Progress Energy

Serial: NPD-NRC-2009-126 | 10 CFR 52.79
June 26, 2009

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

**SHEARON HARRIS NUCLEAR POWER PLANT, UNITS 2 AND 3
DOCKET NOS. 52-022 AND 52-023
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 062 RELATED TO REGIONAL CLIMATOLOGY**

Reference: Letter from Manny Comar (NRC) to James Scarola (PEC), dated May 31, 2009, "Request for Additional Information Letter No. 062 Related to SRP Section 02.03.01 for the Shearon Harris Nuclear Plant Units 2 and 3 Combined License Application"

Ladies and Gentlemen:

Progress Energy Carolinas, Inc. (PEC) hereby submits our response to the Nuclear Regulatory Commission's (NRC) request for additional information provided in the referenced letter.

A response to the NRC request is addressed in the enclosure. The enclosure also identifies changes that will be made in a future revision of the Shearon Harris Nuclear Power Plant Units 2 and 3 application.

If you have any further questions, or need additional information, please contact Bob Kitchen at (919) 546-6992, or me at (919) 546-6107.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on June 26, 2009.

Sincerely,

Garry D. Miller
General Manager
Nuclear Plant Development

Enclosure

cc: U.S. NRC Region II, Regional Administrator
Mr. Brian Hughes, U.S. NRC Project Manager

Progress Energy Carolinas, Inc.
P.O. Box 1551
Raleigh, NC 27602

D084
NRO

Shearon Harris Nuclear Power Plant Units 2 and 3
Response to NRC Request for Additional Information Letter No. 062 Related to SRP Section 02.03.01 for the Combined License Application, dated May 31, 2009

NRC RAI #	Progress Energy RAI #	Progress Energy Response
02.03.01-13	H-0475	Response enclosed – see following pages
02.03.01-14	H-0476	Response enclosed – see following pages

NRC Letter No.: HAR-RAI-LTR-062

NRC Letter Date: May 31, 2009

NRC Review of Final Safety Analysis Report

NRC RAI NUMBER: 02.03.01-13

Text of NRC RAI:

Address, in FSAR Section 2.3.2, the extreme frozen winter precipitation event and extreme liquid winter precipitation event as site characteristics in accordance with the Interim Staff Guidance (ISG) DC/COLISG-07, "Interim Staff Guidance on Assessment of Normal and Extreme Winter Precipitation Loads on the Roofs of Seismic Category I Structures" (ML081990438) and provide a discussion for the site characteristic values chosen. The applicant may also justify an alternative approach.

When describing the extreme liquid winter precipitation, please also include a discussion on the potential for ponding of rainwater with pre-existing snow pack conditions leading to roof collapse for safety-related structures

PGN RAI ID #: H-0475

PGN Response to NRC RAI:

Progress Energy (PE) agrees with the methodology presented in Interim Staff Guidance (ISG) DC/COL ISG-07, "Interim Staff Guidance on Assessment of Normal and Extreme Winter Precipitation Loads on the Roofs of Seismic Category I Structures." The document provides guidance for determining the normal and extreme winter precipitation events and the resulting normal and extreme winter precipitation roof loads (Reference RAI 02.03.01-13 01).

1. Normal and Extreme Winter Precipitation Events

Following the ISG-07 guidance, winter precipitation-related roof loadings should be based on the weight of the antecedent snowpack resulting from the normal winter precipitation event, plus the larger resultant weight from either (1) the extreme frozen winter precipitation event, or (2) the extreme liquid winter precipitation event (Reference RAI 02.03.01-13 01).

Normal Winter Precipitation Event

The normal winter precipitation event was determined by taking the highest ground-level weight (in pounds per square foot [psf]) associated with the 100-year return period snowpack, the historical maximum snowpack, the 100-year return period snowfall event or the historical maximum snowfall event in the site region.

The 100-year return period snowpack was based on published 50-year recurrence ground snow loads for Charlotte, Greensboro, Raleigh-Durham, and Wilmington using Figure 7-1, "Ground Snow Loads, p_g, for the United States (psf)," from American Society of Civil Engineers (ASCE)

7-05, "Minimum Design Loads for Buildings and Other Structures." A correction to the 50-year recurrence values to convert to 100-year recurrence values was performed using Table C7-3, "Factors for Converting from Other Annual Probabilities...," from ASCE 7-05 (Reference FSAR 2.3-216).

The historical maximum snowfall event and the projected 100-year return period snowfall event were obtained from the National Climatic Data Center's (NCDC's) Snow Climatology website (Reference RAI 02.03.01-13 02). The snow climatology website provides the 100-year return period snowfall event and the historical maximum snowfall event in the form of 1-, 2-, and 3-day events for the 100-year return period and the associated observed maximum snowfall, respectively (Reference RAI 02.03.01-13 02).

The historical maximum snowpack was obtained from Local Climatological Data (LCD) Summaries (Reference FSAR 2.3-203 to FSAR 2.3-206) and the "Climatography of the United States No. 20" publications (Reference RAI 02.03.01-13 03).

The following table summarizes the projected 100-year return period snowpack, the observed historical maximum snowpack, the 100-year return period snowfall event, and the historical maximum snowfall events for Charlotte, Greensboro, Raleigh-Durham, and Wilmington.

	Charlotte, NC	Greensboro, NC	Raleigh-Durham, NC	Wilmington, NC
50-yr/ 100-yr Return Period Snowpack [a] (pounds per square foot [psf])	10/ 12.2	15/ 18.3	15/ 18.3	10/ 12.2
100-yr Return Period Snowfall Event [b,c] (inches/psf)	16.5/ 12.9	17.4/ 13.6	18.3/ 14.3	13.1/ 10.2
Historical Maximum Snowfall Event [b, c] (inches/psf)	12.7/ 9.9	**23.9/ 18.6**	20.3/ 15.8	10.6/ 8.3
Historical Maximum Snowpack [c, d, e] (inches/psf)	13.0/ 9.1	16.4/ 12.5	17.9/ 14.1	11.7/ 6.0

a) ASCE Standard No. 7-05 (Reference FSAR 2.3-216)
b) NCDC Snow Climatology (Reference RAI 02.03.01-13 02)
c) NCDC reference provides data in inches of snowfall or snow depth.
d) National Oceanic and Atmospheric Administration (NOAA) "Local Climatological Data" (Reference FSAR 2.3-203 to FSAR 2.3-206)
e) NOAA "Climatography of the United States No. 20" (Reference RAI 02.03.01-13 03)

Extreme Frozen Winter Precipitation Event

The extreme frozen winter precipitation event was determined by taking the highest ground-level weight (in psf) of the 100-year return period snowfall event or the historical maximum snowfall event in the site region, resulting in a ground-level weight of 18.6 psf (Greensboro, NC).

Extreme Liquid Winter Precipitation Event

The extreme liquid winter precipitation event was assumed to be the 48-hour Winter Probable Maximum Precipitation (PMP) for the area as described in the PE-prepared calculation HAG-

0000-X7C-021, Rev. 0, “Calculation of 48-hour Probable Maximum Winter Precipitation.” This calculation is available in the PE-provided Reading Room. This calculation documents the winter PMP for the site region, which resulted in a PMP of 24.5 inches (water equivalent).

2. Normal and Extreme Winter Precipitation Roof Loads

The ISG-07 guidance document describes NRC’s preferred methodology for converting the normal and extreme winter precipitation events into their resulting normal and extreme winter precipitation roof loads.

Normal Winter Precipitation Roof Load

The normal winter precipitation roof load was determined using the ASCE 7-05 standard for converting ground snow from a normal winter precipitation event to snow load on the roof. The snow load on the roof was calculated from the Flat Roof Snow Load equation:

$$p_f = 0.7 \cdot C_e \cdot C_t \cdot I \cdot p_g \qquad (1)$$

Where,
P_g = ground snow load (18.6 psf)
C_e = exposure factor (1.1)
C_t = thermal factor (1.0)
I = importance factor (1.0)

The calculated normal winter precipitation roof load is 20.5 psf. This value is well within the AP1000 Design Control Document (DCD) parameters presented in FSAR Table 2.0-201. The DCD site characteristic ground snow load value for the AP1000 is 75 psf with an exposure factor of 1.1, thermal factor of 1.0, and importance factor of 1.2.

Potential for Extreme Winter Precipitation Roof Loading

The extreme winter precipitation event roof load would be based on the roof loading due to the normal winter precipitation event plus any accumulation of water associated with an additional antecedent extreme winter precipitation event. While the design of the AP1000 structures may allow for the accumulation of snowfall on the roofs, the potential for additional accumulation of precipitation from rainwater ponding during an extreme winter PMP rainfall event is not considered to be significant due to the design of the AP1000 structures.

FSAR Subsection 2.3.1.2 will be revised to provide additional discussion of the above issues.

References:

1. RAI 02.03.01-13 01 U.S. Nuclear Regulatory Commission, “Interim Staff Guidance on Assessment of Normal and Extreme Winter Precipitation Loads on the Roofs of Seismic Category I Structures,” DC/COL ISG-07, NRC

2. RAI 02.03.01-13 02 U.S. Department of Commerce, "United States Snow Climatology", National Climatic Data Center, National Oceanic and Atmospheric Administration, Website, www.ncdc.noaa.gov/ussc/index.jsp, accessed June 9, 2009

3. RAI 02.03.01-13 03 U.S. Department of Commerce, "Climatography of the United States No. 20, 1971-2000," National Climatic Data Center, National Oceanic and Atmospheric Administration, published for Charlotte, Greensboro, Raleigh-Durham, and Wilmington

4. RAI 02.03.01-13 04 U.S. Department of Commerce, "Seasonal Variation of 10-Square-Mile Probable Maximum Precipitation Estimates, United States East of the 105th Meridian," Hydrometeorological Report No. 53, National Oceanic and Atmospheric Administration, April 1980

Associated HAR COL Application Revisions:

The last paragraph of FSAR Rev. 1 Subsection 2.3.1.2.3 "Heavy Snow and Severe Glaze Storms" will be revised from:

Subsection C.I.2.3.1.2 of NRC Regulatory Guide 1.206 suggests that applicants provide site vicinity estimates of the weight of the 100-year return period snowpack (at ground level) and the weight of the 48-hour probable maximum winter precipitation (PMWP) for use in estimating the weight of snow and ice on the roofs of safety-related structures. The 100-year return snowpack was obtained from the Ground Snow Load 50-year recurrence for Charlotte, Greensboro, and Raleigh-Durham 54 kilograms per square meter (kg/m2) (11 pounds per square foot [psf]), 54 kg/m2 (11 psf), and 68 kg/m2 (14 psf) of snowpack, respectively (Reference 2.3-217). A correction of the 50-year recurrence values to 100-year recurrence values was performed using Table C7 3, "Factors for Converting from Other Annual Probabilities...," from SEI/ASCE 7-05, "Minimum Design Loads for Buildings and Other Structures" (Reference 2.3-216). Using the conversion factor of 1.22, the 100 year recurrent ground snow load is calculated to be 65 kg/m2 (13.4 psf), 65 kg/m2 (13.4 psf), and 83 kg/m2 (17 psf) for Charlotte, Greensboro, and Raleigh-Durham, respectively. The 48-hour PMWP for the HAR site is estimated to be approximately 620 kg/m2 (126.9 psf) or approximately 62.23 cm (24.5 in.) of precipitable water (Reference 2.3-219). December averages 1.52 cm (0.6 in.), 2.29 cm (0.9 in.), and 1.27 cm (0.5 in.) of snowfall for Charlotte, Greensboro, and Raleigh-Durham, respectively. Maximum 24-hour snowfall for Charlotte is 30.73 cm (12.1 in.), recorded in January 1988; 36.32 cm (14.3 in.) for Greensboro, recorded in December 1930; and 45.47 cm (17.9 in.) for Raleigh Durham, recorded in January 2000.

To:

Subsection C.I.2.3.1.2 of NRC Regulatory Guide 1.206 and Interim Staff Guidance (ISG) DC/COL ISG-07, "Interim Staff Guidance on Assessment of Normal and Extreme Winter Precipitation Loads on the Roofs of Seismic Category I Structures" suggests that applicants identify winter precipitation events as site characteristics and site parameters for determining normal and extreme winter precipitation loads on roofs of Seismic Category I structures. The normal winter precipitation event was determined by taking the highest ground-level weight (in pounds per square foot [psf]) associated with the projected 100-year return period snowpack, the historical maximum snowpack, the projected 100-year return period snowfall event or the historical maximum snowfall event in the site region.

The 100-year return period snowpack was based on the published 50-year recurrence Ground Snow Load for Charlotte, Greensboro, Raleigh-Durham, and Wilmington using Figure 7-1, "Ground Snow Loads, pg, for the United States (lb/ft2)," from American Society of Civil Engineers (ASCE) 7-05, "Minimum Design Loads for Buildings and Other Structures" (Reference 2.3-216). The 100-year return period snowpack was estimated to be 48.8 kilograms per square meter (kg/m2) (10 pounds per square foot [psf]), 73.2 kg/m2 (15 psf), 73.2 kg/m2 (15 psf), and 48.8 kg/m2 (10 psf) for Charlotte, Greensboro, Raleigh-Durham, and Wilmington, respectively. (Reference 2.3-216). Using the conversion factor of 1.22, the 100-year recurrent ground snow load is calculated to be 59.6 kg/m2 (12.2 psf), 89.3 kg/m2 (18.3 psf), 89.3 kg/m2 (18.3 psf), and 59.6 kg/m2 (12.2 psf) for Charlotte, Greensboro, Raleigh Durham, and Wilmington, respectively.

The historical maximum snowfall event and the projected 100-year return period snowfall event were obtained from the National Climatic Data Center's (NCDC's) Snow Climatology website (Reference 2.3-230) and converted to ground snow loads using guidance provided in DC/COL ISG-07. The historical maximum snowfall event for Charlotte, Greensboro, Raleigh-Durham, and Wilmington was 48.3 kg/m2 (9.9 psf), 90.8 kg/m2 (18.6 psf), 77.1 kg/m2 (15.8 psf), and 40.5 kg/m2 (8.3 psf), respectively. The projected 100-year return period snowfall event for Charlotte, Greensboro, Raleigh-Durham, and Wilmington was 63.0 kg/m2 (12.9 psf), 66.4 kg/m2 (13.6 psf), 69.8 kg/m2 (14.3 psf), and 49.8 kg/m2 (10.2 psf), respectively.

The historical maximum snowpack for Charlotte, Greensboro, Raleigh-Durham, and Wilmington was 44.4 kg/m2 (9.1 psf), 61.0 kg/m2 (12.5 psf), 68.8 kg/m2 (14.1 psf), and 29.3 kg/m2 (6.0 psf), respectively.

The site characteristic ground snow load is selected as the greater of the above values or 18.6 psf (Greensboro, NC).

ISG DC/COL ISG-07 presents the methodology for converting the normal and extreme winter precipitation events into their resulting normal and extreme winter precipitation roof loads.

Normal winter precipitation roof load was determined using the ASCE 7-05 standard for converting ground snow from a normal winter precipitation event to snow load on the roof (Reference 2.3-216). The resulting normal winter precipitation roof load is 20.5 psf.

Extreme winter precipitation event roof load is based on the roof load due to the normal winter precipitation event plus any accumulation of water associated with an additional antecedent extreme winter precipitation event. While the design of the AP1000 structures may allow for the accumulation of snowfall on the roofs, the potential for additional accumulation of precipitation from rainwater ponding during an extreme winter PMP rainfall event is not considered to be significant due to the design of the AP1000 structures. Therefore, no significant additional roof loadings are assumed to occur beyond the weight of pre-existing snowpack.

Attachments/Enclosures:
None

NRC Letter No.: HAR-RAI-LTR-062

NRC Letter Date: May 31, 2009

NRC Review of Final Safety Analysis Report

NRC RAI NUMBER: 02.03.01-14

Text of NRC RAI:

The response to RAI 02.03.01-8 (September 17, 2008), Table 2.3.1-206, stated, in footnote (a) that the "Maximum Safety temperatures are 100-yr estimates based on available POR and a regression analyses."

The staff's analysis for the Maximum Safety 100-year recurrent coincident wet bulb temperature shows a value considerably warmer than that shown in Table 2.3.1-206 (from RAI response 02.03.01-8) and in Table 2.0-201 (from RAI response 02.03.01-11, same date).

Please explain the regression analysis that was performed in order to calculate the Maximum Safety temperature 100-year estimates.

PGN RAI ID #: H-0476

PGN Response to NRC RAI:

The mean coincident wet-bulb temperature (MCWB) for the 100-year return interval, 2 hour sustained dry-bulb temperature was estimated using a multiple-step linear regression analysis. First, an analysis was performed between the 2-hour sustained dry-bulb temperature and coincident relative humidity at the highest observed temperature range (2 hour sustained dry-bulb temperatures greater than 90oF), followed by an extrapolation of the regression equation to include the 100-year return interval, 2-hour sustained dry-bulb temperature. Next, the regression equation was used to determine the relative humidity coincident with the 100-year return interval, 2-hour sustained dry-bulb temperature. Finally, a psychrometric table was used to determine the MCWB from the 100-year return interval, 2-hour dry-bulb temperature and coincident relative humidity from the regression analysis.

A more detailed explanation of the regression analysis that was used to determine the 100 year maximum safety temperature estimates is provided in the calculation, HAG-0000-X6C-001, Rev. 0, "Dry-bulb/Wet-bulb Temperature Evaluation," which is available in the Progress Energy-provided Reading Room.

References:
None

Associated HAR COL Application Revisions:
None

Attachments/Enclosures:

None