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NUCLEAR ENERGY

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May 4, 2011

UN#11-150

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

Subject: UniStar Nuclear Energy, NRC Docket No. 52-016
Response to Request for Additional Information for the
Calvert Cliffs Nuclear Power Plant, Unit 3,
RAI No. 285, Tornado Loads

References:
1) Surinder Arora (NRC) to Robert Poche (UniStar Nuclear Energy), "FINAL RAI 285 SEB2 5314" email dated January 7, 2011

2) UniStar Nuclear Energy Letter UN#11-073, from Greg Gibson to Document Control Desk, U.S. NRC, Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3, RAI No. 285, Tornado Loads, dated February 4, 2011

The purpose of this letter is to respond to the request for additional information (RAI) identified in the NRC e-mail correspondence to UniStar Nuclear Energy, dated January 7, 2011 (Reference 1). This RAI addresses Tornado Loads as discussed in Section 3.3.2 of the Final Safety Analysis Report (FSAR), as submitted in Part 2 of the Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 Combined License Application (COLA), Revision 7.

Reference 2 provided a schedule for the response to Question 03.03.02-8. The Enclosure provides the response to RAI No. 285, Question 03.03.02-8, and includes revised COLA content. A Licensing Basis Document Change Request has been initiated to incorporate these changes into a future revision of the COLA.

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NRO

Our response does not include any new regulatory commitments. This letter does not contain any sensitive or proprietary information.

If there are any questions regarding this transmittal, please contact me at (410) 470-4205, or Mr. Wayne A. Massie at (410) 470-5503.

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

Executed on May 4, 2011

for Greg Gibson

Enclosure: Response to NRC Request for Additional Information, RAI No. 285, Tornado Loads, Question 03.03.02-8, Calvert Cliffs Nuclear Power Plant, Unit 3

cc: Surinder Arora, NRC Project Manager, U.S. EPR Projects Branch
Laura Quinn, NRC Environmental Project Manager, U.S. EPR COL Application
Getachew Tesfaye, NRC Project Manager, U.S. EPR DC Application (w/o enclosure)
Charles Casto, Deputy Regional Administrator, NRC Region II (w/o enclosure)
Silas Kennedy, U.S. NRC Resident Inspector, CCNPP, Units 1 and 2
U.S. NRC Region I Office

GTG/SJS/mdf

Enclosure

**Response to NRC Request for Additional Information,
RAI No. 285, Tornado Loads, Question 03.03.02-8,
Calvert Cliffs Nuclear Power Plant, Unit 3**

RAI 285

Question 03.03.02-8

Supplemental Question to RAI 128

General Design Criterion 2 (GDC 2) requires that structures, systems and components important to safety, be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunamis, and seiches without loss of capability to perform their intended safety functions. GDC 2 further requires that the design bases reflect appropriate considerations for the most severe natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated in the past.

The Calvert Cliffs Nuclear Power Plant Unit 3 FSAR, Revision 6, Section 3.3.2.3, and the applicant's response to RAI No. 128, Question 3.3.2-1, parts 1 and 2, created additional concerns for the staff.

In response to RAI 128, Question 3.3.2-1, Part 2, the applicant provided information regarding the design methodology for the non-safety related structures, which are in close proximity to safety related structures. These structures include the Switchgear Building and Forebay. Although the applicant indicated that these structures are designed to withstand the tornado loading, the staff requests additional information for each structure as indicated below due to the applicants' unclear statements in the design methodology section for the aforementioned two structures.

Switchgear Building (SB): As the applicant indicated, the structural system for this building will use the engineered pressure relief siding panels to mitigate the effect of tornado loading. The staff concern is about the magnitude of the damages to the safety related structures caused by the mass of the panels in case of separation from the wall due to the tornado loading and impact on safety related structures. Therefore, the applicant is requested to provide the following information:

1. Explain how the design bases assumptions, as referenced by the applicant in FSAR Revision 6, Section 3.5.1.4, consider the separation of panels from the switchgear building walls during tornado events and the effects of the panel's impact as a missile on safety related structures;
2. Explain the basis for determining the magnitude of the damages on safety related structures panel missile impact; and,
3. If the panels due to its mass are considered a missile as described in FSAR, Revision 6, Section 3.5.1.4, explain how the applicant determined that it's mass enveloped by the missile spectra of RG 1.76.

The staff needs this information to ensure that the panels, generated as a missile by tornado loadings, will not adversely affect the safety related structures, which will allow the staff to make their final safety conclusions.

Forebay: The applicant indicated that, in order for this structure to mitigate adverse effects on safety related structures, the Forebay structure and elements are designed to

withstand the tornado loadings in a manner similar to the safety related Ultimate Heat Sink Makeup Water Intake Structure (UHS MWIS). The applicant is requested to clarify the meaning of the phrase "in a manner similar" to the design of safety related structures.

There appears to be inconsistent or confusing information about the design of the Forebay structure. As noted above, on page 4 of the RAI response, the applicant used the terms "is designed to withstand tornado loadings in a manner similar to the design of safety related UHS MWIS," and in Table 1 of the response, the applicant indicated that the Forebay structure is a non-safety related structure. The staff needs additional information to resolve this apparent inconsistency to assure there is no adverse interactions between seismic category I (SCI) and non-SCI structures. The design of the Forebay in resisting the tornado loading could lead to significantly different performance and impacts on safety related structures depending on whether the structure is designed "in a manner similar" to safety related structure or as a non-safety related structure. Specifically, the staff needs to know which part(s) of the Forebay structure will be designed as a safety related structure.

The FSAR should be revised to include the responses to this RAI.

Response

Switchgear Building

Item 1

The potential for missiles generated by separation of panels from the switchgear building walls during tornado events and subsequent panel impact as a missile on safety-related structures was evaluated and found to be enveloped by the Regulatory Guide (RG) 1.76 Region I tornado missile spectrum. These missiles are a conservative representation of those that could be generated by the less intense extreme wind conditions anticipated at the CCNPP Unit 3 site. The RG 1.76, Region I tornado missile spectrum utilized in the U.S. EPR FSAR was used for the safety-related structures at CCNPP Unit 3 as discussed in COLA FSAR Revision 7, Subsection 3.5.1.4. As such, the panel missile is enveloped.

Item 2

Global and local impact evaluations were conducted to determine magnitudes of damages on safety-related structures due to possible impact of a detached siding panel. For the global impact evaluation, interface force-time functions were developed for a detached panel missile and compared with the interface force-time functions of the Schedule 40 pipe design-basis tornado missile of RG 1.76. It was determined, based on impulse function comparisons and single-degree-of-freedom (SDOF) inelastic response charts, that for an arbitrary SDOF inelastic system, the Schedule 40 pipe missile has a higher response ductility demand than the panel missile.

The siding panels are thin walled structures having aspect ratios of the panel dimensions to its thickness between 120 and 1440. Therefore, a detached siding panel will buckle upon impact with a concrete target. However, for the local impact evaluation, buckling

effects were neglected and the panel was conservatively treated as a 1-inch solid steel rod with a mass equal to that of the panel. An impact velocity of 135 ft/s was selected, in accordance with the RG 1.76 values specified for Region I pipe missile. For these conditions, the calculated maximum penetration depth on a concrete target is less than the minimum concrete barrier thickness for safety-related structures at the Calvert Cliffs Unit 3 site.

Item 3

The siding panels used for the exterior of the switchgear building are lightweight structures made of corrugated steel sheet metal. Each panel measures maximum 3 ft x 36 ft in dimension and has a 22 gage thickness. This results in a maximum mass for each panel of 180 lbs. In comparison, the schedule 40 pipe missile taken from the RG 1.76 design missile spectrum and used in the US EPR design has a mass of 287 lbs. Since the mass of the panel is less than the Schedule 40 pipe missile mass, the mass of the panel is enveloped by the RG 1.76 design missile spectrum.

Forebay

The Forebay is a safety-related Seismic Category I Structure. It is designed for the tornado parameters presented in the U.S. EPR FSAR Table 2.1-1, as described in CCNPP Unit 3 FSAR Section 3.3 in response to COL Item 3.3-1.

At the time the response to RAI 128 was submitted[1], the Forebay was classified as a Non-Safety-Augmented Quality, Seismic Category II Structure. The design intent was that the structure would withstand a tornado. Subsequently, it was determined that the Forebay needed to withstand all external events and was re-categorized as a safety-related Seismic Category I Structure. This change was reflected in an update to FSAR Table 3.2-1 "Classification Summary for Site Specific SSCs" provided in response to COLA FSAR RAI 182[2]. However, that change did not remove the Forebay from the list of non safety-related structures in FSAR Section 3.3.2.3.

In response to RAI 253[3], UniStar Nuclear Energy submitted a revised design for the intake structure which combined the Ultimate Heat Sink Makeup Water Intake Structure and Electrical Building into a single structure. This analysis and COLA change addressed the Forebay as a safety-related Seismic Category I structure. The FSAR markups included with that submittal updated Section 3.3.2.3 to remove the discussion of the Forebay as a non safety-related structure.

COLA Revision 7 incorporates the FSAR changes associated with all three of the above mentioned RAI responses.

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[1] UniStar Nuclear Energy Letter UN#09-378, from Greg Gibson to Document Control Desk, U.S. NRC, Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3, RAI No. 128, Tornado Loads, dated September 10, 2009.

[2] UniStar Nuclear Energy Letter UN#10-062, from Greg Gibson to Document Control Desk, U.S. NRC, Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3, RAI No. 182, System Quality Group Classification, dated March 12, 2010.

[3] UniStar Nuclear Energy Letter UN#10-285, from Greg Gibson to Document Control Desk, U.S. NRC, Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3, RAI No. 253, Seismic System Analysis, dated November 16, 2010.

COLA Impact

COLA FSAR Section 3.3.2.3 will be updated as follows:

3.3.2.3 Interaction of Non-Seismic Category I Structures with Seismic Category I Structures

{Non-safety-related structures located on the site and not included in U.S. EPR FSAR Section 3.3.2.3 include:

- Fire Protection Water Tanks
- Fire Protection Building
- Storage / Warehouse
- Central Gas Supply Building
- Security Access Facility
- Switchgear Building
- Grid Systems Control Building
- Circulating Water System Cooling Tower
- Circulating Water System Pump Building
- Circulating Water System Makeup Water Intake Structure
- Circulating Water System Retention Basin
- Desalinization/Water Treatment Plant
- Waste Water Treatment Plant
- Demineralized Water Tanks

Except for the Switchgear Building, and concrete portions of the Circulating Water System (CWS) Makeup Water Intake Structure (MWIS), the non-safety-related buildings are miscellaneous steel and concrete structures, which are not designed for tornado loadings. These structures are distant enough from safety-related structures that their collapse due to tornado loadings would not result in adverse interaction with any safety-related structure. During detailed design of such structures, their heights and separation distances from Safety-related structures will be maintained such that the failure of these structures due to tornado loadings will not affect the ability of safety-related structures to perform their intended safety functions. Missiles generated by the collapse of these structures during tornado loadings are enveloped by the design basis tornado missile loads described in U.S. EPR FSAR Section 3.5.1.4.

The Switchgear Building has a potential for interaction with safety-related structures and is designed to withstand the effects of tornado loadings. The structural system of the Switchgear Building employs engineered pressure relief sliding panels to mitigate the effects of tornado loadings. Potential missiles generated by detachment of these siding panels are addressed in Subsection 3.5.1.4. Conservatively, the concrete portion of CWS MWIS is designed for tornado loadings.}

COLA FSAR Section 3.5.1.4 will be updated as follows:

3.5.1.4 Missiles Generated by Tornadoes and Extreme Winds

. . .

The site-specific Seismic Category I Ultimate Heat Sink (UHS) Makeup Water Intake Structure is constructed of reinforced concrete, and the missile barrier walls and roof slabs meet Region 1 design-basis missile spectrum, including the automobile missile guidance of Regulatory Guide 1.76 (NRC, 2007a). On this basis, the site-specific conditions are conservatively enveloped for all required elevations.

Potential missiles generated by detachment of the siding panels of the Switchgear Building at the CCNPP Unit 3 site during a Region I tornado event were evaluated. For Seismic Category I structures at the CCNPP Unit 3 Site, the target response ductilities and required minimum wall thickness for these postulated panel missiles were found to be enveloped by those for the Regulatory Guide 1.76 Region I missile spectrum.

Thus, by the standard U.S. EPR meeting the Region I tornado missile spectrum requirements for all Category I structures, the site-specific conditions at CCNPP Unit 3 are in compliance with all Regulatory Guide 1.76 (NRC, 2007a) tornado missile requirements.}