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UniStar
NUCLEAR ENERGY

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May 30, 2014

UN#14-047

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 411, Probabilistic Risk Assessment and Severe Accident Evaluation

References:
1) Surinder Arora (NRC) to Paul Infanger (UniStar Nuclear Energy), "CCNPP3 - Final RAI 411 SPRA 7240," dated February 10, 2014

2) UniStar Nuclear Energy Letter UN#14-041, from Paul Infanger to Document Control Desk, U.S. NRC, Schedule Information for Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3, RAI 411, Probabilistic Risk Assessment and Severe Accident Evaluation, dated May 2, 2014

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 February 10, 2014 (Reference). This RAI addresses Probabilistic Risk Assessment and Severe Accident Evaluation, as discussed in Chapter 19 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 9.

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Reference 2 indicated that a response to RAI 411, Questions 19-31 and 19-32, would be provided to the NRC by May 30, 2014. The enclosure provides our response to RAI 411, Questions 19-31 and 19-32.

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

If there are any questions regarding this transmittal, please contact me at (410) 369-1987 or Mr. Mark Finley at (410) 369-1907.

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

Executed on May 30, 2014

Paul Infanger

Enclosure: Response to NRC Request for Additional Information, RAI 411, Questions 19-31 and 19-32, Calvert Cliffs Nuclear Power Plant, Unit 3

cc: Surinder Arora, NRC Project Manager, U.S. EPR Projects Branch
Tomeka Terry, NRC Environmental Project Manager, U.S. EPR COL Application
Patricia Holahan, Acting Deputy Regional Administrator, NRC Region II, (w/o enclosures)
Silas Kennedy, U.S. NRC Resident Inspector, CCNPP, Units 1 and 2
David Lew, Deputy Regional Administrator, NRC Region I (w/o enclosures)

UN#14-047

Enclosure

Response to NRC Request for Additional Information,
RAI 411, Questions 19-31 and 19-32,
Calvert Cliffs Nuclear Power Plant, Unit 3

RAI No 411

Question Number: 19-31

This RAI is a Follow Up to RAI 387 (eRAI 6937), Question 19-28.

The staff has reviewed the applicant's response to RAI Question 19-28 and agrees with the applicant's proposed quantitative screening thresholds. However, shutdown high wind induced LOOPs are similar to LOOPs caused by loss of the switchyard at LPSD. Both initiating events result in a loss or interruption of the DHR function, and both initiating events are analyzed in the PRA. In order to be consistent with the high winds evaluation provided in FSAR Section 19.1.5, the staff requests for the applicant to please remove the exclusion of shutdown high wind events from the screening thresholds.

Response

As stated in Question 19-31, high wind induced loss of offsite power (LOOP) events are postulated to occur either when the plant is at-power or during shutdown. The only impact on the Probabilistic Risk Assessment (PRA) from high winds is from LOOP, and LOOP is included in the PRA both during at-power and shutdown conditions.

Therefore, the response to Question 19-32 applies the screening threshold to calculated at-power and shutdown risk from high winds LOOP, i.e., the exclusion of shutdown high wind events from the screening thresholds was removed.

COLA Impact

Revision to the COLA FSAR is not required as a result of this response.

RAI No 411

Question Number: 19-32

This RAI is a Follow Up to RAI 387 (eRAI 6937), Question 19-29.

The staff has reviewed the applicant's response to RAI 19-29. The staff understands that the Transformer and Switchyard Areas and the Normal Heat Sink are non-safety related and not designed for high wind loads. The staff also reviewed NUREG/CR 6890 which reports in Table D-1 a plant specific weather related LOOP frequency of 3.8E-3 per reactor year. The frequency was estimated by using a Bayesian update based on the industry frequency (4.8E-3 per reactor year from Table ES-2) as a prior and plant specific data from the period 1997-2004. These frequency estimates are different and lower than the design wind velocity of 102 mph per 100 year return period as documented in Section 3.3.1.1 of the FSAR. The staff requests for the applicant to please use the re-occurrence interval of 1/150 reactor year wind speed to confirm that extreme winds for the site (beyond the design wind speeds) do not affect the full power and shutdown CDF by more than 10% (positive or negative). In addition, please report the CDF values and the results if they exceed the 10% threshold.

Response

As stated in the response to RAI 387 Question 19-29[1], all pieces of equipment that are credited by Probabilistic Risk Assessment (PRA) and are not designed for extreme winds (greater than 230 mph) are completely dependent on offsite power. The Transformer and Switchyard Areas and the Normal Heat Sink are not safety-related and not designed for high wind loads. Their loss is completely enveloped by assuming a loss of offsite power. The Switchgear Building is not safety-related, but is designed for high winds, including tornado wind loading of 230 mph. Therefore, the impact on core damage frequency (CDF) from high winds is completely enveloped by a loss of offsite power (LOOP) event and will be evaluated by using the LOOP event tree.

If one assumes the re-occurrence interval of 1/150 year wind speed causes a LOOP with a conditional probability of 1.0, then the CDF due to high winds LOOP can be calculated as shown in following sensitivity study:

At-power CDF sensitivity study due to high winds LOOP

Calvert Cliffs Unit 3 incorporates the U.S. EPR plant at-power and low-power and shutdown (LPSD) internal events PRA results by reference. From the U.S. EPR plant FSAR Revision 004:

- The at-power LOOP frequency is 1.9E-02 per reactor-year.
- The at-power probability of LOOP and LOOP nonrecovery during the PRA 24-hour mission time is 4.8E-05.

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[1]UniStar Nuclear Energy Letter UN#13-101, from Mark T. Finley to Document Control Desk, U.S. NRC, Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3, RAI 387, Probabilistic Risk Assessment and Severe Accident Evaluation, dated July 19, 2013

For high wind inclusion the at-power LOOP frequency and the probability of LOOP during the PRA mission time are modified as follows:

- At power LOOP frequency: The LOOP frequency was increased by (1/150-yr) to account for the re-occurrence interval of 1/150 year wind assumed LOOP. At the same time, the weather-related LOOP portion was reduced by a factor of (6/19) to remove double-counting of the six high winds LOOPs out of the 19 weather-related LOOPs that are referenced in NUREG/CR-6890 Table 1.
- At-power probability of LOOP during the PRA mission time was increased to account for the increase in the LOOP frequency described above.

The baseline (based on U.S. EPR plant FSAR Revision 004) and sensitivity study at-power LOOP values are shown in Table B3-1.

LPSD CDF sensitivity study due to high winds LOOP

From the U.S. EPR plant FSAR Revision 004:

- The LPSD LOOP frequency is 2.0E-01 per reactor-year.
- The LPSD probability of LOOP and LOOP nonrecovery during the PRA 24-hour mission time is 2.2E-04.

For high wind inclusion the LPSD LOOP frequency and the probability of LOOP during the PRA mission time are modified as follows

- LPSD LOOP frequency: The LOOP frequency was increased by (1/150-yr) to account for the re-occurrence interval of 1/150 year wind assumed LOOP. The weather-related LOOP portion was conservatively not reduced to remove double-counting of the high winds contribution because the LPSD LOOP was not a significant contributor to the total risk.
- LPSD probability of LOOP during the PRA mission time was increased to account for the increase in the LPSD LOOP frequency, described above.

The baseline (based on U.S. EPR plant FSAR Revision 004) and sensitivity study LPSD LOOP values are shown in Table B3-1.

	Baseline	High Wind Sensitivity Study	% Change
LOOP Initiating Event Frequency At-Power [1/yr]	1.9E-02	2.4E-02	26%
LOOP Probability – at power Mission Time	4.8E-05	5.8E-05	21%
LOOP Initiating Event Frequency LPSD[1] [1/yr]	2.0E-01	2.1E-01	5.0%

LOOP Probability – LPSD Mission Time	2.2E-04	2.3E-04	4.5%

Table B3-1: PRA LOOP Inputs Used in the High Wind Sensitivities

1 - LOOP is not considered explicitly as a separate initiator in the LPSD PRA, but it is included through "Loss of RHR" initiator.

The original LOOP recovery curves from NUREG/CR-6890, Table ES-3 were used in the sensitivity evaluations. No attempts were made to generate a new LOOP recovery curve, because no data were available specifically for the high wind events. The sensitivity results are summarized in Table B3-2.

	Baseline	High Wind Sensitivity Study	% Change
CDF at-power [1/yr]	5.3E-07	5.7E-07	7.5%
CDF LPSD [1/yr]	5.8E-08	5.9E-08	1.7%
Total CDF [1/yr]	5.9E-07	6.3E-07	6.8%

Table B3-2: CDF Values with PRA LOOP Inputs Used in the High Wind Sensitivities

Additional Margin

In addition, there is evidence to support that using a conditional probability of LOOP of 1.0 is overly conservative.

- As stated in RAI 387, Question 19-29[1] and its response, non safety-related equipment may be designed for a wind speed of 101.65 mph, while the 1/150 year re-occurrence interval wind speed is 105.45 mph. This represents a very small increase in wind speed above design that makes an assumption of guaranteed LOOP conservative.
- The industry-wide weather related LOOP frequency of 4.8E-03 per reactor year represents all types of weather related LOOPs, yet is smaller than the re-occurrence interval of 1/150 years, indicating that high winds with this re-occurrence interval are unlikely to cause a LOOP.
- As stated in the response to RAI 387, Question 19-29[1], no wind related LOOPs have occurred at the existing Calvert Cliffs Units through year 2012, even though 104 mph winds have been recorded.

Sensitivity study results, using a re-occurrence interval of 1/150 reactor year wind speed (as summarized in Table B3-2) confirm that extreme winds for the site (beyond the design wind

speeds) affect the at-power and LPSD CDF by no more that 6.8% (positive or negative). This value may be less if additional margin is factored. No reporting is required as 6.8% is less than 10%.

COLA Impact

Revision to the COLA FSAR is not required as a result of this response.