPA Region 7 and started with the Nebraska Department of Environmental Quality. His technical experience is in permit modeling, meteorological and photochemical modeling, long range transport modeling and smoke transport modeling. Mr. Anderson is a graduate of the University of Nebraska-Lincoln with a B.S. in Geography and has an M.S. in computer information systems from Bellevue University.
- **Mr. Mark Garrison** is a Partner and Technical Fellow with Environmental Resources Management (ERM) with over forty years of experience as a meteorologist and air quality dispersion modeler in the environmental consulting field, for the electric utility industry, and for the U.S. EPA Region 3. Mr. Garrison has extensive experience with permitting and air quality issues for air emissions sources for a wide variety of industries both domestically and internationally, and extensive experience in the application and evaluation of air quality models and finding solutions to complex problems.
- **Mr. Erik Snyder** is the Lead Regional Air Quality Modeler at EPA Region 6. He has 24 years of experience in Air Quality field including 18 years in the Air Branch at the U.S. Environmental Protection Agency (EPA) Region 6 office in Dallas, Texas. Prior to joining EPA he worked in state government and consulting in the air quality field. B.S Engineering Physics from University of Oklahoma.

Charge Questions:

- 1) As part of the model evaluation process for establishing preferred models and approving alternative models for regulatory applications, the *Guideline* recommends the use of the EPA Protocol for Determining Best Performing Model, *i.e.*, the Cox-Tikvart method to judge model performance. Is the Cox-Tikvart method still appropriate for near-field regulatory applications?

What are the advantages and disadvantages of the Cox-Tikvart protocol? How can or should applications that do not fit the Cox-Tikvart paradigm (*i.e.*, episodic or short-term tracer studies) be evaluated?
- 2) What evaluation methods, other than Cox-Tikvart, may be appropriate for consideration by EPA in updating the *Guideline* or could be used now for non-regulatory applications, such as risk assessments, where spatial and temporal distributions may be more important?
- 3) What evaluation methods and tools are available and appropriate for long range transport applications? In comparing the model evaluation needs for near-field and long-range transport application, what are the metrics most important or relevant to each and why do they differ?
- 4) What are the key features of model evaluation data sets for near-field models and long-range transport models?