Exponent's Comments on CALPUFF and AERMOD Modeling Guidance

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Concerns Raised About CALPUFF

- In earlier reviews of LRT model performance, EPA stated that the "*CALPUFF dispersion model had performed in a reasonable manner, and had no apparent bias toward over or under prediction, so long as the transport distance was limited to less than 300km*." (see current Guideline).

- Several documents included in the Proposed Regulatory Docket have raised concerns about the CALPUFF modeling system
  - Preamble to proposed rulemaking notice
  - Supplemental Information for EPA's 2009 Draft Report regarding Reassessment of IWAQM Phase 2 Recommendations
  - Summary of CALPUFF Ownership since 2003 Promulgation

Concerns Raised About CALPUFF

Preamble to Proposed Rulemaking Notice:

- EPA expresses "*concerns about the management and maintenance of the model code given the frequent change in ownership of the model code…*" and refers to uncertainties in the development process of the model.
- These "concerns" and uncertainties seem exaggerated given the history of the model.
  - Despite two changes in the ownership organization, the personnel maintaining and enhancing CALPUFF largely have not changed.
  - CALPUFF has been continuously and freely available at the same web address since its adoption as a preferred model (http://www.src.com/calpuff/)
  - The model developers have routinely provided EPA with copies of CALPUFF updates, and maintained both an EPA Approved Code which primarily incorporates bug fixes and a separate version which incorporates model enhancements.
  - CALPUFF satisfies all requirements listed in Section 3.1.b of the Guideline for EPA-preferred models.

Concerns Raised About CALPUFF

Preamble to Proposed Rulemaking Notice:

- Do EPA's "concerns" about ownership changes and model updates apply to all models? For example:
    - Ramboll's recent acquisition of ENVIRON and the CAMx model
    - Recent evolutions of SCIPUFF's ownership
    - Frequent updates to AERMOD, CAMx, SCIPUFF, SCICHEM, CMAQ

Concerns Raised About CALPUFF

Preamble to Proposed Rulemaking Notice:

- Language in the complex winds section of Appendix W (inhomogeneous local winds and shoreline fumigation) has been removed regarding the use of CALPUFF.
  - EPA provides inadequate technical basis for this change.
  - The preamble refers to "technical issues" but the notice offers no basis or explanation of the technical issues of concern.
  - The current Guideline allows use of CALPUFF for complex winds and states *"The purpose of choosing a modeling system like CALPUFF is to fully treat the time and space variations of meteorology effects on transport and dispersion."*
- The need to fully treat the time and space variations of meteorology still exists.

Concerns Raised About CALPUFF

Supplemental Information for EPA's 2009 Draft Report regarding Reassessment of IWAQM Phase 2 Recommendations:

- EPA observes that CALPUFF does not include photochemistry for modeling SO_2, NO_2, sulfates, and nitrates. However:
  - CALPUFF does include the capability to model secondary $PM_{2.5}$ and is widely used and approved for regulatory use for Class I AQRV analyses involving S and N deposition.
  - With enhancements, CALPUFF could interact with grid models to access ambient oxidant and ammonia fields in order to achieve more accurate predictions.
  - The CALPUFF model developers are interested in achieving this goal.
- EPA states that CALPUFF cannot model single source impacts on ozone.
  - Ozone formation is best modeled using grid models.
- EPA observes that CALPUFF predictions are sensitive to CALMET meteorological inputs.
  - WRF/MMIF represents an alternative to CALMET. Concerns about CALMET should be addressed, but should not affect the status of CALPUFF.
  - All models will be sensitive to meteorological inputs.
  - WRF and other meteorological models also require expert skill and judgment.

Concerns Raised About CALPUFF

Supplemental Information for EPA's 2009 Draft Report regarding Reassessment of IWAQM Phase 2 Recommendations:

- EPA has concerns about CALPUFF model evaluation performance.
  - Many LRT model evaluation studies have been conducted, and results have varied with no clear winner in terms of performance.
  - EPA CALPUFF modeling for ETEX-1 evaluation study had several significant issues (as discussed at 10th Modeling Conference) that affected EPA's conclusions.
  - CALPUFF performance improves significantly with corrected model configuration.
  - Use of higher resolution MM5 data yields CALPUFF performance comparable to models identified by EPA as the best performing.
  - Note that ETEX modeling domain and the modeling domain of several additional cited LRT studies is of a regional scale that far exceeds the application range (up to 300 km) for LRT modeling.

Concerns Raised About CALPUFF

Supplemental Information for EPA's 2009 Draft Report regarding Reassessment of IWAQM Phase 2 Recommendations:

- Model evaluation should not focus solely on developing a scorecard.
  - Poor model "scores" need to be examined to determine if they are due to:
    - Poorly performing model algorithms (which would be candidates for revision),
    - Problems with input data (especially meteorology),
    - Errors in model setup, or
    - Limits on the model formulation (e.g., Plume vs. Puff vs. Grid).
  - This process would lead to improvements in modeling science.
- Model evaluation is best done in an open manner, with data and results fully available for review.
- The statistics used in assessing model performance should reflect the modeling goals.

Concerns Raised About CALPUFF

Summary of CALPUFF Ownership since 2003 Promulgation:

- Memorandum cites *"…a lag in the ability for EPA to adequately understand, review and approve changes largely due to the lack of an open development process.*"
  - Exponent's current modeling team is committed to working with EPA to establish an open development process.
  - We are willing to discuss a wide range of options to achieving this goal.

New AERMOD Algorithms and Enhancements

- The report summarizing the comparison of the revised version of AERMOD with BLP shows many unexplained differences, some of which are quite large.
  - Are they equivalent?
  - Does AERMOD treat hours with calms or low wind speeds in a manner consistent with BLP?
- Does the revised AERMOD replace CAL3QHC and CAL3QHCR?
  - The revised version of AERMOD does not include queuing algorithms.
  - Even though MOVES accounts for the effect of queuing on emissions, how should the length of queue links be determined for use in AERMOD?
- EPA states that negative emission rates cannot be used in AERMOD for NO_2 modeling.
  - Guidance on how to model for increment and for net air quality benefit analyses involving NO_2 is needed.

New AERMOD Algorithms and Enhancements

- Why are all LOWWIND options still beta options?
- What is status of ARM2? Why is it still a beta option?
- Proposed language requiring consideration of potential building downwash effects for stacks at or above GEP height is a change from longstanding guidance and practice.
  - PRIME was developed using data from buildings with W/H <4.4 and sub-GEP stacks.
  - To our knowledge PRIME has not been evaluated for stacks above GEP height.
  - Modeling for potential downwash at existing sources may cause problems for existing sources with stack heights and emission controls or limits based on prior modeling.