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UniStar
NUCLEAR ENERGY

10 CFR 50.4
10 CFR 52.79

February 27, 2012

UN#12-020

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 327, Probable Maximum Surge and Seiche Flooding

References:
1) Surinder Arora (NRC) to Paul Infanger (UniStar Nuclear Energy), "FINAL RAI No. 327 RHEB 6185" email dated November 28, 2011

2) UniStar Nuclear Energy Letter UN#12-017, from Mark T. Finley to Document Control Desk, U.S. NRC, Updated RAI Closure Plan, dated February 21, 2012

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 November 28, 2011 (Reference 1). This RAI addresses Probable Maximum Surge and Seiche Flooding, as discussed in Section 02.04.05 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 indicated that our response to RAI No. 327, Question 02.04.05-08, would be provided to the NRC by February 28, 2012. The enclosure provides our response to RAI No. 327, Question 02.04.05-08.

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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) 369-1907, or Mr. Wayne A. Massie at (410) 369-1910.

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

Executed on February 27, 2012

Mark T. Finley

Enclosure: Response to NRC Request for Additional Information RAI No. 327, Question 02.04.05-08, Probable Maximum Surge and Seiche Flooding, Calvert Cliffs Nuclear Power Plant, Unit 3

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

UN#12-020

Enclosure

Response to NRC Request for Additional Information
RAI No. 327, Question 02.04.05-08, Probable Maximum Surge and Seiche Flooding
Calvert Cliffs Nuclear Power Plant, Unit 3

RAI No. 327

Question 02.04.05-08

To meet the requirements of GDC 2, 10 CFR 52.17, and 10 CFR Part 100, estimates of the probable maximum hurricane (PMH) and probable maximum storm surge are needed. In response to RAI No. 289, Question 02.04.05-7, the applicant provided a table of PMH tracks and associated parameters that were used in the Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model simulations. The applicant performed 59 SLOSH simulations presented in Table 12 of the RAI response (ML11111A126). The applicant stated in the RAI response that SLOSH case WTON9 was used to generate the storm track in COLA Revision 7; in Table 11 of the RAI response, the applicant stated that the maximum surge level for the WTON9 case was estimated to be 18.8 ft. The applicant stated in the RAI response that CCNPP Unit 3 COLA would not be updated as a result of the response to RAI No. 289, Question 02.04.05-7. However, in COLA Revision 7, FSAR Section 2.4.5.2.2.4 states that the final PMSS elevation in 17.6 ft NGVD29 and wave height and runup are estimated in FSAR Section 2.4.5.3.2 using the same PMSS stillwater elevation, 17.6 ft NGVD29.

The applicant is requested to explain why the higher stillwater elevation of 18.8 ft, obtained from SLOSH case WTON9, was apparently not used in COLA Revision 7, or provide updated estimates of maximum PMSS water surface elevation accounting for wind wave activity.

Response

The WTON9 case (Scenario C in Table 1 below), developed by Bechtel from SLOSH analyses, resulted in a surge elevation of 18.8 ft and did not account for storm decay due to land interaction. The Bechtel data (WTON 9) data was included in the RAI 289, Question 02.04.05-7[1] response to show how the worst case storm surge was selected. The Bechtel study was a scoping study and found that the WTON9 case is the most limiting storm track. RIZZO then refined the WTON9 case taking into account storm decay due to land interaction. RIZZO performed a more comprehensive study using the same Probable Maximum Hurricane (PMH) track, but the pressure gradient and Radius of Maximum Wind (RMW) were adjusted to account for the decay due to land interaction, resulting in a surge level of 17.6 ft. The RIZZO analysis was then revised by incorporating the antecedent water level directly in the SLOSH simulations, resulting in a total calculated surge level of 17.3 ft. Table 1 compares the Probable Maximum Surge and Seiche (PMSS) obtained from these three studies.

[1] UniStar Nuclear Energy Letter UN#11-129, 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 289, Probable Maximum Surge and Seiche Flooding, dated April 18, 2011

Table 1: Comparison of Surge Results

Scenarios	Initial Still Water Level	SLOSH Primary Surge elevation (NGVD29)	20% on SLOSH Primary Surge (NGVD29)	Antecedent Water Level addition (NGVD 29)	Total PMSS (NGVD29)
A[1]	0.00	11.00 ft (3.35 m)	2.20 ft (0.67 m)	4.4 ft (1.32 m)	17.6 ft (5.35 m)
B[2]	4.34 ft (1.32 m)	15.10 ft (4.60 m)	2.15 ft (0.66 m)	0	17.3 ft (5.27m)
C[3]	4.3 ft (1.31 m)	18.8 ft (5.73 m)	-	0	18.8 ft (5.73 m)

NOTES:

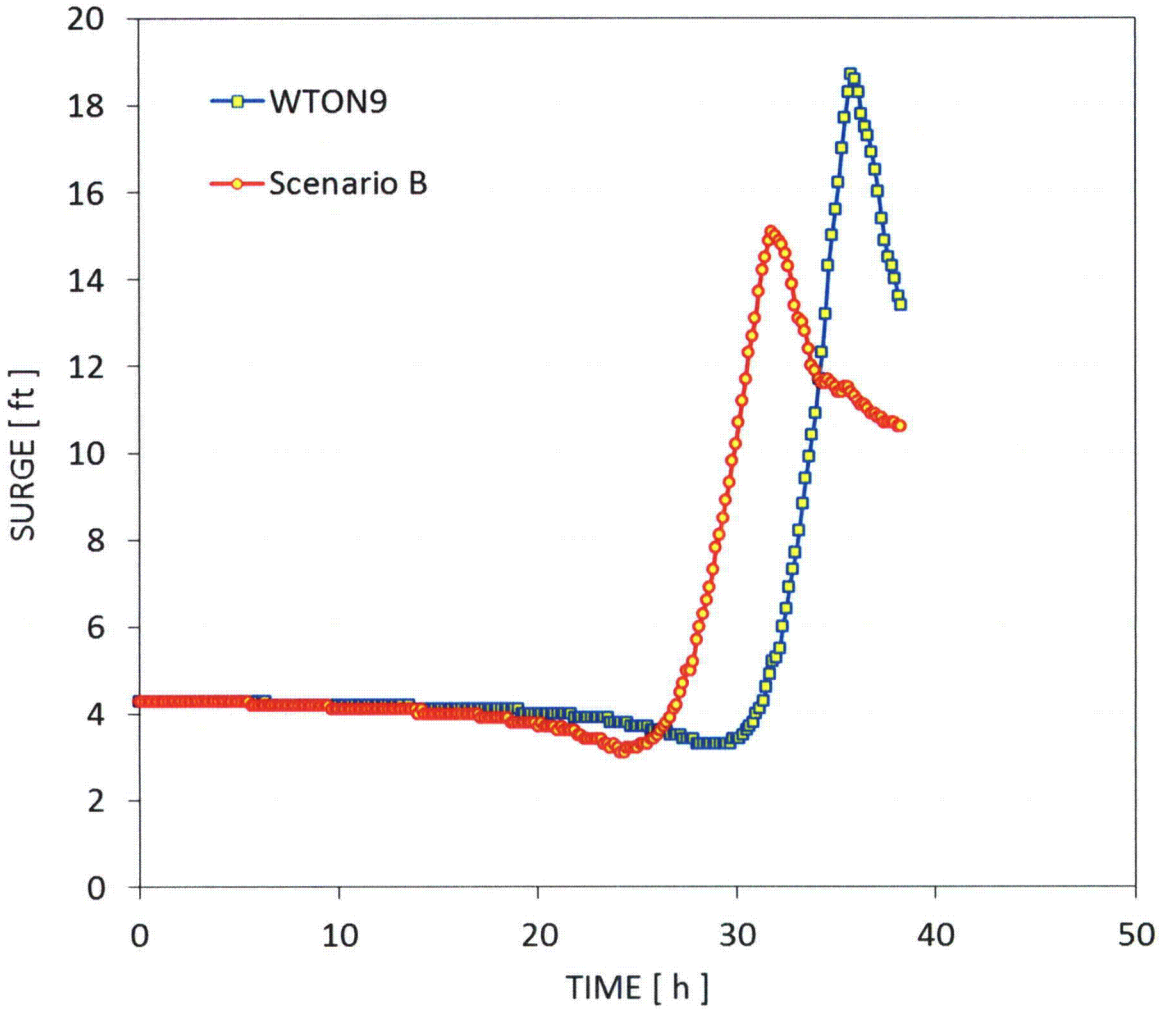
1 The values were taken from a RIZZO analysis in which antecedent water level was not incorporated within SLOSH simulations. Upper bound determined by using 20% accuracy on computed Primary Surge.
2 The values were taken from a RIZZO analysis in which an antecedent water level was incorporated within SLOSH simulations. Upper bound determined by applying 20% accuracy on the net increase water level computed by SLOSH.
3 The values were taken from results given by Bechtel for WTON9 track.

Analyses conducted by Rizzo and Bechtel confirm that the maximum surge at the project site occurs after landfall, and that the maximum surge does occur when the storm is on land and therefore the analysis that results in a 17.6 ft surge level represents a more realistic scenario when compared to the WTON9 (Scenario C) analysis, which does not account for reduced storm energy after landfall.

Figure 1 shows the surge level computed by RIZZO (labeled Scenario B) and Scenario C (labeled as WTON9) at the same location on land where the maximum surge levels occur. Figure 1 shows that the values presented in Scenario B are lower than the values of the WTON9 (Scenario C) model. This is because, at the 24th hour from the beginning of the simulation, the hurricane makes landfall and the RIZZO analysis incorporates decay values to the pressure gradient and RMW, which in turn diminish the surge value. However, the WTON9 analysis uses a simplistic approach with an equal pressure gradient on both land and water. This simplified approach explains the higher surge value.

In Figure 1, Scenario B is compared to Scenario C because both analyses incorporated the antecedent water level in the SLOSH simulations. Scenario A adds the antecedent water level after the SLOSH simulations, which results in a higher, more conservative result than Scenario B. Scenario A was used as the basis for Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 Combined License Application (COLA) Revision 7 FSAR Figure 2.4-23.

Figure 1: Comparison of Surge Levels WTON9 (Scenario C) and Scenario B



In comparing the storm files (.stm) it was observed that the pressure difference in the input file starts at 123 millibar, then is reduced in accordance with reference guidance once the hurricane makes landfall. In the WTON9 (Scenario C) input file, the pressure difference remains constant (123 millibar). The RIZZO calculation assumed decay in the central pressure once the hurricane is over land. The pressure gradient is reduced by a factor varying with time.

The track file for the WTON9 (Scenario C) shows a constant pressure gradient whereas the RIZZO input file has a decreasing pressure gradient after the hurricane makes landfall. The RMW was also assumed to change with respect to pressure gradient, as defined by the relationship between RMW and difference in pressure.

Thus, the change in pressure gradient and RMW values resulted in the difference between the WTON9 (Scenario C) estimated surge value and the reported surge value of 17.6 ft. Although the WTON9 (Scenario C) value of 18.8 ft may be more conservative, it does not reflect a realistic scenario where the hurricane wind speed and pressure gradient is not the same over

water and land. The 17.6 ft surge results from the most realistic modeling scenario and it is therefore the most representative and adequately conservative value.

COLA Impact

The COLA FSAR will not be revised as a result of this response.