From James H. Smith, Ph.D. May 24, 2005

In the discussions on model performance evaluation and uncertainty, it is worth noting that what is often most important to the decision-making process is the response of the model to changes in inputs (growth and/or control of emissions). In performance evaluation, at least some effort should be made to evaluate the model's response, in addition to evaluating it's ability to reproduce historical events. EPA's recently-released draft final Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-hour Ozone NAAQS offers several suggestions of how this can be accomplished, including retrospective analyses, use of various probing tools, comparison to observation-based models, and running sensitivity analyses for both the base and predictive cases using a variety of assumptions. These types of analyses are intended to provide confidence that the model responds appropriately to changes in inputs, despite the many types of uncertainties involved.

The guidance should offer some practical methods that can be used to address uncertainty in the decision-making process. Two approaches are integral to the aforementioned draft final 8-hour ozone guidance: One is the concept of Weight-of-Evidence (WoE), in which the model is only one (albeit the most important) component in a suite of analyses designed to show whether or not an area is expected to achieve the air quality standard. A second key concept is the use of the model in a relative, rather than absolute, predictive mode. This approach uses "relative reduction factors" multiplied by observed concentrations in place of absolute predictions. In theory, such an approach will tend to cancel out systematic biases in the model formulation, hence reducing the uncertainty in the predictions used for decision-making.

A third approach to dealing with uncertainty is the use of ensemble modeling. This approach involves running several different models and using a composite of the results. While ensemble modeling is very resource-intensive, it is worth considering for applications involving extreme cost or risk, such as hurricane forecasting.