NINA

Nuclear Innovation
North America LLC
4000 Avenue F, Suite A
Bay City, Texas 77414

August 29, 2012
U7-C-NINA-NRC-120059

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville MD 20852-2738

South Texas Project
Units 3 and 4
Docket Nos. 52-012 and 52-013
<u>Supplemental Response to Request for Additional Information</u>

The Attachment provides a supplemental response to NRC staff question 02.03.01-24 related to the Combined License Application (COLA) Part 2, Tier 2, Section 3H.11. Following the audit performed during the week of July 23, 2012, the NRC Staff requested that Nuclear Innovation North America LLC provide additional information to support the review of the COLA. This response completes the actions requested by the NRC Staff.

Where there are COLA markups, they will be made at the first routine COLA update following NRC acceptance of the RAI response. There are no commitments in this letter.

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

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

Executed on 8/29/12

Scott Head
Manager, Regulatory Affairs
South Texas Project Units 3 & 4

jep

Attachment:

RAI 02.03.01-24, Supplement 3

D091
NRO

STI 33588918

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

Director, Office of New Reactors
U. S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

Regional Administrator, Region IV
U. S. Nuclear Regulatory Commission
1600 E. Lamar Blvd
Arlington, TX 76011–4511

Kathy C. Perkins, RN, MBA
Assistant Commissioner
Division for Regulatory Services
Texas Department of State Health Services
P. O. Box 149347
Austin, Texas 78714-9347

Alice Hamilton Rogers, P.E.
Inspection Unit Manager
Texas Department of State Health Services
P. O. Box 149347
Austin, Texas 78714-9347

*Steven P. Frantz, Esquire
A. H. Gutterman, Esquire
Morgan, Lewis & Bockius LLP
1111 Pennsylvania Ave. NW
Washington D.C. 20004

*Tom Tai
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852

(electronic copy)

*George F. Wunder
*Tom Tai
Fred Brown
U. S. Nuclear Regulatory Commission

Jamey Seely
Nuclear Innovation North America

Peter G. Nemeth
Crain, Caton and James, P.C.

Richard Peña
Kevin Pollo
L. D. Blaylock
CPS Energy

RAI 02.03.01-24, Supplement 3

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.

SUPPLEMENTAL RESPONSE:

Supplement 2 to the response to RAI 02.03.01-24 was submitted with Nuclear Innovation North America (NINA) letter U7-C-NINA-NRC-120040, dated May 22, 2012. Supplement 3 to RAI 02.03.01-24 provides the response to Punch List Items 269 and 271.

Each of the above 2 Punch List Items is addressed below.

1. Clarify that 1,024 kip load is the peak of the triangular impulse load for the automobile impact in the horizontal direction and that 445 kip load is peak of the triangular impulse load for the vertical direction in COLA. Also, in the RAI response clarify that the DLF is always greater than or equal to 1. ***(Punch List Item 269)***

   The auto missile impact loads are based on the peak of the triangular impulse loads as follows:

   - The peak of the triangular impulse load for an auto impact in the horizontal direction is 1024 kips.
   - The peak of the triangular impulse load for an auto impact in the vertical direction is 445 kips.

   The Dynamic Load Factor (DLF) for an auto missile impact load is always greater than or equal to 1.0.

   For COLA markups reflecting the above, see Tables 3H.11-1 through 3H.11-5 of the Enclosure.

2. Evaluate automobile impact due to hurricane for:
   a) East wall of Control Building between elevation 50'-11" and 67'-3/4"
   b) East wall of Reactor Building between elevation 54'-1/2" and 71'-9"
   (Punch List Item 271)

   A comparison of the DCD tornado missiles and site-specific hurricane missiles was provided in Item 5C of the response to RAI 02.03.01-24 Supplement 2. The comparison shows that the DCD designs for tornado missiles (per DCD Tier 1 Table 5.0) for the Reactor Building and Control Building are adequate for site-specific hurricane missiles excluding the horizontal automobile missile. Therefore, only the exterior wall panels of the Reactor Building and Control Building which are susceptible to a horizontal hurricane-generated automobile missile impact require additional panel assessment.

   <u>Panel Assessment for Reactor Building</u>

   The Reactor Building east, west, and south walls are susceptible to hurricane-generated automobile missile impacts. The north face of the Reactor Building is protected by the Control Building for heights at which automobile missiles are applicable (i.e. up to 30 feet above grade). Considering panel thickness, span and reinforcement of these walls, the wall panel between elevations 54'-½" and 71'-9" on the east face of the Reactor Building was selected as the critical panel for detailed analysis.

   To maximize the effects of the automobile missile impact for flexure and shear, multiple impact locations were considered (near the center of the panel for flexure and near the support for shear). The results of this assessment show that shear controls with a maximum impact force of 1024 kips and a minimum shear capacity of 1310 kips. Therefore, the portions of the Reactor Building exterior walls that are susceptible to hurricane automobile missile impact are adequate to resist hurricane generated missiles.

Panel Assessment for Control Building

The Control Building east, west, and north walls are susceptible to hurricane-generated automobile missile impacts. The south face of the Control Building is protected by the Reactor Building. Considering panel thickness, span and reinforcement of these walls, the wall panel between elevations 50'-11" and 67'-5 ½" on the east face of the Control Building was selected as the critical panel for detailed analysis.

To maximize the effects of the automobile missile impact for flexure and shear, multiple impact locations were considered (near the center of the panel for flexure and near the support for shear). The results of this assessment show that shear controls for an impact near the side of the Control Building with a maximum impact force of 1024 kips and a minimum shear capacity of 1056 kips, and flexure controls for an impact near the center of the panel with a ductility demand of less than 1 and ductility limit of 10. Therefore, the portions of the Control Building exterior walls that are susceptible to hurricane automobile missile impact are adequate to resist hurricane generated missiles.

See Enclosure for COLA markups.

Enclosure

COLA MARKUPS

3H.11.3.1 Hurricane Evaluations for the Reactor Building

The Reactor Building was evaluated under hurricane loading for local damage, panel capacity, global effects, and stability.

The minimum required wall thickness to prevent penetration, perforation, and scabbing is 15.4 inches (391 mm). The minimum wall thickness of the Reactor Building is 16.7 inches (425 mm). The minimum required roof thickness to prevent penetration, perforation, and scabbing is 11.4 inches (290 mm). The minimum roof thickness of the Reactor Building is 13.2 inches (335 mm).

~~Based on the DCD design for tornado wind and missiles per DCD Tier 1 Table 5.0, the Reactor Building exterior wall and slab panels are adequate for site-specific hurricane wind and missiles.~~ The results of panel evaluations for hurricane generated missile impacts on the Reactor Building are presented in Table 3H.11-4.

The global hurricane wind pressure on the Reactor Building is enveloped by the global tornado wind pressure from grade up to approximately 60 ft above grade. From approximately 60 ft above grade to the top of the Reactor Building, the global hurricane wind pressure exceeds the global tornado wind pressure. A comparison of the seismic shear versus the total hurricane shear on the Reactor Building shows that the hurricane load is significantly less than the seismic loading. Therefore, the hurricane loading has no impact on the global design or stability. See Table 3H.1-23 for Reactor Building stability.

3H.11.3.2 Hurricane Evaluations for the Control Building

The Control Building was evaluated under hurricane loading for local damage, panel capacity, global effects, and stability.

The minimum required wall thickness to prevent penetration, perforation, and scabbing is 15.4 inches (391 mm). The minimum wall thickness of the Control Building is 23.6 inches (600 mm). The minimum required roof thickness to prevent penetration, perforation, and scabbing is 11.4 inches (290 mm). The minimum roof thickness of the Control Building is 15.75 inches (400 mm).

~~Based on the DCD design for tornado wind and missiles per DCD Tier 1 Table 5.0, the Control Building exterior wall and slab panels are adequate for site-specific hurricane wind and missiles.~~ The results of panel evaluations for hurricane generated missile impacts on the Control Building are presented in Table 3H.11-5.

The global hurricane wind pressure on the Control Building is enveloped by the global tornado wind pressure. A comparison of the seismic shear versus the total hurricane shear on the Control Building shows that the hurricane load is significantly less than the seismic loading. Therefore, the hurricane loading has no impact on the global design.

The factors of safety against sliding and overturning for the hurricane load combination are reported in Table 3H.2-5.

Table 3H.11-1 Hurricane Missile Impact Evaluations for UHS/RSW Pump House

<table>
<tr><td rowspan="2">Local Check</td><td colspan="2" rowspan="2">UHS / RSW Pump House Walls and Roof</td><td>Minimum Required Thickness to Prevent Penetration, Perforation, and Scabbing = 15.4"</td></tr>
<tr><td>Minimum Provided Thickness = 18"</td></tr>
<tr><td rowspan="4">Overall Check of Impacted Element
(See Note 1)</td><td rowspan="2">RSW Pump House</td><td>Roof</td><td>Shear Controls.
Maximum impact load including Dynamic Load Factor (DLF) of 1.0 = 161 Kips
Minimum capacity = 188 Kips</td></tr>
<tr><td>Walls</td><td>Shear Controls.
Maximum impact load including Dynamic Load Factor (DLF) of 1.53 = 1566 Kips
Minimum capacity = 1732 Kips</td></tr>
<tr><td rowspan="2">UHS</td><td>Fan Enclosure Walls</td><td>Flexure Controls.
Ductility demand = 2.1
Ductility limit = 10</td></tr>
<tr><td>Basin Walls</td><td>Shear Controls.
Maximum impact load including Dynamic Load Factor (DLF) of 1.0 = 1024 Kips
Minimum capacity = 1130 Kips</td></tr>
</table>

Notes:

(1) The reported impact loads for the subject wall(s) are the resulting loads due to a horizontal automobile missile impact with a minimum impact load of 1024 kips (the peak of a triangular impulse load for a horizontal impact). The reported impact loads for the subject slab(s) are the resulting loads due to a vertical automobile missile impact with a minimum impact load of 445 kips (the peak of a triangular impulse load for a vertical impact).

Table 3H.11-2 Hurricane Missile Impact Evaluation for Diesel Generator Fuel Oil Storage Vault

Local Check	**DGFOS Vault Walls and Roof**	Minimum Required Thickness to Prevent Penetration, Perforation, and Scabbing = 15.4"
		Minimum Provided Thickness = 18"
Overall Check of Impacted Element (See Note 2)	**Roof**	Impacts where Shear Controls. Maximum impact load including Dynamic Load Factor of 1.0= 445 Kips Minimum capacity = 613 Kips
		Impacts where Flexure Controls. Ductility demand < 1.0 Ductility limit = 10
	Protection Hood	Shear Controls. Maximum impact load including Dynamic Load Factor of 1.0 = 227 Kips Minimum capacity = 534 Kips The minimum capacity is based on the inclusion of the following shear reinforcement: - #3 bars spaced at 6" o.c. in both directions
	Walls (Excluding Walls 9, 10, &16)	Shear Controls. Maximum impact load including Dynamic Load Factor of 1.1 = 1126 Kips Minimum capacity = 1202 Kips Maximum impact load and minimum capacity based on largest ratio of impact load to capacity.

Table 3H.11-2 Hurricane Missile Impact Evaluation for Diesel Generator Fuel Oil Storage Vault (Continued)

Overall Check of Impacted Element (See Note 2)	**Short Access Room Walls** (Walls 9 & 10) ~~(See Note 2)~~	Shear Controls. <u>For Vertical Beam Shear:</u> Maximum impact load including Dynamic Load Factor of 1.0 = 415 Kips Minimum capacity = 487 Kips <u>For Horizontal Beam Shear:</u> Maximum impact load including Dynamic Load Factor of 1.0 = 385 Kips Minimum capacity = 620 Kips Shear ties are required to withstand a missile strike near the top panel support. See Table 3H.6-11 and Figures 3H.6-176B and 3H.6-180B for reinforcement size and location.
	Entry Way Wall (Wall 16) ~~(See Note 2)~~	Shear Controls. <u>For Vertical Beam Shear:</u> Maximum impact load including Dynamic Load Factor of 1.0 = 507 Kips Minimum capacity = 625 Kips <u>For Horizontal Beam Shear:</u> Maximum impact load including Dynamic Load Factor of 1.0 = 457 Kips Minimum capacity = 620 Kips Shear ties are required to withstand a missile strike near the top and bottom panel supports. See Table 3H.6-11 and Figure 3H.6-208 for reinforcement size and location.

Notes:

(1) See Figure 3H.6-141 for location of Walls 9, 10, and 16.

(2) The reported impact loads for the subject wall(s) are the resulting loads ~~in the subject wall(s)~~ due to a~~n~~ horizontal automobile missile impact with a minimum impact load of 1024 kips (the peak of a triangular impulse load for a horizontal impact). The reported impact loads for the subject slab(s) are the resulting loads due to a vertical automobile missile impact with a minimum impact load of 445 kips (the peak of a triangular impulse load for a vertical impact).

Table 3H.11-3 Hurricane Missile Impact Evaluation for Diesel Generator Fuel Oil Tunnel

Local Check	**DGFOT and Access Regions Walls and Roof**	Minimum Required Thickness to Prevent Penetration, Perforation, and Scabbing = 15.4"
		Minimum Provided Thickness = 24"
Overall Check of Impacted Element (See Note 1)	**DGFOT Roof**	Shear Controls. Maximum impact load including Dynamic Load Factor (DLF) of 1.0 = 302 Kips Minimum capacity = 1058 Kips
	Access Region Walls ~~(See Note 1)~~	Shear Controls. Maximum impact load including Dynamic Load Factor (DLF) of 1.0 = 420 Kips Minimum capacity = 821 Kips The minimum capacity is based on the inclusion of the following shear reinforcement: - #3 bars spaced at 6" o.c. in both directions

Note (1): The reported impact loads for the subject wall(s) are the resulting loads ~~in the subject wall(s)~~ due to a~~n~~ horizontal automobile missile impact with a minimum impact load of 1024 kips (the peak of a triangular impulse load for a horizontal impact). The reported impact loads for the subject slab(s) are the resulting loads due to a vertical automobile missile impact with a minimum impact load of 445 kips (the peak of a triangular impulse load for a vertical impact).

Table 3H.11-4 Hurricane Missile Impact Evaluation for Reactor Building

Local Check	**Reactor Building Walls**	Minimum Required Thickness to Prevent Penetration, Perforation, and Scabbing = 15.4"
		Minimum Provided Thickness = 16.7"
	Reactor Building Roof	Minimum Required Thickness to Prevent Penetration, Perforation, and Scabbing = 11.4"
		Minimum Provided Thickness = 13.2"
Overall Check of Impacted Element (See Note 1)	**Roof and Walls above elevation 64'-0"**	Based on the DCD design for tornado missiles per DCD Tier 1 Table 5.0, the Reactor Building roof and exterior walls above elevation 64'-0" are adequate for hurricane missiles.
	Walls between grade (elevation 34'-0") and elevation 64'-0"	Shear Controls. Maximum impact load including Dynamic Load Factor of 1.0 = 1024 Kips Minimum capacity = 1310 Kips

Notes:

(1) The reported impact loads for the subject wall(s) are the resulting loads due to a horizontal automobile missile impact with a minimum impact load of 1024 kips (the peak of a triangular impulse load for a horizontal impact).

Table 3H.11-5 Hurricane Missile Impact Evaluation for Control Building

Local Check	**Control Building Walls**	Minimum Required Thickness to Prevent Penetration, Perforation, and Scabbing = 15.4"
		Minimum Provided Thickness = 23.6"
	Control Building Roof	Minimum Required Thickness to Prevent Penetration, Perforation, and Scabbing = 11.4"
		Minimum Provided Thickness = 15.75"
Overall Check of Impacted Element (See Note 1)	**Roof and Walls above elevation 64'-0"**	Based on the DCD design for tornado missiles per DCD Tier 1 Table 5.0, the Control Building roof and exterior walls above elevation 64'-0" are adequate for hurricane missiles.
	Walls between grade (elevation 34'-0") and elevation 64'-0"	Impacts where Shear Controls. Maximum impact load including Dynamic Load Factor of 1.0 = 1024 Kips Minimum capacity = 1056 Kips
		Impacts where Flexure Controls. Ductility demand < 1.0 Ductility limit = 10

Notes:

(1) The reported impact loads for the subject wall(s) are the resulting loads due to a horizontal automobile missile impact with a minimum impact load of 1024 kips (the peak of a triangular impulse load for a horizontal impact).