8th Conference on Air Quality Modeling

Presentation by Ken Steinberg on behalf of
the American Petroleum Institute

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American Petroleum Institute Supports Sound Models

API is strongly interested in this revision of the "Guideline on Air Quality Models"

- Air quality regulations will require use of AERMOD
- AERMOD will be used for a host of regulatory applications (e.g., residual risk) in addition to tall stacks

API's goal is to ensure the most scientifically sound (i.e., accurate) air quality models are used for regulatory purposes.

Summary of API's Performance Concerns with AERMOD

Based on reviewing the two U.S. EPA reports on the performance of AERMOD with PRIME

- "AERMOD: Latest Features and Evaluation Results," EPA-454/R-03-003, June 2003 and
- "Comparison of Regulatory Design Concentrations: AERMOD vs. ISCST3, CTDMPLUS, and ISC-PRIME," EPA-454/R-03-002, June 2003.

Summary of API's Performance Concerns with AERMOD

Analysis of annual results from EPA's limited modeling for area and volume sources shows:

- Urban/rural performance of AERMOD is not consistent with that of ISC, and
- AERMOD appears to appreciably over-predict majority of concentrations throughout modeling domain

Urban/Rural Performance of AERMOD Not Consistent with ISC

Examined Flat & Simple Terrain simulations for area and volume sources from EPA-454/R-03-002

- Two meteorological data sets (i.e., Pittsburgh 1964 & Oklahoma City 1984)
- Various source configurations, and
- Standard receptor arrays

Simple analysis shows AERMOD does not show the traditional enhanced dispersion in urban areas versus rural

Area Source Analysis

Comparison of Annual Regulatory Design Concentrations

Area Source Cases	ISC	AERMOD:ISC	AERMOD
RAREFO	2573	0.614	1580
RAREFP	3044	0.682	2076
Average rural concentration	**2808**	0.651	**1828**
UAREFO	1095	1.434	1570
UAREFP	1287	1.417	1824
Average urban concentration	**1191**	1.425	**1697**

R=rural, U=urban, ARE=Area, F=flat terrain, P=Pittsburgh met data, and O=Oklahoma met data

Area Source Analysis

Comparison of Annual Regulatory Design Concentrations

1. In ISC, significant *increase* in dispersion from rural to urban (Ratio for rural: urban for *area* source in ISC = (2808/1191) = 2.36)

2. In AERMOD, minimal *increase* in dispersion from rural to urban (Ratio for rural: urban for *area* source in AERMOD = (1828/1697) = 1.08

3. In rural settings, significant *increase* in dispersion from ISC to AERMOD

4. In urban settings, significant *decrease* in dispersion from ISC to AERMOD

Volume Source Analysis

Comparison of Annual Regulatory Design Concentrations

Volume Source Cases	ISC	AERMOD:ISC	AERMOD
R10VolFO	2496	1.054	2630
R10V0lFP	1656	1.039	1720
Average Rural concentration	**2076**	1.048	**2175**
U10VolFO	1775	1.348	2390
U10VolFP	1106	1.492	1650
Average urban concentration	**1440**	1.403	**2020**

R=rural, U=urban, Vol=volume source, F=flat terrain, P=Pittsburgh met data, and O=Oklahoma met data

Volume Source Analysis

Comparison of Annual Regulatory Design Concentrations

- In ISC, some *increase* in dispersion from rural to urban. (Ratio for rural: urban for *volume* source in ISC = (2076/1440) = 1.44)
- In AERMOD, minimal *increase* in dispersion from rural to urban. (Ratio for rural: urban for *volume* source in AERMOD = (2175/2020) = 1.08)
- In rural settings, slight *decrease* in dispersion from ISC to AERMOD (*note for the area source, the opposite response was observed from ISC to AERMOD)*
- In urban settings, significant *decrease* in dispersion from ISC to AERMOD

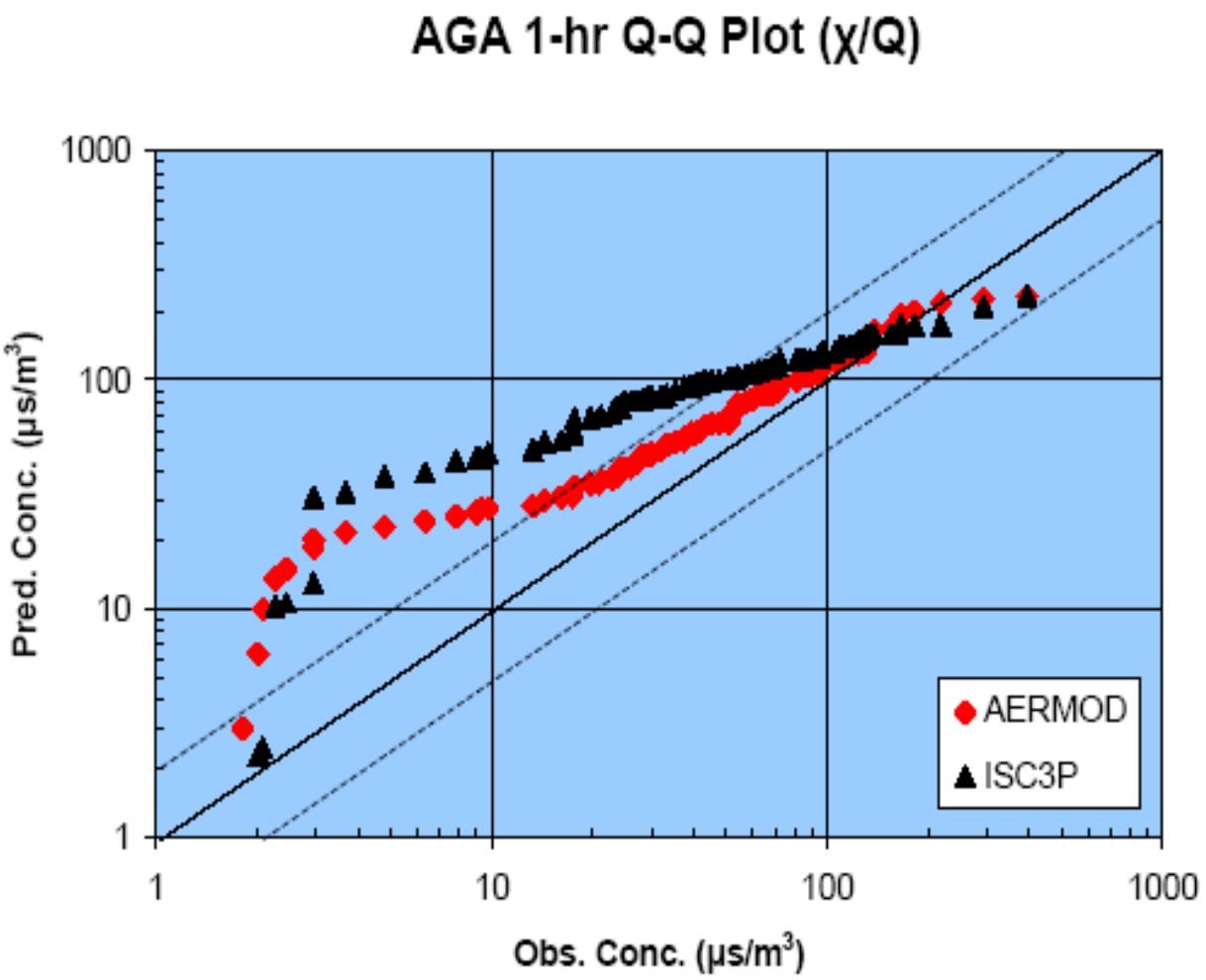
Though smaller, it is again not clear if volume source behaviors are supported by data or are unintentional products of AERMOD.

AERMOD Appears to Appreciably Over-predict Majority of Concentrations Throughout Modeling Domain

Residual risk assessments require use of regulatory air quality models, too.

Model predictions throughout the entire concentration domain are very important, not just the high and high-second-high value.

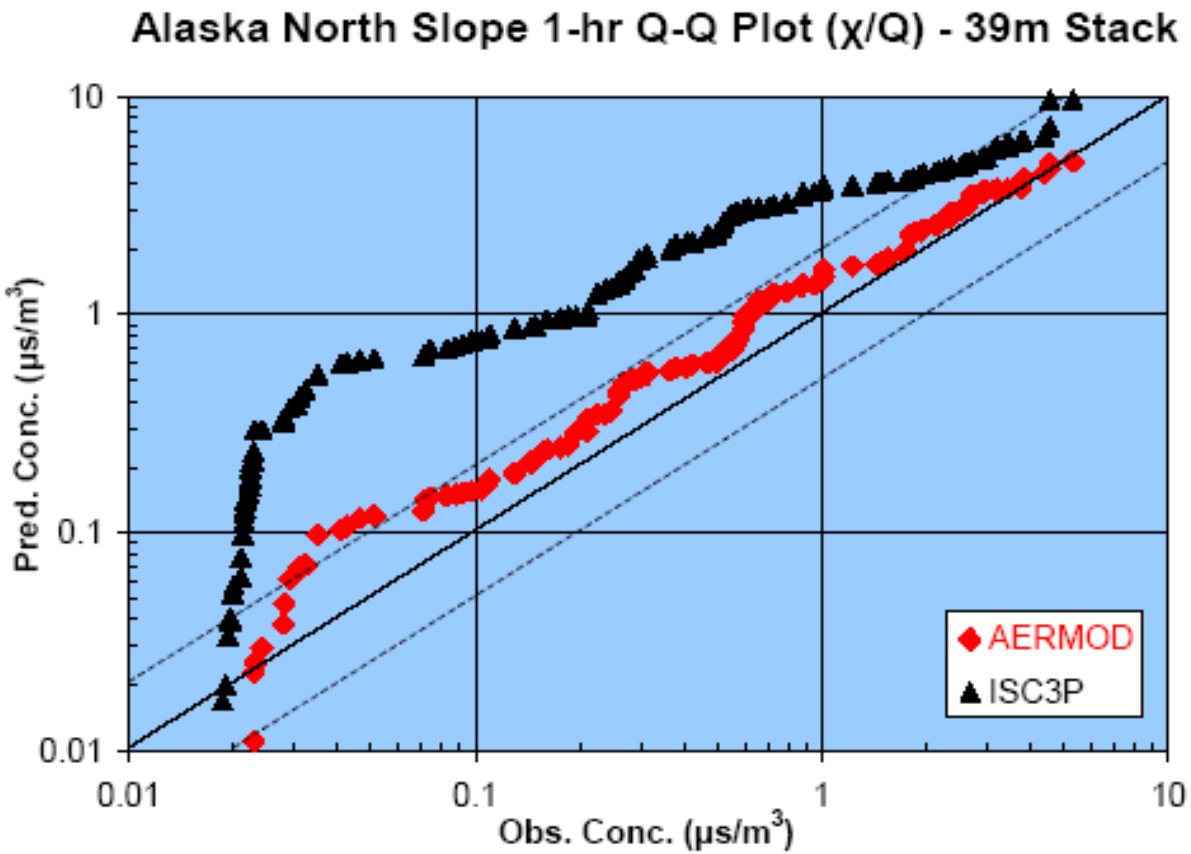
Figure 16. Q-Q Plot for AGA 1-Hour Averages (SF_6)



AERMOD Appears to Appreciably Over-predict Majority of Concentrations Throughout Modeling Domain

- AERMOD predictions of concentrations are poor throughout most of the concentration domain.
- AERMOD significantly over-predicts lowest observed concentrations.
- Suggests significant over-prediction of annual averages that are used in risk assessment studies.

Figure 15. Q-Q Plot for Alaska North Slope 1-Hour Averages for 39-m Releases (SF_6)



AERMOD Appears to Appreciably Over-predict Majority of Concentrations Throughout Modeling Domain

- AERMOD predictions are better than for the AGA
  - Still show a trend towards poorer performance at the lower concentrations
- AERMOD still over-predicts the concentrations by about 50%
- Again, behavior suggests over-prediction of annual averages that are used in risk assessment studies.

Conclusions & Recommendations

Analysis of annual results from EPA's limited modeling for area and volume sources shows:

- Urban and rural performance of AERMOD is not consistent with that of ISC,
- Not apparent whether behaviors (some dramatic) are supported by data
- AERMOD appears to appreciably over-predict majority of concentrations throughout modeling domain

Conclusions & Recommendations

EPA should examine the area/volume performance

- Previous evaluations show good agreement for concentrations at the highest end of the distribution, but show poorer agreement over the remainder of the concentration domain
- This performance would cause annual concentrations used in risk assessments to be significantly over-predicted

Conclusions & Recommendations

EPA should investigate both urban performance and the distribution of predictions before requiring the use of AERMOD for area and volume sources.

API believes that concerns regarding model performance suggest, at the very minimum, that the grandfather period be extended to allow these concerns to be technically addressed.