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 4

October 13, 2009

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
ENTERGY NUCLEAR OPERATIONS, INC.	)	Docket Nos. 50-247/50-286-LR
	)	
(Indian Point Nuclear Generating Units 2 and 3)	)	
	)	

NRC STAFF'S RESPONSE TO THE STATE OF NEW YORK'S
STATEMENT OF MATERIAL FACTS NOT IN DISPUTE

Pursuant to 10 C.F.R. §§ 2.1205(b) and 2.710(b), the NRC Staff ("Staff") herein submits its response to the State of New York's ("NYS" or "the State") "Statement of Material Facts Not in Dispute," filed in support of its motion for partial summary disposition of NYS Contention 16/16A on August 28, 2009. In the following document, each of the NYS statements of material fact are recited *seriatim*, followed by the Staff's response thereto, and certain additional facts which the Staff believes are pertinent to the resolution of NYS' Motion.

> 1. The Indian Point Nuclear Power Station (the "Indian Point Station") is located in the Village of Buchanan in the northwest comer of Westchester County on the eastern bank of the Hudson River. Draft Supplemental Environmental Impact Statement, Draft NUREG-1437, Supplement 38 ("DSEIS") at § 2.1, p. 2-1.

Response: Admitted as to the general location of the Indian Point Nuclear Power Station Units 2 and 3 (respectively, "IP2" and "IP3").

> 2. The Indian Point reactors and spent fuel pools are approximately 24 miles north of the New York City line, and approximately 37 miles north of Wall Street, in lower Manhattan. *Id.*

Response: Admitted as to the Indian Point site's general location with respect to New York City. **Disputed** as to the site's distance to Wall Street, which is not referenced in the DSEIS (cited by NYS here), and is not addressed in NYS Contention 16/16A.

> 3. The station is approximately three miles southwest of Peekskill, with a population of 22,441; five miles northeast of Haverstraw, with a population of 33,811; 16 miles southeast of Newburgh, with a population of 31,400; 17 miles northwest of White Plains, with a population of 52,802 and approximately 18 miles southwest of Brewster, New York. It is also 23 miles northwest of Greenwich, Connecticut; 37 miles west of Bridgeport, Connecticut and 37-39 miles north northeast of Jersey City and Newark, New Jersey. *Id.*

Response: Admitted as to the general location of IP2 and IP3 to surrounding cities. **Disputed** as to the populations of Newburgh, White Plains, and Brewster, New York, which are not discussed in the DSEIS (cited by NYS to support these assertions).

> 4. Portions of four counties - Westchester, Rockland, Orange, and Putnam - fall within the inner 10-mile Emergency Planning Zone, and significant population centers in New York, Connecticut, and New Jersey lie within the 50 mile Emergency Planning Zone. The U.S. Census Bureau estimated that New York City, located approximately 24 miles south of plant, had a population of 8,214,426 in 2006. *Id.*

Response: Admitted to the general location of surrounding cities within 10 and 50 miles of IP2 and IP3 and the population of New York City in 2006.

> 5. More than 17 million people live within 50 miles of the Indian Point power reactors and spent fuel pools. *See* DSEIS at Figure 2-1; p. 2 -3. Indian Point also has the highest surrounding population within 50 miles of any operating nuclear power plant in the Nation. April 17, 1973 Atomic Energy Commission Report Population Distribution Around Nuclear Power Plant Sites, Appendix B, Figures 2 & 4, PDR Fiche No. 8111120800.

Response: Admitted that the estimated population within 50 miles of IP2 and IP3 is approximately 17 million. **Disputed** to the extent that the State suggests that a 1973 Atomic Energy Commission report constitutes an accurate assessment of population densities in 2009.

6. The Indian Point Station is on a point of land in the Hudson River valley that protrudes into the Hudson River as the river bends west. DSEIS at § 2.2.5.1, p. 2-33. The region surrounding the Indian Point site has undulating terrain with many peaks and valleys. DSEIS at § 2.1.

Response: Admitted as to the general location of IP2 and IP3 on the Hudson River and the general description of terrain in the vicinity of the Indian Point site.

7. On the west side of the Hudson River one mile north of the station, is Dunderberg Mountain. *Id.* This mountain rises to a height of 1,086 feet above sea level at a distance of approximately 2.5 miles from the station. Id.

Response: Admitted.

8. North of the Indian Point Station, the eastern bank of the river is formed by high grounds reaching an elevation of 800 feet; to the west across the river, the Timp Mountains reach an elevation of 844 feet. *Id.*

Response: Admitted that north of IP2 and IP3 the eastern bank of the river has elevations reaching 800 feet at some locations. **Disputed** as the height of the Timp Mountains. The Timp Mountains reach an elevation of 846 feet. DSEIS § 2.1, p. 2-2.

9. Releases from the station may come from near ground level sources or from stack vents with heights up to 334 feet and within 1-2 miles of high terrain features on the opposite side of the Hudson River, such as Dunderberg and the Timp Mountains, that rise well above the facility and well above the top of the 122 meter meteorological tower located onsite. *See* Declaration of Dr. Bruce Egan, sworn to August 28, 2009 ("Egan Decl."), ¶ 32; DSEIS § 2.1.1, p.2-2.

Response: Admitted as to the height of the stack at the Indian Point site and that, for emergency planning and response purposes, the releases could occur at a variety of heights. **Disputed** to the extent that Paragraph 9 implies that different heights of release must be modeled for each SAMA rather than following NRC-approved guidance for height of release in a SAMA analysis. Affidavit of Robert Palla Concerning the State of New York's Motion for Partial Summary Disposition of NYS Contention 16/16A ("Palla Affidavit") ¶¶ 9, 13, 17, 19 – 21 (attached as Exhibit ("Ex.") 2).

> 10. The DSEIS relies on the MACCS2 computer code output to calculate the economic cost of a hypothetical severe accident at Indian Point. DSEIS at § 5.2.2, p. 5-2.

Response: Admitted insofar as the State asserts that the MACCS2 computer code was utilized in the Indian Point SAMA analysis, but otherwise **disputed** as the statement is materially incomplete. The MACCS2 code calculates off-site economic costs; other costs, including onsite and replacement power costs are provided by NRC regulatory guidance. Affidavit of Joseph A. Jones and Dr. Nathan E. Bixler Concerning the State of New York's Motion for Partial Summary Disposition of NYS Contention 16/16A ("Joint Sandia Affidavit") ¶ 20 (attached as Ex. 3); Palla Affidavit ¶ 18. Such on-site and other costs, which are also accounted for in the SAMA analysis, are not part of the MACCS2 code calculations. Joint Sandia Affidavit ¶ 20 Palla Affidavit ¶ 18.

> 11. In order to carry out the MACCS2 analysis it is necessary to calculate the dispersion of airborne radiation following the hypothetical severe accident. United States Department of Energy Office of Environment, Safety and Health, MACCS2 Computer Code Application Guidance for Documented Safety Analysis: Final Report (June 2004) at 4-1 ("MACCS2 Guidance")(annexed to the Egan Declaration as Exhibit 10).

Response: Admitted that the U.S. Department of Energy ('DOE") published a report on the MACCS2 code, and that the MACCS2 code models the dispersion, transport, deposition and radioactive decay of contamination for potential severe reactor accidents. **Disputed** to the extent that Paragraph 11 implies that the DOE or the DOE's publication applies to the conduct of SAMA analyses under NRC regulations and regulatory guidance. Palla Affidavit ¶¶ 7-16 and 19 – 21.

> 12. Atmospheric dispersion modeling is the field of predicting the fate and consequences of releases of contaminants into the atmosphere. See Egan Decl. at ¶ 18.

Response: Admitted that atmospheric dispersion modeling is generally utilized in predicting the path and deposition of contaminants released into the atmosphere.

Disputed as to the State's use of the terms "fate" and "consequences," which are undefined and unduly vague. Joint Sandia Affidavit at ¶ 22.

> 13. Dispersion models are routinely used for determining compliance with ambient air quality standards by state and federal agencies, for assessing the incremental changes in air quality levels associated with the permitting of new facilities and for health risk assessments for nuclear energy facilities. Id.

Response: Disputed to the extent that the terms "dispersion models," "compliance," and "health risk assessments" are undefined and unduly vague. **Disputed** to the extent that Paragraph 13 implies that different air dispersion models may be used interchangeably without regard to the purpose of the analysis in which the models are used. Joint Sandia Affidavit ¶¶ 13 – 15, 36, 38, 61, 63, and 65; Palla Affidavit ¶¶ 22, 24, and 26 – 27. **Disputed** to the extent that Paragraph 13 implies that a deterministic air dispersion model should be used for the probabilistic modeling which is conducted in a SAMA analysis. Joint Sandia Affidavit ¶¶ 13 –15, 36, 38, 61, 63, and 65.

> 14. Dispersion models use meteorological and emission rate information as inputs to mathematical algorithms that simulate the transport and dispersion of air pollutants. Id.

Response: Disputed to the extent that the term "dispersion models" and "emission rate" are undefined and unduly vague. Admitted to the extent that air dispersion models are generally described as mathematical algorithms. **Disputed** to the extent that this Paragraph seeks to describe the purpose and methodology of a SAMA analysis and PRA. Joint Sandia Affidavit at ¶¶ 8-17; Palla Affidavit at ¶¶ 4 – 16 and 21 – 22.

> 15. Dispersion models estimate the ambient air concentrations, deposition rates of particles to ground surfaces at all places of interest and for different averaging times. Models can include chemical or nuclear atmospheric transformation algorithms to estimate dosages to exposed populations. Id.

Response: **Disputed** to the extent that the term "dispersion models" is undefined and unduly vague. Admitted as to the generic description of air dispersion models.

> 16. The precision required for the model to determine air dispersion of the pollutant of interest depends upon the precision required in the result. Egan Decl. at ¶ 19.

Response: **Disputed** as to the terms "precision" and "result" which are unduly vague. **Disputed** as to the proposition that any uncertainty in the air dispersion model predictions must be eliminated for the results to be acceptable for use in a SAMA analysis. Joint Sandia Affidavit at ¶¶ 25-26, 28, and 61.

> 17. Where the purpose of the air dispersion model is to predict the actual exposure of individuals in the path of the pollutant plume in order to assign a monetary cost to the full extent of the potential health risk, and then to quantify in monetary terms the cost savings that can be achieved by mitigating that exposure, the air dispersion model must have a high degree of accuracy to avoid either understating or overstating the economic costs and benefits involved. Egan Decl. at ¶ 25.

Response: **Disputed** as to the terms "purpose," "actual exposure," "full extent," and "high degree of accuracy," which are undefined and unduly vague. **Disputed** insofar as Paragraph 17 requires that a SAMA analysis determine the actual exposure of individuals rather than a frequency weighted mean of exposure. Joint Sandia Affidavit at ¶¶ 25-26 and 61; Palla Affidavit at ¶¶ 9-10 and 27-29. **Disputed** insofar as Paragraph 17 implies that the potential health risk in a SAMA analysis is closely and directly related to exposures to an airborne plume, and that SAMA analyses require accuracy in air dispersion modeling beyond that which is necessary to form a sufficient and adequate statistical basis to evaluate potential SAMAs. Joint Sandia Affidavit at ¶¶ 25-26 and 61; Palla Affidavit at ¶¶ 9-10 and 27-29.

> 18. The need for accuracy in the predictive model is particularly important where the number of individuals who could be exposed to the pollutant, the level of such exposures and the duration of such exposures is greatly impacted by the actual path the pollutant plume follows once it is released from the source. Egan Decl. at ¶ 26.

Response: **Disputed** as to the extent that Paragraph 18 implies that the potential health risk determined in a SAMA analysis is closely and directly related to the plume path when determining mean exposures. Joint Sandia Affidavit at ¶ 24. **Disputed** to the extent that that statement assumes that exposure is materially dependant on the path of the plume for SAMA analyses utilizing PRA techniques. On the contrary, for the purposes of conducting valid SAMA analysis, the majority of the exposure occurs long after the plume has passed and dissipated. Joint Sandia Affidavit at ¶ 24; Palla Affidavit at ¶ 18. The MACCS2 code accounts for potential paths of the plume through sampling and rotation through 360 degrees. Joint Sandia Affidavit at ¶¶ 24 and 36; Palla Affidavit at ¶ 26.

> 19. The need for accuracy in the predictive model is also particularly important where the economic cost of mitigation measures and the economic benefits of mitigation measurements are fairly close, such as within a factor of 2 of each other. Egan Decl. at ¶ 27.

Response: **Disputed** to the extent that paragraph 19 implies that the difference in the potential cost benefit of mitigation in this case is within a factor of 2. **Disputed** as to the need for accuracy when the cost benefits are "fairly close," and insofar as Paragraph 19 ignores the consideration of on-site and other costs in a SAMA analysis Joint Sandia Affidavit at ¶¶ 24-27. **Disputed** to the extent that Paragraph 19 implies that the use of uncertainty and sensitivity analysis cannot address or compensate for differences identified in the cost benefit analysis. Joint Sandia Affidavit at ¶ 30.

> 20. MACCS2, as relied upon the DSEIS, relies on an air dispersion model to calculate the dispersion of airborne radiation

> following the hypothetical severe accident. MACCS2 Guidance, Egan Decl., Ex. 10.

Response: Admitted that the MACCS2 code utilizes an air dispersion model to perform some of the required calculations for a severe accident.

> 21. The model used by MACCS2 as applied to the Indian Point site and relied upon in the DSEIS is called ATMOS. *See* Answer Of Entergy Nuclear Operations, Inc. Opposing New York State Notice Of Intention To Participate and Petition to Intervene (Jan. 22, 2008), at 110; MACCS2 Guidance, Egan Decl., Ex. 10.

Response: Admitted insofar as Paragraph 21 refers to the air dispersion model utilized in the MACCS2 code for the Indian Point SAMA analysis.

> 22. ATMOS is a steady-state straight line Gaussian plume model which assumes that any emissions from the Indian Point Station are imbedded in an air mass having a single wind speed that flows for each period of simulation in a single straight line direction. Egan Decl. at ¶ 35. The atmospheric stability classification is also assumed to be constant over that time period. *Id.* Thus each simulation will result in a prediction that the pollutants will theoretically travel in a straight line to infinity or to the limits of the computational domain, regardless of topographical features that might render such a trajectory impossible. *Id.*

Response: **Disputed** in that the atmospheric stability classification and wind speed in the ATMOS model are changed hourly to match the meteorological data. Joint Sandia Affidavit at ¶ 33. **Disputed** in that ATMOS as implemented in the MACCS2 code produces a frequency-weighted statistical mean for any emissions from the Indian Point Station, which are dispersed by the model using the various postulated meteorological conditions throughout the area of interest (i.e., within 50 miles of IP2 and IP3). Joint Sandia Affidavit at ¶¶ 13 –15, 33 – 36, 38, 61, 63, and 65; Palla Affidavit at ¶¶ 22, 24, and 26 – 27.

> 23. The concentrations of contaminants within the plume are assumed to have a maximum value along the plume centerline and to fall off in a bell shaped, Gaussian distribution curve with distance away from the plume centerline. Egan Decl. at ¶ 35.

Response: Admitted as to the description of a normal distribution as being "bell shaped."

24. High terrain in the potential path of the plume introduces several complicating factors into dispersion analyses:

Response: Admitted that high terrain has an impact when modeling individual plumes for the purpose of emergency planning and response. **Disputed** to the extent that the terms "[h]igh terrain" and "several complicating factors" is undefined and unduly vague. **Disputed** as to the alleged impact of high terrain on a SAMA analysis, which utilizes a frequency-weighted mean of various factors in its model calculations. Joint Sandia Affidavit at ¶¶ 13 –15, 33 – 36, 38, 61, 63, and 65. **Disputed** to the extent that Paragraph 24 implies that the SAMA analysis as conducted for IP2 and IP3 is unreliable based on the input data or models used in the analysis due to high terrain or other factors. Joint Sandia Affidavit ¶¶ 38-40.

a. The presence of high terrain distorts and changes the directions of approaching winds as the flow cannot pass through the terrain.

Response: Admitted as to the general proposition that terrain may change the direction of approaching wind at low altitudes, under actual conditions. **Disputed** to the extent that Paragraph 24a implies that the meteorological data used at IP2 and IP3 is not representative or is unreliable for purposes of conducting a SAMA analysis utilizing PRA techniques, or that the local terrain must be expressly modeled in the Indian Point SAMA analysis. Joint Sandia Affidavit ¶¶ 13 –15, 33 – 36, 38 – 40, 61, 63, and 65; Palla Affidavit ¶ 26. **Disputed** to the extent that Paragraph 24a implies that the ATMOS module to the MACCS2 code is not reliable for use in a SAMA analysis for IP2 and IP3. Joint Sandia Affidavit ¶¶ 38-40; Palla Affidavit ¶ 26.

> b. The distortion of the flow direction materially changes the downwind destination of pollutant material emitted into the airflow and also, for elevated emissions, changes the proximity of contaminants to the ground surface increasing the ground level concentrations.

Response: Admitted as to the general proposition that flow direction may change the downwind destination of a contaminant. **Disputed** to the extent that Paragraph 24b alleges that such distortion will "materially" change the outcome in a SAMA analysis, which utilizes a frequency-weighted mean of various factors. **Disputed** to the extent that Paragraph 24b implies that the meteorological data used for the SAMA analysis at IP2 and IP3 is not representative or is unreliable. Joint Sandia Affidavit ¶¶ 38-40; Palla Affidavit ¶ 26. **Disputed** to the extent that Paragraph 24b implies that ATMOS module to the MACCS2 code is not reliable for use in a SAMA analysis for IP2 and IP3. **Disputed** to the extent that Paragraph 24b implies that the reliability of the atmospheric dispersion model should be evaluated on the basis of single trials rather than a frequency weighted mean as used in the Indian Point SAMA analysis. Joint Sandia Affidavit ¶¶ 38-40; Palla Affidavit ¶ 26.

> c. The presence of valley sidewalls together with radiational cooling will cause drainage flows that further distort air flow directions.

Response: Admitted as to the general proposition that a valley may undergo drainage flows given proper conditions. **Disputed** to the extent that Paragraph 24c implies that the meteorological data used for the SAMA analysis at IP2 and IP3 is not representative or is unreliable. Joint Sandia Affidavit ¶¶ 13 –15, 33 – 36, 38 – 40, 61, 63, and 65; Palla Affidavit ¶ 26. **Disputed** to the extent that Paragraph 24c implies that ATMOS module to the MACCS2 code is not reliable for use in a SAMA analysis for IP2 and IP3. Joint Sandia Affidavit ¶¶ 13 –15, 33 – 36, 38 – 40, 61, 63, and 65; Palla Affidavit ¶ 26. **Disputed** to the extent that Paragraph 24c implies that the reliability of the atmospheric dispersion model should be evaluated on the basis of single trials rather than a frequency weighted mean as used in the SAMA analysis. Joint Sandia Affidavit ¶¶ 38-40; Palla Affidavit ¶ 26. **Disputed** to the extent that Paragraph 24c implies that the presence of valley side walls may have a material effect on the Indian Point SAMA analysis conclusions. Joint Sandia Affidavit ¶¶ 38-40; Palla Affidavit ¶ 26.

> d. High terrain may degrade the reliability of a single meteorological station of being representative of the transport wind speed and direction needed by the model, especially for longer distance transport calculations, because wind directions measured near the surface will vary with location. The effect is most pronounced during lighter wind and stable atmospheric conditions that occur at night. Egan Decl. at ¶¶ 20, 21, 23.

Response: Disputed to the extent that Paragraph 24d implies that the meteorological data used for the SAMA analysis at IP2 and IP3 is not representative or is unreliable for use in a SAMA analysis, or that the use of the IP2/IP3 meteorological data in the Indian Point frequency-weighted SAMA analysis is inappropriate. Joint Sandia Affidavit ¶¶ 38-40; Palla Affidavit ¶ 26. **Disputed** to the extent that Paragraph 24d implies that ATMOS module to the MACCS2 code is not reliable for use in a SAMA analysis for IP2 and IP3 based on the data available. Joint Sandia Affidavit ¶¶ 38-40; Palla Affidavit ¶ 26. **Disputed** to the extent that Paragraph 24d implies that "high terrain" in the vicinity of the Indian Point site may have a material effect of the SAMA analysis conclusions. Joint Sandia Affidavit ¶¶ 38-40; Palla Affidavit ¶ 26.

> 25. For the Indian Point site, from a meteorological air flow perspective, the presence of the river, nearby terrain features and non-homogeneous ground surface features all affect the overall air flow patterns, which in turn affect the rates of vertical and horizontal mixing of any pollutants released from the plant. Egan Decl. at ¶ 38.

Response: Disputed to the extent that Paragraph 25 implies that topographical features in the vicinity of IP2 and IP3 cause the SAMA analysis as conducted to be unreliable or inadequate and that the meteorological data which has been input into the SAMA analysis are unreliable or inaccurate. Joint Sandia Affidavit ¶¶ 38-40; Palla Affidavit ¶ 26. While variations in the local topography have some potential to impact the path of a single plume during an actual release, such features do not affect the SAMA analysis, which utilizes frequency weighted statistical mean results for the 50 mile radial area of interest. The nominal local impacts of local topography on a single plume would not distort, or materially change the conclusions of the SAMA analyses as conducted for IP2 and IP3.

> 26. For the Indian Point site, the presence of high terrain features that rise above the height of the meteorological towers at the Indian Point station means that the wind speeds and directions measured on the towers are unlikely to be representative of the larger scale flow patterns that carry contaminants from the plant to the surrounding areas. Egan Decl. at ¶ 39.

Response: Disputed. *See* Response to Paragraphs 24 and 25 *supra*.

> 27. For the Indian Point site, in the case of terrain features across the river, the flow will either turn and pass along the side or rise over the feature depending upon atmospheric stability conditions. Thus, air pollution imbedded in the air flow will not take the straight line trajectory across the valley that would be predicted by ATMOS using data from the Indian Point meteorological tower. *Id.*

Response: Disputed. *See* Response to Paragraphs 24 and 25 *supra*.

> 28. The Indian Point Station is located in a turning part of the Hudson River. *See* United States Department of the Interior Geological Survey maps, annexed to the Egan Declaration at Exhibit 3. *See also* Egan Declaration. ¶ 34.

Response: Admitted.

> 29. The high terrain of Dunderberg Mountain to the west distorts and turns winds which might be measured to be from the east at the anemometer at the primary tower location. Egan Decl. ¶ 34.

Response: Disputed. *See* Response to Paragraphs 24 and 25 *supra*.

> 30. Under overall light wind conditions, even though the Hudson is still tidal at the Indian Point location, the net average downstream

movement of the river water and the effects of drainage induced airflows will favor movement of air above and near the river surface to be down river. *Id.*

Response: Disputed. *See* Response to Paragraphs 24 and 25 *supra*.

31. For the Indian Point site, under the more stable atmospheric conditions associated with greater ground level impacts, the plume is likely to be turned down the overall river valley, as it cannot pass through the terrain. Egan Decl. ¶ 39.

Response: Disputed. *See* Response to Paragraphs 24 and 25 *supra*.

32. A second effect of mountainous terrain occurs for sources, like Indian Point, located in river valleys because of the presence of the valley side walls on creating drainage flows. Egan Decl. ¶ 40.

Response: Disputed. *See* Response to Paragraphs 24 and 25 *supra*.

33. For the Indian Point site, at night when the earth's surface cools by radiation, the air in contact with the surface cools and being heavier than other air at that elevation, flows, under, the forces of gravity, down the valley slopes to-ward the base of the valley. In the absence of other influences, the pooling of the heavier air at the low point of the valley cross section, causes that air to then tend to flow down river following the valley contours. *Id.*

Response: Disputed. *See* Response to Paragraphs 24 and 25 *supra*.

34. For the Indian Point site, the presence of high terrain causes increased turbulence generated by the air having to flow close to the surface of terrain features and the mixing also associated with the thermal flows generated by the radiational heating and cooling. Egan Decl. at 11 39, 40.

Response: Disputed. *See* Response to Paragraphs 24 and 25 *supra*.

35. ATMOS, as implemented in the DSEIS SAMA analysis, did not account for the variations created by the Indian Point terrain as set forth in paragraphs 23-33, *supra*. Egan Decl. ¶ 37.

Response: Disputed. *See* Response to Paragraphs 24 and 25 *supra*.

36. For over three decades atmospheric scientists and meteorologists have been identifying problems in the use of models similar to ATMOS for complex terrain settings like Indian Point. *See* Steven R. Hanna, Gary A. Briggs, Rayford P. Hosker, Jr., National Oceanic and Atmospheric Administration, Atmospheric Turbulence and Diffusion Laboratory, *Handbook on Atmospheric Diffusion* (1982) (excerpt annexed to the Egan Declaration as Exhibit 11); Egan Dec. ¶ 59.

Response: Admitted that scientists and meteorologists have been working on models for complex terrain for over three decades. **Disputed** to the extent that Paragraph 36 implies that such persons have found that ATMOS is not reliable for use at IP2 and IP3 or other sites for the purpose of a SAMA analysis or that the Indian Point site is a "complex terrain setting" for the purpose of modeling severe reactor accidents in a SAMA analysis. Joint Sandia Affidavit ¶¶ 26-28, 30-31, and 42-43. **Disputed** to the extent that Paragraph 36 implies that undefined problems have been identified in the use of ATMOS or other Gaussian plume models that make the use of such models inappropriate for developing frequency weighted means for use in a SAMA analysis utilizing PRA techniques. *Id.*

> 37. Different air dispersion models can be used depending upon the application and regulatory requirements. For example, EPA recommends simple screening models (EPA, SCREEN3, or CT SCREEN) that are structured to provide conservative concentration estimates for simple pass or fail determinations. Egan Decl. ¶ 24. If the estimates fail the test, *i.e.*, if the concentrations are too high for regulatory purposes, the modeler would have an option of using a more refined model and more appropriate meteorological input data in further analyses. *Id.*

Response: Admitted for the general proposition that different purposes may require the use of different atmospheric dispersion models. **Disputed** to the extent that Paragraph 37 implies that EPA's statements regarding screening models, pass or fail determinations, and high concentrations are applicable to the preparation or methodology of a SAMA analysis at IP2 and IP3. Joint Sandia Affidavit ¶¶ 17, 26-28, 30-31, and 42-43. **Disputed** to the extent that Paragraph 37 implies that EPA regulatory requirements are applicable to SAMA analyses conducted under NRC regulations and regulatory guidance.

> 38. Even these screening models must be appropriate for the terrain in which the source is located, SCREEN3 is appropriate for

> sources located in flat terrain. CTSCREEN is appropriate for complex terrain. *Id.*

Response: **Disputed** to the extent that Paragraph 38 is not relevant or material to the SAMA analysis at IP2 and IP3 or NYS Contention 16/16A. **Disputed** to the extent that Paragraph 38 implies that the topography around IP2 and IP3 is complex, and that the EPA regulatory models are appropriate for a SAMA analysis. *See also,* Response to Paragraph 37, *supra.*

> 39. Where the goal is to ascertain the total amount of a pollutant to which a population would be exposed in the event of a release and the population density varies depending upon the direction and distance the plume takes following the release, screening technologies would be inappropriate because they could not provide a reliable upper limit exposure value without artificially assuming that all the released pollution reached the areas of highest population. Egan Decl. ¶ 24.

Response: **Disputed** to the extent that the term "screening technologies" is undefined and unduly vague. **Disputed** on the grounds that Paragraph 39 is not relevant or material to the NYS Contention 16/16A. **Disputed** to the extent that Paragraph 39 implies that the purpose of SAMAs is to "provide a reliable upper limit exposure value without artificially assuming that all the released pollution reached the areas of highest population." Joint Sandia Affidavit ¶¶ 36, 38, 55, 63, and 65; Palla Affidavit ¶¶ 24-26. The purpose of a SAMA analysis is determine whether SAMAs exist which are potentially cost-beneficial based on a probabilistic risk analysis. Joint Sandia Affidavit ¶¶ 36, 38, 55, 63, and 65; Palla Affidavit ¶¶ 24-26. It is not appropriate to base SAMA decisions on the worst case scenario. Joint Sandia Affidavit ¶¶ 36, 38, 55, 63, and 65; Palla Affidavit ¶¶ 24-26.

> 40. Generally, the selection of a dispersion model depends critically upon the complexity of the meteorology and terrain influencing a release from a source and at what downwind distances the concentration projections are needed. In flat terrain settings, homogeneous surface characteristics (e.g., surface roughness, albedo and Bowen ratio) and

> relatively evenly distributed populations of interest the simple straight-line Gaussian plume model algorithm is often appropriate. Egan Decl. ¶ 28.

Response: **Disputed** to the extent that the term "dispersion model" is undefined and unduly vague. **Disputed** to the extent that Paragraph 40 implies that an air dispersion model in a SAMA analysis should be selected only on the basis of "the complexity of the meteorology and terrain," or that the ATMOS module is inappropriate for use in a SAMA analysis for IP2 and IP3. Joint Sandia Affidavit ¶¶ 14-15, 17, 61, 63, and 65-66. **Disputed** to the extent that Paragraph 40 implies that a Gaussian plume model is inappropriate for use in the IP2 and IP3 SAMA analysis.

> 41. The Industrial Source Complex (ISC3ST) model (a Gaussian plume model) was used for such permitting applications by EPA until it was replaced in 2005 by AERMOD. United States Environmental Protection Agency (2005) Appendix W to Part 51 - Guideline on Air Quality Models, 40 CFR Ch. I (11-9-05 Edition) at 68218-68261; Egan Decl. ¶ 28.

Response: **Disputed** to the extent that the term "such permitting applications" is undefined and unduly vague. **Disputed** to the extent that Paragraph 41 is not relevant or material to the conduct of a SAMA analysis for IP2 and IP3 or to NYS Contention 16/16A. **Disputed** to the extent that Paragraph 41 implies that EPA models or guidance should be used to conduct a SAMA analysis at IP2 and IP3 under NRC regulations and regulatory guidance. Joint Sandia Affidavit ¶¶ 14-15, 17, 61, 63, and 65-66. **Disputed** to the extent that the EPA's alleged replacement of ISC3T with AERMOD implies that ATMOS module is inappropriate for use in performing SAMA analysis at IP2 and IP3. *Id.*

> 42. The ISC3ST model was not deemed suitable for calculating concentrations on terrain elevations above the height of the source. This limitation was the reason that EPA sought the development of models appropriate for complex terrain settings. Egan Decl. ¶ 28.

Response: **Disputed** to the extent that it is not relevant or material to the conduct of a SAMA analysis for IP2 and IP3. **Disputed** to the extent that paragraph 42 implies that EPA models should used to conduct SAMA analysis at IP2 and IP3. Joint Sandia Affidavit ¶¶ 14-15, 17, 61, and 65-66. **Disputed** to the extent that the EPA's alleged replacement of ISC3T with AERMOD implies that ATMOS module is inappropriate for use in performing SAMA analysis at IP2 and IP3 under NRC regulations and regulatory guidance. Joint Sandia Affidavit ¶¶ 17, 61, 63, and 65-66. **Disputed** to the extent that the EPA's alleged rationale for its actions is material or relevant to the performance of a SAMA analysis for IP2 and IP3 or to NYS Contention 16/16A. *See* Response to Paragraph 41, *supra.*

> 43. After the CTMD project, sources located in complex terrain (defined by EPA as terrain that exceeded the height of the release) were required to use complex terrain screening models or refined models such as CTDM-PLUS. *See* 40 C.F.R. Part 51, Appendix W: Guideline on, Air Quality Models at 18453; Egan Decl. ¶ 28.

Response: Disputed in that Paragraph 43 is not relevant or material to NYS Contention 16/16A or to the performance of a SAMA analysis at IP2 and IP3 under NRC regulations and regulatory guidance. **Disputed** to the extent that the EPA decision implies that IP2 and IP3 are located on complex terrain which requires additional consideration for the purpose of a SAMA analysis. Joint Sandia Affidavit ¶¶ 61, 63, 65-66. **Disputed** to the extent that EPA decision implies that the ATMOS module is inappropriate for performing SAMA analysis at IP2 and IP3. *Id. See* Response to Paragraphs 41 and 42, *supra.*

> 44. The adoption of AERMOD as a refined model for both simple (flat) and complex terrain settings obviated the need for separate refined dispersion models. United States Environmental Protection Agency (2005) *Appendix W to Part 51 - Guideline on Air Quality Models,* 40 C.F.R. Ch. I (Nov. 9, 2005) (70 Fed.Reg. 68218 (Nov. 9, 2005)); 40 C.F.R. Part 51, Appendix W: Guideline on Air Quality Models; Egan Decl. T 28.

Response: **Disputed** in that Paragraph 44 is not relevant or material to NYS Contention 16/16A or to the performance of a SAMA analysis at IP2 and IP3 under NRC regulations and regulatory guidance. **Disputed** to the extent that Paragraph 44 implies that EPA dispersion models should be used in place of the ATMOS module in the MACCS2 code. Joint Sandia Affidavit ¶¶ 61, 63, 65-66. **Disputed** to the extent that Paragraph 44 implies that AERMOD is a refined model for the purposes of a SAMA analysis. AERMOD has severe limitations including the inability to model the entire 50 mile radial area of interest, and it has not been shown to be more accurate than the Gaussian plume model. Joint Sandia Affidavit ¶¶ 26, 28, 30, 31, 40, 45, and 47. *See* Response to Paragraphs 41 and 42, *supra*.

> 45. AERMOD was developed for applications within 50 Km (about 31 Miles) of a source. Egan Decl. ¶ 29.

Response: Admitted that AERMOD is unable to model the entire 50 mile radial area necessary for conducting a SAMA analysis. **Disputed** to the extent that Paragraph 45 is not relevant or material to NYS Contention 16/16A or to the performance of a SAMA analysis at IP2 and IP3 under NRC regulations and regulatory guidance.

> 46. AERMOD was developed after more than a decade of efforts of many researchers to incorporate the greatly advanced understanding of boundary layer meteorology into the dispersion algorithms that were available when the Gaussian plume model was parameterized by Pasquill and Gifford. Egan Decl. ¶ 29; *see also* Egan Decl., Ex. 2 (Declaration of Dr. Bruce Egan in Support of the State of New York's Petition to Intervene (Nov. 27, 2007), at TT 22 – 26 (discussing boundary layer meteorology).

Response: **Disputed** to the extent that Paragraph 46 implies that AERMOD should be used in place of the ATMOS module for the purpose of conducting a SAMA analysis. **Disputed** to the extent that Paragraph 46 is not relevant or material to NYS Contention 16/16A or to the performance of a SAMA analysis at IP2 and IP3 under NRC regulations and regulatory guidance. *See* Response to Paragraphs 41-45, *supra*.

> 47. The AERMOD model was subjected to extensive statistical model evaluations in a variety of terrain settings. Egan Decl. ¶ 29. These efforts showed that AERMOD represented a major improvement over the ISC3ST and other models. *Id.*

Response: Disputed to the extent that Paragraph 47 is not relevant or material to NYS Contention 16/16A or to the performance of a SAMA analysis at IP2 and IP3 under NRC regulations and regulatory guidance. **Disputed** to the extent that AERMOD was not shown to be "a major improvement" over the ATMOS module utilized in the MACCS2 code, or that AERMOD could be used in a SAMA analysis or in any analysis of a 50-mile radial area. Joint Sandia Affidavit at ¶¶ 26, 28, 30, 31, 40, 45, and 47. **Disputed** in that AERMOD has been found to exhibit an error of a factor 2 in the same manner as the ATMOS module. *Id.* **Disputed** to the extent that the "extensive statistical evaluations" cited in Paragraph 47 did not evaluate the model for use in a SAMA analysis utilizing PRA techniques. *Id. See* Response to Paragraphs 41-46 *supra*.

> 48. The CALPUFF model is appropriate for simulating transport and dispersion in wind fields that change with space and time. Egan Decl. ¶ 30. It is often coupled to CALMET, a model that computes the needed wind and dispersion fields from meteorological data. *Id.*

Response: Disputed to the extent that Paragraph 48 is not relevant or material to NYS Contention 16/16A or to the performance of a SAMA analysis at IP2 and IP3 under NRC regulations and regulatory guidance. **Disputed** to the extent that Paragraph 48 implies that CALPUFF and CALMET should be used to perform the SAMA analysis at IP2 and IP3. Joint Sandia Affidavit ¶¶ 61,63, and 65-66. **Disputed** to the extent that Paragraph 48 implies that the ATMOS module is not appropriate for conducting a SAMA analysis at IP2 and IP3. Joint Sandia Affidavit ¶¶ 17, 26, 28, 30-31, 40, 45, and 47. *See* Response to Paragraphs 41-47 *supra*.

> 49. CALPUFF may also be coupled to a full mesoscale meteorological flow model such as MM5. Id. CALPUFF also has

> benefited from advances in the parameterization of wind, fields and turbulent dispersion over the past four decades. Id.

Response: **Disputed** to the extent that Paragraph 49 is not relevant or material to NYS Contention 16/16A or to the performance of a SAMA analysis at IP2 and IP3 under NRC regulations and regulatory guidance. **Disputed** to the extent that Paragraph 49 implies that CALPUFF and meteorological flow model should be used to perform the SAMA analysis at IP2 and IP3. Joint Sandia Affidavit ¶¶ 17, 26, 28, 30-31, 40, 45, and 47. **Disputed** to the extent that Paragraph 49 implies that the ATMOS module is not appropriate for conducting a SAMA analysis at IP2 and IP3. *Id. See* Response to Paragraphs 41-48 *supra.*

> 50. CALPUFF is routinely used in both simple and complex terrain settings to estimate ambient air concentrations at distances beyond the recommended 50 kilometer upper limit of AERMOD. *Id.* The air flow fields used by CALPUFF generally use data from more than one meteorological station in order to estimate concentrations at large distances from a source. *Id.*

Response: **Disputed** to the extent that Paragraph 50 is not relevant or material to NYS Contention 16/16A or to the performance of a SAMA analysis at IP2 and IP3 under NRC regulations and regulatory guidance. **Disputed** to the extent that Paragraph 50 implies that CALPUFF should be used to perform the SAMA analysis at IP2 and IP3. Joint Sandia Affidavit ¶¶ 17, 26, 28, 30-31, 40, 45, and 47. **Disputed** to the extent that Paragraph 50 implies that the ATMOS module is not appropriate for conducting a SAMA analysis at IP2 and IP3. *Id.* .*See* Response to Paragraphs 41-49 *supra.*

> 51. The NRC, in Part 2 of a 2009 Presentation to the National Radiological Emergency Planning Conference ("NRC 2009 Presentation"), concluded that straight-line Gaussian plume models cannot accurately predict dispersion in a complex terrain such as the Indian Point site and are therefore scientifically defective for that purpose. *See* Stephen F. LaVie, Sr. Emergency Preparedness Specialist, United States Nuclear Regulatory Commission, Power Point Presentation: *What's in the Black Box Known as Emergency Dose Assessment?*

> Prepared for the 2009 National Radiological Emergency Planning Conference (relevant excerpt annexed to the Egan Declaration as Exhibit 3; the full presentation is available at ML091050226, ML091050257, and ML091050269 (page references used here refer to the portion attached, Part 2, ML091050257)).

Response: Admitted that Stephen LaVie, an NRC Staff employee, made a PowerPoint presentation to emergency planning and response personnel using the cited slides, but **disputed** insofar as Paragraph 51 characterizes Mr. LaVie's presentation as an "NRC ... conclu[sion]" or regulatory position. **Disputed** to the extent that Mr. LaVie made no reference to the use of Gaussian or other plume models in SAMA or probabilistic risk analyses, did not discuss the Indian Point site or topography, and did not conclude that a Gaussian plume model was not appropriate for use in the SAMA analysis for IP2 and IP3. *See* Affidavit of Steven F. Lavie In Support Of NRC Staff's Response In Opposition to State of New York's Motion For Partial Summary Disposition Of NYS Contention 16/16a ("LaVie Affidavit") at ¶¶ 9-11 (attached as Ex. 3). **Disputed** to the extent that the presentation did not make any conclusions regarding air dispersion models appropriate for use in SAMA analyses. *Id.*

> 52. The NRC in its 2009 Presentation, states that the "most limiting aspect" of the basic Gaussian Model, is its "inability to evaluate spatial and temporal differences in model inputs." NRC 2009 Presentation, Slide 28. Because ATMOS is non-spatial, it cannot account for the effect of terrain on the trajectory of the plume - that is, the plume is assumed to travel in a straight line regardless of the surrounding terrain. Therefore, it cannot, for example, "'curve' a plume around mountains or follow a river valley." NRC 2009 Presentation, Slide 33.

Response: **Disputed** insofar as Paragraph 52 characterizes Mr. LaVie's presentation as "the NRC" presentation or regulatory position Admitted that slides 28 and 33 of Mr. LaVie's 2009 Presentation describe issues concerning Gaussian plume models for use in emergency planning and response activities. **Disputed** to the extent that Mr. LaVie made no reference to the use of a Gaussian plume model in SAMA or probabilistic risk analyses, did not discuss the Indian Point site or topography, and did not conclude that a Gaussian plume model was not appropriate for use in the SAMA analysis for IP2 and IP3. **Disputed** to the extent that Paragraph 52 implies that these issues are relevant to the reliability or adequacy of the use of the Gaussian plume model for the purpose of conducting a SAMA analysis for IP2 and IP3. Joint Sandia Affidavit at ¶¶ 8-17, 61, and 65-66. *See* Response to Paragraph 51 *supra.*

> 53. The NRC 2009 Presentation also acknowledges the "gravity sink" phenomenon that could cause the plume to travel down river towards New York City from a valley site such as Indian Point. Egan Decl. ¶ 45. As Slide 46 explains, the air in a valley is not heated directly by the sun but by heat convection from the earth. *Id.*; NRC 2009 Presentation, Slide 46. At night the earth cools and because higher elevations cool faster, cool air flows toward warmer air in the valley. This flow is described by the NRC as "gravity drainage," and in the absence of other meteorological influences (such as high wind speeds), the drainage will tend to flow down river. *Id.*

Response: Disputed insofar as Paragraph 53 characterizes Mr. LaVie's presentation as "the NRC" Presentation" or regulatory position. Admitted that Mr. LaVie's Presentation discussed gravity drainage effects on dispersion models for emergency planning and response activities. **Disputed** to the extent that Mr. LaVie made no reference to the use of a Gaussian plume model in SAMA or probabilistic risk analyses, did not discuss the Indian Point site or topography, and did not conclude that a Gaussian plume model was not appropriate for use in the SAMA analysis for IP2 and IP3. **Disputed** to the extent that Paragraph 53 implies that gravity drainage would have an impact on the SAMA analysis for IP2 and IP3. LaVie Affidavit at ¶¶ 8-14. **Disputed** in that the slides do not address high wind speed effects on gravity drainage. *Id. See* Response to Paragraphs 51-52 *supra.*

> 54. In its introduction to a discussion of advanced air dispersion models, the NRC 2009 Presentation summed up the Gaussian model's inability to project dispersion in a complex terrain:

> In many Gaussian models, terrain height is addressed only in determining the effective plume height.
>
> The impact of terrain on plume transport is not addressed. Straight-line models can not "curve" a plume around mountains or follow a river valley.

NRC 2009 Presentation, Slide 33.

Response: **Disputed** insofar as Paragraph 54 characterizes Mr. LaVie's presentation as "the NRC" Presentation" or regulatory position. Admitted that the NRC 2009 Presentation contained slide 33. **Disputed** to the extent that Paragraph 54 implies that Gaussian plume model cannot project dispersion in "complex terrain." Joint Sandia Affidavit at ¶¶ 17, 26, 28, 30-31, 40, 45, and 47. **Disputed** to the extent that Mr. LaVie made no reference to the use of a Gaussian plume model in SAMA or probabilistic risk analyses, did not discuss the Indian Point site or topography, and did not conclude that a Gaussian plume model was not appropriate for use in the SAMA analysis for IP2 and IP3. **Disputed** to the extent that Mr. LaVie's presentation was directed at issues regarding plume modeling for emergency planning and response purposes, and did not concern the SAMA analysis for IP2 and IP3. LaVie Affidavit at ¶¶ 13-14. *See* Response to Paragraphs 51-53 *supra*.

> 55. The NRC 2009 Presentation discussed the methods of more advanced models that can address terrain impact on plume transport, including models in which emissions from a source are released as a series of puffs, each of which can be carried separately by the wind. NRC 2009 Presentation Slides 35, 36.

Response: Disputed insofar as Paragraph 55 characterizes Mr. LaVie's presentation as "the NRC" Presentation" or regulatory position. Disputed to the extent that Mr. LaVie made no reference to the use of a Gaussian plume model in SAMA or probabilistic risk analyses, did not discuss the Indian Point site or topography, and did not conclude that a Gaussian plume model was not appropriate for use in the SAMA analysis for IP2 and IP3. Disputed in that the statement describing slides 35 and 36 is materially incomplete. Disputed to the extent that Paragraph 55 implies that other models used for emergency planning and response are appropriate for developing a frequency weighted mean for use in conducting a SAMA analysis at IP2 and IP3 using PRA techniques. Joint Sandia Affidavit at ¶¶ 61, 63, and 65-66. *See* Response to Paragraphs 51-54 *supra*.

> 56. Lawrence Livermore National Laboratory conducted a study apparently intended to compare the results of using a Gaussian, a two-dimensional and a three-dimensional model. *See Comparison ofAverage Transport and Dispersion Among a Gaussian, A Two-Dimensional and a Three-Dimensional Model,* Lawrence Livermore National Laboratory (Oct. 2004) ("Livermore Report"), annexed to the Egan Declaration at Exhibit 5.

Response: Admitted.

> 57. The study did not compare the results for a discrete event such as a postulated severe accident. *Id.*

Response: **Disputed** inasmuch as the source term used in the study is fundamentally similar to a reactor source term. Joint Sandia Affidavit at ¶ 59.

> 58. The study did not compare the computer generated results with actual measurements to see how close any of the models came to predicting reality. *Id.*

Response: Admitted.

> 59. The study was conducted in terrain that was fairly homogenous with little vertical variations and no major valleys, mountains or rivers. Id.

Response: **Disputed** as being incomplete, in that the study was conducted in a location with sufficient meteorological data to properly measure the results. **Disputed** to the extent that Paragraph 59 implies that area was homogeneous meteorologically and temporally, in that the meteorological data varied temporally and distally. Joint Sandia Affidavit at ¶¶ 26, 28, 31, and 59.

> 60. The study found the results of the ATMOS model when compared to the most sophisticated of the models used - the LODI model - produced average differences of as much as a factor of two: "All of the arc average and the great majority of the arc-sector average exposures and depositions are within a factor of two when comparing MACCS2 to the state-of-the-art model, LODI." *Id.* at 72.

Response: **Disputed** in that the ATMOS module results and the LODI model results were within 40% of each other, not within a factor of two, when looking at data relevant to the conduct of a SAMA analysis. Joint Sandia Affidavit at ¶¶ 26, 28, and 31.

> 61. The authors included a strong caveat cautioning about the use of simple straight line Gaussian models in complex terrain. *See id.* at 72 ("this study was performed in an area with smooth or favorable terrain and persistent winds although with structure in the form of low-level nocturnal jets and severe storms. In regions with complex terrain, particularly if the surface wind direction changes with height, caution should be used.")

Response: **Disputed** to the extent that the statement mischaracterizes the authors' analysis of the Gaussian model. **Disputed** insofar as the meteorological phenomena were complex at the test site. Joint Sandia Affidavit at ¶¶ 26, 28, and 31.

> 62. In March 1996, the NRC issued RTM-96, Response Technical Manual, which contains "simple methods for estimating the possible consequences of different kinds of radiological accidents." T. McKenna, J. Trefethen, K. Gant (ORNL), J. Jolicoeur, G. Kuzo, G. Athey, United States Nuclear Regulatory Commission, Incident Response Division, Office for Analysis and Evaluation of Operational Data, RTM-96: Response Technical Manual (NUREG/BR-0 150, Vol. 1, Rev. 4) (Mar. 1996) (annexed to the Egan Declaration as Exhibit 7). In the glossary of that document, the NRC's definition of "Gaussian plume dispersion model" states that such models have important limitations, including the inability to "deal well with complex terrain." *Id.*

Response: Admitted to the extent that manual contained a definition regarding the Gaussian plume dispersion model. **Disputed** to the extent that the manual was prepared for emergency planning and response purposes and the cited "important limitations" are not relevant and material to the SAMA analysis for IP2 and IP3.

> 63. In December 2005, as part of a cooperative program between the governments of United States and Russia to improve the safety of nuclear power plants designed and built by the former Soviet Union, the NRC issued a Procedures Guide for a Probabilistic Risk Assessment, related to a Russian Nuclear Power Station. United States Nuclear Regulatory Commission/ Brookhaven National Laboratory, NUREG/CR-6572, Rev. 1, Kalinin VVER-1000 Nuclear Power Station Unit 1 PRA: Procedure Guides for a Probabilistic Risk Assessment (Dec. 2005) (ML060450618). The Guide, prepared by the Brookhaven National Laboratory and NRC staff, explained that atmospheric transport of released material is carried out assuming Gaussian plume dispersion, which is "generally valid for flat terrain." *Id.* at 3-114. However, the Guide contained the caveat that in "specific cases of plant location, such as, for example, a mountainous area or a valley, more detailed dispersion models may have to be considered." *Id.;* Egan Decl. at ¶55.

Response: Admitted that Brookhaven National Laboratory ("Brookhaven") produced NUREG/CR-6572, Rev. 1; for the Division of Risk Analysis and Applications, NRC Office of Nuclear Regulatory Research; **disputed** insofar as Paragraph 63 describes the document as an NRC publication. **Disputed** to the extent that NUREG/CR-6572 made no findings regarding IP2 or IP3, and did not find that a Gaussian plume model should not be used for a SAMA analysis at a site with the terrain features of the IP2/IP3 site. **Disputed** to the extent Paragraph 63 implies that the NRC or Brookhaven concluded that the Gaussian model is not appropriate for use in areas with varying terrain or in a SAMA analysis. **Disputed** to the extent that Paragraph 63 implies that terrain surrounding IP2 and IP3 is "a mountainous area or a valley" for the purposes of modeling in a SAMA analysis.

> 64. The U.S. Department of Energy ("DOE") has also acknowledged problems with the ATMOS simple straight line Gaussian plume model in the MACCS2 Code when used in complex terrain. For example, the Radiation Safety Information Computational Center ("RSICC") of DOE's Oak Ridge National Laboratory has a summary description of the MACCS2 Code in its Code Package CCC-652. *See* RSICC Code Package CCC-652, *MACCS2 Ver. 1.13.1. MELCOR Accident Consequence Code System for the Calculation of the Health and Economic Consequences of Accidental Atmospheric Radiological Releases* (Abstract dated May 1997, revised June 1998, March 2004, June 2005) (annexed to the Egan Declaration as Exhibit 9). Under the heading "Restrictions or Limitations," the RSICC unequivocally states that

"the atmospheric model included in the code does not model the impact of terrain effects on atmospheric dispersion." *Id.* (emphasis added).

Response: **Disputed** to the extent that Paragraph 64 implies that the U.S. Department of Energy ("DOE") found there are "problems" with the ATMOS model which are pertinent to its use in SAMA analyses. **Disputed** to the extent that the paragraph implies that the DOE document addresses the use of ATMOS for conducting SAMA analyses. **Disputed** in that DOE continues to endorse the Gaussian plume model for dose calculations.

65. In June 2004, the U.S. Department of Energy's Office of Environment, Safety and Health issued a final report entitled MACCS2 Computer Code, Application Guidance for Documented Safety Analysis. United States Department of Energy Office of Environment, Safety and Health, *MACCS2 Computer Code Application Guidance for Documented Safety Analysis: Final Report* (June 2004)(annexed to the Egan Declaration as Exhibit 10). In Table 2- 1, Summary Description of MACCS2 Code Software, under the heading Restrictions or Limitations, the Guidance also states "the atmospheric model included in the Code does not model the impact of terrain effects on atmospheric dispersion nor can it accept more than one weather spatial location." *Id.* at 2-5. Table 6-1, entitled "Limitations of Gaussian Plume Model in MACCS2 and MACCS," describes the "terrain sensitivity" of the Gaussian plume model as "flat earth" to "gently rolling" and instructs that "complicated terrain over the region of transport may require Lagrangian particle or other models." *Id.* at 6-1.

Response: **Disputed**. See response to Paragraph 64 *supra*.

66. More recently, the NRC revised their Regulatory Guide 1.23, Meteorological Monitoring Programs for Nuclear Power Plants. *See* United States Regulatory Commission, Regulatory Guide 1.23, Meteorological Monitoring Plan for Nuclear Power Plants (Rev. 1, Mar. 2007) (annexed to the Egan Declaration as Exhibit 13). Regulatory Guide 1.23 recognizes the important relationship between meteorological measurements and atmospheric dispersion modeling. *See id.,* Introduction at 3: "Thus, each nuclear power plant has multiple needs for an onsite program to measure and document basic meteorological information. These data may be used to develop atmospheric transport and diffusion parameters that with *appropriate* atmospheric dispersion models, may be used to estimate potential radiation doses to the public resulting from actual routine or accidental releases of radioactive materials to the atmosphere or to evaluate the potential dose to the public and control room as a result of hypothetical reactor accidents.... This

> regulatory guide describes a suitable onsite program to provide meteorological data to estimate these impacts." (emphasis added).

Response: Admitted that Regulatory Guide ("RG") 1.23 has been revised and includes the language quoted. **Disputed** to the extent that the quote is incomplete. **Disputed** to the extent that RG 1.23 is not directed to determining the "appropriate" model for SAMA analysis, and RG 1.23 recognizes that models should be selected based on their intended use. **Disputed** to the extent that RG 1.23 does not address the extent or nature of meteorological monitoring necessary for a sufficient SAMA analysis, and does not state that a Gaussian plume model is inappropriate for use in conducting a SAMA analysis.

> 67. Regulatory Guide 1.23 also states that the program should be capable of providing the meteorological information needed to make several assessments including: "a realistic assessment by both the applicant and the regulatory staff of the potential dispersion of radioactive materials from, and the radiological consequences of, a spectrum of accidents to aid in evaluating the environmental risk posed by a nuclear power plant in accordance with Subpart A to 10 CFR Part *51." Id.* at 5. On page 11, the section entitled *Special Considerations for Complex Terrain Sites* states that the program "should provide an adequate basis for atmospheric transport and diffusion estimates ... [within 8 kilometers (5 miles) in each downwind sector]" (brackets in original) and mentions special "complex flow patterns in nonuniform terrain" and "circulation for a hill-valley complex or a site near a large body of water." *Id.* at 11. The Regulatory Guide also states that "[t]he plant's operational meteorological monitoring program should provide an adequate basis for atmospheric transport estimates within the plume exposure emergency planning zone [i.e., within approximately 16 kilometers (10 miles)]." *Id.*

Response: Admitted that RG 1.23 contains the quoted language. **Disputed** as to the applicability of RG 1.23 to the conduct of a SAMA analysis for IP2 and IP3. SAMA analyses have distinct purposes and approaches which differ from other purposes for which meteorological monitoring data are utilized. **Disputed** to the extent that Paragraph 67 implies that IP2 and IP3 are located in "complex terrain" for the purpose of a SAMA analysis.

68. The inability of a simple Gaussian plume model to accurately predict air transport and dispersion in complex terrains is discussed in a textbook for a college-level introductory course in environmental science and engineering. In listing the assumptions that are made to develop a simple straight line Gaussian plume model, the textbook warns that:

> The equation is to be used over relatively flat, homogeneous terrain. It should not be used routinely in coastal or mountainous areas, in any area where building profiles are highly irregular, or where the plume travels over warm bare soil and then over colder snow or ice-covered surfaces.

ENVIRONMENTAL SCIENCE AND ENGINEERING, J. Glynn Henry & Gary W. Heinke (Prentice- Hall 1989) at 528.

Response: **Disputed** as to the materiality of the cited quote to the conduct of SAMA analysis using PRA techniques for IP2 and IP3. **Disputed** to the extent that Paragraph 68 implies that terrain surrounding IP2 and IP3 is unsuitable for utilizing a Gaussian plume model in a SAMA analysis. For the purposes of a SAMA analysis, a frequency weighted mean is utilized instead of an arbitrary day of data for a single trial run. Joint Sandia Affidavit at ¶¶ 8-17, 26, 28, 31, 61, 63, and 65-66.

NRC Staff's Statement of Additional Material Facts
Relevant to the Resolution of NYS' Motion

1. The use of alternative dispersion models will not result in the identification of other potentially cost beneficial SAMAs.

2. It is not feasible to substitute alternative dispersion models for the ATMOS model in the MACCS2 code.

Respectfully submitted,

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Sherwin E. Turk
Counsel for NRC Staff

Dated at Rockville, Maryland
this 13th day of October, 2009