Are EPA Regulatory Models Capable of Providing Accurate Estimates of Future Air Quality?

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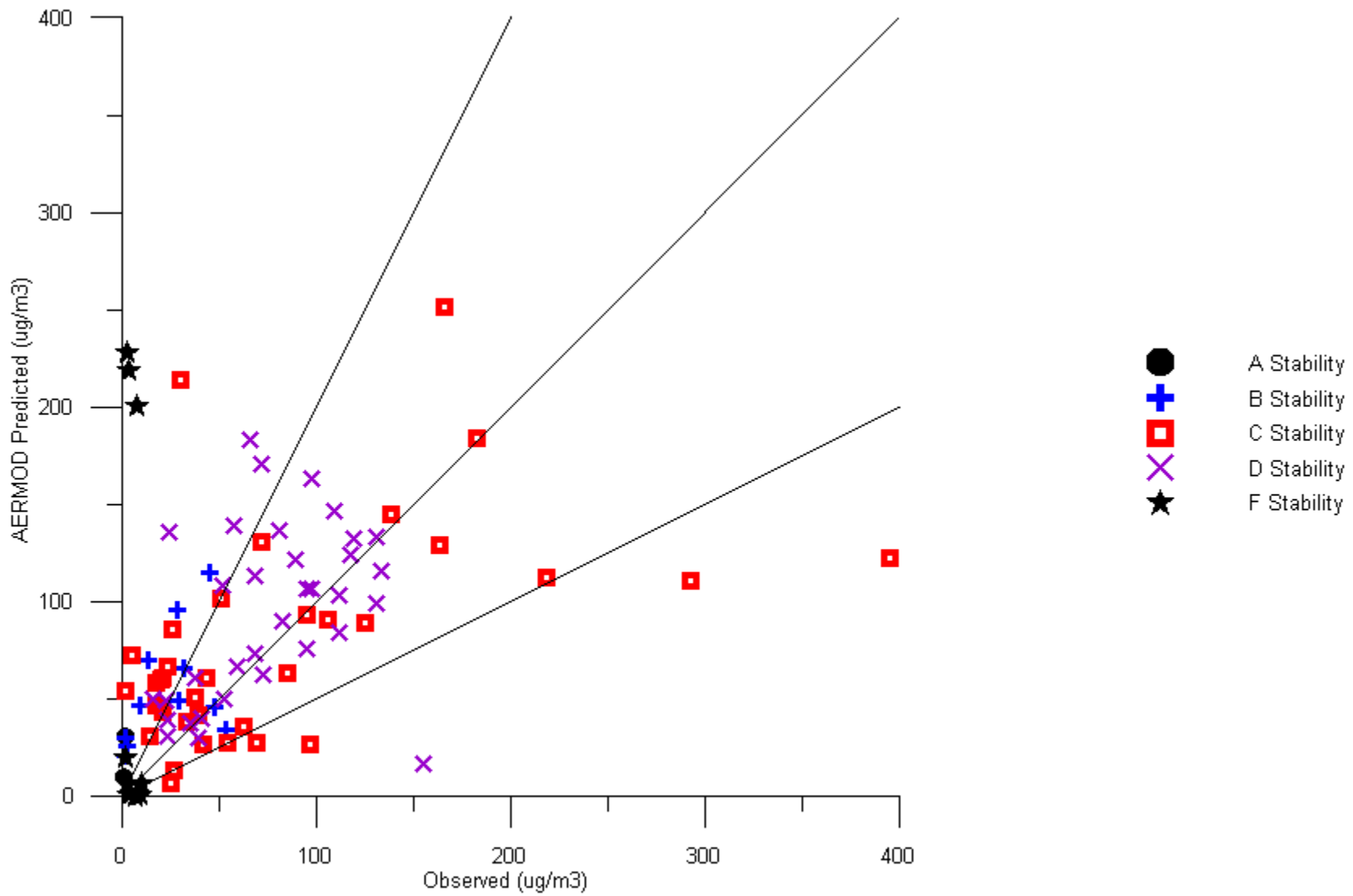
Recent 1-Hour Standards Providing More Stress on Model Accuracy

- NO_2 NAAQS - 100 ppb
  - Western NO_2 background = 30 ppb (98^{th} percentile)
  - 100 ppb - 30 ppb background = **70 ppb for all new and existing sources**
- If model accuracy is +/- a factor of 2, compliance with the standard can range from 35 to 140 ppb
  - Well controlled sources run the risk of exceeding the standard as a result of model uncertainty
  - Poorly controlled sources run the risk of passing the standard

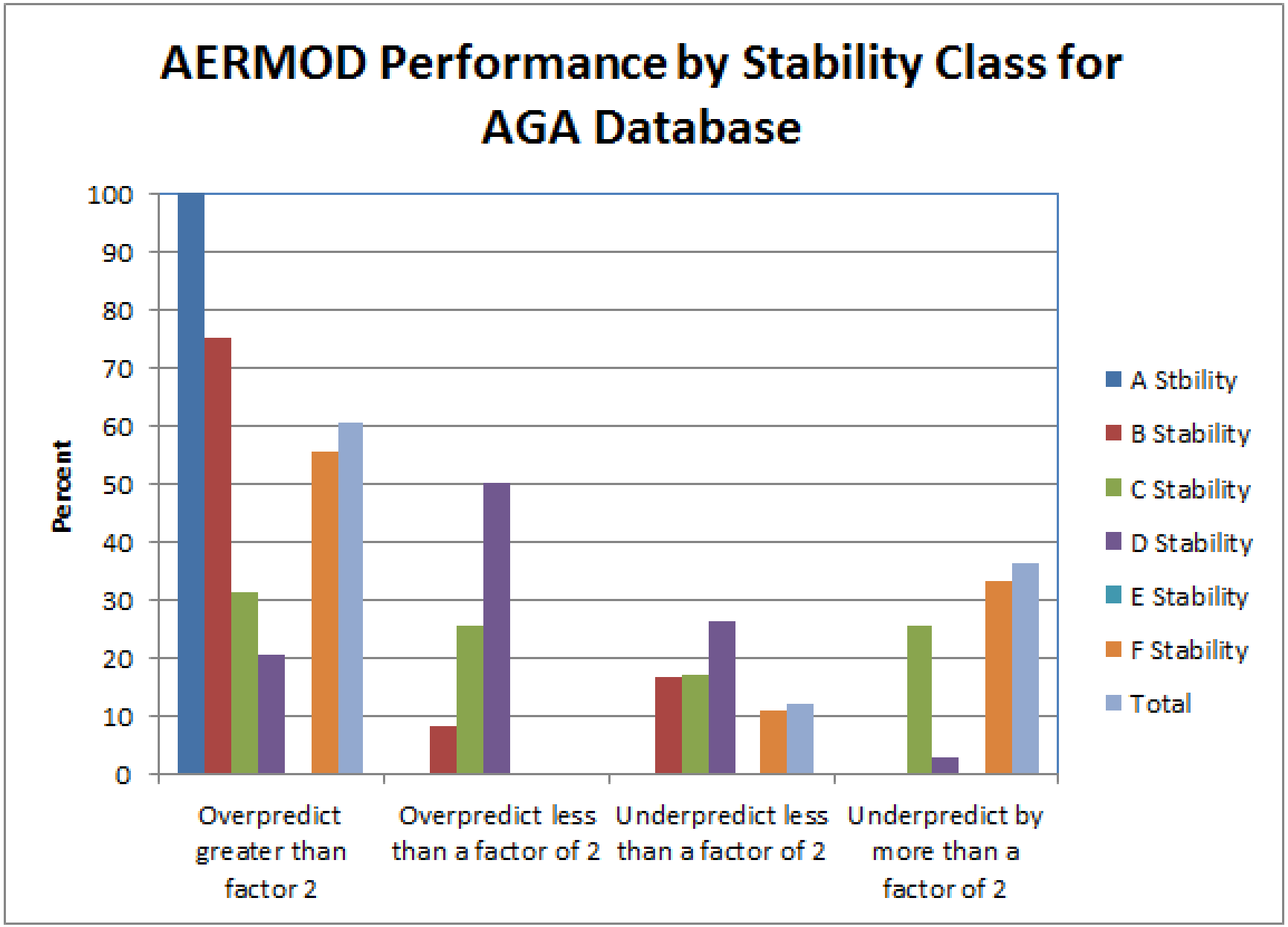
Note: NO_2 background is not a measure of NO_2 but rather NO_Y

EPA Model Evaluations

- Focus on AGA Data Base
- Database examined dispersion from natural gas compressor engines – source of concern for natural gas industry
- Experiments used tracer gas so emission rate is known
- Multiple downwind measurements (plume centerline concentration is known)
- While this is an old data base, it is one of the most useful because of source type and multiple downwind measurements



AERMOD Model Performance for AGA Data Base


AERMOD Performance by Stability Class for AGA Database
Percent
100
90
80
70
60
50
40
30
20
10
0
Overpredict greater than factor 2
Overpredict less than a factor of 2
Underpredict less than a factor of 2
Underpredict by more than a factor of 2
A Stbility
B Stability
C Stability
D Stability
E Stability
F Stability
Total

Implications of AGA Data Base

- Provides model performance for natural gas compressor engines
- **60%** of the time model over predicts by more than a factor of 2
- **35%** of the time model under predicts by more than a factor of 2
- This means that it is more likely that well controlled sources will result in a non-compliance
  - As EPA adds more conservative assumptions, the risk increases of a well controlled source failing to meet the standard
- Minimum wind speed tested in experiments was **1.3 m/s**
  - EPA has now stated that wind speeds of **0.2 to 0.3 m/s** are valid and has provided no verification of the model at wind speeds less than 1 m/s
  - Industry provided model improvements for light wind speeds 3-years ago with no reaction from EPA

Steady State Modeling Assumptions

- AERMOD is a steady state model
- For cumulative 1–hour NO_2 modeling, distant sources may violate steady state modeling assumptions
- If steady state assumptions are violated, it is appropriate to exclude such impacts from cumulative impacts

Approaches To Test If Steady State Model Assumptions Are Violated

- If travel time exceeds meteorological persistence, then impacts can be excluded
- If the actual trajectory of the plume indicates that the plume would not arrive at the receptor of concern, then impacts can be excluded
- If steady state assumptions are violated, then a using a PUFF (e.g., CALPUFF) model as opposed to AERMOD should be considered

AQRVs - CALPUFF

- Industry has provided critical comments over the past 12 years regarding:
  - The basic formulation, accuracy and lack of model evaluation of MESOPUFF II chemistry in CALPUFF
  - Model estimates of secondary SO_4 and NO_4 have not be evaluated against monitoring data.
- API has further developed a new chemistry mechanism that addresses many of the past comments
- As a result of industry comments and providing EPA with a revised model, nothing has changed regarding how visual range impacts are estimated through modeling –
- Regulatory modeling is still based on MESOPUFF II chemistry and impacts are not consistent with monitoring data

AQRVs and CALPUFF (continued)

- In a regulatory setting, using models that contain better science can be a difficult process
- For a recent EIS BP spent 1.5 years waiting to complete the EIS while WYDEQ, BLM and EPA debated the merits of CALPUFF compared to CAMx.
  - CAMx has more accurate model physics than CALPUFF but the debate regarding regulatory consistency compared to model accuracy has proved to be very difficult
- Even if a photochemical grid model is used such as CAMx, there is a bias toward over estimating actual impacts and models **should be used in a relative manner**

Recommendations and Conclusions

- Modeling issues and challenges are substantial and models need to be improved
- There is a pressing need for independent peer review of EPA development
- EPA needs to publish a research plan to identify pressing modeling issues –OAQPS and ORD need to develop a plan with stakeholder input and comment
- Better evaluation tools and databases are needed