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U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
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South Texas Project
Units 3 and 4
Docket Nos. 52-012 and 52-013
Response to Request for Additional Information

Attached is the first part of the response to the NRC staff question in Request for Additional Information (RAI) letter 414, related to the Combined License Application (COLA) Part 2, Tier 2, Section 2.3S, Meteorology. This letter provides the response to the following NRC staff question:

02.03.01-24

This portion of the response provides all changes to COLA Part 2, Tier 2, Chapters 1 and 2. A future supplement to this RAI response will provide changes to COLA Part 2, Tier 2, Chapter 3, and necessary supporting changes to other parts of the COLA.

There are no commitments in this letter.

When a change to the COLA is indicated, it will be incorporated in a future revision of the COLA following the NRC acceptance of the RAI response.

If you have any questions regarding these responses, please contact me at (361) 972-7136 or Bill Mookhoek at (361) 972-7274.

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NRO

STI 33200824

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

Executed on 1/12/12

Scott Head
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rhb

Attachment: RAI 02.03.01-24

cc: w/o attachment except*
(paper copy)

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02.03.01-24

QUESTION:

10 CFR 52.79(a)(1)(iii) states, in part, that the COL FSAR should include the meteorological characteristics of the proposed site with appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area and with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated. 10 CFR 100.20(c)(2) states that the meteorological characteristics of the site that are necessary for safety analysis or that may have an impact upon plant design must be identified and characterized and 10 CFR 100.21(d) states, in part, that the meteorological characteristics of the site must be evaluated and site parameters established such that potential threats from such physical characteristics will pose no undue risk to the type of facility proposed to be located at the site.

10 CFR Part 50, Appendix A, GDC 2 requires that SSCs that are important to safety be designed to withstand the effects of natural phenomena, such as tornadoes and hurricanes, without loss of the ability to perform their safety functions. 10 CFR Part 50, Appendix A, GDC 4 requires that SSCs that are important to safety be appropriately protected against the effects of missiles that may result from events and conditions outside the nuclear power unit.

Nuclear power plants must be designed so that they remain in a safe condition under extreme meteorological events, including those that could result in the most extreme wind events (tornadoes and hurricanes) that could reasonably be predicted to occur at the site. Initially, the U.S. Atomic Energy Commission (predecessor to the NRC) considered tornadoes to be the bounding extreme wind events and issued RG 1.76, "Design-Basis Tornado for Nuclear Power Plants," in April 1974. The design-basis tornado wind speeds were chosen so that the probability that a tornado exceeding the design basis would occur was on the order of 10^{-7} per year per nuclear power plant. In March 2007, the NRC issued Revision 1 of RG 1.76, "Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants." Revision 1 of RG 1.76 relied on the Enhanced Fujita Scale, which was implemented by the National Weather Service in February 2007. The Enhanced Fujita Scale is a revised assessment relating tornado damage to wind speed, which resulted in a decrease in design-basis tornado wind speed criteria in Revision 1 of RG 1.76. Since design-basis tornado wind speeds were decreased as a result of the analysis performed to update RG 1.76, it was no longer clear that the revised tornado design basis wind speeds would bound design-basis hurricane wind speeds in all areas of the United States. This prompted an investigation into extreme wind gusts during hurricanes and their relation to design basis hurricane wind speeds, which resulted in issuing RG 1.221, "Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants," in October 2011.

RG 1.221 also evaluated missile velocities associated with several types of missiles considered for different hurricane wind speeds. The hurricane missile analyses presented in RG 1.221 are based on missile aerodynamic and initial condition assumptions that are similar to those used for the analyses of tornado-borne missile velocities adopted for Revision 1 to RG 1.76. However, the assumed hurricane wind field differs from the assumed tornado wind field in that the

hurricane wind field does not change spatially during the missile's flight time but does vary with height above the ground. Because the size of the hurricane zone with the highest winds is large relative to the size of the missile trajectory, the hurricane missile is subjected to the highest wind speeds throughout its trajectory. In contrast, the tornado wind field is smaller, so the tornado missile is subject to the strongest winds only at the beginning of its flight. This results in the same missile having a higher maximum velocity in a hurricane wind field than in a tornado wind field with the same maximum (3-second gust) wind speed.

The STP COLA incorporates by reference the ABWR Design Control Document (DCD). Section 3.5.1.4 of the DCD states, in part, that "tornado-generated missiles have been determined to be the limiting natural phenomena hazard in the design of all structures required for safe shutdown of the nuclear power plant. Since tornado missiles are used in the design basis, it is not necessary to consider missiles generated from other natural phenomena." However, Section 3.5.4.2 of the DCD states, in part, that the COL applicant "shall identify missiles generated by other site-specific natural phenomena that may be more limiting than those considered in the ABWR design and shall provide protection for the structures, systems, and components against such missiles."

Accordingly, the applicant is requested to address the following:

a. Consistent with the requirements of 10 CFR 52.79(a)(1)(iii), 10 CFR 100.20(c)(2), 10 CFR 100.21(d), and the Combined License Information requirement of ABWR DCD Section 3.5.4, please identify hurricane wind speed and missile spectra for the STP site. RG 1.221 describes a method that the staff considers acceptable in selecting site-specific hurricane wind speed and hurricane-generated missiles.

b. Pursuant to the requirements of GDC 2, GDC 4, and the Combined License Information requirement of ABWR DCD Section 3.5.4, please confirm that the ABWR standard plant and STP site-specific SSCs important to safety are designed to protect against the combined effects of hurricane winds and missiles defined in question a above.

c. Please revise the appropriate FSAR sections to appropriately reflect the results of questions a and b above.

RESPONSE:

Nuclear Innovation North America LLC (NINA), using the new data and new guidance in Regulatory Guide 1.221, "Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants," Revision 0, determined that the STP site specific design-basis hurricane windspeed is 338 kilometers per hour (km/h) (210 miles per hour (mph)) for a 3-second wind gust.

To ensure that the STP 3 & 4 design reflects the guidance provided in Regulatory Guide 1.221, COLA Part 2, Tier 2, Table 2.0-2, "Comparison of ABWR Standard Plant Site Design Parameters and STP 3 & 4 Site Characteristics," is being revised to include a requirement for

"STP Site Hurricane Wind Speed and Missiles." This change is incorporated as Tier 2 site-specific departure, STP DEP 3.5-2, "Hurricane Generated Missile Protection."

COLA Part 2, Tier 2, Chapter 1 and 2, changes necessary to incorporate Regulatory Guide 1.221 are included with this response.

The hurricane-generated missile spectrum consistent with the guidance provided in Regulatory Guide 1.221 will be incorporated into COLA Part 2, Tier 2, Chapter 3, as a new section, 3H.11, "Design for Site-Specific Hurricane Winds and Missiles." A future supplement to this RAI response will provide new section 3H.11 and other supporting changes to COLA Part 2, Tier 2, Chapter 3. The supplemental response to this RAI will also include changes to Section 3.0 of COLA Part 7, to describe and justify the site-specific departure, STP DEP 3.5-2, that incorporates guidance provided in Regulatory Guide 1.221. Additionally, COLA Part 9, "Inspections, Tests, Analyses and Acceptance Criteria" (ITAAC) will be revised as necessary to ensure these additional requirements are properly implemented.

Changes to the COLA Part 2, Tier 2, Chapters 1 and 2, are shown on the following pages:

The following changes to the COLA, Part 2, Tier 2, will be incorporated in a future revision of the COLA:

Table 1.9S-1 Site-Specific Conformance with Regulatory Guides (Continued)

No.	Title	Rev.
1.142	Safety-Related Concrete Structures for Nuclear Power Plants (Other than Reactor Vessels and Containments)	2 (11/01)
1.143	Design Guidance for Radioactive Waste Management Systems, Structures, and	2 (11/01)
1.153	Criteria for Safety Systems	1 (6/96)
1.160	Monitoring the Effectiveness of Maintenance at Nuclear Power Plants [per NEI 07-02]	2 (3/97)
1.165	Identification and Characterization of Seismic Sources and Determination of	0 (3/97)
1.182	Assessing and Managing Risk Before Maintenance Activities at Nuclear Power	0 (5/00)
1.189	Fire Protection for Nuclear Power Plants	1 (3/07)
1.194	Atmospheric Relative Concentrations for Control Room Radiological Habitability	0 (6/03)
1.198	Procedures and Criteria for Assessing Seismic Soil Liquefaction at Nuclear	0 (11/03)
1.199	Anchoring Components and Structural Supports in Concrete	0 (11/03)
1.204	Guidelines for Lightning Protection of Nuclear Power Plants	0 (11/05)
1.206	Combined License Applications for Nuclear Power Plants	0 (6/07)
1.208	A Performance-Based Approach to Define the Site-Specific Earthquake Ground	0 (3/07)
1.221	Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants	0 (10/11)
Division 4		
4.15	Quality Assurance for Radiological Monitoring Programs (Normal Operation) – Effluent Streams and the Environment	1 (2/79)

COLA Part 2, Tier 2, Table 2.0-2, is revised to include a new line item for "STP Site Hurricane Wind Speed and Missiles" and an associated Note 12, as shown below:

Table 2.0-2 Comparison of ABWR Standard Plant Site Design Parameters and STP 3 & 4 Site Characteristics

Subject	ABWR Standard Plant Site	STP 3 & 4 Site Characteristics	Bounded (Yes/No)	Discussion
Extreme Wind	Basic Wind Speed: 177 km/h [1] /197 km/h [2] Per Section 3.3.1.1, the reference ABWR DCD basic wind speed corresponds to a 50- year/100-year wind velocity (3- second wind gust) of: 203 km/h/224 km/h (126 mph/139 mph)	201 km/h/215 km/h (125 mph/134 mph) for 3-second wind gust	Yes	Further information on extreme winds is provided in Subsection 2.3S.1.
STP Site Hurricane Wind Speed and Missiles [12]	None	338 km/h (210 mph) for 3-second wind gust	Not Applicable	Maximum hurricane wind speed for the STP Site was determined in accordance with Regulatory Guide 1.221 as described in Subsection 2.3S.1.3.3.2. Hurricane generated missile spectrum was determined in accordance with Regulatory Guide 1.221 as described in Subsection 3H.11.

[12] Design requirements and exceptions applicable to tornado windspeed and tornado-generated missiles noted in various sections of the COLA are also applicable to hurricane wind speed and associated hurricane-generated missile spectrum (Refer to STP DEP 3.5-2).

COLA Part 2, Tier 2, Subsection 2.3S.1.3.1, Extreme Winds, is renumbered to Subsection 2.3S.1.3.1.1, Extreme Wind, and new Subsection 2.3S.1.3.1.2, STP Site Hurricane Wind Speed and Associated Missile Hazard, is added as shown below:

2.3S.1.3.1.1 Extreme Winds

To ensure that the design bases for SSCs important to safety include appropriate consideration for the most severe natural phenomena historically reported for the site and surrounding area, the design and operating bases wind loadings on plant structures were determined in accordance with the ASCE-SEI design standard, "Minimum Design Loads for Buildings and Other Structures," (Reference 2.3S-10). This is consistent with the guidance provided in NUREG-0800, Section 2.3.1 (Reference 2.3S-6).

Design wind loading is based on a basic wind speed, which is the "3-second gust speed at 33 feet (10 meters) above the ground in Exposure Category C," as defined in Sections 6.2 and 6.3 of Reference 2.3S-10. The basic wind speed for the STP 3 & 4 site is approximately 125 mph (201 km/h), based on a linear interpolation from the plot of basic wind speeds in Figure 6-1 of ASCE 2007 (Reference 2.3S-10) for that portion of the U.S. that includes the site for STP 3 & 4. From a probabilistic standpoint, a basic wind speed of 125 mph (201 km/h) for the STP 3 & 4 site is associated with a mean recurrence interval of 50 years. Section C6 (Table C6-7) of the ASCE-SEI design standard provides conversion factors for estimating 3-second-gust wind speeds for other recurrence intervals (Reference 2.3S-10). Based on this guidance, the 100-year return period value is determined by multiplying the 50-year return period value by a scaling factor of 1.07, which yields a 100-year return period 3 second-gust wind speed for the site of approximately 134 mph (215 km/h).

Three-second gust wind speed is always greater than the fastest mile wind speed. In the reference ABWR DCD, the listed extreme of 122 mph is the fastest mile wind speed. This corresponds to a 139 mph 3-second gust; therefore, the calculated 100-year fastest mile 3-second gust related to the reference ABWR DCD is not exceeded.

The reference ABWR DCD Tier 1, Table 5.0 and reference ABWR DCD Tier 2, Table 2.0-1 include the following site parameter values for Extreme Wind, for which the ABWR plant is designed:

- 177 km/h (110 mph) equivalent to 126 mph (3-second gust) - Basic Wind Speed, 50-year recurrence interval (for design of nonsafety-related structures only)

- 197 km/h (122 mph) equivalent to 139 mph (3-second gust) - 100-year recurrence interval (for design of safety-related structures only)

Using the data and the methodology recommended in Reference 2.3S-10, both the site-specific 50-year fastest mile basic wind speed and 100-year recurrence interval fastest mile wind for the STP 3 & 4 site are less than or equal to those specified in the reference ABWR.

The NOAA Coastal Services Center (CSC) Hurricane Track Query was also used to review the historical record of tropical cyclone tracks and intensities near the STP 3 & 4 site for the period from 1851 to the present. This review identified eleven tropical cyclones with wind speeds that exceed a design basis wind loading for the STP 3 & 4 site calculated in accordance with Reference 2.3S-10. The top five storms include: Not named 1886 (155 mph sustained wind speed); Not named 1900 (144 mph sustained wind speed); Not named 1932 (144 mph sustained wind speed); Not named 1945 (138 mph sustained wind speed); and Hurricane Carla 1961 (144 mph sustained wind speed). The maximum wind speeds are not measured by anemometers for these eleven storms and estimates are from other data. Additionally, CSC Hurricane Track Query is typically not used for the determination of design wind loading for buildings. However, ~~wind speeds identified during this review fall within the envelope for wind speeds addressed in Sections 2.3S.1.3.2, "Tornadoes," and do not represent a threat to the integrity of any STP 3 & 4 SSC.~~ as explained in Subsection 2.3S.1.3.3.2, Site Specific Design-Basis Hurricane, the STP site specific design-basis hurricane windspeed, which is listed in Table 2.0-2, was determined in accordance with Regulatory Guide 1.221 (Reference 2.3S-70).

Using the data and the methodology recommended in Reference 2.3S-10 to verify design basis wind loadings are less than or equal to those specified in the reference ABWR, without specific consideration of the CSC Hurricane Track Query data, satisfies the requirements of ASCE/SEI-7 (Reference 2.3S-10) and NUREG-0800 (Reference 2.3S-6). The ASCE/SEI-7 design standard wind speed map considered wind speeds of historically reported hurricanes and is updated periodically. However, as explained in Subsection 2.3S.1.3.1.2, STP Site Hurricane Wind Speed and Associated Missile Hazard, the STP 3 & 4 design incorporates the guidance provided in Regulatory Guide 1.221 for hurricane wind speed and the associated missile hazard. Therefore, appropriate consideration has been given to the most severe tropical cyclones ~~historically reported~~ and the consequences of these storms ~~are bounded by other phenomena considered in the design basis~~.

2.3S.1.3.1.2 STP Site Hurricane Wind Speed and Associated Missile Hazard

Regulatory Guide 1.221, "Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants," (Reference 2.3S-70) provides guidance for selecting the design-basis hurricane windspeed and hurricane-generated missiles.

The STP 3 & 4 design incorporates the guidance provided in Regulatory Guide 1.221 by the inclusion of a Site Characteristic requirement in Table 2.0-2 for hurricane wind speed and the associated missile hazard. Subsection 2.3S.1.3.3.2, Site Specific Design-Basis Hurricane, describes how hurricane windspeed and hurricane missiles are addressed consistent with guidance provided in Regulatory Guide 1.221.

COLA Part 2, Tier 2, Subsection 2.3S.1.3.3, Tropical Cyclones, is renumbered to Subsection 2.3S.1.3.3.1, Tropical Cyclones, and new Subsection 2.3S.1.3.3.2, Site Specific Design-Basis Hurricane, is added as shown below:

2.3S.1.3.3.1 Tropical Cyclones

2.3S.1.3.3.2 Site Specific Design-Basis Hurricane

The STP site specific design-basis hurricane windspeed listed in Table 2.0-2 was determined in accordance with Regulatory Guide 1.221 (Reference 2.3S-70). The resulting hurricane generated missile spectrum was determined in accordance with Regulatory Guide 1.221 as described in Subsection 3H.11.

COLA Part 2, Tier 2, Subsection 2.3S.6, References, is revised to include the following new reference:

2.3S-70 Regulatory Guide 1.221, "Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants," Revision 0, October 2011.