From: "Davis, James T." <JTDAVIS@southernco.com>
To: "Christian Araguas" <CJA2@nrc.gov>
Date: 3/26/2007 6:32:22 PM
Subject: RAI Letter # 4 Response
cc: "Dana M. Williams" <X2DANAWI@southernco.com>,"Brian J. Sweeney" <X2SWEENE@southernco.com>

Christian,

Here it is. Fed-X will go out tomorrow with CDs.

<<AR-07-0453_email.pdf>>

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From: "Davis, James T." <JTDAVIS@southernco.com>

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SOUTHERN COMPANY
Energy to Serve Your World℠

MAR 26 2007

Docket No.: 52-011

AR-07-0453

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555-0001

Southern Nuclear Operating Company
Vogtle Early Site Permit Application
Response to Requests for Additional Information Letter No. 4

Ladies and Gentlemen:

By letter dated February 23, 2007, the U.S. Nuclear Regulatory Commission (NRC) provided Southern Nuclear Operating Company (SNC) with requests for additional information (RAIs) on the Vogtle Early Site Permit (ESP) Application. The RAIs pertain to ESP application Part 2, Site Safety Analysis Report (SSAR), Section 2.3, *Meteorology*. SNC's response to the RAIs is provided in the following Enclosures to this letter.

The SNC contact for this RAI response letter is J. T. Davis at (205) 992-7692.

Mr. J. A. (Buzz) Miller states he is a Vice President of Southern Nuclear Operating Company, is authorized to execute this oath on behalf of Southern Nuclear Operating Company and to the best of his knowledge and belief, the facts set forth in this letter are true.

Respectfully submitted,

SOUTHERN NUCLEAR OPERATING COMPANY

Joseph A. (Buzz) Miller

Sworn to and subscripted before me this 26th *day of* March, *2007*

Dana M. Williams
Notary Public

My commission expires: 12/29/2010

JAM/BJS/dmw

NOTARY PUBLIC STATE OF ALABAMA AT LARGE
MY COMMISSION EXPIRES: Dec 29, 2010
BONDED THRU NOTARY PUBLIC UNDERWRITERS

Enclosures:

1. Response to February 23, 2007 RAI Letter No. 4 for the Vogtle ESP Application
2. Proposed Revision to Affected SSAR Section 2.3 Text, Tables and Figures
3. Westinghouse Letter DCP/NUS0463
4. Pickard, Lowe and Garrick Letter of April 27, 1988
5. Meteorological Input-Output Files on CDROM

cc: Southern Nuclear Operating Company
Mr. J. B. Beasley, Jr., President and CEO (w/o enclosures)
Mr. J. T. Gasser, Executive Vice President, Nuclear Operations (w/o enclosures)
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File AR.01.01.06

Nuclear Regulatory Commission
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Georgia Power Company
Mr. O. C. Harper, Vice President, Resource Planning and Nuclear Development (w/o enclosure)

Oglethorpe Power Corporation
Mr. M. W. Price, Chief Operating Officer (w/o enclosure)

Municipal Electric Authority of Georgia
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Dalton Utilities
Mr. D. Cope, President and Chief Executive Officer (w/o enclosure)

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Mr. R. W. Prunty, Licensing Engineer (w/o enclosures)

Southern Nuclear Operating Company

AR-07-0453

Enclosure 1

Response to February 23, 2007 RAI Letter No 4

for the

Vogtle ESP Application

Section 2.3 Meteorology

2.3.1-1 The response to information need 2.3.1-2 enclosed in Southern Nuclear Operating Company, Inc. (SNC), letter AR-07-0059 (dated January 30, 2007) explains the selection criteria for the regional climatological observing stations used in the site safety analysis report (SSAR) to characterize the regional climatology of the Vogtle early site permit (ESP) site. Please include these selection criteria in a future revision to the ESP application.

Response:

The selection criteria for the climatological observing stations used to characterize conditions in the Vogtle site area and vicinity, as summarized in the referenced response to Information Need (IN) 2.3.1-2 under AR-07-0059, will be addressed in the next revision to SSAR Subsection 2.3.1.1.

In addition, revision to 2.3 will be made based on SNC letter AR-07-0059 (dated January 30, 2007) responses to INs 2.3.1-1, 2.3.1-3, and 2.3.2-5. The revisions include changes to text, tables and figure(s) in SSAR Subsections 2.3.1 and 2.3.2 as shown in Enclosure 2.

2.3.1-2 Part I of SSAR Table 1-1 lists the 100-yr snowpack site characteristic value as 10 lb/sq ft. The Vogtle ESP region experienced its heaviest snowfall event on record from February 9 through February 11, 1973. The highest recorded amount of snow in the Vogtle ESP site vicinity, 22 in., occurred at Bamberg, South Carolina. The Southeast Regional Climate Center (SERCC) states that the liquid equivalent of the snowfall at Bamberg was 7.79 in. Assuming 1 in. of liquid water is equivalent to 5.2 lb/sq ft, the associated snowpack during this event was 40.5 lb/sq ft. Please justify why the 100-yr snowpack of 10 lb/sq ft listed as a site characteristic is conservative enough given the impact from this storm.

Response:

The snowpack site characteristic, listed in Part I of SSAR Table 1-1, refers to SSAR Section 2.3.1.3.4, *Precipitation Extremes*. As described in Section 2.3.1.3.4, the estimated weight of the snowpack was determined in accordance with the guidance in Section C7.0 of the ASCE Standard ASCE/SEI 7-02, *Minimum Design Loads for Buildings and Other Structures*, dated January 2002 **(ASCE 2002).** Both Regulatory Guide 1.70 and Draft Regulatory Guide DG-1145 specify the use of snowpack in determining roof snow loads.

As referenced in Section 7.2 of the ASCE standard, Figure 7-1 shows the VEGP site to be in a region having a ground snow load (snowpack) of 10 lb/sq ft. Furthermore, Section C7, Table C7-1, specifically lists the Augusta National Weather Service location as having a maximum observed ground snow load of 8 lb/sq ft, over a period of record of 40 years. This period of record encompasses the 1973 time frame. As presented in the ASCE standard, the predicted snowload for the Southeastern U.S. (based on actual recorded data) is well below 40.5 lb/sq ft.

SNC believes that the total snow depth and liquid equivalent data for the Bamberg Station is suspect based on a comparison with similar data for other NWS first order and cooperative stations in the vicinity of the VEGP site for this same 1973 snow event. A description for the National Climatic Data Center (NCDC) project "Production of Snowfall and Snow Depth Climatologies for NWS Cooperative Observing Stations" indicates that the TD-3200 data base was utilized in those analyses. Section 1.3 summarizes the three-level quality control (QC) process that the TD-3200 data set were put through in order to obtain the best snowfall and snow depth data possible.

The TD-3200 snowfall total and snow depth record for February 10, 1973 has been assigned a data quality flag of "T" which indicates these values failed an internal consistency check. In the first-level QC check, data values were examined to identify gross errors in the data base and determine whether they should be removed or could be corrected. In the case of concurrent precipitation (rainfall), snowfall, and snow depth values, when it could not be determined which of these elements should be corrected, the values were flagged as suspect and not altered. Hence, the data quality flag "T" indicated above.

The second-level QC check included temporal checks as well as additional inter-element checks. However, the description indicates that precipitation (and temperature) values were not examined for accuracy at that QC level. The reported snowfall total (and snow depth) is likely to be reasonable because the amount recorded is comparable to many of the other stations in the VEGP site area during the same event. However, SNC believes that the daily precipitation total of 6.50 inches on February 10, 1973 at Bamberg, although not flagged as such, is suspect, as this value results in an inordinately high snow density (i.e., ratio of the volume of melted snow to the volume of snow) relative to other stations in the site area. The snowfall totals at the other stations do not have the same data quality flag assigned.

2.3.1-3 (a) The staff considers the "historical maximum dry-bulb temperature with a mean coincident wet-bulb (MCWB) temperature" DCD site parameter to be equivalent to the "100-yr return period maximum dry-bulb temperature with a MCWB temperature" ESP site characteristic. SSAR Table 1.1 presents a 100-year return period maximum dry-bulb temperature as a site characteristic without a corresponding MCWB temperature. Please provide a "100-year return period maximum dry-bulb temperature with a MCWB temperature" as a site characteristic.

Response:

a) As indicated in the AR-07-0059 response to IN - 2.3.1-5, a mean coincident wet-bulb temperature (MCWB) for a 100-year return period cannot, by definition, be determined because the MCWB represents the mean of wet-bulb temperatures that occur when a dry-bulb temperature for a given exceedance probability is recorded in the sequential hourly database used to derive those values.

   Because reliable, sequential hourly meteorological data bases do not exist for durations of 100 years, the 100-year return period dry-bulb temperature value has to be extrapolated and, therefore, would be higher than any of the recorded values in the available data base. Consequently, there would be no occurrences of dry-bulb temperatures to pair with concurrent wet-bulb temperature values and determine an MCWB.

   The previous response to Information Need 2.3.1-5 in letter AR-07-0059 also indicated that formal clarification of the terminology applicable to the temperature-related site parameter values would be requested from Westinghouse, including the basis for determining those values, and that the results of these clarifications would be included in a future revision to the ESP Application. That information has been received from Westinghouse (Enclosure 3 to this letter), such that comparable site characteristic values can be developed. These include:

- <u>Maximum Safety Dry-Bulb and Coincident Wet-Bulb Temperatures</u>. These site parameter limits represent a maximum dry-bulb temperature that exists for 2 hours or more, combined with the maximum wet-bulb temperature that exists in that population of dry-bulb temperatures. In that regard, the term "coincident wet-bulb temperature" is not defined in the same way as the standard NCDC "Engineering Weather Data" and ASHRAE "Climatic Design Information" references (e.g., the MCWB).

The DCD specifies that "[t]he Combined License applicant must provide information to demonstrate that the site parameters are within the limits specified for the standard design". Consistent with the Westinghouse methodology, the highest dry-bulb temperature that persists for at least 2 hours has been determined to be 107.1˚ F from the 30-year, sequential hourly meteorological data set for the NWS station at Augusta, GA. This data set is the same as was used previously to determine the 100-year return period values reported in SSAR Subsection 2.3.1.5 of the SSAR. The highest of the coincident wet-bulb temperatures has been determined to be 80.1˚ F. This dry-bulb / wet-bulb pair will be reported as part of the revised discussion in SSAR Subsection 2.3.1.5.

- Maximum Safety Wet-Bulb Temperature (Non-Coincident). The response provided for IN 2.3.1-6 in SNC letter AR-07-0059 (dated January 30, 2007) indicated that, based on a conversation with Westinghouse, the maximum wet-bulb temperature with a 0.4% annual exceedance probability appeared to correspond most closely to the Maximum Safety Non-Coincident Wet-Bulb Temperature in Table 5.0-1 of the Tier 1 material in the AP1000 DCD.

  However, based on subsequent information provided by Westinghouse (Enclosure 3), this site parameter limit represents a maximum wet-bulb temperature that exists for a duration of 2 hours or more. Similar to the approach described above for determining the Maximum Safety Dry-Bulb Temperature, the highest wet-bulb temperature that persists for at least 2 hours has been determined to be 83.0˚ F from the 30-year, sequential hourly meteorological data set for the Augusta, GA, NWS station.

  This Maximum Safety Wet-Bulb Temperature (Non-Coincident) value determined on this basis will be reported as part of the revised discussion in SSAR Subsection 2.3.1.5.

(b) Please also provide the following site characteristics: (1) maximum normal (1 percent exceedance) dry-bulb temperature and coincident wet-bulb temperature, and (2) maximum normal (1 percent exceedance) noncoincident wet-bulb temperature.

Response:

b) The Westinghouse methodology **(Westinghouse 2007)** for determining the two components of the Maximum Normal Dry-Bulb and Coincident Wet-Bulb Temperatures in DCD Tier 2, Table 2-1, or "maximum normal (1 percent exceedance) dry-bulb temperature and coincident wet-bulb temperature" as expressed in RAI No. 2.3.1-3(b) above, is discussed below.

- Maximum Normal Dry-Bulb and Coincident Wet-Bulb Temperatures. The dry-bulb temperature component of this site parameter pair is represented by a maximum dry-bulb temperature, excluding the highest 1 percent of the data (i.e., the 1 percent exceedance), that exists for 2 hours or more. The wet-bulb temperature component is similarly represented by the highest wet-bulb temperature excluding the highest 1 percent of the data although there is no minimum 2-hour persistence criterion associated with this wet-bulb temperature value.

  Westinghouse considers this a conservative approach to the selection of the maximum normal coincident condition compared to either the mean coincident wet-bulb temperature or the highest wet-bulb temperature coincident with the 1 percent exceedance dry-bulb temperature determined as above. However, in that regard, the term "coincident wet-bulb temperature" is not defined as is traditionally understood.

Nevertheless, the 1 percent exceedance dry-bulb temperature that persists for at least 2 hours can be identified from the 30-year, sequential hourly meteorological data set for the NWS station at Augusta, GA, as can the 1 percent exceedance wet-bulb temperature, for comparison to this site parameter pair in DCD Tier 2, Table 2-1. The 30-year data set is for approximately the same period that encompasses period of the NCDC and ASHRAE references mentioned above. As an alternative, 1 percent exceedance dry-and wet-bulb temperatures, which are readily available in the NCDC and ASHRAE references, would be conservative estimates because the minimum 2-hour persistence criterion is not reflected in those statistics. From the NCDC "Engineering Weather Data" for Augusta Georgia, the 1 percent exceedance dry-and wet-bulb temperatures are 94 ˚F and 78 ˚F, respectively. These the Maximum Normal Dry-Bulb and Coincident Wet-Bulb Temperatures will be reported as part of the revised discussion in SSAR Subsection 2.3.1.5.

Finally, the Westinghouse methodology **(Westinghouse 2007)** for determining the Maximum Normal Wet-Bulb Temperature (Non-Coincident) in DCD Tier 2, Table 2-1, or "maximum normal (1 percent exceedance) noncoincident wet-bulb temperature" as expressed in RAI No. 2.3.1-3(b) above, is discussed below.

- Maximum Normal Wet-Bulb Temperature (Non-Coincident). This site parameter value is represented by a maximum wet-bulb temperature, excluding the highest 1 percent of the data (i.e., the 1 percent exceedance), that exists for 2 hours or more. Similar to the approach above for determining the Maximum Normal Dry-Bulb Temperature, the highest 1 percent exceedance wet-bulb temperature that persists for at least 2 hours can also be identified from the 30-year, sequential hourly meteorological data set for the Augusta, GA, NWS station.

  Alternatively, the 1 percent exceedance wet-bulb temperature is also readily available in the NCDC and ASHRAE references mentioned earlier. Such a value would be a conservative estimate in that the minimum 2-hour persistence criterion is not reflected in those statistics. This value, 78 ˚F, is provided as the Maximum Normal Wet-Bulb Temperature (Non-Coincident) and will be reported as part of the revised discussion in SSAR Subsection 2.3.1.5.

  Reference: **(Westinghouse 2007)** Westinghouse letter DCP/NUS0463, dated March 23, 2007 (Enclosure 3)

2.3.3-1 The response to information need 2.3.3-1 enclosed in SNC letter AR-07-0059 (dated January 30, 2007) states that the 5-yr hourly onsite meteorological database submitted in support of the ESP application is being revised and reformatted in response to questions regarding the meteorological database discussed during a site audit conducted on December 6, 2006. Please provide a copy of this revised hourly onsite meteorological database.

Response:

The revised hourly data will be provided in ASCII format (and as PDF files) on CDROM, which will be sent under separate cover by March 30, 2007. In addition, the tables and figures in the following list that are noted with an asterisk (*) will also accompany the revised hourly data. As a result of this revised data the following Tables and Figures are included in Enclosure 2. These Tables and Figures present the revised meteorological data (e.g., Joint Frequency Distributions and Wind Roses) and the results of the analyses which have been performed using this revised data (e.g., atmospheric dispersion and ground deposition).

SSAR Section 2.3.4.2 PAVAN Modeling Results

- Table 2.3-7 Wind Direction Persistence/Wind Speed Distributions for the VEGP Site – 10-m Level *
- Table 2.3-8 Wind Direction Persistence/Wind Speed Distributions for the VEGP Site – 60-m Level *
- Table 2.3-10 Joint Frequency Distribution of Wind Speed and Wind Direction (10-m Level) by Atmospheric Stability Class for the VEGP Site
- Table 2.3-11 Joint Frequency Distribution of Wind Speed and Wind Direction (60-m Level) by Atmospheric Stability Class for the VEGP Site
- Table 2.3-14 PAVAN Output – X/Q Values at the Dose Calculation EAB
- Table 2.3-15 PAVAN Output – X/Q Values at the LPZ
- Table 2.3-16 Shortest Distances Between the VEGP Units 3 and 4 Power Block Area and Receptors of Interest by Downwind Direction Sector
- Table 2.3-17 XOQDOQ-Predicted Maximum X/Q and D/Q Values at Receptors of Interest
- Table 2.3-18 XOQDOQ-Predicted Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries
- Figures 2.3-2 through 2.3-13 Wind Roses for months and seasons for 10 m and 60 m levels *

* Transmitted under separate cover letter

2.3.3-2 Part II of SSAR Table 1-1 lists postulated design parameters. Please include the proposed natural draft cooling tower height and width as part of this table since this information is used in SSAR Section 2.3.3 to determine the potential impact of the natural draft cooling tower wake effects on the onsite meteorological measurements.

Response:

Table 1-1, Part II (Design Parameters), will be modified to include cooling tower physical dimensions as shown below. These are conceptual design dimensions that were used in SSAR Section 2.3.3 to demonstrate the adequacy of the separation between the cooling towers and the meteorological tower.

Part II Design Parameters		
Item	**Single Unit [Two Unit] Value**	**Description and Reference**
Structures		
Building Height	234 ft 0 in.	The height from finished grade to the top of the tallest power blocks structure, excluding cooling towers (i.e., Containment Building). Refer to Section 2.3.3.3
Building Foundation Embedment	39 ft 6 in. to bottom of basemat from plant grade	The depth from finished grade to the bottom of the basemat for the most deeply embedded power block structure (i.e., Containment/Auxiliary Building). Refer to Sections 2.4.12 and 2.5.4.10
Cooling Tower Height	600 ft	The height is from the finished grade to the top of the cooling tower Refer to Section 2.3.3.3
Cooling Tower Base Diameter	550 ft	The bottom of the cooling tower where it connects to the basin Refer to Section 2.3.3.3
Cooling Tower Diameter at the Top	330 ft	The cooling tower diameter at its highest elevation Refer to Section 2.3.3.3

2.3.4-1 The description and reference for the accident atmospheric dispersion factors listed in SSAR Table 1-1 states, in part: "The atmospheric dispersion values presented represent typical site parameter values by reactor vendors." This appears to be an inaccurate statement. Please verify that accident atmospheric dispersion factors listed in Table 1-1 represent site-specific values.

Response:

Table 1-1, Part I (Atmospheric Dispersion (χ/Q) (Accident)) will be revised, as shown below, to remove the statement "The atmospheric dispersion values presented represent typical site parameter values by reactor vendors."

It should be noted that the χ/Q and D/Q values in Table 1-1 will also be revised as shown below to reflect revised results in SSAR Section 2.3. See RAI 2.3.3-1 for additional information. These revisions will be reflected in the next revision to the ESP application.

Airborne Effluent Release Point		
Atmospheric Dispersion (χ/Q) (Accident)		
0-2 hr @ Exclusion Area Boundary (EAB)	3.49E-04 sec/m^3	The atmospheric dispersion coefficients used in the design safety analysis to estimate dose consequences of accident airborne releases. Refer to Section 2.3.4.2; Table 15-11.
0-8 hr @ Low Population Zone (LPZ)	7.04E-05 sec/m^3	
8-24 hr @ LPZ	5.25E-05 sec/m^3	
1-4 day @ LPZ	2.77E-05 sec/m^3	
4-30 day @ LPZ	1.11E-05 sec/m^3	
Atmospheric Dispersion (χ/Q) (Routine Release)		
Annual Average Undepleted/No Decay χ/Q Value @ EAB	5.5E-06 sec/m^3	The maximum annual average EAB undepleted/no decay atmospheric dispersion factor (χ/Q) value for use in determining gaseous pathway doses to the maximally exposed individual. Refer to Section 2.3.5.2; Table 2.3-17
Annual Average Undepleted/ 2.26-Day Decay χ/Q Value @ EAB	5.5E-06 sec/m^3	The maximum annual average EAB undepleted/2.26-day decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual. Refer to Table 2.3-17

Annual Average Depleted/ 8.00-Day Decay χ/Q Value @ EAB	5.0E-06 sec/m^3	The maximum annual average EAB depleted/8.00-day decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual. Refer to Table 2.3-17
Annual Average D/Q Value @ EAB	1.7E-08 1/m^2	The maximum annual average EAB relative deposition factor (D/Q) value for use in determining gaseous pathway doses to the maximally exposed individual. Refer to Table 2.3-17
Annual Average Undepleted/No Decay χ/Q Value @ Nearest Resident	3.4E-06 sec/m^3	The maximum annual average resident undepleted/no decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual. Refer to Section 2.3.5.2; Table 2.3-17
Annual Average Undepleted/ 2.26-Day Decay χ/Q Value @ Nearest Resident	3.4E-06 sec/m^3	The maximum annual average resident undepleted/2.26-day decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual. Refer to Table 2.3-17
Annual Average Depleted/ 8.00-Day Decay χ/Q Value @ Nearest Resident	3.0E-06 sec/m^3	The maximum annual average resident depleted/8.00-day decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual. Refer to Table 2.3-17
Annual Average D/Q Value @ Nearest Resident	1.08E-08 1/m^2	The maximum annual average resident D/Q value for use in determining gaseous pathway doses to the maximally exposed individual. Refer to Table 2.3-17
Annual Average Undepleted/No Decay χ/Q Value @ Nearest Meat Animal	3.4E-06 sec/m^3	The maximum annual average meat animal undepleted/no decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual. Refer to Section 2.3.5.2; Table 2.3-17

Annual Average Undepleted/ 2.26-Day Decay χ/Q Value @ Nearest Meat Animal	3.4E-06 sec/m^3	The maximum annual average meat animal undepleted/2.26-day decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual. Refer to Table 2.3-17
Annual Average Depleted/ 8.00-Day Decay χ/Q Value @ Nearest Meat Animal	3.0E-06 sec/m^3	The maximum annual average meat animal depleted/8.00-day decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual. Refer to Table 2.3-17
Annual Average D/Q Value @ Nearest Meat Animal	1.0E-08 1/m^2	The maximum annual average meat animal D/Q value for use in determining gaseous pathway doses to the maximally exposed individual. Refer to Table 2.3-17
Annual Average Undepleted/No Decay χ/Q Value @ Nearest Vegetable Garden	3.4E-06 sec/m^3	The maximum annual average vegetable garden undepleted/no decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual. Refer to Table 2.3-17
Annual Average Undepleted/ 2.26-Day Decay χ/Q Value @ Nearest Vegetable Garden	3.4E-06 sec/m^3	The maximum annual average vegetable garden undepleted/2.26-day decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual. Refer to Table 2.3-17
Annual Average Depleted/ 8.00-Day Decay χ/Q Value @ Nearest Vegetable Garden	3.0E-06 sec/m^3	The maximum annual average vegetable garden depleted/8.00-day decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual. Refer to Table 2.3-17
Annual Average D/Q Value @ Nearest Vegetable Garden	1.08E-08 1/m^2	The maximum annual average vegetable garden D/Q value for use in determining gaseous pathway doses to the maximally exposed individual. Refer to Table 2.3-17

2.3.4-2 SSAR Table 1-2 indicates that SSAR Section 2.3.4 is in compliance with the regulatory requirements of Appendix E to 10 CFR Part 50. Please explain how Appendix E to 10 CFR Part 50 is applicable to the development of the short-term (accident releases) atmospheric dispersion site characteristics presented in SSAR Section 2.3.4. Please also revise the SSAR as appropriate.

Response:

SSAR Table 1-2 will be revised to remove 10 CFR 50, Appendix E from SSAR Section 2.3.4. The revised SSAR Table 1-2 will be reflected in the next revision to the ESP application as part of a comprehensive table update as committed to in AR-07-0401, response to RAI 2.1.1-1.

2.3.4-3 SSAR Table 1-2 indicates that SSAR Section 2.3.4 conforms with RG 1.78. Please explain how RG 1.78 is applicable to the development of the short-term (accident releases) atmospheric dispersion site characteristics presented in SSAR Section 2.3.4. Please also revise the SSAR as appropriate.

Response:

Section 2.3.4 of DG-1145 discusses the treatment of atmospheric disposition of hazardous non-radioactive materials. That discussion references RG 1.78. In fact, SSAR Section 2.3.4 does not rely on RG 1.78. The meteorological conditions in the toxic chemical analyses are fully described in SSAR Section 2.2.3.

SSAR Table 1-2 will be revised to remove the reference to RG 1.78. This revised SSAR Table 1-2 will be reflected in the next revision to the ESP Application as part of a comprehensive table update as committed to in SNC letter AR-07-0401, response to RAI 2.1.1-1.

2.3.4-4 Section 2.3.4 of the SSAR states that the 0-2 hr maximum sector-dependent 0.5 percentile χ/Q values are greater than the corresponding overall site 5 percentile χ/Q values at the exclusion area boundary (EAB) and low population zone (LPZ). The staff ran the PAVAN computer code using the PAVAN input files provided during a site audit conducted on December 6, 2006 and found that the overall site 5 percentile χ/Q values at the EAB and LPZ are the limiting values for the site. Please confirm which set of χ/Q values (the maximum sector 0.5 percentile χ/Q values or the overall site 5 percentile χ/Q values) is bounding and revise the SSAR as appropriate.

Response:

Using the joint frequency distributions associated with the revised meteorological data (presented in response to RAI 2.3.3-1) the PAVAN computer program was rerun to obtain the accident χ/Q's for the EAB and the LPZ. The new run showed that the 5 percentile overall site χ/Q's did indeed bound the 0.5 percentile sector dependent χ/Q's. The PAVAN input file for this new run is included in response to RAI 2.3.4-5. Therefore, the 5 percentile overall χ/Q values will be revised in the next revision to SSAR Section 2.3.4.2 as shown in Enclosure 2.

2.3.4-5 The response to information need 2.3.4-1 enclosed in SNC letter AR-07-0059 (dated January 30, 2007) states that the 5-year hourly onsite meteorological data used as part of the ESP Application is being revised and therefore the PAVAN input files will be affected. Please provide a copy of the updated PAVAN input file.

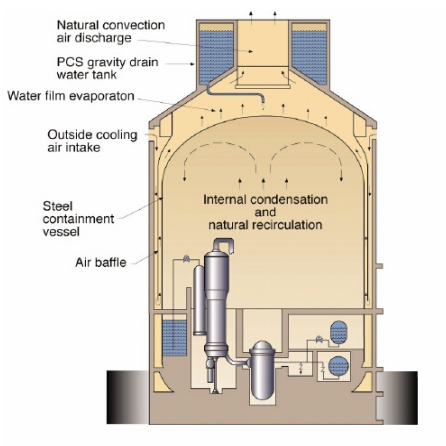
Response:

The new PAVAN input and output files, using the revised meteorological data, is provided on CDROM in Enclosure 5.

2.3.5-1 Please provide the basis for calculation of the containment building minimum cross-sectional area and equivalent structural height, since this information has been used as input to the XOQDOQ computer code to derive the long-term (routine release) atmospheric dispersion estimates presented in SSAR Section 2.3.5. Please also revise the SSAR as appropriate.

Response:

The containment building minimum cross-sectional area contains two parts; the reactor enclosure building plus a PCS water tank on the top. None of the other nearby buildings onsite is included in the calculation.



The height of the entire contiguous building is 234.4 ft (71.4 m) while the bottom (W_B) and the top (W_T) widths of the building are 146.3 ft (44.6 m) and 89 ft (27.1 m), respectively. The height of the PCS is 39.1 ft.

The total calculated cross-sectional area of the structure (A_T) is 31498 ft^2 (2926 m^2). Using this total area, and dividing by the actual building bottom width (146.3 ft), the equivalent structural height is calculated ($H_e = A_T / W_B$) to be 215.2' (65.6 m), assuming that the structure width is uniform in the vertical direction.

These calculated values were input into the XOQDOQ model to predict the required annual average X/Q and D/Q values. SSAR Section 2.3.5 will reflect the details of the above discussion in the next revision to the ESP Application.

2.3.5-2 Are the "8.00 Day Decay" χ/Q values listed in SSAR Table 2.3-17 also "depleted" χ/Q values; that is, are these the χ/Q values that result from assuming the plume travels downwind with dry deposition, as well as decay with a half-life of 8.00 days? Please clarify and revise the SSAR as appropriate.

Response:

SSAR Table 2.3-17 will be revised to show the word "undepleted" in the "No Decay" and "2.26 Day Decay" columns. In the "8 Day Decay" column the word "depleted" will be added. Table 2.3-17 will be revised as shown below.

It should be noted that the χ/Q and D/Q values in Table 2.3-17 will also be revised as shown in Enclosure 2 to reflect revised results in SSAR Section 2.3. The revision is as a result of revised meteorological data and a revised model which places the sensitive receptors (meat animal, vegetable garden, and residence) in all compass directions. The distance is based on the closest of these receptors, which happens to be the nearest residence. Table 2.3-16 will be revised as shown in Enclosure 2. See RAI 2.3.3-1 for additional information on meteorological data.

2.3.5-3 SSAR Table 1-2 indicates that SSAR Section 2.3.5 complies with the regulatory requirements of Appendix E to 10 CFR Part 50. Please explain how Appendix E to 10 CFR Part 50 is applicable to the development of the long-term (routine release) atmospheric dispersion site characteristics presented in SSAR Section 2.3.5.

Response:

SSAR Table 1-2 will be revised to remove 10 CFR 50, Appendix E from SSAR Section 2.3.5. This revised SSAR Table 1-2 will be reflected in the next revision of the ESP Application.

2.3.5-4 The response to information need 2.3.5-1 enclosed in SNC letter AR-07-0059 (dated January 30, 2007) states that the 5-yr hourly onsite meteorological data used as part of the ESP application is being revised and therefore the XOQDOQ input files will be affected. Please provide a copy of the updated XOQDOQ input file.

Response:

The new XOQDOQ input file, using the revised meteorological data, is provided on CDROM in Enclosure 5.

2.3.5-5 Chapter 8 of Revision 21 of the VEGP ODCM (dated October 1, 2003) presents the models used to compute the specific values of meteorological-related parameters that are referenced throughout the VEGP ODCM. ODCM Equations 8.1 and 8.3, which present the algorithms used to calculate χ/Q values for ground-level releases and elevated releases, respectively, both contain terrain recirculations factor (K_r) that were taken from Appendix A of Reference 15 (i.e., Letter to Southern Company Services from Pickard, Lowe, and Garrick, Inc., Washington, DC, April 27, 1988).

(a) Please provide a copy of the terrain recirculation factors used in the VEGP ODCM.

Response:

a) A copy of the subject Pickard, Lowe and Garrick letter is included as Enclosure 4 to this letter. Appendix A to that letter contains the terrain recirculation factors used in the VEGP ODCM.

(b) Please describe the basis for the derivation of these terrain recirculation factors.

Response:

b) A copy of the subject Pickard, Lowe and Garrick letter is included as Enclosure 4 to this letter. Appendix A to that letter contains the terrain recirculation factors used in the VEGP ODCM.

(c) Please justify why the terrain recirculation factors used in the VEGP ODCM should not be used in developing the long-term (routine release) atmospheric dispersion factors presented in SSAR Section 2.3.5.

Response:

c) Terrain recirculation factors were not used in the analyses reported Unit 1 / Unit 2 FSAR and similarly, they have not been used in the analyses which were performed for Units 3 & 4 and reported in the SSAR of the ESP Application. The rationale for not applying the terrain recirculation factors used in VEGP ODCM is provided below:

- Topographical features in the vicinity of the VEGP site have been examined and the dispersion characteristics of the site were discussed in the SSAR Sections 2.3.1, 2.3.2 and 2.3.3. Findings indicate that the site and its vicinity can be characterized as open terrain, with airflow dominated mostly by large-scale weather patterns and occasionally by recirculation of airflow during periods of prolonged atmospheric stagnation.

- Unlike the variable trajectory models, the Gaussian straight-line trajectory model (e.g., XOQDOQ) assumed that a constant mean wind transports and diffuses effluents, within the entire 50 miles, in the direction of airflow at the release point. Since the terrain at the site and its vicinity are gently rolling, a default recirculation factor of 1 as suggested in the XOQDOQ Users Manual was adopted in the original calculation.

- A set of site specific terrain recirculation factors for all the receptor-grid points within the 50-mile modeling domain were developed based on a variable trajectory model and used in the VEGP ODCM. The results of the study indicate that a majority of the recirculation factors are about 1 with a few downwind receptors toward the south and southeast sectors occasionally reaching a factor of 1.5. At and beyond 20 miles from the VEGP site, the XOQDOQ model over-predicts the ground level concentrations (i.e., the recirculation factors fall below a value of 1). These results further support the reasonableness of using a recirculation factor of 1 in making the long-term dispersion estimates.

2.3.5-6 Section II.D of Appendix I to 10 CFR Part 50 requires that gaseous radwaste systems for light-water-cooled nuclear power reactors include all items of reasonably demonstrated technology that, when added to the system sequentially and in order of diminishing cost-benefit return, can, for a favorable cost-benefit ratio, effect reductions in dose to the population reasonably expected to be within 50 mi of the reactor. The COL or CP applicant will be required to perform this demonstration at the COL or CP stage. Please provide annual average χ/Q and D/Q values in all 16 radial sectors from the site boundary to a distance of 50 mi from the proposed facility in accordance with Section 2.3.5 of RS-002.

Response:

Annual average χ/Q and D/Q values in all 16 radial sectors are presented as a function of distance in Enclosure 2. These tables will replace SSAR Table 2.3-18 in the revised ESP Application.

Southern Nuclear Operating Company

AR-07-0453

Enclosure 2

Proposed Revision to Affected SSAR Section 2.3 Text, Tables and Figures

NOTE: This enclosure consists of a 25-page proposed ESP application section.

2.3.4.2 PAVAN Modeling Results

As presented in Table 2.3-14, the maximum 0- to 2-hour, 0.5 percentile, direction-dependent χ/Q value (3.14×10^{-4} sec/m^3) is less than the corresponding 5 percentile overall site χ/Q value (3.49×10^{-4} sec/m^3) at the Dose Calculation EAB. Therefore, the 5 percentile overall site χ/Qs should be used as the proper χ/Qs at the Dose Calculation EAB.

Similarly, Table 2.3-15 shows that the maximum 0- to 2-hour, 0.5 percentile, direction-dependent χ/Q value (1.17×10^{-4} sec/m^3) is less than the corresponding 5 percentile overall site χ/Q value (1.27×10^{-4} sec/m^3) at the LPZ. Therefore, the 5 percentile overall site χ/Qs should be used as the proper χ/Qs at the LPZ.

The maximum χ/Qs presented in Tables 2.3-14 and 2.3-15 for the Dose Calculation EAB and the LPZ, respectively, are summarized below for the 0- to 2-hour time period, the annual average time period, and other intermediate time intervals evaluated by the PAVAN model.

Summary of PAVAN χ/Q Results (5% Limiting Case), 1998–2002 Meteorological Data

Source Location	Receptor Location	0-2 hr (Dir, Dist)	0-8 hr (Dir, Dist)	8-24 hr (Dir, Dist)	1-4 days (Dir, Dist)	4-30 days (Dir, Dist)	Annual (Dir, Dist)
ESP PBAC[a]	Dose Calculation EAB	3.49E-04	2.41E-04	2.00E-04	1.34E-04	7.56E-05	3.74E-05
ESP PBAC[a]	LPZ	1.27E-04 [b]	7.04E-05	5.25E-05	2.77E-05	1.11E-05	3.63E-06

Notes:
a - PBAC = Power Block Area Circle
b - The 0-2 hour χ/Q values are reported here for reference only (not required based on RG 1.145).

Table 2.3-10 Joint Frequency Distribution of Wind Speed and Wind Direction (10-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP10M **Direction:** DI10M **Lapse:** DT60M

Stability Class A Delta Temperature Extremely Unstable

Wind Speed (m/s)

Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	0	0	3	7	38	63	4	0	0	0	0	115
NNE	0	0	2	3	17	48	33	13	0	0	0	0	116
NE	0	0	0	7	6	36	79	17	0	0	0	0	145
ENE	0	0	1	3	13	75	127	30	0	0	0	0	249
E	0	0	0	5	15	77	133	10	0	0	0	0	240
ESE	0	0	1	4	17	66	55	0	0	0	0	0	143
SE	0	1	1	4	11	41	49	5	0	0	0	0	112
SSE	0	0	1	9	2	32	36	2	1	0	0	0	83
S	0	1	0	10	22	42	51	5	0	0	0	0	131
SSW	0	0	2	6	19	59	97	12	0	0	0	0	195
SW	0	0	2	8	18	71	117	20	3	0	0	0	239
WSW	0	0	2	6	23	74	167	26	3	0	0	0	301
W	0	2	0	4	17	79	156	26	2	0	0	0	286
WNW	0	0	0	5	9	39	88	16	3	0	0	0	160
NW	0	0	0	6	9	28	57	14	3	0	0	0	117
NNW	1	0	1	2	6	23	59	1	0	0	0	0	93
Totals	1	4	13	85	211	828	1367	201	15	0	0	0	2725

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	11
Number of Invalid Hours	1633
Number of Valid Hours for this Table	2725
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.3-10 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (10-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP10M **Direction:** DI10M **Lapse:** DT60M

Stability Class B Delta Temperature Moderately Unstable

	Wind Speed (m/s)												
Wind Direction (from)	**0.23 - 0.50**	**0.51 - 0.75**	**0.76 - 1.0**	**1.1 - 1.5**	**1.6 - 2.0**	**2.1 - 3.0**	**3.1 - 5.0**	**5.1 - 7.0**	**7.1 - 10.0**	**10.1 - 13.0**	**13.1 - 18.0**	**> 18.0**	**Total**
N	0	0	1	3	9	39	64	5	0	1	0	0	122
NNE	0	0	0	5	13	38	36	8	2	0	0	0	102
NE	0	1	0	4	7	40	48	7	0	0	0	0	107
ENE	1	0	0	1	11	54	69	23	0	0	0	0	159
E	0	0	0	5	4	44	65	8	0	0	0	0	126
ESE	0	0	1	6	6	31	22	3	0	0	0	0	69
SE	0	0	4	7	8	23	22	1	0	0	0	0	65
SSE	0	0	0	7	14	21	18	1	0	0	0	0	61
S	0	1	0	2	12	30	27	4	0	0	0	0	76
SSW	0	0	0	3	17	53	51	5	2	0	0	0	131
SW	0	0	1	9	18	51	75	19	2	0	0	0	175
WSW	0	0	0	4	7	58	64	18	1	0	0	0	152
W	0	0	0	2	8	60	96	22	3	0	0	0	191
WNW	0	0	0	2	7	37	75	28	4	1	0	0	154
NW	0	0	0	3	5	33	42	12	2	0	0	0	97
NNW	0	0	0	1	11	37	70	4	0	0	0	0	123
Totals	1	2	7	64	157	649	844	168	16	2	0	0	1910

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	44
Number of Invalid Hours	1633
Number of Valid Hours for this Table	1910
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.3-10 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (10-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP10M **Direction:** DI10M **Lapse:** DT60M

Stability Class C Delta Temperature Slightly Unstable

Wind Direction (from)	Wind Speed (m/s) 0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	1	1	8	24	81	84	5	1	0	0	0	205
NNE	0	0	4	6	17	72	72	3	0	0	0	0	174
NE	0	0	0	5	15	60	72	13	0	0	0	0	165
ENE	0	0	3	6	19	74	115	17	0	0	0	0	234
E	0	0	1	9	21	58	105	1	1	0	0	0	196
ESE	0	0	2	9	15	52	44	1	0	0	0	0	123
SE	0	1	2	11	19	43	35	5	1	0	0	0	117
SSE	0	0	2	10	9	28	45	10	1	0	0	0	105
S	0	0	3	8	29	70	47	4	0	0	0	0	161
SSW	0	1	0	7	26	70	84	8	1	0	0	0	197
SW	0	0	0	11	22	74	127	21	3	0	0	0	258
WSW	0	1	0	11	24	94	101	23	1	0	0	0	255
W	0	0	3	10	27	110	138	41	5	0	0	0	334
WNW	0	0	0	8	22	53	71	43	7	0	0	0	204
NW	0	2	1	3	24	68	66	14	4	0	0	0	182
NNW	2	1	2	4	20	81	67	1	0	0	0	0	178
Totals	2	7	24	126	333	1088	1273	210	25	0	0	0	3088

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	114
Number of Invalid Hours	1633
Number of Valid Hours for this Table	3088
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.3-10 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (10-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP10M **Direction:** DI10M **Lapse:** DT60M

Stability Class D Delta Temperature Neutral

	Wind Speed (m/s)												
Wind Direction (from)	**0.23 - 0.50**	**0.51 - 0.75**	**0.76 - 1.0**	**1.1 - 1.5**	**1.6 - 2.0**	**2.1 - 3.0**	**3.1 - 5.0**	**5.1 - 7.0**	**7.1 - 10.0**	**10.1 - 13.0**	**13.1 - 18.0**	**> 18.0**	**Total**
N	0	7	13	78	137	345	215	29	0	0	0	0	824
NNE	2	6	8	72	106	278	209	32	2	0	0	0	715
NE	3	4	15	57	99	342	507	75	1	0	0	0	1103
ENE	1	2	12	61	95	303	454	87	4	1	0	0	1020
E	1	10	18	67	114	268	215	21	3	0	0	0	717
ESE	3	5	14	49	71	165	124	9	0	0	0	0	440
SE	1	16	9	48	80	138	149	39	2	0	0	0	482
SSE	4	9	17	65	96	186	152	18	0	0	0	0	547
S	2	9	14	78	114	240	125	10	0	0	0	0	592
SSW	1	9	21	47	96	229	219	38	3	0	0	0	663
SW	3	3	14	83	117	269	238	40	7	0	0	0	774
WSW	1	8	18	68	141	294	246	53	2	1	0	0	832
W	1	4	11	72	123	269	334	81	16	0	0	0	911
WNW	6	3	19	59	109	222	287	83	14	0	0	0	802
NW	2	4	11	69	97	212	123	31	4	0	0	0	553
NNW	0	3	12	60	98	244	154	17	0	0	0	0	588
Totals	31	102	226	1033	1693	4004	3751	663	58	2	0	0	11563

Number of Calm Hours for this Table	4
Number of Variable Direction Hours for this Table	543
Number of Invalid Hours	1633
Number of Valid Hours for this Table	11563
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.3-10 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (10-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP10M **Direction:** DI10M **Lapse:** DT60M

Stability Class E Delta Temperature Slightly Stable

	Wind Speed (m/s)												
Wind Direction (from)	**0.23 - 0.50**	**0.51 - 0.75**	**0.76 - 1.0**	**1.1 - 1.5**	**1.6 - 2.0**	**2.1 - 3.0**	**3.1 - 5.0**	**5.1 - 7.0**	**7.1 - 10.0**	**10.1 - 13.0**	**13.1 - 18.0**	**> 18.0**	**Total**
N	9	16	26	87	94	154	108	12	1	0	0	0	507
NNE	9	11	37	89	93	224	112	13	1	0	0	0	589
NE	9	20	26	88	124	338	272	23	3	0	0	0	903
ENE	12	14	33	94	149	327	206	29	6	1	0	0	871
E	7	23	38	95	164	330	114	19	2	0	0	0	792
ESE	12	8	50	123	184	246	86	14	0	0	0	0	723
SE	13	21	45	110	184	293	160	9	0	0	0	0	835
SSE	13	25	47	167	250	322	101	8	0	0	0	0	933
S	10	21	60	239	233	271	76	9	1	0	0	0	920
SSW	3	21	43	151	200	272	135	17	1	0	0	0	843
SW	8	18	53	167	245	335	170	13	1	0	0	0	1010
WSW	9	18	40	191	223	266	82	10	1	0	0	0	840
W	5	13	59	127	156	281	169	15	0	0	0	0	825
WNW	9	11	22	113	122	216	185	29	1	0	0	0	708
NW	8	14	27	102	107	147	84	9	1	0	0	0	499
NNW	7	8	21	57	85	128	75	6	2	0	0	0	389
Totals	143	262	627	2000	2613	4150	2135	235	21	1	0	0	12187

Number of Calm Hours for this Table	35
Number of Variable Direction Hours for this Table	396
Number of Invalid Hours	1633
Number of Valid Hours for this Table	12187
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.3-10 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (10-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP10M **Direction:** DI10M **Lapse:** DT60M

Stability Class F Delta Temperature Moderately Stable

	Wind Speed (m/s)												
Wind Direction (from)	**0.23 - 0.50**	**0.51 - 0.75**	**0.76 - 1.0**	**1.1 - 1.5**	**1.6 - 2.0**	**2.1 - 3.0**	**3.1 - 5.0**	**5.1 - 7.0**	**7.1 - 10.0**	**10.1 - 13.0**	**13.1 - 18.0**	**> 18.0**	**Total**
N	11	20	20	56	61	65	15	0	0	0	0	0	248
NNE	16	21	30	62	44	61	25	0	0	0	0	0	259
NE	22	15	24	70	71	97	19	0	0	0	0	0	318
ENE	17	29	27	77	86	162	24	1	0	0	0	0	423
E	16	28	45	103	128	117	5	0	0	0	0	0	442
ESE	16	25	37	94	112	69	2	0	0	0	0	0	355
SE	21	17	35	85	112	52	6	0	0	0	0	0	328
SSE	15	28	30	88	106	65	7	0	0	0	0	0	339
S	12	22	47	143	111	55	0	1	0	0	0	0	391
SSW	20	14	36	138	135	88	10	0	0	0	0	0	441
SW	19	24	36	148	224	99	7	0	0	0	0	0	557
WSW	12	19	47	183	228	110	1	0	0	0	0	0	600
W	10	18	50	169	129	64	9	1	0	0	0	0	450
WNW	10	24	30	103	110	45	11	3	0	0	0	0	336
NW	6	16	21	66	57	34	3	0	0	0	0	0	203
NNW	12	14	18	44	49	38	7	0	0	0	0	0	182
Totals	235	334	533	1629	1763	1221	151	6	0	0	0	0	5872

Number of Calm Hours for this Table	39
Number of Variable Direction Hours for this Table	230
Number of Invalid Hours	1633
Number of Valid Hours for this Table	5872
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.3-10 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (10-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP10M **Direction:** DI10M **Lapse:** DT60M

Stability Class G Delta Temperature Extremely Stable

	Wind Speed (m/s)												
Wind Direction (from)	**0.23 - 0.50**	**0.51 - 0.75**	**0.76 - 1.0**	**1.1 - 1.5**	**1.6 - 2.0**	**2.1 - 3.0**	**3.1 - 5.0**	**5.1 - 7.0**	**7.1 - 10.0**	**10.1 - 13.0**	**13.1 - 18.0**	**> 18.0**	**Total**
N	26	31	49	75	46	18	5	0	0	0	0	0	250
NNE	25	26	34	33	13	16	1	0	1	0	0	0	149
NE	45	30	35	58	24	16	0	0	0	0	0	0	208
ENE	29	26	42	73	61	36	2	0	0	0	0	0	269
E	28	33	55	101	78	30	3	0	0	0	0	0	328
ESE	28	33	56	110	40	17	1	0	0	0	0	0	285
SE	21	31	39	48	48	20	3	0	0	0	0	0	210
SSE	20	34	43	46	36	14	2	0	0	0	0	0	195
S	15	20	41	58	47	22	1	0	1	0	0	0	205
SSW	24	22	56	104	111	49	5	0	0	0	0	0	371
SW	32	34	56	150	203	68	2	0	0	0	0	0	545
WSW	19	38	61	207	170	50	2	0	0	0	0	0	547
W	25	36	78	178	133	42	0	0	0	0	0	0	492
WNW	26	34	43	83	56	14	2	1	0	0	0	0	259
NW	35	32	32	41	21	6	0	0	0	0	0	0	167
NNW	22	25	45	81	28	16	1	0	0	0	0	0	218
Totals	420	485	765	1446	1115	434	30	1	2	0	0	0	4698

Number of Calm Hours for this Table	67
Number of Variable Direction Hours for this Table	432
Number of Invalid Hours	1633
Number of Valid Hours for this Table	4698
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.3-10 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (10-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP10M **Direction:** DI10M **Lapse:** DT60M

Summary of All Stability Classes Delta Temperature

Wind Direction (from)	Wind Speed (m/s) 0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	>18.0	Total
N	46	75	110	310	378	740	554	55	2	1	0	0	2271
NNE	52	64	115	270	303	737	488	69	6	0	0	0	2104
NE	79	70	100	289	346	929	997	135	4	0	0	0	2949
ENE	60	71	118	315	434	1031	997	187	10	2	0	0	3225
E	52	94	157	385	524	924	640	59	6	0	0	0	2841
ESE	59	71	161	395	445	646	334	27	0	0	0	0	2138
SE	56	87	135	313	462	610	424	59	3	0	0	0	2149
SSE	52	96	140	392	513	668	361	39	2	0	0	0	2263
S	39	74	165	538	568	730	327	33	2	0	0	0	2476
SSW	48	67	158	456	604	820	601	80	7	0	0	0	2841
SW	62	79	162	576	847	967	736	113	16	0	0	0	3558
WSW	41	84	168	670	816	946	663	130	8	1	0	0	3527
W	41	73	201	562	593	905	902	186	26	0	0	0	3489
WNW	51	72	114	373	435	626	719	203	29	1	0	0	2623
NW	51	68	92	290	320	528	375	80	14	0	0	0	1818
NNW	44	51	99	249	297	567	433	29	2	0	0	0	1771
Totals	833	1196	2195	6383	7885	12374	9551	1484	137	5	0	0	42043

Number of Calm Hours for this Table 147

Number of Variable Direction Hours for this Table 1770

Number of Invalid Hours 1633

Number of Valid Hours for this Table 42043

Total Hours for the Period 43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.3-11 Joint Frequency Distribution of Wind Speed and Wind Direction (60-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP60M **Direction:** DI60M **Lapse:** DT60M

Stability Class A Delta Temperature Extremely Unstable

Wind Direction (from)	Wind Speed (m/s) 0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	0	0	4	5	22	36	33	6	0	0	0	106
NNE	0	0	0	1	6	24	34	21	9	1	0	0	96
NE	0	0	0	0	4	23	84	88	28	0	0	0	227
ENE	0	0	1	3	7	35	141	71	15	1	0	0	274
E	0	0	0	1	2	31	86	26	2	0	0	0	148
ESE	1	0	0	4	3	19	52	21	1	0	0	0	101
SE	0	0	0	2	2	10	31	7	0	0	0	0	52
SSE	0	0	1	2	4	27	49	14	1	0	0	0	98
S	0	0	2	4	6	15	51	32	8	0	0	0	118
SSW	0	0	0	2	11	27	80	51	23	3	0	0	197
SW	0	0	0	3	14	33	98	110	60	13	0	0	331
WSW	0	1	1	2	9	26	96	104	76	15	5	0	335
W	0	1	0	2	9	34	57	48	46	5	0	0	202
WNW	0	0	1	2	1	12	37	37	12	7	0	0	109
NW	0	0	0	2	10	19	46	30	4	1	2	0	114
NNW	0	0	1	0	5	22	47	33	2	0	0	0	110
Totals	1	2	7	34	98	379	1025	726	293	46	7	0	2618

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	6
Number of Invalid Hours	3217
Number of Valid Hours for this Table	2618
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.3-11 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (60-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP60M **Direction:** DI60M **Lapse:** DT60M

Stability Class B Delta Temperature Moderately Unstable

Wind Direction (from)	Wind Speed (m/s) 0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	0	1	4	4	17	48	20	8	0	0	0	102
NNE	0	0	0	1	5	15	33	22	5	0	0	0	81
NE	0	1	0	4	1	20	60	46	12	0	0	0	144
ENE	0	0	0	2	3	23	67	35	4	0	0	0	134
E	0	0	0	2	3	18	43	21	1	0	0	0	88
ESE	0	0	0	1	2	18	27	10	0	0	0	0	58
SE	0	0	1	0	3	12	20	10	0	0	0	0	46
SSE	0	0	0	3	1	15	19	5	0	0	0	0	43
S	0	0	0	1	4	15	29	11	8	0	0	0	68
SSW	0	0	1	1	1	17	48	22	18	1	1	0	110
SW	0	0	0	0	8	28	80	46	35	4	1	0	202
WSW	0	0	0	1	6	26	73	49	35	7	1	0	198
W	0	0	0	1	6	17	67	48	29	12	0	0	180
WNW	0	0	0	0	3	14	46	26	17	7	2	0	115
NW	0	0	0	2	4	17	52	27	8	1	0	0	111
NNW	0	0	0	0	5	18	53	28	2	0	0	0	106
Totals	0	1	3	23	59	290	765	426	182	32	5	0	1786

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	26
Number of Invalid Hours	3217
Number of Valid Hours for this Table	1786
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.3-11 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (60-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP60M **Direction:** DI60M **Lapse:** DT60M

Stability Class C Delta Temperature Slightly Unstable

	Wind Speed (m/s)												
Wind Direction (from)	**0.23 - 0.50**	**0.51 - 0.75**	**0.76 - 1.0**	**1.1 - 1.5**	**1.6 - 2.0**	**2.1 - 3.0**	**3.1 - 5.0**	**5.1 - 7.0**	**7.1 - 10.0**	**10.1 - 13.0**	**13.1 - 18.0**	**> 18.0**	**Total**
N	0	0	0	2	12	54	80	27	4	0	0	0	179
NNE	1	1	1	3	10	34	62	24	8	0	0	0	144
NE	0	2	0	6	7	36	99	48	6	0	0	0	204
ENE	0	0	2	5	8	45	97	49	8	0	0	0	214
E	0	0	0	6	11	44	100	16	2	1	0	0	180
ESE	0	0	1	6	5	18	34	11	0	1	0	0	76
SE	0	0	1	1	7	19	41	14	2	0	0	0	85
SSE	0	0	0	6	5	26	51	13	6	1	0	0	108
S	0	0	0	4	13	38	63	21	10	0	0	0	149
SSW	0	0	0	4	9	37	85	38	13	3	0	0	189
SW	0	0	2	3	4	49	102	73	34	7	0	0	274
WSW	0	1	0	5	9	52	122	60	41	6	1	0	297
W	0	1	1	1	12	47	111	54	44	11	1	0	283
WNW	0	0	0	4	5	34	69	43	26	12	2	0	195
NW	0	0	1	5	12	40	92	30	5	2	0	0	187
NNW	0	1	3	5	4	46	89	22	5	0	0	0	175
Totals	1	6	12	66	133	619	1297	543	214	44	4	0	2939

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	60
Number of Invalid Hours	3217
Number of Valid Hours for this Table	2939
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.3-11 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (60-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP60M **Direction:** DI60M **Lapse:** DT60M

Stability Class D Delta Temperature Neutral

	Wind Speed (m/s)												
Wind Direction (from)	**0.23 - 0.50**	**0.51 - 0.75**	**0.76 - 1.0**	**1.1 - 1.5**	**1.6 - 2.0**	**2.1 - 3.0**	**3.1 - 5.0**	**5.1 - 7.0**	**7.1 - 10.0**	**10.1 - 13.0**	**13.1 - 18.0**	**> 18.0**	**Total**
N	2	2	1	24	47	152	291	114	39	2	0	0	674
NNE	0	4	9	24	49	129	319	182	62	2	0	0	780
NE	0	3	5	25	42	147	425	382	125	1	0	0	1155
ENE	1	1	8	27	59	158	352	199	47	3	2	0	857
E	1	4	6	24	40	115	237	91	27	1	0	0	546
ESE	2	0	6	21	32	76	134	50	12	2	0	0	335
SE	2	2	9	20	38	72	170	100	41	1	0	0	455
SSE	1	5	7	23	43	114	210	109	22	0	0	0	534
S	1	4	4	29	59	148	233	100	22	3	0	0	603
SSW	2	3	7	19	36	102	231	138	57	12	1	0	608
SW	1	3	6	22	48	135	307	186	111	13	1	0	833
WSW	2	3	6	23	37	149	299	253	155	22	2	0	951
W	0	4	9	24	45	143	286	212	166	46	8	0	943
WNW	0	5	6	26	33	93	189	139	93	21	0	0	605
NW	0	2	11	18	34	122	206	109	31	5	0	0	538
NNW	2	2	5	22	42	158	258	109	45	1	0	0	644
Totals	17	47	105	371	684	2013	4147	2473	1055	135	14	0	11061

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	257
Number of Invalid Hours	3217
Number of Valid Hours for this Table	11061
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.3-11 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (60-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP60M **Direction:** DI60M **Lapse:** DT60M

Stability Class E Delta Temperature Slightly Stable

	Wind Speed (m/s)												
Wind Direction (from)	**0.23 - 0.50**	**0.51 - 0.75**	**0.76 - 1.0**	**1.1 - 1.5**	**1.6 - 2.0**	**2.1 - 3.0**	**3.1 - 5.0**	**5.1 - 7.0**	**7.1 - 10.0**	**10.1 - 13.0**	**13.1 - 18.0**	**> 18.0**	**Total**
N	3	2	7	18	17	91	205	107	21	8	0	0	479
NNE	0	0	3	20	25	93	248	212	58	0	0	0	659
NE	2	1	4	12	32	87	331	373	122	4	0	0	968
ENE	1	1	4	19	31	89	347	277	50	4	3	0	826
E	1	2	4	15	21	82	312	204	27	3	0	0	671
ESE	1	2	6	16	24	71	289	221	24	1	0	0	655
SE	0	1	6	9	16	81	345	215	18	0	0	0	691
SSE	0	4	6	31	48	196	513	163	11	1	0	0	973
S	0	3	5	25	41	179	421	222	29	2	1	0	928
SSW	1	3	6	13	21	90	371	336	57	3	0	0	901
SW	1	4	3	18	27	71	419	368	98	7	0	0	1016
WSW	2	2	2	11	25	64	310	288	106	9	0	0	819
W	3	3	5	13	26	48	253	364	146	10	1	0	872
WNW	2	1	6	11	15	61	170	204	112	9	0	0	591
NW	1	3	3	16	14	60	169	147	41	2	0	0	456
NNW	1	0	8	15	25	61	131	91	17	3	1	0	353
Totals	19	32	78	262	408	1424	4834	3792	937	66	6	0	11858

Number of Calm Hours for this Table	8
Number of Variable Direction Hours for this Table	83
Number of Invalid Hours	3217
Number of Valid Hours for this Table	11858
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.3-11 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (60-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP60M **Direction:** DI60M **Lapse:** DT60M

Stability Class F Delta Temperature Moderately Stable

	Wind Speed (m/s)												
Wind Direction (from)	**0.23 - 0.50**	**0.51 - 0.75**	**0.76 - 1.0**	**1.1 - 1.5**	**1.6 - 2.0**	**2.1 - 3.0**	**3.1 - 5.0**	**5.1 - 7.0**	**7.1 - 10.0**	**10.1 - 13.0**	**13.1 - 18.0**	**> 18.0**	**Total**
N	1	3	1	8	9	39	78	43	8	0	0	0	190
NNE	0	0	1	3	13	39	117	68	15	0	0	0	256
NE	1	2	0	8	9	39	100	156	33	0	0	0	348
ENE	2	1	1	8	16	27	150	174	26	0	0	0	405
E	1	1	2	8	7	30	163	142	2	0	0	0	356
ESE	3	2	1	13	14	44	157	89	3	0	0	0	326
SE	1	1	3	6	15	41	157	85	6	0	0	0	315
SSE	1	2	4	18	27	94	142	94	5	0	0	0	387
S	1	1	11	25	30	80	156	149	8	0	0	0	461
SSW	1	5	3	4	8	47	187	212	28	0	0	0	495
SW	3	1	5	10	15	40	156	280	44	0	0	0	554
WSW	0	0	3	8	11	26	150	242	37	1	0	0	478
W	2	1	4	6	14	29	133	216	49	0	0	0	454
WNW	1	0	2	7	13	31	89	142	31	0	0	0	316
NW	0	0	3	5	8	30	87	80	5	0	0	0	218
NNW	2	2	2	4	9	27	75	51	7	0	0	0	179
Totals	20	22	46	141	218	663	2097	2223	307	1	0	0	5738

Number of Calm Hours for this Table	4
Number of Variable Direction Hours for this Table	14
Number of Invalid Hours	3217
Number of Valid Hours for this Table	5738
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.3-11 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (60-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP60M **Direction:** DI60M **Lapse:** DT60M

Stability Class G Delta Temperature Extremely Stable

	Wind Speed (m/s)												
Wind Direction (from)	**0.23 - 0.50**	**0.51 - 0.75**	**0.76 - 1.0**	**1.1 - 1.5**	**1.6 - 2.0**	**2.1 - 3.0**	**3.1 - 5.0**	**5.1 - 7.0**	**7.1 - 10.0**	**10.1 - 13.0**	**13.1 - 18.0**	**> 18.0**	**Total**
N	2	2	4	10	16	32	69	17	0	0	1	0	153
NNE	2	2	2	12	15	56	86	17	1	0	0	0	193
NE	1	1	7	15	22	37	90	55	7	0	0	0	235
ENE	0	3	8	13	12	40	118	88	20	0	0	0	302
E	0	4	3	9	13	24	123	97	10	0	0	0	283
ESE	2	2	5	7	8	28	111	72	1	0	0	0	236
SE	1	1	4	9	20	38	90	43	2	0	0	0	208
SSE	1	2	7	17	29	76	82	39	4	0	0	0	257
S	1	1	7	18	33	70	113	94	27	0	0	0	364
SSW	1	3	5	13	12	34	135	172	45	0	0	0	420
SW	1	0	2	9	13	43	147	171	58	0	0	0	444
WSW	4	1	2	7	15	41	103	216	37	0	0	0	426
W	4	5	3	12	15	47	126	159	33	0	0	0	404
WNW	1	3	3	8	10	41	102	90	11	0	0	0	269
NW	1	1	6	11	12	47	98	50	4	0	0	0	230
NNW	0	0	3	8	16	44	57	31	2	0	0	0	161
Totals	22	31	71	178	261	698	1650	1411	262	0	1	0	4585

Number of Calm Hours for this Table	9
Number of Variable Direction Hours for this Table	42
Number of Invalid Hours	3217
Number of Valid Hours for this Table	4585
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.3-11 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (60-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP60M **Direction:** DI60M **Lapse:** DT60M

Summary of All Stability Classes Delta Temperature

	Wind Speed (m/s)												
Wind Direction (from)	**0.23 - 0.50**	**0.51 - 0.75**	**0.76 - 1.0**	**1.1 - 1.5**	**1.6 - 2.0**	**2.1 - 3.0**	**3.1 - 5.0**	**5.1 - 7.0**	**7.1 - 10.0**	**10.1 - 13.0**	**13.1 - 18.0**	**> 18.0**	**Total**
N	8	9	14	70	110	407	807	361	86	10	1	0	1883
NNE	3	7	16	64	123	390	899	546	158	3	0	0	2209
NE	4	10	16	70	117	389	1189	1148	333	5	0	0	3281
ENE	4	6	24	77	136	417	1272	893	170	8	5	0	3012
E	3	11	15	65	97	344	1064	597	71	5	0	0	2272
ESE	9	6	19	68	88	274	804	474	41	4	0	0	1787
SE	4	5	24	47	101	273	854	474	69	1	0	0	1852
SSE	3	13	25	100	157	548	1066	437	49	2	0	0	2400
S	3	9	29	106	186	545	1066	629	112	5	1	0	2691
SSW	5	14	22	56	98	354	1137	969	241	22	2	0	2920
SW	6	8	18	65	129	399	1309	1234	440	44	2	0	3654
WSW	8	8	14	57	112	384	1153	1212	487	60	9	0	3504
W	9	15	22	59	127	365	1033	1101	513	84	10	0	3338
WNW	4	9	18	58	80	286	702	681	302	56	4	0	2200
NW	2	6	24	59	94	335	750	473	98	11	2	0	1854
NNW	5	5	22	54	106	376	710	365	80	4	1	0	1728
Totals	80	141	322	1075	1861	6086	1581	5115	94 3250	324	37	0	40585

Number of Calm Hours for this Table	21
Number of Variable Direction Hours for this Table	488
Number of Invalid Hours	3217
Number of Valid Hours for this Table	40585
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.3-14 PAVAN Output – X/Q Values at the Dose Calculation EAB

```
/PLANT NAME: Vogtle COL                          METEOROLOGICAL INSTRUMENTATION
 DATA PERIOD: 1998-2002 JFD                      WIND SENSORS HEIGHT:   10 m
 TYPE OF RELEASE: Ground-Level Release           DELTA-T HEIGHTS: 10 m - 60 m
 SOURCE OF DATA: Onsite
 COMMENTS: Accidental Releases
 PROGRAM: PAVAN, 10/76, 8/79 REVISION, IMPLEMENTATION OF REGULATORY GUIDE 1.145
0                                    RELATIVE CONCENTRATION (X/Q) VALUES (SEC/CUBIC METER)
                                                        VERSUS                                  HOURS PER YEAR MAX
                                                   AVERAGING TIME                                    0-2 HR X/Q IS
 DOWNWIND DISTANCE                                                                                  EXCEEDED  DOWNWIND
 SECTOR   (METERS)        0-2 HOURS      0-8 HOURS     8-24 HOURS       1-4 DAYS      4-30 DAYS ANNUAL AVERAGE IN SECTOR    SECTOR
      S      800.         2.53E-04       1.69E-04       1.38E-04       8.89E-05       4.73E-05       2.19E-05      29.9         S
    SSW      800.         2.22E-04       1.49E-04       1.21E-04       7.84E-05       4.18E-05       1.94E-05     530.6       SSW
     SW      800.         2.59E-04       1.77E-04       1.46E-04       9.61E-05       5.29E-05       2.54E-05      34.4        SW
    WSW      800.         2.67E-04       1.82E-04       1.50E-04       9.95E-05       5.49E-05       2.65E-05      32.5       WSW
      W      800.         2.88E-04       1.97E-04       1.63E-04       1.08E-04       5.94E-05       2.88E-05      36.9         W
    WNW      800.         2.85E-04       1.92E-04       1.57E-04       1.02E-04       5.52E-05       2.59E-05      36.4       WNW
     NW      800.         2.47E-04       1.67E-04       1.37E-04       8.97E-05       4.87E-05       2.30E-05      30.0        NW
    NNW      800.         2.45E-04       1.67E-04       1.38E-04       9.16E-05       5.06E-05       2.45E-05      29.3       NNW
      N      800.         2.42E-04       1.67E-04       1.39E-04       9.26E-05       5.20E-05       2.57E-05      25.6         N
    NNE      800.         2.78E-04       1.92E-04       1.59E-04       1.06E-04       5.92E-05       2.91E-05      34.1       NNE
     NE      800.         3.14E-04       2.21E-04       1.85E-04       1.26E-04       7.30E-05       3.73E-05      43.7        NE
    ENE      800.         2.95E-04       2.10E-04       1.77E-04       1.22E-04       7.18E-05       3.74E-05      36.7       ENE
      E      800.         3.03E-04       2.11E-04       1.77E-04       1.19E-04       6.82E-05       3.43E-05      40.1         E
    ESE      800.         2.59E-04       1.75E-04       1.44E-04       9.45E-05       5.14E-05       2.44E-05      31.2       ESE
     SE      800.         2.11E-04       1.42E-04       1.16E-04       7.51E-05       4.03E-05       1.88E-05      26.5        SE
    SSE      800.         2.39E-04       1.56E-04       1.26E-04       7.91E-05       4.07E-05       1.80E-05      26.6       SSE
 MAX X/Q                  3.14E-04                                                   TOTAL HOURS AROUND SITE:   *****

 SRP 2.3.4   800.         1.86E-03       9.75E-04       7.06E-04       3.50E-04       1.28E-04       3.74E-05
 SITE LIMIT               3.49E-04       2.41E-04       2.00E-04       1.34E-04       7.56E-05       3.74E-05
0THE FIVE-PERCENT-FOR-THE-ENTIRE-SITE X/Q IS LIMITING.
0**NOTE**: VALUES ON THIS PAGE ARE APPROXIMATIONS ONLY.
           CHECK THE REASONABLENESS OF THE ENVELOPES
           COMPUTED FOR THE 0-2 HOUR VALUES.  FOR ANY
             FAULTY ENVELOPES, ADJUST THE ABOVE VALUES.
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Table 2.3-15 PAVAN Output – X/Q Values at the LPZ

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/PLANT NAME: Vogtle COL                          METEOROLOGICAL INSTRUMENTATION
 DATA PERIOD: 1998-2002 JFD                      WIND SENSORS HEIGHT:   10 m
 TYPE OF RELEASE: Ground-Level Release           DELTA-T HEIGHTS: 10 m - 60 m
 SOURCE OF DATA: Onsite
 COMMENTS: Accidental Releases
 PROGRAM: PAVAN, 10/76, 8/79 REVISION, IMPLEMENTATION OF REGULATORY GUIDE 1.145
0                                    RELATIVE CONCENTRATION (X/Q) VALUES (SEC/CUBIC METER)
                                                        VERSUS                                  HOURS PER YEAR MAX
                                                   AVERAGING TIME                                    0-2 HR X/Q IS
 DOWNWIND DISTANCE                                                                                  EXCEEDED  DOWNWIND
 SECTOR   (METERS)        0-2 HOURS      0-8 HOURS     8-24 HOURS       1-4 DAYS      4-30 DAYS ANNUAL AVERAGE IN SECTOR    SECTOR
      S     2304.         8.95E-05       4.82E-05       3.54E-05       1.81E-05       6.89E-06       2.12E-06      29.6         S
    SSW     2304.         7.42E-05       4.04E-05       2.98E-05       1.54E-05       5.97E-06       1.87E-06     502.4       SSW
     SW     2304.         8.94E-05       4.94E-05       3.67E-05       1.93E-05       7.64E-06       2.47E-06      32.2        SW
    WSW     2304.         9.17E-05       5.08E-05       3.78E-05       1.99E-05       7.92E-06       2.57E-06      29.5       WSW
      W     2304.         1.02E-04       5.61E-05       4.17E-05       2.19E-05       8.66E-06       2.79E-06      34.5         W
    WNW     2304.         1.03E-04       5.56E-05       4.09E-05       2.10E-05       8.10E-06       2.52E-06      34.9       WNW
     NW     2304.         8.52E-05       4.67E-05       3.45E-05       1.80E-05       7.04E-06       2.24E-06      28.3        NW
    NNW     2304.         8.53E-05       4.72E-05       3.51E-05       1.85E-05       7.36E-06       2.38E-06      28.5       NNW
      N     2304.         8.32E-05       4.66E-05       3.48E-05       1.86E-05       7.52E-06       2.49E-06      24.1         N
    NNE     2304.         1.00E-04       5.55E-05       4.13E-05       2.18E-05       8.68E-06       2.82E-06      32.8       NNE
     NE     2304.         1.11E-04       6.28E-05       4.73E-05       2.56E-05       1.06E-05       3.61E-06      39.5        NE
    ENE     2304.         1.17E-04       6.59E-05       4.95E-05       2.65E-05       1.08E-05       3.63E-06      43.7       ENE
      E     2304.         1.15E-04       6.40E-05       4.78E-05       2.53E-05       1.01E-05       3.32E-06      42.3         E
    ESE     2304.         9.13E-05       4.99E-05       3.69E-05       1.92E-05       7.48E-06       2.36E-06      29.4       ESE
     SE     2304.         7.34E-05       3.98E-05       2.94E-05       1.51E-05       5.83E-06       1.82E-06      25.8        SE
    SSE     2304.         8.49E-05       4.47E-05       3.24E-05       1.61E-05       5.92E-06       1.74E-06      26.6       SSE
 MAX X/Q                  1.17E-04                                                   TOTAL HOURS AROUND SITE:   984.3

 SRP 2.3.4  2304.         3.47E-04       1.63E-04       1.12E-04       4.94E-05       1.53E-05       3.63E-06
 SITE LIMIT               1.27E-04       7.04E-05       5.25E-05       2.77E-05       1.11E-05       3.63E-06
0THE FIVE-PERCENT-FOR-THE-ENTIRE-SITE X/Q IS LIMITING.
```

Table 2.3-16 Shortest Distances Between the VEGP Units 3 and 4 Power Block Area and Receptors of Interest by Downwind Direction Sector [a]

Direction	Meat Animal	Residence	Vegetable Garden	EAB
N	1071	1071	1071	800
NNE	1071	1071	1071	800
NE	1071	1071	1071	800
ENE	1071	1071	1071	800
E	1071	1071	1071	800
ESE	1071	1071	1071	800
SE	1071	1071	1071	800
SSE	1071	1071	1071	800
S	1071	1071	1071	800
SSW	1071	1071	1071	800
SW	1071	1071	1071	800
WSW	1071	1071	1071	800
W	1071	1071	1071	800
WNW	1071	1071	1071	800
NW	1071	1071	1071	800
NNW	1071	1071	1071	800

Notes:

a – Distances shown are in meters.

b – EAB = Exclusion Area Boundary.

c – There are no milk-giving animals (i.e., cows, goats) within a 5-mile radius of the VEGP Units 3 and 4 Site.

Table 2.3-17 XOQDOQ-Predicted Maximum X/Q and D/Q Values at Receptors of Interest

Type of Location	Direction from Site	Distance (miles)	X/Q (sec/m^3) (No Decay) (Undepleted)	X/Q (sec/m^3) (2.26 Day Decay) (Undepleted)	X/Q (sec/m3) (8 Day Decay) (Depleted)	D/Q (1/m^2)
Residence	NE	0.67	3.4E-06	3.4E-06	3.0E-06	1.0E-08#
Dose Calculation EAB	NE	0.5	5.5E-06	5.5E-06	5.0E-06	1.7E-08+
Meat Animal	NE	0.67	3.4E-06	3.4E-06	3.0E-06	1.0E-08#
Vegetable Garden	NE	0.67	3.4E-06	3.4E-06	3.0E-06	1.0E-08#

Notes: + NE and ENE * ENE and E # NE, ENE and E - WSW

Table 2.3-18 XOQDOQ-Predicted Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

No Decay X/Qs at Various Distances

EXIT ONE - GROUND LEVEL RELEASE - NO PURGE RELEASES
NO DECAY, UNDEPLETED
0ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	1.097E-05	3.306E-06	1.697E-06	1.088E-06	6.032E-07	3.998E-07	2.971E-07	2.339E-07	1.912E-07	1.606E-07	1.377E-07
SSW	9.903E-06	2.986E-06	1.546E-06	9.958E-07	5.570E-07	3.707E-07	2.750E-07	2.160E-07	1.762E-07	1.478E-07	1.265E-07
SW	1.326E-05	3.993E-06	2.063E-06	1.328E-06	7.408E-07	4.926E-07	3.660E-07	2.881E-07	2.353E-07	1.976E-07	1.694E-07
WSW	1.342E-05	4.026E-06	2.076E-06	1.336E-06	7.479E-07	4.982E-07	3.702E-07	2.912E-07	2.378E-07	1.996E-07	1.711E-07
W	1.421E-05	4.237E-06	2.168E-06	1.392E-06	7.796E-07	5.201E-07	3.877E-07	3.059E-07	2.504E-07	2.106E-07	1.808E-07
WNW	1.282E-05	3.803E-06	1.947E-06	1.251E-06	7.014E-07	4.684E-07	3.498E-07	2.764E-07	2.266E-07	1.908E-07	1.639E-07
NW	1.157E-05	3.450E-06	1.790E-06	1.156E-06	6.516E-07	4.357E-07	3.241E-07	2.552E-07	2.086E-07	1.751E-07	1.502E-07
NNW	1.210E-05	3.626E-06	1.899E-06	1.231E-06	6.940E-07	4.637E-07	3.443E-07	2.706E-07	2.208E-07	1.852E-07	1.586E-07
N	1.239E-05	3.719E-06	1.951E-06	1.266E-06	7.147E-07	4.779E-07	3.543E-07	2.781E-07	2.266E-07	1.898E-07	1.624E-07
NNE	1.424E-05	4.240E-06	2.171E-06	1.395E-06	7.821E-07	5.221E-07	3.892E-07	3.071E-07	2.515E-07	2.115E-07	1.816E-07
NE	1.832E-05	5.438E-06	2.773E-06	1.778E-06	9.945E-07	6.633E-07	4.952E-07	3.914E-07	3.208E-07	2.702E-07	2.322E-07
ENE	1.781E-05	5.295E-06	2.696E-06	1.728E-06	9.670E-07	6.451E-07	4.816E-07	3.805E-07	3.119E-07	2.626E-07	2.257E-07
E	1.645E-05	4.895E-06	2.488E-06	1.591E-06	8.856E-07	5.890E-07	4.395E-07	3.473E-07	2.847E-07	2.397E-07	2.060E-07
ESE	1.211E-05	3.630E-06	1.865E-06	1.198E-06	6.685E-07	4.449E-07	3.310E-07	2.607E-07	2.132E-07	1.791E-07	1.537E-07
SE	9.657E-06	2.893E-06	1.486E-06	9.531E-07	5.289E-07	3.509E-07	2.611E-07	2.058E-07	1.684E-07	1.415E-07	1.215E-07
SSE	9.037E-06	2.711E-06	1.382E-06	8.836E-07	4.892E-07	3.242E-07	2.413E-07	1.903E-07	1.558E-07	1.310E-07	1.125E-07

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	1.201E-07	7.112E-08	4.917E-08	2.936E-08	2.045E-08	1.546E-08	1.232E-08	1.018E-08	8.626E-09	7.459E-09	6.552E-09
SSW	1.102E-07	6.491E-08	4.471E-08	2.655E-08	1.841E-08	1.388E-08	1.103E-08	9.093E-09	7.694E-09	6.642E-09	5.826E-09
SW	1.477E-07	8.727E-08	6.025E-08	3.589E-08	2.493E-08	1.883E-08	1.498E-08	1.236E-08	1.046E-08	9.039E-09	7.932E-09
WSW	1.492E-07	8.812E-08	6.081E-08	3.621E-08	2.515E-08	1.899E-08	1.511E-08	1.246E-08	1.055E-08	9.113E-09	7.996E-09
W	1.579E-07	9.376E-08	6.494E-08	3.885E-08	2.707E-08	2.048E-08	1.632E-08	1.348E-08	1.143E-08	9.884E-09	8.682E-09
WNW	1.432E-07	8.529E-08	5.918E-08	3.548E-08	2.475E-08	1.875E-08	1.495E-08	1.236E-08	1.048E-08	9.067E-09	7.967E-09
NW	1.309E-07	7.737E-08	5.339E-08	3.178E-08	2.206E-08	1.664E-08	1.323E-08	1.091E-08	9.232E-09	7.971E-09	6.992E-09
NNW	1.381E-07	8.131E-08	5.597E-08	3.318E-08	2.297E-08	1.730E-08	1.373E-08	1.130E-08	9.553E-09	8.239E-09	7.221E-09
N	1.413E-07	8.295E-08	5.697E-08	3.369E-08	2.328E-08	1.751E-08	1.388E-08	1.142E-08	9.644E-09	8.313E-09	7.281E-09
NNE	1.585E-07	9.419E-08	6.524E-08	3.904E-08	2.720E-08	2.058E-08	1.640E-08	1.355E-08	1.149E-08	9.932E-09	8.724E-09
NE	2.029E-07	1.209E-07	8.394E-08	5.038E-08	3.517E-08	2.666E-08	2.127E-08	1.759E-08	1.492E-08	1.291E-08	1.135E-08
ENE	1.971E-07	1.174E-07	8.150E-08	4.889E-08	3.413E-08	2.586E-08	2.064E-08	1.706E-08	1.447E-08	1.253E-08	1.101E-08
E	1.800E-07	1.073E-07	7.453E-08	4.477E-08	3.129E-08	2.373E-08	1.895E-08	1.568E-08	1.331E-08	1.152E-08	1.013E-08
ESE	1.341E-07	7.943E-08	5.492E-08	3.279E-08	2.282E-08	1.725E-08	1.374E-08	1.134E-08	9.613E-09	8.310E-09	7.297E-09
SE	1.060E-07	6.292E-08	4.357E-08	2.607E-08	1.818E-08	1.376E-08	1.097E-08	9.066E-09	7.689E-09	6.652E-09	5.845E-09
SSE	9.818E-08	5.836E-08	4.046E-08	2.425E-08	1.693E-08	1.283E-08	1.024E-08	8.467E-09	7.186E-09	6.220E-09	5.468E-09

Table 2.3-18 (cont.) XOQDOQ-Predicted Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

No Decay X/Qs at Various Segments

EXIT ONE - GROUND LEVEL RELEASE - NO PURGE RELEASES
NO DECAY, UNDEPLETED
0CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

	SEGMENT BOUNDARIES IN MILES FROM THE SITE									
DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	1.784E-06	6.205E-07	2.992E-07	1.917E-07	1.380E-07	7.225E-08	2.980E-08	1.554E-08	1.020E-08	7.469E-09
SSW	1.621E-06	5.717E-07	2.769E-07	1.767E-07	1.268E-07	6.600E-08	2.697E-08	1.395E-08	9.115E-09	6.651E-09
SW	2.165E-06	7.609E-07	3.686E-07	2.360E-07	1.697E-07	8.868E-08	3.643E-08	1.892E-08	1.238E-08	9.051E-09
WSW	2.181E-06	7.677E-07	3.727E-07	2.385E-07	1.714E-07	8.955E-08	3.676E-08	1.908E-08	1.249E-08	9.125E-09
W	2.283E-06	8.003E-07	3.903E-07	2.511E-07	1.812E-07	9.519E-08	3.941E-08	2.057E-08	1.351E-08	9.897E-09
WNW	2.050E-06	7.200E-07	3.521E-07	2.272E-07	1.642E-07	8.656E-08	3.598E-08	1.883E-08	1.238E-08	9.079E-09
NW	1.877E-06	6.678E-07	3.263E-07	2.092E-07	1.504E-07	7.861E-08	3.226E-08	1.672E-08	1.093E-08	7.982E-09
NNW	1.986E-06	7.111E-07	3.467E-07	2.215E-07	1.589E-07	8.267E-08	3.371E-08	1.738E-08	1.133E-08	8.251E-09
N	2.039E-06	7.319E-07	3.568E-07	2.273E-07	1.627E-07	8.438E-08	3.424E-08	1.760E-08	1.145E-08	8.325E-09
NNE	2.286E-06	8.027E-07	3.918E-07	2.521E-07	1.819E-07	9.562E-08	3.960E-08	2.068E-08	1.358E-08	9.945E-09
NE	2.923E-06	1.021E-06	4.985E-07	3.217E-07	2.326E-07	1.227E-07	5.108E-08	2.677E-08	1.763E-08	1.293E-08
ENE	2.843E-06	9.930E-07	4.847E-07	3.127E-07	2.260E-07	1.192E-07	4.958E-08	2.598E-08	1.710E-08	1.254E-08
E	2.624E-06	9.106E-07	4.425E-07	2.854E-07	2.064E-07	1.089E-07	4.539E-08	2.383E-08	1.571E-08	1.154E-08
ESE	1.961E-06	6.867E-07	3.333E-07	2.138E-07	1.540E-07	8.068E-08	3.328E-08	1.733E-08	1.137E-08	8.321E-09
SE	1.562E-06	5.440E-07	2.629E-07	1.688E-07	1.217E-07	6.390E-08	2.645E-08	1.382E-08	9.086E-09	6.660E-09
SSE	1.456E-06	5.035E-07	2.430E-07	1.562E-07	1.127E-07	5.925E-08	2.460E-08	1.289E-08	8.486E-09	6.228E-09

Table 2.3-18 (cont.) XOQDOQ-Predicted Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

D/Qs at Various Distances

EXIT ONE - GROUND LEVEL RELEASE - NO PURGE RELEASES

********** RELATIVE DEPOSITION PER UNIT AREA (M**-2) AT FIXED POINTS BY DOWNWIND SECTORS **********

DIRECTION	DISTANCES IN MILES										
FROM SITE	.25	.50	.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
S	3.128E-08	1.058E-08	5.431E-09	3.335E-09	1.663E-09	1.008E-09	6.817E-10	4.940E-10	3.756E-10	2.959E-10	2.396E-10
SSW	2.900E-08	9.807E-09	5.035E-09	3.092E-09	1.541E-09	9.348E-10	6.321E-10	4.580E-10	3.483E-10	2.744E-10	2.221E-10
SW	4.066E-08	1.375E-08	7.059E-09	4.334E-09	2.161E-09	1.311E-09	8.861E-10	6.421E-10	4.882E-10	3.847E-10	3.114E-10
WSW	4.440E-08	1.502E-08	7.710E-09	4.734E-09	2.360E-09	1.431E-09	9.678E-10	7.013E-10	5.333E-10	4.201E-10	3.401E-10
W	3.911E-08	1.323E-08	6.791E-09	4.170E-09	2.079E-09	1.261E-09	8.525E-10	6.177E-10	4.697E-10	3.701E-10	2.996E-10
WNW	2.948E-08	9.971E-09	5.119E-09	3.143E-09	1.567E-09	9.505E-10	6.426E-10	4.657E-10	3.541E-10	2.790E-10	2.258E-10
NW	2.963E-08	1.002E-08	5.145E-09	3.159E-09	1.575E-09	9.552E-10	6.458E-10	4.680E-10	3.559E-10	2.804E-10	2.270E-10
NNW	3.119E-08	1.055E-08	5.415E-09	3.325E-09	1.658E-09	1.005E-09	6.797E-10	4.925E-10	3.745E-10	2.951E-10	2.389E-10
N	3.408E-08	1.152E-08	5.917E-09	3.633E-09	1.811E-09	1.099E-09	7.427E-10	5.382E-10	4.092E-10	3.224E-10	2.610E-10
NNE	3.910E-08	1.322E-08	6.789E-09	4.169E-09	2.078E-09	1.260E-09	8.522E-10	6.175E-10	4.696E-10	3.699E-10	2.995E-10
NE	4.897E-08	1.656E-08	8.503E-09	5.221E-09	2.603E-09	1.579E-09	1.067E-09	7.735E-10	5.882E-10	4.634E-10	3.751E-10
ENE	4.850E-08	1.640E-08	8.422E-09	5.171E-09	2.578E-09	1.564E-09	1.057E-09	7.661E-10	5.825E-10	4.589E-10	3.715E-10
E	4.798E-08	1.622E-08	8.330E-09	5.115E-09	2.550E-09	1.547E-09	1.046E-09	7.578E-10	5.762E-10	4.539E-10	3.675E-10
ESE	3.612E-08	1.221E-08	6.271E-09	3.851E-09	1.920E-09	1.164E-09	7.872E-10	5.704E-10	4.338E-10	3.417E-10	2.766E-10
SE	2.507E-08	8.478E-09	4.353E-09	2.673E-09	1.333E-09	8.082E-10	5.464E-10	3.960E-10	3.011E-10	2.372E-10	1.920E-10
SSE	2.440E-08	8.252E-09	4.237E-09	2.602E-09	1.297E-09	7.867E-10	5.319E-10	3.854E-10	2.931E-10	2.309E-10	1.869E-10

DIRECTION	DISTANCES IN MILES										
FROM SITE	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
S	1.982E-10	9.712E-11	6.094E-11	3.080E-11	1.864E-11	1.250E-11	8.956E-12	6.725E-12	5.229E-12	4.177E-12	3.409E-12
SSW	1.837E-10	9.004E-11	5.650E-11	2.856E-11	1.728E-11	1.159E-11	8.304E-12	6.235E-12	4.848E-12	3.873E-12	3.161E-12
SW	2.576E-10	1.262E-10	7.920E-11	4.003E-11	2.423E-11	1.625E-11	1.164E-11	8.741E-12	6.796E-12	5.429E-12	4.431E-12
WSW	2.813E-10	1.379E-10	8.651E-11	4.372E-11	2.646E-11	1.774E-11	1.271E-11	9.547E-12	7.423E-12	5.930E-12	4.840E-12
W	2.478E-10	1.214E-10	7.620E-11	3.851E-11	2.331E-11	1.563E-11	1.120E-11	8.409E-12	6.538E-12	5.223E-12	4.263E-12
WNW	1.868E-10	9.155E-11	5.744E-11	2.903E-11	1.757E-11	1.178E-11	8.442E-12	6.339E-12	4.929E-12	3.937E-12	3.214E-12
NW	1.877E-10	9.200E-11	5.773E-11	2.918E-11	1.766E-11	1.184E-11	8.484E-12	6.371E-12	4.954E-12	3.957E-12	3.230E-12
NNW	1.976E-10	9.683E-11	6.075E-11	3.071E-11	1.859E-11	1.246E-11	8.929E-12	6.705E-12	5.213E-12	4.164E-12	3.399E-12
N	2.159E-10	1.058E-10	6.639E-11	3.356E-11	2.031E-11	1.362E-11	9.757E-12	7.327E-12	5.697E-12	4.551E-12	3.714E-12
NNE	2.477E-10	1.214E-10	7.617E-11	3.850E-11	2.330E-11	1.562E-11	1.120E-11	8.406E-12	6.536E-12	5.221E-12	4.262E-12
NE	3.103E-10	1.521E-10	9.541E-11	4.823E-11	2.919E-11	1.957E-11	1.402E-11	1.053E-11	8.187E-12	6.540E-12	5.338E-12
ENE	3.073E-10	1.506E-10	9.450E-11	4.776E-11	2.891E-11	1.938E-11	1.389E-11	1.043E-11	8.109E-12	6.477E-12	5.287E-12
E	3.040E-10	1.490E-10	9.347E-11	4.724E-11	2.859E-11	1.917E-11	1.374E-11	1.032E-11	8.021E-12	6.407E-12	5.229E-12
ESE	2.288E-10	1.121E-10	7.036E-11	3.557E-11	2.153E-11	1.443E-11	1.034E-11	7.766E-12	6.038E-12	4.823E-12	3.937E-12
SE	1.588E-10	7.784E-11	4.884E-11	2.469E-11	1.494E-11	1.002E-11	7.178E-12	5.390E-12	4.191E-12	3.348E-12	2.733E-12
SSE	1.546E-10	7.577E-11	4.754E-11	2.403E-11	1.454E-11	9.752E-12	6.988E-12	5.247E-12	4.080E-12	3.259E-12	2.660E-12

Table 2.3-18 (cont.) XOQDOQ-Predicted Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

D/Qs at Various Segments

EXIT ONE - GROUND LEVEL RELEASE - NO PURGE RELEASES

********** RELATIVE DEPOSITION PER UNIT AREA (M**-2) BY DOWNWIND SECTORS **********

SEGMENT BOUNDARIES IN MILES

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	5.643E-09	1.743E-09	6.937E-10	3.791E-10	2.409E-10	1.035E-10	3.209E-11	1.272E-11	6.793E-12	4.204E-12
SSW	5.232E-09	1.616E-09	6.432E-10	3.515E-10	2.234E-10	9.595E-11	2.975E-11	1.179E-11	6.298E-12	3.898E-12
SW	7.335E-09	2.266E-09	9.017E-10	4.927E-10	3.132E-10	1.345E-10	4.171E-11	1.653E-11	8.829E-12	5.465E-12
WSW	8.011E-09	2.475E-09	9.848E-10	5.382E-10	3.420E-10	1.469E-10	4.556E-11	1.806E-11	9.643E-12	5.968E-12
W	7.056E-09	2.180E-09	8.675E-10	4.740E-10	3.013E-10	1.294E-10	4.013E-11	1.591E-11	8.494E-12	5.257E-12
WNW	5.319E-09	1.643E-09	6.539E-10	3.574E-10	2.271E-10	9.756E-11	3.025E-11	1.199E-11	6.403E-12	3.963E-12
NW	5.346E-09	1.652E-09	6.572E-10	3.591E-10	2.283E-10	9.804E-11	3.040E-11	1.205E-11	6.435E-12	3.983E-12
NNW	5.626E-09	1.738E-09	6.917E-10	3.780E-10	2.402E-10	1.032E-10	3.200E-11	1.268E-11	6.772E-12	4.192E-12
N	6.148E-09	1.899E-09	7.558E-10	4.130E-10	2.625E-10	1.128E-10	3.496E-11	1.386E-11	7.400E-12	4.580E-12
NNE	7.054E-09	2.179E-09	8.672E-10	4.739E-10	3.012E-10	1.294E-10	4.012E-11	1.590E-11	8.491E-12	5.255E-12
NE	8.835E-09	2.730E-09	1.086E-09	5.936E-10	3.773E-10	1.620E-10	5.025E-11	1.992E-11	1.064E-11	6.583E-12
ENE	8.751E-09	2.703E-09	1.076E-09	5.879E-10	3.736E-10	1.605E-10	4.977E-11	1.972E-11	1.053E-11	6.520E-12
E	8.656E-09	2.674E-09	1.064E-09	5.815E-10	3.696E-10	1.587E-10	4.923E-11	1.951E-11	1.042E-11	6.449E-12
ESE	6.516E-09	2.013E-09	8.011E-10	4.377E-10	2.782E-10	1.195E-10	3.706E-11	1.469E-11	7.843E-12	4.855E-12
SE	4.523E-09	1.397E-09	5.560E-10	3.039E-10	1.931E-10	8.295E-11	2.572E-11	1.020E-11	5.444E-12	3.370E-12
SSE	4.403E-09	1.360E-09	5.413E-10	2.958E-10	1.880E-10	8.075E-11	2.504E-11	9.924E-12	5.300E-12	3.280E-12

Southern Nuclear Operating Company

AR-07-0453

Enclosure 3

Westinghouse Letter DCP/NUS0463

NOTE: This enclosure consists of a 5-page letter.

Davis, James T.

From: Whiteman, Jesse L. [whitemjl@westinghouse.com]
Sent: Friday, March 23, 2007 4:18 PM
To: Davis, James T.
Cc: McCallum, Thomas O.; Gill, Frank G.; Aston, Patricia S.; McDermott, Daniel J.; Corletti, Michael M.; Hutchings, Donald F.; Geric, David R.; Whiteman, Jesse L.; Sterdis, Andrea
Subject: DCP/NUS0463 Westinghouse's Feedback to SNC/Bechtel's Request for Clarification Regarding the Basis for Changes to the Maximum Site Air Temperature Limits Planned in the AP1000 DCD

Attachments: SNC Bechtel Temp Questions2.doc

SNC Bechtel
mp Questions2.d

Jim, please find attached for your information and use as was requested in the March 13th telecon between representatives from Southern Nuclear, Bechtel, and Westinghouse, Westinghouse's feedback relative to the following three Southern Nuclear/Bechtel requests for clarification in regards to "Maximum Site Temperature Limits":

1. Please clarify the definitions of maximum safety limit and maximum normal site temperature limit.
2. Please describe the process by which the revised maximum wet bulb (noncoincident) value to be revised in the AP1000 DCD was determined by the COL Applicant
3. Identify the various functions which utilize the maximum safety and maximum normal limits.

The intent of this transmittal is to provide clarification regarding the basis for the approved planned change to air temperatures reflected in the AP1000 Design Control Document (DCD).

Should questions arise or additional information be required, please do not hesitate to contact Dan McDermott at 412-374-4503 or myself.

Regards,

Jesse Whiteman
Principal Engineer
AP1000 Licensing & Customer Interface
Phone : 412-374-4726
FAX: 412-374-5005

Responses to Southern Nuclear/Bechtel Questions on Site Temperature Limits

1. Please clarify the definition of the maximum safety and maximum normal site temperature limits:

The following provides a discussion of AP1000 (and Westinghouse approved changes) to the site air temperatures reflected or to be reflected in the Design Control Document (DCD).

The DCD specifies:

> *The AP1000 is designed for air temperatures, humidity, precipitation, snow, wind, and tornado conditions as specified in Table 2-1. The Combined License applicant must provide information to demonstrate that the site parameters are within the limits specified for the standard design.*

Table 2-1 of the DCD is reflected in the tabulation below by the first two columns. These values are the site ambient design temperatures from the Utility Requirements Dcoument (URD). The third column represents the proposed changes to the DCD that were approved by the Westinghouse Configuration Control Board on March 16, 2007. The basis for the changes was to broaden the application of the AP1000 design to encompass more domestic southern site locations and to clarify the meaning of the site design limit temperatures.

Air Temperature		
	Current Specified Conditions	Revised Approved Conditions
Maximum Safety [(a)]	115°F dry bulb/80°F coincident wet bulb 81°F wet bulb (noncoincident)	Same coincident air temperatures apply 85.5°F wet bulb (noncoincident)
Minimum Safety [(a)]	-40°F	Same air temperatures apply
Maximum Normal [(b)]	100°F dry bulb/77°F coincident wet bulb 80°F wet bulb (noncoincident) [(d)]	101ºF dry bulb/80.1ºF coincident wet bulb 80.1ºF (non-coincident) [(d)]
Minimum Normal [(b)]	-10°F	Same air temperatures apply

Notes:

(a) Maximum and minimum safety values are based on historical data and exclude peaks of less than 2 hours duration.

(b) Maximum and minimum normal values are the 1 percent exceedance magnitudes.

(c) n/a

(d) The noncoincident wet bulb temperature is applicable to the cooling tower only.

As specified in the DCD, the COL Applicant must provide information to demonstrate that the site parameters are within the limits specified for the standard design. To provide guidance and clarification, the following additional information relative to the definitions of Site Temperature limits is provided. It is expected that the COL applicant would base confirmation of site conformance on historical site data plus any margin deemed appropriate.

Maximum **Safety** Limits:

The maximum safety limit is the bounding temperature used by Westinghouse in the Chapter 15 Safety Analyses. We have selected bounding values to encompass a large population of potential sites in the US.

Our conditions are mainly based on a potential COL Applicant's calculation of their maximum coincident dry bulb/wet bulb temperature limits which was based on the maximum dry bulb temperature that has existed at the site for 2 hours or more combined with the maximum wet bulb temperature that exists in that population of dry bulb temperatures. This temperature selection process is based on historical meteorological data.

The maximum non-coincident wet bulb temperature is based on the maximum wet bulb temperature that has existed at the site for 2 hours or more based on historical meteorological data.

Maximum **Normal** Limits:

The maximum normal limits are not used in the Chapter15 DCD Analyses. These limits represent the maximum normal range of operation for power generation systems.

Our conditions are mainly based on a potential COL Applicant's calculation of their maximum coincident normal temperature limit is based on a 1% exceedance dry bulb temperature that existed for two hours or more in historical meteorological data. The complementary coincident wet bulb temperature was not selected based on a median or a maximum value from the 1% exceedance coincident data set. Since a slightly lower dry bulb temperature with its complimentary coincident wet bulb temperature may be more limiting and to simplify this process, the 1% exceedance wet bulb value was selected as the coincident temperature. This is considered a conservative approach to the selection of maximum normal coincident condition.

The maximum normal non-coincident wet bulb temperature limit is the 1% exceedance maximum wet bulb temperature that has existed at the site for 2 hours or more based on historical meteorological data.

2. Describe the process by which COL Applicants have determined conformance with site temperature limits.

Response: It is Westinghouse's understanding that the above process using purely historical meteorological data has been followed to establish limiting conditions demonstrating conformance with the standard design site temperature limits.

3. Identify the various system functions which utilize the maximum safety limits and maximum normal limits.

Response: The application of these temperature limits are explicitly defined in the DCD and summarized below based on DCD sections and commitments

Maximum safety temperature design basis applications:

DCD Tier 2 Section 5.4.7.1.2.3 identifies that one of the functions of the Normal Residual Heat Removal Systems (RNS) function is to provide for cooling of the IRWST during operation of the passive residual heat removal heat exchanger during normal operation. The limiting performance capability described is to maintain the IRWST below boiling for extended PRHR operation with an ambient wet bulb temperature at a zero exceedance value.

DCD Tier 2 Section 2.2.2.3 provides a discussion of the safety evaluation for the Passive Containment Cooling System (PCS). The section identifies that the environmental limiting conditions assumed for the performance of the PCS is a zero exceedance. This function has been evaluated at both the coincident wet bulb/dry bulb and non-coincident wet bulb.

DCD Tier 2 Section 9.2.2.1.2.1 This section describes the CCS performance capability to be able to supply component cooling water to components at less than 95ºF for normal power operation mode at a zero exceedance condition and a single train of CCS. For the revised meteorological design conditions with a higher wet bulb temperature of 85.5ºF, the ability to provide 95 ºF to components during these conditions is challenged and will be changed to 99 ºF. Components serviced have been evaluated to demonstrate the acceptability of this condition.

DCD Tier 2 Section 9.4.1 discusses the performance of the Nuclear Island Non-radioactive Ventilation System (VBS) design basis and as documented in the DCD Tier 2 Chapter 2, Table 2-1.
The VBS maintains the main control room emergency habitability system passive cooling heat sink and the heat sinks for the Division A, B, C and D 1E electrical equipment rooms below their initial design ambient air temperature limit of 75°F with the air safety temperature conditions shown in Chapter 2, Table 2-1.
The passive heat sinks associated with the Main Control Room Habitability System (VES) control the auxiliary building safety related room temperatures post accident. The temperature profiles of these rooms are impacted by the ambient dry bulb temperature which is enveloped by current baseline.
The VBS controls the main control environment including temperature, CO_2 levels, smoke removal, pressurization and humidity with design basis limits if in service post accident.

DCD Tier 2 Section 9.2.7.2.4 describes performance capability of the chilled water system (VWS). The low capacity subsystem provides cooling to the nuclear island non-radioactive ventilation system (VBS), the CVS makeup pump and compartment coolers and the normal residual heat removal pump.

The performance of the AP1000 systems to provide direct or supporting capability for the above functions at the temperature limits have been demonstrated for the original and revised maximum safety site temperature limits.

Maximum normal temperature design basis applications:

DCD Tier 2 Section 9.4 discusses the performance of the remainder of the HVAC systems (not specifically identified as subject to maximum safety limits) ability control design basis conditions under maximum normal conditions

DCD Tier 2 Section 5.4.7.1.2 describes that the normal residual heat removal system has the capability to reduce the temperature of the reactor coolant system from 350° to 125°F within 96 hours after shutdown.

DCD Tier 2 Section 9.1.3.1.3.1 and 9.1.3.1.3.2: The spent fuel pool cooling system is designed to remove heat from the spent fuel pool such that the spent fuel pool water temperature will be ≤ 120°F following a partial core fuel shuffle refueling or following a full core off-load based.

DCD Tier 2 Section 9.2.1.2.3.4 describes the Service Water Systems (SWS) capability to support operation during the plant cooldown phase in which the normal residual heat removal system has been placed in service and is providing shutdown cooling.

DCD Tier 2 Section 9.2.2.1.2.2 describes that the component cooling water system, in conjunction with the normal residual heat removal system removes both residual and sensible heat from the core and the reactor coolant system. The system performance commitment is to provide the capability to reduce the temperature of the reactor coolant system from 350°F at approximately 4 hours after reactor shutdown to 125°F within 96 hours after shutdown.

DCD Tier 2 Section 9.2.2.1.2.3 describes the performance capability of the CCS during refueling operations. The component cooling water system maintains the spent fuel pool water temperature below 120°F.

DCD Tier 2 Section 9.2.7.2.4 describes performance capability of the chilled water system (VWS).

The high capacity subsystem provides cooling to the following loads:

a. Radiologically controlled area ventilation system (VAS)
b. Containment recirculation cooling system (VCS)
c. Containment air filtration system (VFS)
d. Health physics/control access area HVAC system (VHS)
e. Radwaste building ventilation system (VRS)
f. Annex/auxiliary building nonradioactive ventilation system (VXS)

System performance is based on the maximum normal temperatures.

DCD Tier 2 Section 8.3.1.1.2.3 specified that both the diesel engine and the associated generator are rated based on 104°F ambient temperature. Since the DG and generator are air cooled via radiator, the limit is enveloped by the maximum normal site temperature limit.

Southern Nuclear Operating Company

AR-07-0453

Enclosure 4

Pickard, Lowe and Garrick Letter of April 27, 1988

NOTE: This enclosure consists of a 29-page letter.

Reference 15 for VEGP ODCM Rev. 8 and up
APP. A Used for VEGP ODCM Section 8.1
CC: DFH, KCH, SCE

PICKARD, LOWE AND GARRICK, INC.
1615 M STREET, N.W., SUITE 730
WASHINGTON, D.C. 20036

HED 5/5/88

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DAVID M. WHEELER
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JOHN W. STETKAR
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ALI MOSLEH
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SHOBHA B. RAO
JACKIE LEWIS
T. EDWARD FENSTERMACHER
DAVID B. SIMPSON
JOHN G. STAMPELOS
VICKI M. BIER
WEE TEE LOH
WILLARD C. GEKLER
WILLIAM R. FULLER
THOMAS B. MEADE
JAMES K. LIMING
DONALD J. WAKEFIELD
KATHLEEN C. RAMP
THOMAS J. MIKSCHL

MORTON J. SMITH
TIMOTHY J. MCINTYRE
JACK W. READ
JOHN P. KINDINGER
HAEJUNG CHANG
GRANT A. TINSLEY
MELISSA C. BRADLEY
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BRIAN A. FAGAN
PATRICK Y. C. CHEN
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STEVEN S. BYERS
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April 27, 1988

Mr. J. A. Bailey
Southern Company Services
P. O. Box 2625
Birmingham, AL 35202

Dear Jim:

As requested in your letter of March 1, 1988, we are enclosing dispersion calculations for use in Plant Vogtle's ODCM and for other related licensing activities. Three dispersion factors were computed for releases at both ground level and at the plant vent as follows:

- X/Q: Annual average atmospheric dispersion for non-reactive gases.
- Depleted X/Q: Same as X/Q, however, depletion due to deposition of halogens, and particulates is accounted for.
- D/Q: Ground deposition factor for halogens and particulates.

These calculations were made using the straight-line Gaussian dispersion model described in NRC Regulatory Guide 1.111 and in the Vogtle Unit II FSAR Section 2.3.5.

The dispersion calculations include the effects of site specific recirculation patterns as described in Appendix A. Appendix B provides the X/Q, depleted X/Q, and D/Q values calculated using the 3-year period of record of onsite meteorological data from January 1, 1985 through December 31, 1987. Values in tables of Appendix B are for specific receptor locations used in the ODCM for making dose calculations for routine releases out to five miles and by direction sector for ten standard distances out to 50 miles.

ENGINEERS • APPLIED SCIENTISTS • MANAGEMENT CONSULTANTS

Appendix C is the response prepared for SRP Question E451.14 which discusses the effect of the Unit I and II cooling towers on ground and elevated releases from the plant vent.

Please call if you have any questions or need further information.

Very truly yours,

Mark J. Abrams

Enclosures

cc: A. Desrosiers

APPENDIX A. RECIRCULATION FACTORS

The Plant Vogtle specific recirculation factors were calculated using site weather data in a modified version of the MESODIF-II program (ref. NUREG/CR-0523, "MESODIF-II: A Variable Trajectory Plume Segment Model to Assess Ground Level Air Concentrations and Deposition of Effluent Releases from Nuclear Power Facilities"). The original MESODIF-II program makes elevated or ground release calculations separately, but does not evaluate a single mixed mode case. Therefore, for mixed mode release calculations, it was necessary to modify the MESODIF-II program to allow both the elevated and ground level contributions to be include in the same run. Momentum plume rise for the elevated portion of the mixed mode release was included in the calculation using the same plume rise equations as used in MESODIF-II for elevated releases. MESODIF-II was further modified to force straight-line calculations by assuming persistence of weather conditions for each hour of meteorological data analyzed. Both straight-line (persistent) and variable trajectories were run using the same modified MESODIF-II program to assure that the recirculation factors were computed using the same methodology.

Recirculation factors were determined by dividing variable trajectory results by straight-line (persistent) results using the modified MESODIF-II program for both. These recirculation factors were then applied to straight-line calculations using the standard straight-line, Gaussian dispersion model (ref. FSAR Section 2.3.5).

Recirculation factors were computed for three years (1985 through 1987) of Vogtle on-site meteorological data. Table A-1 provides recirculation factors for the plant vent releases and Table A-2 provides recirculation factors for ground level releases. Table A-3 provides the release assumptions that were used in making these calculations.

Table A-1. Vogtle Recirculation Factors For Mixed Mode Releases 1985 Through 1987										
Direction From Site	Distance From Source in Miles									
	1.0	1.5	2.0	3.0	4.5	7.5	10.0	20.0	35.0	50.0
S	2.230	1.950	1.820	1.800	1.486	1.561	1.564	1.493	1.213	1.070
SSW	1.468	1.566	1.566	1.443	1.363	1.298	1.151	1.145	0.988	1.107
SW	1.045	1.077	1.106	1.117	1.114	1.029	0.880	0.765	0.563	0.451
WSW	1.044	1.096	1.093	1.138	1.197	1.052	1.089	0.968	0.722	0.578
W	1.357	1.432	1.151	1.250	1.151	1.037	1.252	1.010	0.722	0.676
WNW	1.195	1.202	1.173	1.178	1.201	1.039	0.983	0.822	0.569	0.421
NW	1.121	1.230	1.179	1.193	1.220	1.074	1.149	0.986	0.614	0.475
NNW	1.371	1.272	1.184	1.297	1.217	1.130	0.970	0.702	0.445	0.345
N	2.023	1.826	1.481	1.545	1.197	1.321	1.058	0.941	0.773	0.475
NNE	1.756	1.501	1.718	1.401	1.100	1.151	1.009	0.826	0.671	0.460
NE	1.655	1.507	1.412	1.239	1.017	0.997	0.888	0.787	0.513	0.323
ENE	1.246	1.306	1.240	1.321	1.120	1.018	0.946	0.693	0.487	0.326
E	1.401	1.526	1.493	1.303	1.150	1.118	1.060	0.880	0.594	0.513
ESE	1.824	1.444	1.366	1.272	1.183	1.040	1.005	0.740	0.561	0.422
SE	2.024	1.657	1.883	1.279	1.279	0.896	0.915	0.749	0.572	0.425
SSE	1.861	1.367	1.387	1.216	1.146	0.959	0.945	0.778	0.516	0.331

Table A-2. ~~1985~~ Vogtle Recirculation Factors for Ground Level Releases 1985 Through 1987										
Direction From Site	Distance From Source in Miles									
	1.0	1.5	2.0	3.0	4.5	7.5	10.0	20.0	35.0	50.0
S	1.115	1.164	1.209	1.317	1.274	1.451	1.438	1.379	1.040	0.913
SSW	1.092	1.148	1.208	1.261	1.339	1.250	1.150	0.745	1.012	1.103
SW	1.051	1.075	1.150	1.063	1.012	0.977	0.842	0.690	0.597	0.511
WSW	1.021	1.073	1.093	1.136	1.129	1.107	1.074	0.909	0.685	0.635
W	1.054	1.132	1.102	1.146	1.093	1.036	1.135	0.876	0.719	0.652
WNW	1.076	1.136	1.115	1.213	1.129	1.035	0.996	0.798	0.621	0.585
NW	1.044	1.138	1.170	1.166	1.170	1.089	1.036	0.966	0.573	0.472
NNW	1.039	1.063	1.108	1.216	1.203	1.133	1.086	0.873	0.790	0.505
N	1.044	1.091	1.144	1.216	1.157	1.282	1.095	0.959	0.663	0.607
NNE	1.034	1.044	1.114	1.144	1.031	1.138	1.004	0.772	0.531	0.460
NE	1.034	1.067	1.098	1.104	1.034	0.978	0.935	0.802	0.648	0.444
ENE	1.023	1.046	1.016	1.096	1.055	1.328	0.916	0.712	0.527	0.441
E	1.031	1.084	1.112	1.077	1.108	1.076	1.063	0.831	0.589	0.584
ESE	1.054	1.072	1.106	1.194	1.152	1.047	1.009	0.732	0.578	0.474
SE	1.094	1.113	1.227	1.334	1.241	1.237	0.930	0.774	0.565	0.447
SSE	1.053	1.050	1.118	1.102	1.053	1.531	0.828	0.677	0.426	0.297

Table A-3. Parameter Values Used to Calculate Vogtle Recirculation Factors	
Plant Vent (Release) Height (m)	60.0
Exit Velocity (m/s)	14.3
Vent Diameter (m)	2.42
Containment Cross Sectional Area (m^2)	2368.0

APPENDIX B. DISPERSION FACTORS

The values in Tables A-1 and A-2 of Appendix A were used to multiply all straight-line calculation results (X/Q, depleted X/Q, and D/Q values) obtained from the straight-line dispersion equations specified in Section 2.3.5 of the FSAR. Any values in Tables A-1 and A-2 less than one were set to 1.0. Results are provided out to 50 miles for mixed mode plant vent releases in Tables B-1 through B-3 and for ground level releases in Tables B-4 through B-6. Dispersion values for use with special receptor locations in the ODCM are provided in Table B-7 for mixed mode releases and in Table B-8 for ground level releases. Special receptor locations include the site boundary, nearest residence, nearest garden, and nearest meat animal. Locations were taken from the latest site survey performed April 27 through April 28, 1987 by Georgia Power Company.

Table B-1. Plant Vogtle X/Q (sec/m3) for Mixed Mode Releases January 1, 1985 Through December 31, 1987

Direction	0.5	1.5	2.5	3.5	4.5 Meters	7.5	15	25	35	45
	804	2413	4022	5631	7240	12067	24135	40225	56315	72405
N	5.25E-7	1.47E-7	9.14E-8	6.93E-8	5.18E-8	2.62E-8	1.01E-8	5.45E-9	3.69E-9	2.74E-9
NNE	6.01E-7	1.64E-7	9.55E-8	6.12E-8	4.53E-8	2.70E-8	1.07E-8	5.92E-9	4.00E-9	2.97E-9
NE	7.19E-7	1.75E-7	9.56E-8	6.34E-8	4.73E-8	3.32E-8	1.36E-8	7.37E-9	4.91E-9	3.63E-9
ENE	4.98E-7	1.32E-7	8.52E-8	6.16E-8	4.90E-8	2.84E-8	1.16E-8	6.37E-9	4.28E-9	3.17E-9
E	4.73E-7	1.37E-7	8.42E-8	5.53E-8	4.11E-8	2.15E-8	9.52E-9	5.00E-9	3.34E-9	2.46E-9
ESE	3.57E-7	9.65E-8	5.32E-8	3.68E-8	2.74E-8	1.42E-8	5.78E-9	3.17E-9	2.13E-9	1.58E-9
SE	2.90E-7	9.46E-8	5.78E-8	3.70E-8	2.77E-8	1.55E-8	6.37E-9	3.52E-9	2.37E-9	1.75E-9
SSE	3.61E-7	1.12E-7	6.51E-8	4.55E-8	3.46E-8	2.38E-8	1.02E-8	5.78E-9	3.93E-9	2.92E-9
S	3.18E-7	1.20E-7	7.61E-8	5.53E-8	4.32E-8	2.57E-8	1.05E-8	5.38E-9	3.26E-9	2.14E-9
SSW	2.42E-7	1.22E-7	8.56E-8	5.88E-8	4.34E-8	2.24E-8	8.74E-9	4.62E-9	3.02E-9	2.18E-9
SW	3.23E-7	1.67E-7	1.13E-7	7.97E-8	5.88E-8	3.31E-8	1.33E-8	6.92E-9	4.51E-9	3.28E-9
WSW	2.40E-7	1.17E-7	7.89E-8	5.64E-8	4.25E-8	2.59E-8	1.04E-8	5.22E-9	3.42E-9	2.50E-9
W	2.36E-7	8.97E-8	6.08E-8	4.67E-8	3.61E-8	2.20E-8	8.87E-9	4.32E-9	2.88E-9	2.12E-9
WNW	1.79E-7	7.85E-8	5.52E-8	4.04E-8	3.06E-8	1.66E-8	7.33E-9	3.99E-9	2.67E-9	1.96E-9
NW	2.06E-7	9.25E-8	6.90E-8	5.01E-8	3.84E-8	2.18E-8	9.77E-9	4.88E-9	3.24E-9	2.38E-9
NNW	2.40E-7	9.31E-8	6.78E-8	5.30E-8	4.01E-8	2.11E-8	8.73E-9	4.80E-9	3.22E-9	2.38E-9

Table B-2. Plant Vogtle Depleted X/Q (sec/m3) for Mixed Mode Releases January 1, 1985 Through December 31, 1987

Direction	6.5	1.5	2.5	3.5	4.5 Meters	7.5	15	25	35	45
	804	2413	4022	5631	7240	12067	24135	40225	56315	72405
N	4.84E-7	1.34E-7	8.40E-8	6.35E-8	4.72E-8	2.36E-8	8.95E-9	4.76E-9	3.18E-9	2.33E-9
NNE	5.54E-7	1.47E-7	8.60E-8	5.48E-8	4.03E-8	2.40E-8	9.36E-9	5.08E-9	3.37E-9	2.45E-9
NE	6.62E-7	1.57E-7	8.54E-8	5.62E-8	4.17E-8	2.94E-8	1.16E-8	6.04E-9	3.89E-9	2.77E-9
ENE	4.60E-7	1.19E-7	7.62E-8	5.47E-8	4.34E-8	2.51E-8	1.00E-8	5.34E-9	3.50E-9	2.52E-9
E	4.36E-7	1.23E-7	7.57E-8	4.94E-8	3.65E-8	1.87E-8	8.19E-9	4.20E-9	2.75E-9	1.98E-9
ESE	3.29E-7	8.75E-8	4.84E-8	3.33E-8	2.46E-8	1.26E-8	4.99E-9	2.67E-9	1.77E-9	1.28E-9
SE	2.68E-7	8.67E-8	5.34E-8	3.41E-8	2.54E-8	1.41E-8	5.69E-9	3.10E-9	2.06E-9	1.49E-9
SSE	3.33E-7	1.03E-7	6.02E-8	4.18E-8	3.17E-8	2.17E-8	9.21E-9	5.14E-9	3.45E-9	2.52E-9
S	2.94E-7	1.11E-7	7.07E-8	5.10E-8	3.96E-8	2.32E-8	9.29E-9	4.67E-9	2.79E-9	1.79E-9
SSW	2.24E-7	1.14E-7	8.01E-8	5.47E-8	4.00E-8	2.03E-8	7.71E-9	3.98E-9	2.56E-9	1.81E-9
SW	3.01E-7	1.56E-7	1.05E-7	7.39E-8	5.41E-8	2.98E-8	1.14E-8	5.56E-9	3.45E-9	2.40E-9
WSW	2.22E-7	1.09E-7	7.36E-8	5.22E-8	3.91E-8	2.34E-8	9.04E-9	4.36E-9	2.76E-9	1.94E-9
W	2.18E-7	8.32E-8	5.66E-8	4.33E-8	3.32E-8	2.01E-8	7.94E-9	3.80E-9	2.50E-9	1.80E-9
WNW	1.65E-7	7.31E-8	5.16E-8	3.76E-8	2.84E-8	1.53E-8	6.66E-9	3.57E-9	2.36E-9	1.71E-9
NW	1.90E-7	8.62E-8	6.47E-8	4.67E-8	3.56E-8	2.00E-8	8.77E-9	4.26E-9	2.76E-9	1.97E-9
NNW	2.22E-7	8.65E-8	6.36E-8	4.96E-8	3.74E-8	1.95E-8	7.96E-9	4.32E-9	2.87E-9	2.09E-9

Table B-3. Plant Vogtle Deposition (1/m2) for Mixed Mode Releases January 1, 1985 Through December 31, 1987

Direction	.5	1.5	2.5	3.5	4.5 Meters	7.5				
	804	2413	4022	5631	7240	12067	24135	40225	56315	72405
N	3.85E-9	8.93E-10	3.89E-10	2.32E-10	1.50E-10	5.80E-11	1.70E-11	6.95E-12	4.12E-12	2.75E-12
NNE	5.06E-9	1.21E-9	5.31E-10	2.74E-10	1.77E-10	7.10E-11	2.13E-11	8.85E-12	5.43E-12	3.88E-12
NE	5.75E-9	1.26E-9	5.30E-10	2.84E-10	1.85E-10	7.86E-11	2.46E-11	1.07E-11	6.88E-12	5.15E-12
ENE	5.40E-9	1.24E-9	6.11E-10	3.58E-10	2.36E-10	9.43E-11	2.90E-11	1.22E-11	7.59E-12	5.50E-12
E	5.73E-9	1.36E-9	6.35E-10	3.37E-10	2.20E-10	8.95E-11	2.81E-11	1.13E-11	6.81E-12	4.74E-12
ESE	4.17E-9	8.83E-10	3.60E-10	2.00E-10	1.31E-10	5.29E-11	1.68E-11	7.01E-12	4.14E-12	2.76E-12
SE	3.15E-9	8.20E-10	3.43E-10	1.67E-10	1.09E-10	4.42E-11	1.37E-11	5.65E-12	3.41E-12	2.39E-12
SSE	3.16E-9	8.43E-10	3.54E-10	1.99E-10	1.33E-10	5.80E-11	1.81E-11	7.33E-12	4.45E-12	3.17E-12
S	3.64E-9	1.06E-9	4.94E-10	2.97E-10	2.02E-10	8.81E-11	2.76E-11	1.04E-11	5.52E-12	3.34E-12
SSW	3.20E-9	1.10E-9	5.69E-10	3.26E-10	2.15E-10	8.76E-11	2.70E-11	1.07E-11	6.08E-12	3.96E-12
SW	3.70E-9	1.15E-9	5.94E-10	3.43E-10	2.24E-10	9.28E-11	2.97E-11	1.27E-11	7.98E-12	5.71E-12
WSW	2.48E-9	7.75E-10	4.01E-10	2.38E-10	1.59E-10	6.89E-11	2.16E-11	8.56E-12	5.35E-12	3.88E-12
W	2.07E-9	5.88E-10	2.87E-10	1.79E-10	1.22E-10	5.53E-11	1.70E-11	6.24E-12	3.72E-12	2.55E-12
WNW	1.45E-9	4.20E-10	2.11E-10	1.24E-10	8.19E-11	3.39E-11	1.08E-11	4.42E-12	2.69E-12	1.92E-12
NW	1.70E-9	4.84E-10	2.52E-10	1.48E-10	9.85E-11	4.27E-11	1.34E-11	5.29E-11	3.43E-12	2.61E-12
NNW	1.81E-9	4.80E-10	2.36E-10	1.45E-10	9.52E-11	3.82E-11	1.19E-11	4.98E-12	2.97E-12	2.02E-12

Table B-4. Plant Vogtle X/Q (sec/m3) for Ground Release January 1, 1985 Through December 31, 1987

Direction	0.5	1.5	2.5	3.5	4.5 Meters 7.5					
	804	2413	4022	5631	7240	12067	24135	40225	56315	72405
N	3.50E-6	7.14E-7	3.71E-7	2.32E-7	1.63E-7	7.94E-8	2.93E-8	1.40E-8	9.05E-9	6.57E-9
NNE	3.63E-6	7.04E-7	3.57E-7	2.22E-7	1.56E-7	7.60E-8	2.93E-8	1.48E-8	9.54E-9	6.96E-9
NE	4.17E-6	8.05E-7	4.02E-7	2.48E-7	1.75E-7	8.65E-8	3.39E-8	1.71E-8	1.11E-8	8.07E-9
ENE	3.77E-6	7.01E-7	3.51E-7	2.24E-7	1.58E-7	7.81E-8	3.06E-8	1.55E-8	9.99E-9	7.29E-9
E	3.08E-6	6.10E-7	3.00E-7	1.81E-7	1.28E-7	6.50E-8	2.52E-8	1.23E-8	7.92E-9	5.75E-9
ESE	2.25E-6	4.39E-7	2.23E-7	1.40E-7	9.75E-8	4.63E-8	1.73E-8	8.64E-9	5.55E-9	4.03E-9
SE	2.29E-6	4.54E-7	2.40E-7	1.51E-7	1.04E-7	4.72E-8	1.70E-8	8.52E-9	5.48E-9	3.99E-9
SSE	3.40E-6	6.41E-7	3.13E-7	1.92E-7	1.36E-7	6.71E-8	2.63E-8	1.32E-8	8.51E-9	6.21E-9
S	2.38E-6	4.60E-7	2.38E-7	1.53E-7	1.10E-7	5.80E-8	2.33E-8	1.09E-8	6.32E-9	4.10E-9
SSW	2.56E-6	5.10E-7	2.53E-7	1.53E-7	1.08E-7	5.30E-8	1.91E-8	8.99E-9	5.93E-9	4.42E-9
SW	3.48E-6	6.95E-7	3.33E-7	1.94E-7	1.37E-7	6.75E-8	2.62E-8	1.31E-8	8.42E-9	6.10E-9
WSW	2.83E-6	5.59E-7	2.82E-7	1.75E-7	1.23E-7	6.12E-8	2.31E-8	1.12E-8	7.17E-9	5.20E-9
W	2.67E-6	5.22E-7	2.60E-7	1.62E-7	1.15E-7	5.84E-8	2.19E-8	1.03E-8	6.62E-9	4.80E-9
WNW	2.37E-6	4.68E-7	2.39E-7	1.50E-7	1.04E-7	4.91E-8	1.83E-8	9.18E-9	5.91E-9	4.29E-9
NW	2.70E-6	5.55E-7	2.81E-7	1.70E-7	1.19E-7	5.81E-8	2.20E-8	1.08E-8	6.98E-9	5.07E-9
NNW	2.91E-6	5.90E-7	3.07E-7	1.94E-7	1.36E-7	6.61E-8	2.43E-8	1.17E-8	7.55E-9	5.48E-9

Table B-5. Plant Vogtle Depleted X/Q (sec/m3) for Ground Release January 1, 1985 Through December 31, 1987

Direction	0.5	1.5	2.5	[illegible]	4.5 Meters	7.5				
	804	2413	4022	5631	7240	12067	24135	40225	56315	72405
N	3.20E-6	6.06E-7	3.01E-7	1.80E-7	1.22E-7	5.57E-8	1.83E-8	7.76E-9	4.53E-9	3.02E-9
NNE	3.32E-6	5.97E-7	2.90E-7	1.73E-7	1.17E-7	5.33E-8	1.84E-8	8.18E-9	4.78E-9	3.20E-9
NE	3.81E-6	6.83E-7	3.26E-7	1.93E-7	1.32E-7	6.06E-8	2.12E-8	9.47E-9	5.54E-9	3.71E-9
ENE	3.45E-6	5.94E-7	2.84E-7	1.74E-7	1.19E-7	5.47E-8	1.92E-8	8.55E-9	5.00E-9	3.35E-9
E	2.82E-6	5.18E-7	2.43E-7	1.41E-7	9.65E-8	4.56E-8	1.58E-8	6.79E-9	3.97E-9	2.64E-9
ESE	2.06E-6	3.73E-7	1.81E-7	1.09E-7	7.34E-8	3.25E-8	1.08E-8	4.77E-9	2.78E-9	1.85E-9
SE	2.09E-6	3.85E-7	1.95E-7	1.18E-7	7.82E-8	3.31E-8	1.06E-8	4.71E-9	2.75E-9	1.83E-9
SSE	3.11E-6	5.44E-7	2.54E-7	1.49E-7	1.02E-7	4.70E-8	1.65E-8	7.31E-9	4.26E-9	2.85E-9
S	2.18E-6	3.91E-7	1.93E-7	1.19E-7	8.27E-8	4.07E-8	1.46E-8	6.03E-9	3.17E-9	1.88E-9
SSW	2.34E-6	4.33E-7	2.05E-7	1.19E-7	8.09E-8	3.72E-8	1.20E-8	4.97E-9	2.97E-9	2.03E-9
SW	3.18E-6	5.90E-7	2.70E-7	1.51E-7	1.03E-7	4.73E-8	1.64E-8	7.25E-9	4.22E-9	2.80E-9
WSW	2.59E-6	4.74E-7	2.28E-7	1.36E-7	9.27E-8	4.29E-8	1.45E-8	6.17E-9	3.59E-9	2.39E-9
W	2.44E-6	4.43E-7	2.11E-7	1.26E-7	8.65E-8	4.10E-8	1.37E-8	5.69E-9	3.31E-9	2.21E-9
WNW	2.16E-6	3.97E-7	1.94E-7	1.17E-7	7.84E-8	3.44E-8	1.14E-8	5.07E-9	2.96E-9	1.97E-9
NW	2.47E-6	4.70E-7	2.28E-7	1.32E-7	8.98E-8	4.08E-8	1.37E-8	5.99E-9	3.50E-9	2.33E-9
NNW	2.66E-6	5.01E-7	2.49E-7	1.51E-7	1.02E-7	4.64E-8	1.52E-8	6.48E-9	3.78E-9	2.52E-9

Table B-6. Plant Vogtle Deposition ~~X~~D/Q (1/m2) for Ground Release January 1, 1985 Through December 31, 1987

Direction	0.5	1.5	2.5	3.5	4.5 Meters	7.5				
	804	2413	4022	5631	7240	12067	24135	40225	56315	72405
N	1.41E-8 2	2.26E-9 3	1.10E-9	5.93E-10	3.73E-10	1.49E-10	4.46E-11	1.57E-11	8.37E-12	5.26E-12
NNE	1.53E-8	2.43E-9	1.16E-9	6.09E-10	3.82E-10	1.51E-10	4.67E-11	1.72E-11	9.16E-12	5.76E-12
NE	1.77E-8	2.80E-9	1.31E-9	6.83E-10	4.30E-10	1.72E-10	5.41E-11	1.99E-11	1.06E-11	6.67E-12
ENE	1.77E-8	2.71E-9	1.27E-9	6.87E-10	4.33E-10	1.74E-10	5.48E-11	2.02E-11	1.08E-11	6.76E-12
E	1.66E-8	2.64E-9	1.22E-9	6.28E-10	4.00E-10	1.66E-10	5.23E-11	1.87E-11	9.96E-12	6.26E-12
ESE	1.07E-8	1.69E-9	8.12E-10	4.38E-10	2.73E-10	1.06E-10	3.23E-11	1.18E-11	6.32E-12	3.97E-12
SE	9.26E-9	1.50E-9	7.51E-10	4.03E-10	2.48E-10	9.18E-11	2.67E-11	9.84E-12	5.25E-12	3.30E-12
SSE	1.29E-8	2.03E-9	9.40E-10	4.87E-10	3.07E-10	1.23E-10	3.86E-11	1.42E-11	7.59E-12	4.77E-12
S	1.14E-8	1.82E-9	8.96E-10	4.94E-10	3.19E-10	1.38E-10	4.55E-11	1.57E-11	7.55E-12	4.24E-12
SSW	1.41E-8 2	2.28E-9 2	1.09E-9	5.70E-10	3.61E-10	1.47E-10	4.39E-11	1.53E-11	8.44E-12	5.47E-12
SW	1.84E-8 1	2.95E-9 1	1.34E-9	6.75E-10	4.27E-10	1.74E-10	5.53E-11	2.04E-11	1.09E-11	6.83E-12
WSW	1.31E-8	2.07E-9	9.89E-10	5.27E-10	3.34E-10	1.36E-10	4.19E-11	1.49E-11	7.94E-12	4.99E-12
W	1.10E-8	1.72E-9	8.10E-10	4.33E-10	2.76E-10	1.15E-10	3.50E-11	1.21E-11	6.45E-12	4.05E-12
WNW	9.37E-9	1.46E-9	7.03E-10	3.80E-10	2.36E-10	9.09E-11	2.75E-11	1.01E-11	5.40E-12	3.40E-12
NW	1.06E-8	1.73E-9	8.25E-10	4.29E-10	2.69E-10	1.07E-10	3.28E-11	1.18E-11	6.32E-12	3.97E-12
NNW	1.13E-8	1.79E-9	8.74E-10	4.76E-10	2.99E-10	1.19E-10	3.57E-11	1.26E-11	6.73E-12	4.23E-12

Table B-7. Plant Vogtle X/Q, Depleted X/Q, and D/Q Values for Mixed Mode Releases Based on Meteorological Data for the Period of January 1, 1985 Through December 31, 1987

Direction and Distance (m)	X/Q (sec/m³)	Depleted X/Q (sec/m³)	D/Q (1/m²)
N 1344 SB .84	2.74E-7	2.48E-7	2.14E-9
NNE 1097 SB	3.90E-7	3.54E-7	3.49E-9
NE 1097 SB	4.62E-7	4.19E-7	3.94E-9
ENE 1097 SB	3.22E-7	2.93E-7	3.71E-9
E 1369 SB .95	2.35E-7	2.13E-7	2.94E-9
ESE 1420 Plant Wilson	1.76E-7	1.59E-7	2.07E-9
ESE 1817 SB	1.34E-7	1.21E-7	1.42E-9
SE 447 Visitor Center .28	7.12E-7	6.74E-7	5.77E-9
SE 1866 SB 1.16	1.16E-7	1.05E-7	1.16E-9
SE 5311 R 3.3	3.94E-8	3.64E-8	1.85E-10
SE 6920 G 4.3	2.92E-8	2.68E-8	1.18E-10
SE 7725 M 4.8	2.58E-8	2.36E-8	9.72E-11
SSE 1773 SB 1.1	1.50E-7	1.37E-7	1.32E-9
SSE 7403 R,M 4.6	3.38E-8	3.08E-8	1.28E-10
S 1692 SB 1.05	1.57E-7	1.45E-7	1.69E-9
S 7081 R 4.4	4.48E-8	4.10E-8	2.10E-10
S 7242 M 4.5	4.44E-8	4.07E-8	2.04E-10
SSW 1680 SB 1.04	1.41E-7	1.31E-7	1.58E-9
CR → SSW 7564 R 4.7	4.11E-8	3.78E-8	1.99E-10 ← CR
SW 1462 SB .91	2.24E-7	2.10E-7	2.10E-9
SW 2092 R 1.3	1.84E-7	1.73E-7	1.37E-9
SW 4828 M 3.0	9.31E-8	8.65E-8	4.47E-10
SW 4989 G 3.1	8.99E-8	8.35E-8	4.25E-10
WSW 1462 SB .91	1.56E-7	1.45E-7	1.40E-9
WSW 2092 R, G 1.3	1.28E-7	1.19E-7	9.22E-~~11~~10
W 1462 SB .91	1.30E-7	1.19E-7	1.14E-9
W 2254 R 1.4	9.43E-8	8.73E-8	6.43E-10
W 6759 G 4.2	3.87E-8	3.57E-8	1.35E-10
W 8047 M 5.0	3.23E-8	2.96E-8	1.03E-10
WNW 1649 SB 1.0	9.62E-8	8.88E-8	6.72E-10
WNW 2897 R 1.8	6.87E-8	6.42E-8	3.15E-10
WNW 7403 G 4.6	2.99E-8	2.77E-8	7.87E-11
WNW 7886 M 4.9	2.78E-8	2.58E-8	7.06E-11
NW 2240 SB 1.4	9.59E-8	8.92E-8	5.27E-10
NW 3597 R 2.2	7.38E-8	6.91E-8	2.90E-10
NW 6437 M 4.0	4.34E-8	4.04E-8	1.18E-10
NW 6598 G 4.1	4.23E-8	3.94E-8	1.14E-10
NNW 1804 SB 1.12	1.12E-7	1.03E-7	7.19E-10

SB = Site Boundary
G = Garden
R = Residence
M = Meat Animal

Table B-8. Plant Vogtle X/Q, Depleted X/Q, and D/Q Values for Ground Level Releases Based on Meteorological Data for the Period of January 1, 1985 Through December 31, 1987

Direction and Distance (m)	X/Q (sec/m³)	Depleted X/Q (sec/m³)	D/Q (1/m²)
N 1344 SB .94	1.61E-6	1.42E-6	6.00E-9 -4
NNE 1097 SB	2.23E-6	1.99E-6	8.94E-9- 1 SRS
NE 1097 SB	2.55E-6	2.29E-6	1.04E-8-
ENE 1097 SB	2.31E-6	2.07E-6	1.04E-8-
E 1369 SB	1.36E-6	1.20E-6	6.86E-9-3
ESE 1420 Plant Wilson	9.45E-7	8.34E-7	4.20E-9
ESE 1817 SB	6.54E-7	5.67E-7	2.64E-9-
SE 447 Visitor Center .28	5.93E-6	5.58E-6	2.28E-8
SE 1866 SB 1.16	6.37E-7	5.51E-7	2.18E-9-
SE 5311 R 3.3	1.66E-7	1.30E-7	4.57E-10
SE 6920 G 4.3	1.11E-7	8.41E-8	2.69E-10
SE 7725 M 4.8	9.42E-8	7.02E-8	2.19E-10
SSE 1773 SB 1.1	9.93E-7	8.62E-7	3.32E-9-8
SSE 7403 R,M 4.6	1.31E-7	9.86E-8	2.94E-10
S 1692 SB 1.05	7.58E-7	6.61E-7	3.24E-9-9
S 7081 R 4.4	1.13E-7	8.53E-8	3.30E-10
S 7242 M 4.5	1.10E-7	8.27E-8	3.18E-10
SSW 1680 SB 1.04	8.43E-7	7.35E-7	4.07E-9-7
CR→SSW 7564 R 4.7	1.04E-7	7.78E-8	3.43E-10 ←CR
SW 1462 SB .91	1.40E-6	1.23E-6	6.88E-9-2
SW 2092 R 1.3	8.37E-7	7.17E-7	3.55E-9
SW 4828 M 3.0	2.47E-7	1.96E-7	9.33E-10
SW 4989 G 3.1	2.34E-7	1.85E-7	8.74E-10
WSW 1462 SB .91	1.14E-6	1.00E-6	4.88E-9-5
WSW 2092 R, G 1.3	6.75E-7	5.78E-7	2.50E-9
W 1462 SB .91	1.07E-6	9.46E-7	4.09E-9- 6
W 2254 R 1.40	5.71E-7	4.87E-7	1.87E-9
W 6759 G 4.2	1.26E-7	9.56E-8	3.09E-10
W 8047 M 5.0	9.88E-8	7.40E-8	2.29E-10
WNW 1649 SB 1.6	8.01E-7	7.00E-7	2.79E-9-
WNW 2987 R 1.8	3.47E-7	2.89E-7	1.06E-9
WNW 7403 G 4.6	1.01E-7	7.56E-8	2.26E-10
WNW 7886 M 4.9	9.20E-8	6.84E-8	2.01E-10
NW 2240 SB 1.4	6.08E-7	5.18E-7	1.89E-9-
NW 3597 R 2.2	3.28E-7	2.68E-7	9.75E-10
NW 6437 M 4.0	1.40E-7	1.07E-7	3.28E-10
NW 6598 G 4.1	1.35E-7	1.03E-7	3.15E-10
NNW 1804 SB 1.12	8.76E-7	7.59E-7	2.81E-9-

SB = Site Boundary
G = Garden
R = Residence
M = Meat Animal

APPENDIX C. COOLING TOWER EFFECT ON PLANT RELEASES IN RESPONSE TO NRC SRP QUESTIONS

SRP Question E451.14

The discussion of the calculation of long-term diffusion estimates presented in Section 2.3.5 of the FSAR requires additional clarification. For example, the statement is made in Section 2.3.5.2.1 on page 2.3.5-1 that "the release is at ground level." However, the discussion in Section 2.3.5.2.3 on page 2.3.5-3 states that the "plant vent release point is elevated." The atmospheric dispersion model presented is for an elevated release.

- The natural draft cooling towers appear to be less than 2000 ft from the Unit 1 containment structure, and these structures could significantly influence low-level airflow in the vicinity of the main plant release points for a number of wind directions. Furthermore, plant releases, when the wind is blowing toward the cooling towers, could be entrained into the wake of these structures. For these situations, releases which may have been considered as partially elevated could behave more like ground level releases. Provide additional information on the influence of the natural draft cooling towers on routine releases of radioactive material to the atmosphere.

Answer E451.14

All release points other than those designated as "plant vent" listed in Table 2.3.5-2 are assumed to discharge into the building wake which would effectively result in a ground level release with initial dilution in the wake cavity. The plant vents are located at the top-center of each reactor building dome and discharge at 419 ft MSL as shown in Table 2.3.5-3 of the FSAR. The vents discharge 19 ft above the top of their respective containments. The containment's highest points are 400 ft MSL and they represent the highest structures onsite with the exception of the two cooling towers discussed further below. Plant grade level is 220 ft MSL.

- Natural draft cooling towers are located generally east of the plant. Therefore, in an east wind, the center of the south cooling tower lies 518m upwind of the center of the Unit 1 containment. The airflow disturbance created by the tower is a cavity attached to the lee surface of the tower, enclosed in an enveloping wake. The tower has the following dimensions: base diameter = 136.5m, throat diameter = 76.2m, top diameter = 84.1m, height = 164m above plant grade which is 219.5 ft MSL. For this analysis, the tower will be considered as a vertical cylinder with diameter d = 97.5m and height H_c = 164.0m, yielding $d/H_c = 0.59$. The length of a cavity created by a vertical cylinder on a ground plane is reported by Hosker in NOAA Oak Ridge ATDL Contr. No. 79/10 as 2.7d when $d/H_c = 1.0$ and 3.1d when $d/H_c = .67$. Using the latter figure, the length of the cooling tower cavity is 3.1 x 97.5 = 302m, which corresponds to a normalized distance $x/H_c = 1.8$. Flow conditions at the end of the cavity exhibit low wind speed and high directional variability. However, these conditions ameliorate with distance downwind. At Unit 1, whose normalized distance from the tower is $x/H_c = 518/164 = 3.2$, the mean velocity deficit is about 17%, according to Hosker Figure 7.26b. No data are available on the turbulence intensity excess nor the streamlined inclination in the vicinity of the Unit 1 release, but these should be small in comparison with flow irregularities created by the plant itself. The net effect of the concentration

increase due to reduced mean velocity and concentration decrease due to increased turbulence should be small. Figure C-1 shows the area affected by the cavity boundary.

In a west wind, some portion of the Unit 1 plume will impinge on the south cooling tower and mix in the cooling tower cavity and wake. The tower occupies about one-half of a 22-1/2° wind direction sector at this location. The horizontal concentration distribution is uniform by virtue of sector averaging. Assuming that vertical mixing creates a uniform vertical-concentration distribution in the cavity over the height of the tower, the average cavity concentration may be approximated by integrating the vertical distribution in the sector average equation and dividing by the cooling tower height to obtain

$$X/Q = 8f(\pi X H_c u)^{-1}. \qquad [1]$$

With X = 518m and H_c = 164m, Equation [1] reduces to

$$X/Q = 3.0x10^{-5} f/u. \qquad [1a]$$

In Equation [1a], f is the fraction of the vertical distribution intersected by the cooling tower and u is the wind speed at release height.

The definition of f is

$$f = \int_{-\infty}^{p} (2\pi)^{-1/2} \exp(-0.5p^2)dp, \qquad [2]$$

where

$$p = (H_c - H_p)/\sigma_z, \qquad [3]$$

H_c = cooling tower height

H_p = plume centerline height.

When H_c, H_p, and σ_z are given, p is found by Equation [3] and f is found by Figure A-3 in Turner's Workbook. The following table shows the calculation of f for several stabilities, assumed H_p = 80m, H_c = 164m, and X = 518m.

Stability	σ_z*	p	f
A	120m	0.7	0.75
D	20m	4.2	1.00
G	5m	16.8	1.000

*From Figure 1 of Regulatory Guide 1.111

The above analysis is applicable in the cavity where mixed concentrations are fairly uniform. Downwind of the cavity, the Gaussian distribution will reform in the vertical as wake turbulence decays and atmospheric turbulence is re-established. Figure C-2 shows how releases from the plant will impact in and around the downwind cooling towers.

Calculations were made for four combinations of weather conditions assuming first that there were no towers and then that towers were in place. Results are summarized in Table C-1 (Table 451.14-1).

Values were within a factor of two with one exception. For the completely elevated Case 1, the plume has not reached ground level, thus the concentration without the tower is 0. However, inspection of the joint frequency tables (Table C-2) showed the frequency of low wind speed (less than 4 mph at 60m) stable cases was less than 0.4% toward either of the towers. The towers should not result in significant changes in routine ground level concentrations for routine releases at Unit 1 or Unit 2.

Table C-1. (Table 451.14-1) Effect of Cooling Tower on Dispersion Factors

Case	10 Meter Wind Speed (mph)	Stability	$\bar{u}$ at Vent Height (m/sec)	f	Fraction at Ground Level, ET	Plume Height (m)	X/Q at 518* with Tower (sec/m^3)	X/Q at 518** Using RG 1.111 Without Tower (sec/m^3)	X/Q at 800m With tower (sec/m^3)
1	2	G	2.1	1.0	0.00	81	1.5E-5	0	0
2	4	G	4.2	1.0	0.11	77	7.2E-6	2.6E-5	1.3E-5
3	7	D	5.5	1.0	0.15	79	5.5E-6	5.9E-6	1.7E-6
4	6	A	4.1	0.75	0.10	88	5.5E-6	6.1E-6	1.7E-6

*Using equation 1a.
**Using Regulatory Guide 1.111.

Table C-2. Plant Vogtle Joint Frequency Table of
Wind Speed and Direction 60m vs Delta Temperature 60-10m
January 1, 1985 Through December 31, 1987

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 85010101-87123124
STABILITY CLASS: A DT/DZ
ELEVATION: SPEED:SPD60M DIRECTION:DIR60M LAPSE:DT60M

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	2	24	19	3	0	0	48
NNE	4	24	21	4	0	0	53
NE	2	21	16	6	0	0	45
ENE	4	24	9	3	0	0	40
E	5	19	20	2	0	0	46
ESE	1	13	8	0	0	0	22
SE	3	21	8	0	0	0	32
SSE	2	26	12	0	0	0	40
S	6	33	18	5	0	0	62
SSW	5	46	30	17	3	0	101
SW	5	53	90	24	3	0	175
WSW	5	64	107	39	5	0	220
W	2	52	120	55	10	0	239
WNW	5	38	64	34	1	0	142
NW	2	24	45	22	0	0	93
NNW	7	23	27	6	0	0	63
TOTAL	60	505	614	220	22	0	1421

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 2724

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 85010101-87123124
STABILITY CLASS: B DT/DZ
ELEVATION: SPEED:SPD60M DIRECTION:DIR60M LAPSE:DT60M

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	7	19	10	4	0	0	40
NNE	1	21	9	4	0	0	35
NE	4	24	21	8	0	0	57
ENE	8	22	29	3	0	0	62
E	2	28	19	0	0	0	49
ESE	3	22	7	0	0	0	32
SE	0	16	7	2	0	0	25
SSE	2	27	13	4	0	0	46
S	4	27	12	2	0	0	45
SSW	2	48	22	9	0	0	81
SW	3	47	48	5	1	0	104
WSW	1	51	55	21	2	0	130
W	2	32	53	30	1	0	118
WNW	1	22	42	12	2	0	79
NW	2	22	22	4	0	0	50
NNW	5	21	12	3	0	0	41
TOTAL	47	449	381	111	6	0	994

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 2724

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 85010101-87123124

STABILITY CLASS: C DT/DZ

ELEVATION: SPEED:SPD60M DIRECTION:DIR60M LAPSE:DT60M

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1	23	16	3	0	0	43
NNE	4	31	28	12	0	0	75
NE	6	49	45	10	0	0	110
ENE	10	43	42	6	0	0	101
E	5	24	16	2	0	0	47
ESE	4	26	16	3	0	0	49
SE	5	28	20	1	0	0	54
SSE	4	41	15	3	0	0	63
S	4	43	20	3	0	0	70
SSW	5	45	25	11	2	0	88
SW	6	51	45	12	0	0	114
WSW	2	70	49	21	3	1	146
W	4	51	48	22	4	0	129
WNW	4	40	19	8	1	0	72
NW	5	36	24	7	0	0	72
NNW	3	40	22	3	0	0	68
TOTAL	72	641	450	127	10	1	1301

PERIODS OF CALM(HOURS): 0

VARIABLE DIRECTION 0

HOURS OF MISSING DATA: 2724

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 85010101-87123124
STABILITY CLASS: D DT/DZ
ELEVATION: SPEED:SPD60M DIRECTION:DIR60M LAPSE:DT60M

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	47	237	182	17	1	0	484
NNE	30	235	358	59	3	0	685
NE	38	297	450	139	6	0	930
ENE	44	229	254	72	1	0	600
E	30	224	142	21	0	0	417
ESE	24	163	102	8	1	0	298
SE	34	146	95	20	0	0	295
SSE	29	213	105	11	2	0	360
S	49	264	88	7	2	0	410
SSW	45	226	101	29	0	0	401
SW	50	260	159	32	1	0	502
WSW	38	229	162	47	15	5	496
W	44	218	175	87	26	2	552
WNW	36	214	111	58	6	0	425
NW	41	196	79	13	1	1	331
NNW	50	308	157	15	1	0	531
TOTAL	629	3659	2720	635	66	8	7717

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 2724

Table C-2 (continued)

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 85010101-87123124
STABILITY CLASS: E DT/DZ
ELEVATION: SPEED:SPD60M DIRECTION:DIR60M LAPSE:DT60M

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	31	114	71	1	0	0	217
NNE	46	148	141	15	1	0	351
NE	54	259	216	38	0	0	567
ENE	53	212	137	11	0	0	413
E	77	213	100	0	0	0	390
ESE	82	246	65	2	0	0	395
SE	69	240	120	6	0	0	435
SSE	66	353	154	7	0	0	580
S	108	391	109	5	0	0	613
SSW	74	300	112	24	0	0	510
SW	75	336	152	32	0	0	595
WSW	60	259	134	24	0	0	477
W	55	288	194	34	3	0	574
WNW	46	193	118	28	2	0	387
NW	52	140	54	12	1	0	259
NNW	60	206	63	4	0	0	333
TOTAL	1008	3898	1940	243	7	0	7096

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 2724

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 85010101-87123124

STABILITY CLASS: F DT/DZ

ELEVATION: SPEED:SPD60M DIRECTION:DIR60M LAPSE:DT60M

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	23	69	21	0	0	0	113
NNE	25	55	31	4	0	0	115
NE	40	137	53	3	0	0	233
ENE	42	86	34	0	0	0	162
E	46	82	22	0	0	0	150
ESE	35	76	18	0	0	0	129
SE	43	97	17	1	0	0	158
SSE	42	126	24	1	0	0	193
S	74	183	37	4	0	0	298
SSW	62	172	54	9	1	0	298
SW	61	204	74	6	0	0	345
WSW	64	213	59	6	0	0	342
W	59	156	36	5	1	0	257
WNW	34	82	34	8	0	0	158
NW	29	69	25	1	0	0	124
NNW	50	98	19	2	0	0	169
TOTAL	729	1905	558	50	2	0	3244

PERIODS OF CALM(HOURS): 0

VARIABLE DIRECTION 0

HOURS OF MISSING DATA: 2724

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 85010101-87123124

STABILITY CLASS: G DT/DZ

ELEVATION: SPEED:SPD60M DIRECTION:DIR60M LAPSE:DT60M

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	51	43	6	0	0	0	100
NNE	46	18	10	0	0	0	74
NE	40	32	8	2	0	0	82
ENE	48	28	16	1	0	0	93
E	34	32	6	0	0	0	72
ESE	32	20	0	1	0	0	53
SE	31	33	4	0	0	0	68
SSE	33	48	3	3	0	0	87
S	54	58	5	1	0	0	118
SSW	57	87	25	4	0	0	173
SW	60	139	42	6	0	0	247
WSW	60	75	32	2	0	0	169
W	35	56	14	2	0	0	107
WNW	37	28	11	0	0	0	76
NW	50	26	8	0	0	0	84
NNW	79	93	8	0	0	0	180
TOTAL	747	816	198	22	0	0	1783

PERIODS OF CALM(HOURS): 0

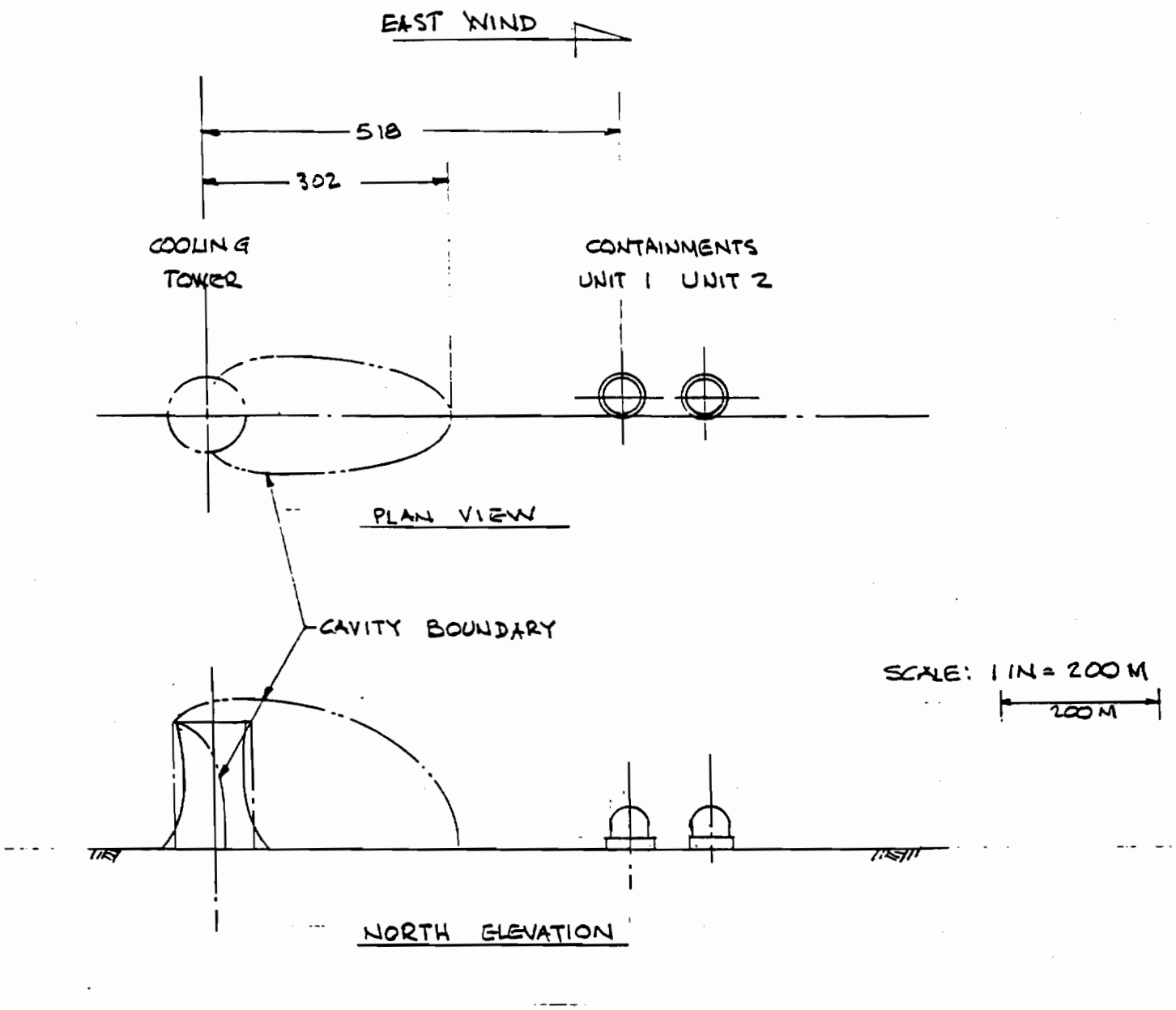
VARIABLE DIRECTION 0

HOURS OF MISSING DATA: 2724

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 85010101-87123124
STABILITY CLASS: ALL DT/DZ
ELEVATION: SPEED:SPD60M DIRECTION:DIR60M LAPSE:DT60M

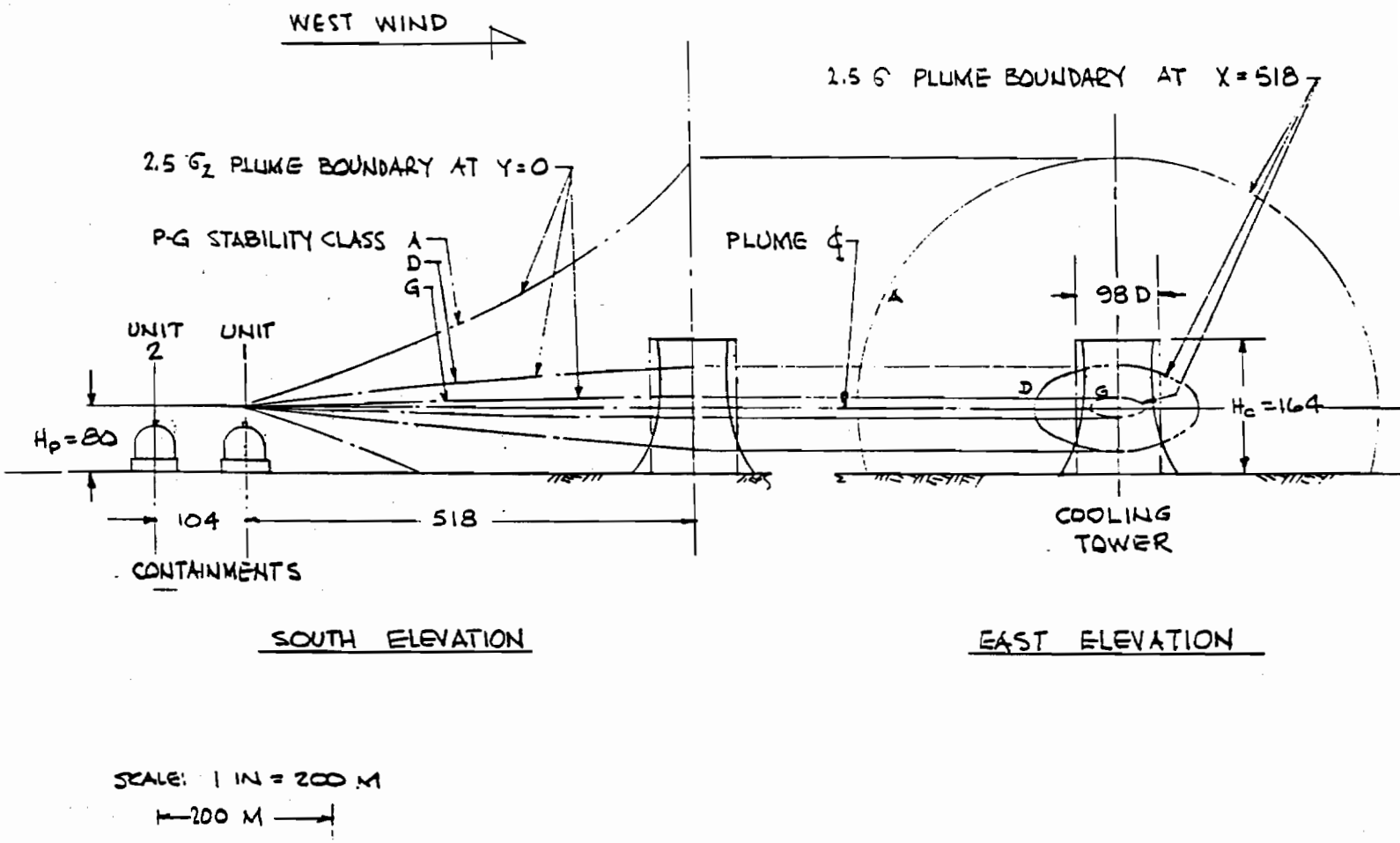
WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	162	529	325	28	1	0	1045
NNE	156	532	598	98	4	0	1388
NE	184	819	809	206	6	0	2024
ENE	209	644	521	96	1	0	1471
E	199	622	325	25	0	0	1171
ESE	181	566	216	14	1	0	978
SE	185	581	271	30	0	0	1067
SSE	178	834	326	29	2	0	1369
S	299	999	289	27	2	0	1616
SSW	250	924	369	103	6	0	1652
SW	260	1090	610	117	5	0	2082
WSW	230	961	598	160	25	6	1980
W	201	853	640	235	45	2	1976
WNW	163	617	399	148	12	0	1339
NW	181	513	257	59	2	1	1013
NNW	254	789	308	33	1	0	1385
TOTAL	3292	11873	6861	1408	113	9	23556

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 2724



Vogtle cooling tower cavity dimensions according to proportions reported by Hosker.

Figure C-1. Cooling Tower Effects From an East Wind



2.5 sigma plume boundaries for P-G stability classes A, D and G for a vent release at Vogtle Unit 1, a plume leveling-off height of 80 m, and a steady west wind.

Figure C-2. Cooling Tower Effects From a West Wind

Southern Nuclear Operating Company

AR-07-0453

Enclosure 5

Meteorological Input and Output Data Files

on

Compact Disc (CD)