Indian Point Nuclear Generating Units 2 and 3
Docket Nos. 50-247/ 50-286-LR

NRC Staff's Response in Opposition to State of New York's Motion for Partial Summary Disposition of NYS Contention 16/16A

Exhibit P

United States Environmental Protection Agency

AERMOD:

Latest Features and Evaluation Results.

ABSTRACT

AERMOD is an advanced plume model that incorporates updated treatments of the boundary layer theory, understanding of turbulence and dispersion, and includes handling of terrain interactions. The model was formally proposed by EPA in April 2000 as a replacement for the ISCST3 model. Several model enhancements were made as a result of public comment, including the installation of the PRIME downwash algorithm. The latest version of the model, version 02222, has been placed on EPA's web site for beta test purposes. This paper reviews the latest features and updated evaluation results for AERMOD version 02222.

The overall model evaluation results for AERMOD version 02222 with nondownwashing databases can be summarized as follows, taking one composite (geometric mean) ratio of predicted to observed RHC value for short-term averages at each site, and also taking the annual average ratio at sites with year-long databases:

- 1.03 is the overall predicted-to-observed ratio for short-term averages (with a range among sites from 0.76 to 1.35).
- 0.73 is the overall predicted-to-observed ratio for annual averages (with a range among sites from 0.30 to 1.64).

While the predicted-to-observed ratios did not vary substantially for AERMOD between simple and complex terrain sites, there was a large change in the average ratio for ISCST3 : 0.96 for simple terrain and 6.4 for complex terrain.

MODEL EVALUATION RESULTS FOR DOWNWASH DATABASES

A developmental evaluation of the AERMOD model with PRIME added was conducted on four developmental databases prior to its application to four independent databases. Paine[32] describes these databases and others that were originally considered for the EPRI PRIME evaluation study. The developmental databases (described below) included one half of the days selected at random from a full year of data for the Bowline power plant database located on the Hudson River near Haverstraw, New York, the Millstone power plant located on the Connecticut coast, the Duane Arnold Energy Center (DAEC) located in eastern Iowa, and the Alaska North Slope field study near Prudhoe Bay, Alaska. The Bowline Point database was used in both the developmental and evaluation evaluations because it was the only full year database, and more complete development testing of both ISC-PRIME and AERMOD version 02222 required the use of half of this database.

The main purpose of testing with the developmental databases was to assure that the AERMOD predictions were consistent with the ISC-PRIME predictions for stack-receptor combinations dominated by building downwash. However, as noted earlier, one correction was made to AERMOD to adjust the threshold trajectory angle of the rising plume that determines whether the plume will escape the effects of the building. As noted below, the evaluation results for the developmental databases included both underpredictions and overpredictions for both AERMOD and ISC-PRIME. However, no attempt was made in the developmental phase of testing to further adjust the downwash algorithm.

Developmental Evaluation (Downwash)

The Bowline Point site[33], located in the Hudson River valley in New York State, is shown in Figure 1 (topographic map). The electric utility site included two 600-MW units, each with an 86.9-m stack and a dominant roof tier with a height of 65.2 m high in a rural area. There were four monitoring sites as shown in Figure 1 that ranged from about 250 to 850 m from the stacks. Hourly emissions data was determined from load data, coal analyses, and site-specific relationships between loads and fuel consumption. Meteorological data was obtained from a

AERMOD and ISC-PRIME had a similar evaluation outcome for the full-year Bowline Point database, featuring buoyant steam electric plant releases, with no significant differences in model performance. The 3-hour Q-Q plot is shown in Figure 8, and the 24-hour Q-Q plot is shown in Figure 9. For each averaging time, both models exhibit a modest overprediction tendency.

Figure 8. Q-Q Plot for Bowline Point 3-Hour Averages (SO_2)

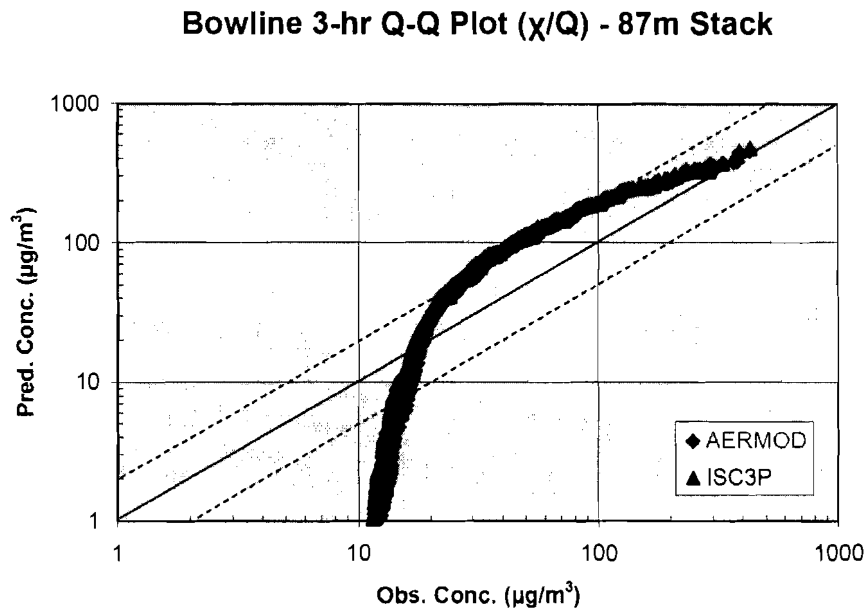
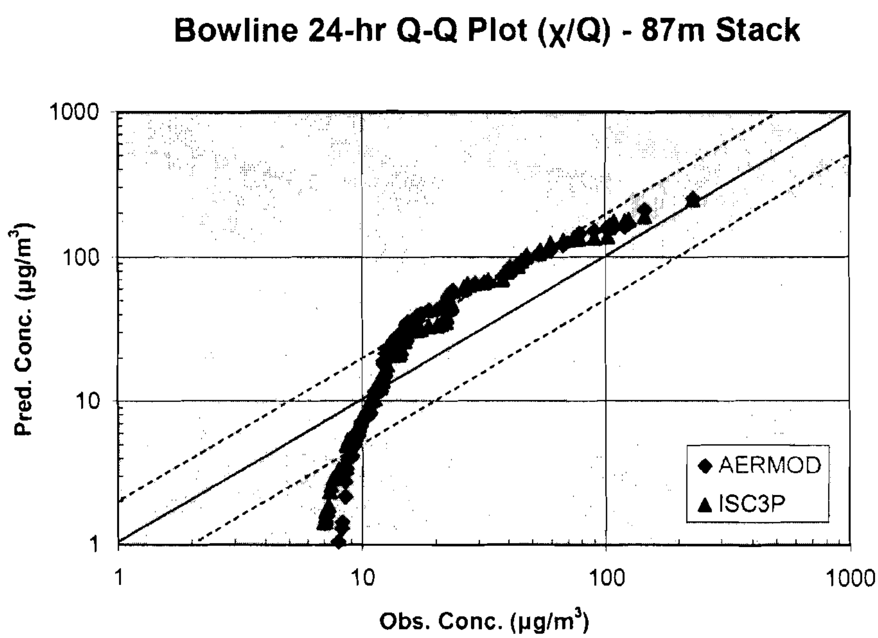


Figure 9. Q-Q Plot for Bowline Point 24-Hour Averages (SO_2)



Both models also had a similar evaluation outcome for two non-buoyant release heights (with two different tracer gases) at the Millstone Nuclear Power Plant. Figure 10 shows that both models overpredict by close to a factor of 2 for the 29-m Freon releases, but underpredict by about a factor of 2 for the 46-m SF_6 releases (see Figure 11).

Figure 10. Q-Q Plot for Millstone 1-Hour Averages for 29-m Releases (Freon)

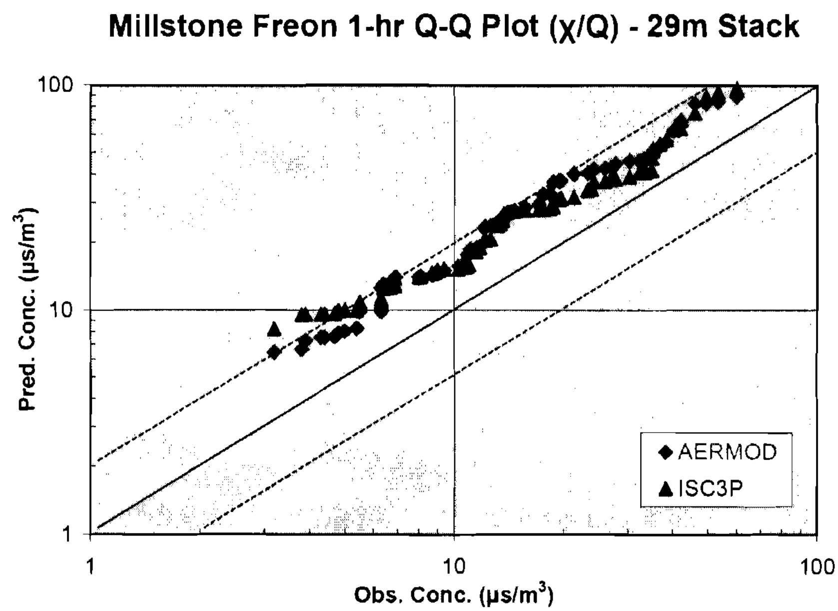
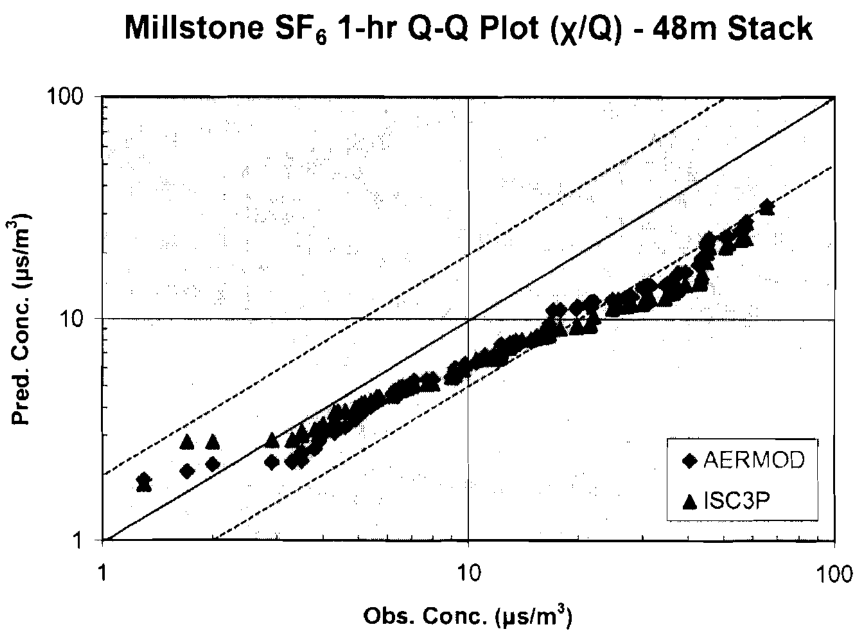


Figure 11. Q-Q Plot for Millstone 1-Hour Averages for 46-m Releases (SF_6)



The Duane Arnold Energy Center also featured similar evaluation outcomes for AERMOD and ISC-PRIME for the non-buoyant releases. Figure 12 shows a 1-m release Q-Q plot, in which both models generally underpredict, but AERMOD has less of an underprediction tendency. Both models underpredict for the 24-m releases (see Q-Q plot in Figure 13), with AERMOD showing a larger underprediction tendency except for the highest concentrations. The Q-Q plot in Figure 14 shows both models with peak concentrations that are nearly unbiased for the 46-m releases.

Figure 12. Q-Qt for DAEC 1-Hour Averages for 1-m Releases (SF_6)

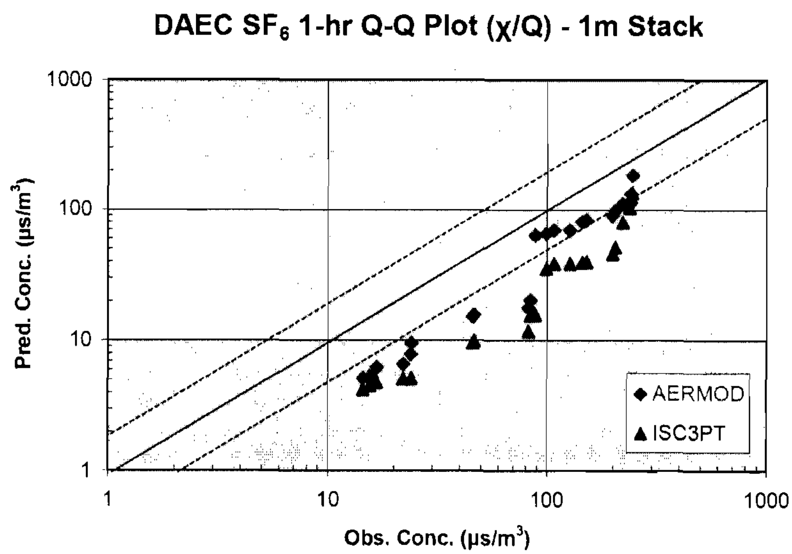


Figure 13. Q-Q Plot for DAEC 1-Hour Averages for 24-m Releases (SF_6)