July 15, 2013

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
NextEra Energy Seabrook, LLC	)	Docket No. 50-443-LR
	)	
(Seabrook Station, Unit 1)	)	

NRC STAFF RESPONSE TO NEXTERA'S STATEMENT OF MATERIAL FACTS
FOR CONTENTION 4D (SAMA ANALYSIS ATMOSPHERIC MODELING)

A. ATMOS Meteorological Model

1. The ATMOS module embedded in the MACCS2 code employed in the Seabrook Station SAMA analysis is a Gaussian plume segment model that simulates a radioactive plume's transport, dispersion, and deposition. ATMOS allows each postulated accident scenario (release category) to be modeled as consisting of up to four plume segments, released over successive intervals. The direction each plume segment travels is determined by the wind direction at the time that plume segment is released (so the four plume segments may travel in different directions), and subsequent transport, dispersion, and deposition also takes into consideration hourly changes in other meteorological input data (such as wind speed, stability, and precipitation). Joint Decl. at ¶¶ 25-28, 33-36, 48, 51.

Response: Admitted.

2. In the Seabrook SAMA analysis, 13 release categories identified from the Seabrook probabilistic risk analysis are considered, each of which is modeled as consisting of four individual plume segments with different defined start times, durations, source term release fractions, and characteristics. Joint Decl. at ¶¶ 39-43 & Table 1.

Response: Admitted.

3. Using one year of hourly meteorological data observed at Seabrook, ATMOS performed 8,760 simulations ("weather trials") for each release category, calculating the air and ground radioactivity concentrations that would result in grid elements over a 50-mile geographic domain if the postulated accident scenario were initiated in each of the 8,760 hours of the year. Other modules in MACCS2 calculated the population dose and offsite economic cost consequences for each simulation, resulting in a distribution of consequences from which mean values are determined. Joint Decl. at ¶¶ 27, 33, 41-44.

Response: Admitted.

4. The meteorological modeling in the Seabrook Station SAMA analysis thus accounted for up to four changes in wind direction in each of the 8,760 simulations performed for each of the 13 release categories, because each release scenario is broken down into four plume segments, with the trajectory of each plume segment dependent upon the wind direction at the

initial hour (or other representative time during that plume segment's release). Joint Decl. at ¶ 48.

Response: Admitted.

5. MACCS2/ATMOS takes into account different meteorological patterns/wind directions by analyzing 8,760 weather trials for each accident scenario, thus encompassing the numerous meteorological conditions that are characteristic of the Seabrook Station environment. Joint Decl. at ¶ 49.

Response: Admitted.

6. The ATMOS model is reasonable for a SAMA analysis because that analysis is focused on calculating integrated (summed) mean annual consequences over a broad region (50-mile radius). Joint Decl. at ¶ 46. Short-term fluctuations in wind direction and terrain effects have little effect on the summed consequences over the entire geographic domain. *Id.* at ¶¶ 46, 49.

Response: Admitted.

B. Comparison of ATMOS Module to More Complex Models

7. An extensive study (Molenkamp et al. (2004), NUREG/CR-6853) demonstrates that the MACCS2 ATMOS Gaussian plume segment model results are within the same range as more complex dispersion models that account for variable meteorological and terrain effects. Joint Decl. at ¶¶ 111-16. That study showed that, when averaged over all distances out to 50 miles, the results from the MACCS2 code were within 10% of the results obtained from a fully three dimensional model that accounted for terrain changes and spatial variability of the weather. Joint Decl. at ¶¶ 113-14.

Response: Admitted.

8. The Molenkamp study also demonstrates that the ATMOS module is more conservative than some more advanced codes, as ATMOS tended to predict larger consequences than the Lagrangian puff model most similar to the CALPUFF model advocated by Friends/NEC. Joint Decl. at ¶¶ 115-16.

Response: Admitted.

C. Confirmatory CALMET Analysis

9. A trajectory analysis performed using the CALMET code (which develops three-dimensional time dependent meteorological fields) and data from over 30 weather observing sites in or on the outskirts of the 50 mile geographic domain shows that the Seabrook Station annual wind rose (from the meteorological data used in the SAMA analysis) is not significantly different from the annual trajectory produced by CALMET. Joint Decl. at ¶¶ 122-24, Figure 4 & Table 2; Wind Rose Report at 28-36. Comparing the annual trajectory roses produced by CALMET and the Seabrook annual wind rose shows that ATMOS and the three-dimensional CALMET trajectory model would produce similar directional distributions. Joint Decl. at ¶¶ 122-24.

Response: Admitted.

10. Using the trajectory analysis, an "exposure index" calculation indicates that use of a more complex meteorological model could potentially produce an approximately 32% increase in total benefits, but this change is not large enough to make the next closest SAMA potentially cost beneficial. Joint Decl. at ¶¶ 130-31.

Response: Denied. The NRC Staff does not agree with NextEra's conclusion that an approximately 32% increase in total benefits "is not large enough to make the next closest SAMA potentially cost beneficial." When determining whether a specific mitigation measure is potentially cost-beneficial, the analysis should account for any uncertainty in the projected benefit. Parillo Aff. at ¶ 4. NextEra's analysis does not account for any uncertainty in the projected benefit. Parillo Aff. at ¶ 13. Using NextEra's previously submitted estimates of uncertainty, 15 additional SAMAs could be identified as potentially cost-beneficial based on NextEra's analysis. Parillo Aff. at ¶¶ 14-21. These include the following SAMAs: 13, 24, 44, 55, 56, 77, 96, 108, 109, 147, 163, 167, 168, 169, and 170. Parillo Aff. at ¶ 21.

The Staff does not, however, dispute NextEra's statement that, "[u]sing the trajectory analysis, an "exposure index" calculation indicates that use of a more complex meteorological model could potentially produce an approximately 32% increase in total benefits."

11. In the Seabrook SAMA analysis, for the next SAMA candidate to become potentially cost beneficial, the expected (best estimate) benefit value must increase by more than a factor of two. Joint Decl. at ¶ 131.

Response: **Denied.** When determining whether a specific mitigation measure is potentially cost-beneficial, the analysis should account for any uncertainty in the projected benefit. Parillo Aff. at ¶ 4. NextEra's analysis does not account for any uncertainty in the projected benefit. Parillo Aff. at ¶ 13. Using NextEra's previously submitted estimates of uncertainty, 15 additional SAMAs could be identified as potentially cost-beneficial based on NextEra's analysis. Parillo Aff. at ¶¶ 14-21.

D. ATMOS and Sea Breezes

12. The Seabrook SAMA analysis accounts for sea breezes. The anemometers on the Seabrook Station meteorological towers are located within about two miles of the coast and capture most of the local sea breezes, whose effects generally extend to a distance of 10-20 miles from the coast. Joint Decl. at ¶ 55.

Response: Admitted.

13. More accurate modeling of the sea breeze phenomenon would not significantly alter the overall impacts estimated by MACCS2/ATMOS. Sea breezes are generally beneficial for the purposes of a SAMA analysis because they reduce localized concentration by acting to dilute the plume and reduce the maximum plume centerline concentration. Joint Decl. at ¶ 54. Although a sea breeze generally extends inland only 10-20 miles, MACCS2/ATMOS conservatively treats sea breezes by modeling sea breeze-initiated plumes out to 50 miles, reaching the more heavily populated areas within the Seabrook SAMA domain. Joint Decl. at ¶ 56. Further, the overall impacts of sea breezes will tend to be counter-balanced by the diurnal effects of land breezes. Joint Decl. at ¶ 52.

Response: Admitted.

14. The CALMET trajectory analysis confirms that consideration of time and spatially variable wind fields, such as sea breezes, would have no significant impact on the SAMA analysis results. Joint Decl. at ¶ 122.

Response: Admitted.

E. ATMOS and "Hot Spots"

15. "Hot spots," as defined by Friends/NEC, do not exist and have no impact on the Seabrook Station SAMA analysis. Joint Decl. at ¶¶ 63-68. Even under very stable atmospheric conditions, radioactive plumes disperse significantly as they travel, with concentrations decreasing by a factor of ten for each factor of ten increase in distance. Joint Decl. at ¶ 65.

Response: Admitted.

16. The CALMET trajectory analysis confirms that, in the Seabrook Station SAMA domain, there is no consistent, frequently-occurring pattern of wind blowing out to sea and then reversing direction and heading for the coast. Joint Decl. at ¶ 68.

Response: Admitted.

F. ATMOS and Terrain Variation

17. The Seabrook SAMA analysis sufficiently considers the varying wind fields caused by terrain variation. The terrain surrounding the Seabrook Station throughout the 50-mile region of the SAMA analysis is relatively flat on average with a broad coastal plain and with a gradual increase in elevation to about 100 to 200 m on the northwestern edge of the domain. Joint Decl. at ¶ 72; Wind Rose Report at 8, 12 (Figures 2 & 4). Further, because at distances beyond the terrain obstacles terrain features such as hills have a dispersive effect on a plume, ATMOS's neglect of the dispersive effects of topographical obstacles is conservative in that it overestimates consequences. Joint Decl. at ¶ 74.

Response: Admitted.

18. The similarity between the annual 2005 Seabrook Station wind rose and the wind roses from other sites on the SAMA domain demonstrates that terrain features in the SAMA domain do not produce significantly different annual wind patterns important for SAMA analysis purposes. Joint Decl. at ¶ 75.

Response: Admitted.

19. Comparison of annual wind roses from an analysis with ATMOS ignoring terrain effects and a CALMET trajectory analysis that considers complexities caused by terrain and coast line shows no significant differences. Joint Decl. at ¶ 75.

Response: Admitted.

G. ATMOS and Contamination Deposition Modeling

20. The Seabrook Station SAMA analysis calculated deposition of radioactive material within the first mile of Seabrook Station with no distinction as to whether deposition was onsite or offsite. Joint Decl. at ¶ 80.

Response: Admitted.

21. All radioactive plume materials deposited within the first mile of Seabrook Station were subject to resuspension in the SAMA analysis in that the MACCS2 code assumed that deposited radioactivity reenters the ambient wind stream due to mechanical agitation from wind, vehicular traffic, or other phenomena. Joint Decl. at ¶ 80.

Response: Admitted.

E. Adequacy of Meteorological Data Set

22. One year of meteorological data is sufficient to estimate the annual averaged impacts over the SAMA analysis domain if that data is representative of other years. Joint Decl. at ¶ 82. The 2005 meteorological data used in the MACCS2 consequence analysis are representative and not significantly different from other years (2004-2008) that could have been selected as a basis for the SAMA analysis. Joint Decl. at ¶¶ 83-88; Wind Rose Report at 15-17. Further, compared to the other years, the 2005 data provides the maximum dose and cost risk and are thus conservative. *Id.* at ¶ 83.

Response: Admitted.

23. Use of meteorological data from a single anemometer at Seabrook Station was sufficient for multiple reasons. The Seabrook Station annual wind speed is representative of the wind speeds from 27 other sites within and just beyond the Seabrook SAMA domain. Joint Decl. at ¶ 97; Wind Rose Report at 25-27. The Seabrook Station annual wind trajectory rose is similar to the wind trajectory roses of 27 other sites within and just beyond the Seabrook SAMA domain. Joint Decl. at ¶¶ 91-97; Wind Rose Report at 17- 24; Appendix B. A CALMET trajectory analysis produces annual trajectory roses very similar to the annual wind rose from the Seabrook SAMA analysis. Joint Decl. at ¶ 90.

Response: Admitted.

Respectfully submitted,

/Signed (electronically) by/

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