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UniStar
NUCLEAR ENERGY

10 CFR 50.4
10 CFR 52.79

July 19, 2013

UN#13-101

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 387, Probabilistic Risk Assessment and Severe Accident Evaluation

References:
1) Surinder Arora (NRC) to Paul Infanger (UniStar Nuclear Energy), "CCNPP3 - FINAL RAI 387 SPRA 6937" email dated April 8, 2013

2) UniStar Nuclear Energy Letter UN#13-062, 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 May 7, 2013

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 8, 2013 (Reference 1). 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.

Reference 2 indicated that a response to RAI 387, Questions 19-28 and 19-29, would be provided to the NRC by July 20, 2013.

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Enclosure 1 provides our response to RAI 387, Questions 19-28 and 19-29, 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.

Enclosure 2 provides a Table of Changes to the CCNPP Unit 3 COLA associated with RAI 387, Questions 19-28 and 19-29.

Our response does not include any new regulatory commitments. This letter, and its enclosures, 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 July 19, 2013

FOR
Mark T. Finley

Enclosures: 1) Response to NRC Request for Additional Information, RAI 387, Questions 19-28 and 19-29, Calvert Cliffs Nuclear Power Plant, Unit 3

2) Table of Changes to CCNPP Unit 3 COLA Associated with the Response to RAI 387, 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
Tomeka Terry, NRC Environmental Project Manager, U.S. EPR COL Application
Amy Snyder, NRC Project Manager, U.S. EPR DC Application, (w/o enclosures)
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)

Enclosure 1

**Response to NRC Request for Additional Information,
RAI 387, Questions 19-28 and 19-29,
Probabilistic Risk Assessment and Severe Accident Evaluation,
Calvert Cliffs Nuclear Power Plant, Unit 3**

RAI No 387

Question 19-28

This RAI Question is a follow-up to RAI 198, Questions 19-20, 19-21, and 19-22 response.

The staff reviewed the applicant's response to RAI 198, Questions 19-20, 19-21, and 19-22, and requests additional information. Regulatory Guide (RG) 1.200, Section 1.2.5, "Screening and Conservative Analysis of Other External Hazards Technical Elements," states that screening methods can often be employed to show that the contribution of many external events to core damage frequency (CDF) and/or large early release frequency (LERF)/LRF (large release frequency) is insignificant. The fundamental criteria that have been recognized (Regulatory Guide 1.200) for screening-out events are the following: an event can be screened out either (1) if it meets the criteria in the NRC's 1975 Standard Review Plan (SRP) or a later revision; or (2) if it can be shown using a demonstrably conservative analysis that the mean value of the design-basis hazard used in the plant design is less than 10-5 per year and that the conditional core damage probability is less than 10-1, given the occurrence of the design-basis-hazard event; or (3) if it can be shown using a demonstrably conservative analysis that the CDF is less than 10-6 per year. It is recognized that for those new reactor designs with substantially lower risk profiles (e.g., internal events CDF below 10-6/year), the quantitative screening value should be adjusted according to the relative baseline risk value.

Based on RG 1.200, please update the screening discussion in Section 19.1.5 of the CCNPP3 FSAR, Revision 8, to be consistent with RG 1.200 Section 1.2.5 or justify your current screening methodology.

Response

Based on the RG 1.200 Revision 2 guidance, in order to reflect the U.S.EPR lower risk profiles, the quantitative screening values for the external hazard events were adjusted to read as follows:

It can be shown that:

1. Initiating event frequency for the external hazard event is less than or equal to 1E-7 per year (assuming that the event would not completely disable the plant mitigating ability), or
2. The Core Damage Frequency (CDF) is less than 10% of the baseline CDF, using demonstrably conservative analysis. The U.S. EPR baseline CDF at power is 5.3E-7 per year.

The external events are reassessed using the adjusted screening criteria, as demonstrated in the responses to RAI 198 Questions 19-21 and 19-22[1].

Please note that the screening evaluation for the CDF (Item #2 above) was done based on the at power CDF only, with the screening value of 5.3E-8 per year, because the screened hazard

[1]UniStar Nuclear Energy Letter UN#10-230, 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. 198, Probabilistic Risk Assessment, dated August 24, 2010

events are evaluated to present lesser challenges to the shutdown operation. This evaluation is based on the following:

- The external hazard events leading to a loss of offsite power (LOOP) event would not necessarily cause an initiating event in shutdown (a loss of shutdown cooling) if emergency power is available, and the emergency diesel generators are located in the separated and protected buildings.

- The mitigating systems that are located in the non-safety/not-protected structures, like Balance of Plant (BOP) systems, are not credited in the shutdown operation.

COLA Impact

FSAR Section 19.1.5.4 has been revised as follows to reflect the response to Question 19-28:

19.1.5 Safety Insights from the External Events PRA for Operations at Power

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19.1.5.4 Other External Risk Evaluations

The U.S. EPR FSAR includes the following COL Item in Section 19.1.5.4:

A COL applicant that references the U.S. EPR design certification will perform the site-specific screening analysis and the site specific risk analysis for external events applicable to their site.

This COL Item is addressed as follows:

The U.S. EPR FSAR scope of external event screening includes a high level assessment of high winds and tornadoes, external flooding and external fires.

{A screening analysis of the risks posed by external events to the CCNPP Unit 3 site was performed. All of the external events listed in Appendix A of ANSI/ANS 58.21 2007 (ANSI, 2007) have been addressed. For each external event, a progressive approach is used following the guidance in ANSI/ANS 58.21 2007 and in NUREG-1407 (NRC, 1991). ~~The low risk profile of the U.S. EPR is considered in screening.~~ To reflect the lower risk profile of the U.S. EPR, the quantitative screening value has been adjusted according to the relative baseline risk value. The quantitative screening threshold has been lowered to either:

1. Initiating event frequency for the external hazard event is less than or equal to 1E-7 per year (assuming that the event would not completely disable the plant mitigating ability), or
2. The Core Damage Frequency (CDF) is less than 10% of the baseline CDF, using demonstrably conservative analysis. The U.S. EPR baseline CDF at power is 5.3E-7 per year.

The screening evaluation for the CDF (Number 2 above) was done based on the at-power CDF only, with the screening value of 5.3E-8 per year, because the screened hazard events are evaluated to present lesser challenges to the shutdown operation. This evaluation is based on the following:

- The external hazard events leading to a LOOP event would not necessarily cause an initiating event in shutdown (a loss of shutdown cooling) if emergency power is available, and the emergency diesel generators are located in the separated and protected buildings.
- The mitigating systems that are located in the non-safety/not-protected structures, like Balance of Plant (BOP) systems, are not credited in the shutdown operation.

An external event that meets the ANSI/ANS-58.21-2007 screening criteria, and is assessed as having a low risk value both in absolute terms and with consideration of the low risk values for the U.S. EPR assessment, is not considered to be a significant contributor to risk and is screened from further consideration.

The plant design bases for external events are compared against ANSI/ANS 58.21 2007 and NUREG-0800 (NRC, 2007c) screening criteria. If the event cannot be qualitatively screened, a quantitative PRA assessment is performed to assess the risk posed by that external event against the quantitative screening criteria.

As defined in ANSI/ANS-58.21-2007, Table 19.1-1 provides a list of all external events considered. Also provided is the reason for screening each event or the relevant section where screening is discussed.

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RAI No 387

Question 19-29

This RAI Question is a follow-up to RAI 198, Questions 19-20, 19-21, 19-22, 19-23, and 19-24 response.

The staff reviewed the applicant's response to RAI 198, Questions 19-20, 19-21, 19-22, 19-23, and 19-24, and requests additional information. The staff also reviewed Section 3.3.1.1, "Design Wind Velocity," in the CCNPP3 FSAR, Revision 8. It states that the 100 year recurrence interval wind speed for CCNPP Unit 3 site is 101.65 mph, which is the wind speed for site-specific non safety-related structures. The staff also noted that high winds (other than tornadoes) were not evaluated in Section 19.1.5.4, "Other External Risk Evaluations," in the CCNPP FSAR, Revision 8. High winds were screened directly based on the CCNPP Unit 3 design basis.

Based on 10 CFR 52.79(d)(1), the applicant referencing a design certification "must use the PRA information for the design certification and must be updated to account for site-specific design information and any design changes or departures."

Considering that non-safety related SSCs (including the switchyard) may only be designed for a wind speed of 101.65 mph, please use the re-occurrence interval of 1/150 years to confirm that extreme winds (beyond the site specific wind speed) as discussed in Chapter 2 and Chapter 3 of the FSAR do not affect the full power core damage frequency (CDF) and shutdown CDF by more than 10% (positive or negative). Please report the CDF values and results if they exceed the 10% threshold.

Response

The RAI indicates that non safety-related structures, systems and components (SSCs) may be designed for a 101.65 mph wind speed, and requests that a re-occurrence interval of 1/150 years be used to confirm that extreme winds do not result in impacts greater than the 1/100 year wind speed and do not affect core damage frequency (CDF). The wind speed associated with the 1/150 year re-occurrence interval is 105.45 mph. Extreme winds affect normal and shutdown CDFs if they damage SSCs credited in contributing Probabilistic Risk Assessments (PRAs) or if they contribute to Loss of Offsite Power (LOOP) events, e.g., at the switchyard. Each scenario was examined with respect to the 1/150 year wind speed re-occurrence interval and no effect in CDF was confirmed based on the following:

- PRA/CDF credited SSCs that are, or are located within safety-related structures are, by definition, not affected by extreme winds. PRA/CDF credited SSCs that are located within non safety-related structures and completely dependent on offsite power are addressed by the LOOP PRA/CDF evaluation below. Remaining PRA/CDF credited SSCs that are located within non safety-related structures and not completely dependent on offsite power include the Switchgear Building and its contents (e.g., the station black-out diesel generators and the non safety-related uninterruptible power supply equipment). The Switchgear Building is designed to withstand tornado wind loadings (230 mph) as discussed in FSAR Sections 19.1.5.4.1 and 3.3.2.3, therefore, the building and its systems and components, are not affected by extreme winds.

- Wind initiated LOOP events are described in NUREG/CR-6890 and its Glossary cites hurricanes, strong winds, and tornados as examples. These LOOP events have been factored into the U.S. EPR PRA and full power/shutdown CDFs. Impact from the 1/150 year reoccurrence interval wind speed is bounded by these wind initiated LOOP events. Historically, none of the wind initiated LOOP events in NUREG/CR-6890 have occurred at the Calvert Cliffs Units 1 and 2 site and site data post NUREG/CR-6890 through 2012 shows no subsequent wind related LOOPs have occurred even though FSAR Section 2.3.1.2.2.6 and Table 2.3-4, show Calvert County recorded 104 mph winds (April 2000).

  Since wind initiated LOOP events in the U.S. EPR PRA remain bounding and there have been no wind initiated LOOP events historically at the Calvert Cliffs Site, the U.S. EPR PRA and CDFs are not affected by extreme winds.

COLA Impact

CCNPP Unit 3 FSAR Section 19.1.5.4.1 has been revised as follows:

19.1.5.4.1 High Winds and Tornado Risk Evaluation

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High Wind Load

The U.S. EPR safety related structures are designed to withstand high wind load characteristics as specified in NUREG-0800, Section 3.3.1. The SRP acceptance criteria for high winds specify that the design velocity pressure for safety-related structures must be greater than or equal to the velocity pressure corresponding to the speed of the 100-year return period 3-second wind gust. The design basis wind speed is 145 mph (65 m/sec) in open terrain with a 50-year mean recurrence interval. For the safety-related structures, the design wind speed is increased by an importance factor of 1.15 to obtain a 100-year mean recurrence interval.

As documented in Section 2.3.1.2.2.15, the 100 year return period 3-second wind gust for the CCNPP Unit 3 site is 102 mph (46 m/sec). This is significantly less than the design basis wind speed. Site-specific structures will be designed in compliance with ASCE 7-05, "Minimum Design Loads for Buildings and Other Structures," (ASCE, 2006), therefore the design wind speed for those structures will be no less than 102 mph. Therefore the NUREG-0800, Section 3.3.1 screening criteria are met for high winds (other than tornadoes).

The non safety-related structures located on-site and not designed for high wind loads are evaluated in Section 3.3, to show that their collapse would not result in an impact on any of the safety-related structures. A subset of these structures that contain systems and components modeled in the PRA are listed below:

- ~~Switchgear Building~~
- Transformer and Switchyard Areas
- Normal Heat Sink
- ~~Turbine Building~~

The Ultimate Heat Sink Make-up Structure also contains equipment that supports the long term operation of systems and components credited in the PRA. However, ~~it's~~its function is not credited within the mission time assumed in the PRA model.

A re-occurrence interval of 1/150 years was also evaluated to confirm that extreme winds do not result in impacts greater than the 1/100 year wind speed and do not affect core damage frequency (CDF). The wind speed associated with the 1/150 year re-occurrence interval is 105.45 mph. Extreme winds affect normal and shutdown CDFs if they damage SSCs credited in contributing Probabilistic Risk Assessments (PRAs) or if they contribute to Loss of Offsite Power (LOOP) events, e.g., at the switchyard. Each scenario was examined with respect to the 1/150 year wind speed re-occurrence interval and no effect in CDF was confirmed based on the following:

- PRA/CDF credited SSCs that are, or are located within safety-related structures are, by definition, not affected by extreme winds. PRA/CDF credited SSCs that are located within non safety-related structures and completely dependent on offsite power are addressed by the LOOP PRA/CDF evaluation below. Remaining PRA/CDF credited SSCs that are located within non safety-related structures and not completely dependent on offsite power include the Switchgear Building and its contents (e.g., the station black-out diesel generators and the non safety-related uninterruptible power supply equipment). The Switchgear Building is designed to withstand tornado wind loadings (230 mph) as discussed in FSAR Sections 19.1.5.4.1 and 3.3.2.3, therefore, the building and its systems and components, are not affected by extreme winds.

- Wind initiated LOOP events are described in NUREG/CR-6890 and its Glossary cites hurricanes, strong winds, and tornados as examples. These LOOP events have been factored into the U.S. EPR PRA and full power/shutdown CDFs. Impact from the 1/150 year reoccurrence interval wind speed is bounded by these wind initiated LOOP events. Historically, none of the wind initiated LOOP events in NUREG/CR-6890 have occurred at the Calvert Cliffs Units 1 and 2 site and site data post NUREG/CR-6890 through 2012 shows no subsequent wind related LOOPs have occurred even though FSAR Section 2.3.1.2.2.6 and Table 2.3-4, show Calvert County recorded 104 mph winds (April 2000).

  Since wind initiated LOOP events in the U.S. EPR PRA remain bounding and there have been no wind initiated LOOP events historically at the Calvert Cliffs Site, the U.S. EPR PRA and CDFs are not affected by extreme winds.

Enclosure 2

Table of Changes to CCNPP Unit 3 COLA Associated with the Response to RAI 387, Calvert Cliffs Nuclear Power Plant, Unit 3

Table of Changes to CCNPP Unit 3 COLA

Associated with the Response to RAI No. 387

Change ID #	Subsection	Type of Change	Description of Change
Part 2 – FSAR			
CC3-10-0054	19.1.5.4 and 19.1.5.4.1	Incorporate COLA markups associated with the response to RAI 198 Questions 19-20, 19-21, and 19-22[1].	FSAR Sections 19.1.5.4 and 19.1.5.4.1 were revised as part of the response to RAI 198 Questions 19-20, 19-21, and 19-22[1].
CC3-13-0117	19.1.5.4 and 19.1.5.4.1	Incorporate COLA markups associated with the response to RAI 387 Questions 19-28 and 19-29 (this response).	As part of the response to RAI 387 Questions 19-28 and 19-29 (this response), an expanded quantitative screening discussion is provided in FSAR Section 19.1.5.4 and FSAR Section 19.1.5.4.1 includes a discussion associated with the consideration of the re-occurrence interval of 1/150 years.