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UniStar
NUCLEAR ENERGY

10 CFR 50.4
10 CFR 52.79

May 20, 2009

UN#09-237

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. 103, Probable Maximum Surge and Seiche Flooding

Reference: John Rycyna (NRC) to Robert Poche (UniStar Nuclear Energy), "RAI No 103 RHEB 2089.doc (PUBLIC)" email dated April 20, 2009

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 April 20, 2009 (Reference). This RAI addresses Probable Maximum Surge and Seiche Flooding, as discussed in Section 2.4 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 4. The reference letter requested UniStar Nuclear Energy to respond to the RAI within 30 days.

The enclosure provides our response to RAI No. 103, Questions 02.04.05-1, 02.04.05-3 and 02.04.05-5. Our responses to Questions 02.04.05-1, 02.04.05-3 and 02.04.05-5 do not include any new regulatory commitments and do not impact COLA content.

A schedule of response dates for the remaining questions will be provided by June 2, 2009.

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NRO

If there are any questions regarding this transmittal, please contact me at (410) 470-4205, or Mr. Michael J. Yox at (410) 495-2436.

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

Executed on May 20, 2009

Greg Gibson

Enclosures: Response for Request for Additional Information RAI No. 103, Questions 02.04.05-1, 02.04.05-3 and 02.04.05-5, Probable Maximum Surge and Seiche Flooding, Calvert Cliffs Nuclear Power Plant Unit 3

cc: John Rycyna, NRC Project Manager, U.S. EPR COL Application
Laura Quinn, NRC Environmental Project Manager, U.S. EPR COL Application
Getachew Tesfaye, NRC Project Manager, U.S. EPR DC Application (w/o enclosure)
Loren Plisco, 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/SFW/jmm

Enclosure

Response for Request for Additional Information RAI No. 103, Questions 02.04.05-1, 02.04.05-3 and 02.04.05-5, Probable Maximum Surge and Seiche Flooding, Calvert Cliffs Nuclear Power Plant Unit 3

RAI 103

Question 02.04.05-1

The USACE Engineer Manual 1110-2-1412 (USACE, 1986) has been superseded by USACE Engineer Manual 1110-2-1100 (USACE, 2006). The guidance in RG 1.59 is that the assessment of hazards from storm surges be based on the Probable Maximum Hurricane (PMH). Please explain why the storm parameters obtained from the USACE (1986) reference and reported in the FSAR are consistent with the PMH estimation procedure described by NOAA (1979), or justify an alternative approach.

Response

In the FSAR Section 2.4.5.1, Rev. 4, the Probable Maximum Hurricane (PMH) parameters are obtained from the charts included in Appendix C of USACE Engineering Manual 1110-2-1412.[1] These charts, which are plots of the PMH parameters against milepost distances from the U.S.-Mexico border, are identical to the ones given in NOAA Technical Report NWS 23.[2]

NWS 23 also includes a table (Table 2.5, in English units) that presents PMH parameters at a number of specific locations (milepost distances). A second table (Table 2.6) provides the same set of parameters in metric units. At milepost 2300 nautical miles, where the PMH parameters in FSAR Section 2.4.5 are referred, the parameters obtained from the charts and from Table 2.5 in NWS 23 are nearly the same as shown below.

	USACE Charts 1986 and NOAA, 1979	**Table 2.5 of NWS 23 (NOAA, 1979)**
Peripheral pressure (inch Hg)	30.12	30.12
Central pressure (inch Hg)	26.56	26.49
Radius of maximum wind (nautical mile)	10.0 – 26.2	10 – 26
Forward speed (knot)	17.6 – 38.0	17 – 38

The storm parameters obtained from the USACE reference and noted in the FSAR are consistent with the PMH estimation procedure described by NOAA (1979).

COLA Impact

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

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1 U.S. Army Corps of Engineers, Storm Surge Analysis And Design Water Level Determinations, Engineering Manual EM 1110-2-1412, April 1986.

2 National Oceanic and Atmospheric Administration, Meteorological Criteria for Standard Project Hurricane and Probable Maximum Hurricane Windfields, Gulf and East Coasts of the Untied States, NOAA Technical Report NWS 23, Washington D.C., September 1979.

Question 02.04.05-3

Please explain how the storm surge water level estimation procedure accounts for more recent hurricanes that have occurred in the last three decades since the publication of the Probable Maximum Hurricane estimation procedure (NOAA, 1979).

Response

The Probable Maximum Storm Surge (PMSS) water level estimation described in FSAR Section 2.4.5, Rev. 4, uses the Probable Maximum Hurricane (PMH) parameters established by Technical Report NWS 23[1] from the National Oceanic and Atmospheric Administration (NOAA). The PMH parameters in NWS 23 were derived using data from historical hurricanes that had landfall on the U.S. coasts from 1851 to 1977. Although NWS 23 did not include the severe hurricanes that made landfall on the U.S. coast after 1977, it includes past cycles of severe hurricanes. Comparisons of past hurricanes with the recent hurricanes that had made landfall after 1977 indicate that the NWS 23 parameters for the PMH are still applicable, as described below.

The effect of long-term climate variability on hurricane intensity is an area of active research.[2] Research on effects of El Niño/Southern Oscillation indicated that while El Niño conditions tend to suppress hurricane formation in the Atlantic basin, La Niña conditions tend to favor hurricane development.[2] El Niño/La Niña typically occur every 3 to 5 years.[3] Additionally, research in the Atlantic Multi-decadal Oscillation (AMO), which is the variation of long-duration sea surface temperature in the northern Atlantic Ocean with cool and warm phases that may last for 20 to 40 years, investigates the relation with hurricane intensity.[2] It shows that hurricane activities increase during the warm phases of the AMO compared to hurricane activities during the AMO cool phases. Recent hurricane data indicates that Atlantic hurricane seasons have been more active since 1995. However, hurricane activities during earlier years, such as from 1945 to 1970, were as active as in the recent decade.[2,4]

Blake et al.[4] indicated that during the past 35 years, the conterminous U.S. was affected by the landfall of three Category 4 or stronger hurricanes: Hurricane Charley of 2004, Hurricane Andrew of 1992, and Hurricane Hugo of 1989. Based on analysis of hurricane data from 1851 to 2006, Blake et al.[4] summarized that, on the average, the U.S. is affected by a Category 4 or stronger hurricane approximately once every 7 years. Consequently, Blake et al.[4] suggested that there have been fewer exceptionally strong hurricane landfalls during the past 35 years than an expected 35-year average of approximately five.

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1 National Oceanic and Atmospheric Administration (NOAA), Meteorological Criteria for Standard Project Hurricane and Probable Maximum Hurricane Windfields, Gulf and East Coasts of the United States, NOAA Technical Report NWS 23, Washington D.C., September 1979.

2 National Oceanic and Atmospheric Administration (NOAA), FAQ/State of the Science: Atlantic Hurricane & Climate, U.S. Department of Commerce, December 2006.

3 Frequently Asked Questions About El Niño and La Niña, National Weather Service, Climate Prediction Center, Available at: http://www.cpc.noaa.gov/products/analysis_monitoring/ensostuff/ensofaq.shtml, Access date: April 20, 2009.

4 Blake, E. S., et al., The Deadliest, Costliest, and Most Intense United States Tropical Cyclones from 1851 to 2006 (and Other Frequently Requested Hurricane Facts), Technical Memorandum NWS TPC-5, National Weather Service, National Hurricane Center, National Oceanic and Atmospheric Administration, April 2007.

Because NOAA Technical Report NWS 23 includes the active hurricane period from 1945 to 1970 (and any such earlier periods from 1851) in the analysis, it is reasonable to assume that the PMH parameters derived are conservative even without inclusion of hurricane data from 1977 to present time. The surge water level thus obtained is therefore conservative.

COLA Impact

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

Question 02.04.05-5

UniStar stated in FSAR Section 2.4.5.4 that period of oscillation of wind-induced seiches in Chesapeake Bay is between 2 and 3 days. Please provide a reference and a summary of the method used to estimate the period of oscillation of wind-induced seiches in Chesapeake Bay.

Response

Wang[1] reported that subtidal water level variation in the Chesapeake Bay caused by local wind forcing has a time scale of 2-3 days. The behavior of water level variation is similar to the finding of Wang and Elliott[2], which suggested that sea level fluctuations were seiches driven by longitudinal wind at 2-3 day time scales. Wang[3] also drew a similar conclusion.

Wang[1] used measured velocity, salinity and water level variation in the Chesapeake Bay over a one-month period in 1975 and correlated the data with measured meteorological data. Two measurements of salinity profiling along the axis of the Chesapeake Bay were also used. Wang and Elliott used water level variation and meteorological data in the Chesapeake Bay measured over a two-month period in 1974 to investigate the effect of wind forcing on the Chesapeake Bay water level. Wang and Elliott also used additional near-bottom current measurement in the Potomac River, and 3-day current profiling data during a storm event. Wang used one-year measurement (1974-1975) of water level variations at six locations in the bay and meteorological observations at two locations. Measured water levels in these studies were filtered to remove high frequency tidal fluctuations prior to using in the analysis. The low-pass filtered data represented the subtidal fluctuations in the water level and velocity measurements.

These studies identified variation in subtidal fluctuations with varying time scales, and hypothesized various physical processes associated with these time scales. The shortest of these time scales with a 2-3 day period was associated with local wind forcing that was hypothesized to initiate a seiche motion in the bay.

COLA Impact

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

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1 Wind Driven Circulation in the Chesapeake Bay, Winter 1975, Journal of Physical Oceanography, Volume 9, pages 564 through 572, D.-P. Wang, May 1979.

2 Non-Tidal Variability in the Chesapeake Bay and Potomac River: Evidence for Non-Local Forcing, Journal of Physical Oceanography, Volume 8, pages 225 through 232, D.-P. Wang and A.J. Elliott, March 1978

3 Subtidal Sea Level Variation in the Chesapeake Bay and Relations to Atmospheric Forcing, Journal of Physical Oceanography, Volume 9, pages 413 through 421, D.-P. Wang, March 1979.