



# Expert Panel: Building Downwash

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US EPA/OAQPS/AQAD

Air Quality Modeling Group



# Background

- Building downwash is accounted for in AERMOD using the Plume Rise Model Enhancements (PRIME) model
- PRIME algorithms in AERMOD have not been updated since the promulgation of AERMOD in 2005
- Analyses have shown AERMOD to both overpredict and underpredict ground-level concentrations in the building wake, depending on the building dimensions; stack height; stack location; and the orientation of the building relative to the wind direction
- Some limitations of PRIME as currently implemented include:
  - Buildings assumed to be rectangular and solid
  - Considers a single building/tier for a wind direction
  - Turbulence is constant in the near wake (cavity)
  - Approach roughness and stability are not considered



## Background (Cont.)

- AERMOD version 19191 includes ALPHA options that represent formulation changes to the current PRIME downwash algorithm.
- Two sets of ALPHA options are now available including:
  - 3 options developed by EPA's Office of Research and Development (ORD) that redefine the height used for wind speed in the building wake and adjust for a discontinuity in the dispersion at the boundary of the cavity and the far wake.
  - 3 options developed by the PRIME2 subcommittee of the Air & Waste Management Association (AWMA) that include new equations for building wake turbulence and velocity deficit with specialized treatment for streamlined buildings.
- An additional change was made to the BPIPFRM building preprocessor by ORD, released as **19191\_DRFT**, related to how effective building dimensions are determined for simple rectangular buildings/tiers **ONLY** when oriented at an angle to the wind flow. Both ORD and AWMA used comparable methods for determining building dimensions during testing/evaluation.



# Panelists

- Steve Perry (EPA ORD)
- Sergio Guerra (A&WMA PRIME2 Subcommittee)
- K. Max Zhang (Cornell)



# Charge Questions

1. 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.