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May 12, 2009

UN#09-232

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. 78, Question 19-9, Probabilistic Risk Assessment and  
Severe Accident Evaluation

References: 1) John Rycyna (NRC) to Robert Poche (UniStar Nuclear Energy), "RAI No 78  
SPLA 1837.doc (PUBLIC)," email dated March 16, 2009  
2) Greg Gibson (UniStar Nuclear Energy) to Document Control Desk, U.S.  
Nuclear Regulatory Commission, RAI No. 78, Probabilistic Risk Assessment  
and Severe Accident Evaluation, dated April 15, 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 March 16, 2009 (Reference 1). This RAI addresses Probabilistic Risk Assessment and Severe Accident Evaluation, as discussed in Section 19.1 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 enclosure provides our response to RAI No 78, Question 19-9. The responses to RAI No 78, Questions 19-8, 19-10 and 19-11 were previously provided in UniStar Nuclear Energy letter UN#09-157 (Reference 2), dated April 15, 2009.

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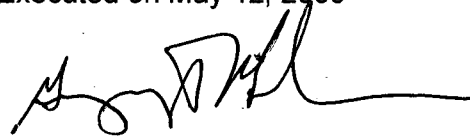
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Our response to Question 19-9 does not include any new regulatory commitments and does not require revised COLA content.

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 12, 2009

A handwritten signature in black ink, appearing to read 'Greg Gibson', with a long horizontal line extending to the right.

Greg Gibson

Enclosure: Response to NRC Request for Additional Information, RAI No. 78, Question 19-9, Probabilistic Risk Assessment and Severe Accident Evaluation, 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

**Enclosure**  
**Response to NRC Request for Additional Information**  
**RAI No. 78, Question 19-9**  
**Probabilistic Risk Assessment and Severe Accident Evaluation**  
**Calvert Cliffs Nuclear Power Plant Unit 3**

## RAI No 78

### Question 19-9

Clarify whether the risk metrics resulting from the quantitative screening of external events described in Section 19.1.5 of the CCNPP Unit 3 FSAR are outputs of the at-power probabilistic risk assessment (PRA) or the PRA considering all modes of operation. If the at-power PRA was used, provide a similar discussion for external events that occur during shutdown so that the staff can use the discussion to reach its conclusions for the impact of external events on total core damage frequency (CDF) and large release frequency (LRF).

### Response

The risk metrics resulting from the quantitative screening of external hazards are based on the at-power PRA, and are bounding for all modes of operation, because:

- External hazards generally affect non-safety structures which are not designed to withstand the same challenges as safety structures. Non-safety systems modeled in the PRA are related to balance of plant systems, which are more important for power operation than during shutdown.
- The U.S. EPR at-power PRA model assumes a full year (365 days) of operation.

As requested, an evaluation of the risk impact of external hazards occurring during shutdown is provided to demonstrate that the risk metrics shown in Section 19.1.5 of the Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 FSAR are indeed bounding for all modes of operation.

In the CCNPP Unit 3 FSAR a detailed quantitative modeling has been performed for two external hazards: tornado hazard (bounds high winds), and aircraft hazard. These were screening calculations and were based on the U.S. EPR at-power PRA model which assumes a full year (365 days) of operation. A quantitative analysis based on the U.S. EPR shutdown PRA model is provided below to show that the core damage frequency (CDF) obtained from the at-power screening calculations bounds the CDF from all modes of operation.

Quantitative screening was also performed for the external flooding hazard. The external flooding risk comes from a potential loss of balance of plant initiating event. This initiating event does not apply outside of at-power operations, therefore the assumption of a full year of operation bounds the CDF from all modes of operation.

The remaining external hazards are screened based on not having an adverse impact on the plant, or based on the frequency of the hazard alone. Therefore, their screening is applicable to all modes of operation.

An evaluation of the bounding tornado and aircraft crash scenarios is performed with the Low Power and Shutdown (LPSD) U.S. EPR PRA model to confirm that the existing screening calculations are bounding for all modes of operation. The following three scenarios are examined:

1. Tornado strike disabling structures, systems and components (SSC) not designed to withstand tornadoes. This would result in an unrecoverable loss of offsite power (LOOP), as well as the loss of electrical equipment located in the switchgear building (SWGRB): Station Blackout (SBO) diesel generators, non safety 2-hour and 12-hour batteries.
2. Aircraft crash into the turbine building and the switchyard. The consequences of this scenario are similar to those of the tornado, with LOOP and failure of SWGRB SSC.
3. Aircraft crash into Safeguard Building (SB) 1 or 4. This is assumed to result in a pipe break in the running residual heat removal (RHR) train. SSC located in the affected SB are assumed to be disabled.

The three scenarios defined above are quantified using the LPSD PRA model. The quantification results are shown below in Table 1. The LPSD tornado CDF is  $2.1E-10$ /yr. The total LPSD aircraft crash CDF is  $5.0E-10$ /yr.

Table 2 compares the LPSD CDF for these scenarios with the at-power CDF obtained from the quantitative analyses described in CCNPP Unit 3 FSAR (Section 19.1.5.4.1 for tornado and 19.1.5.4.4 for aircraft crash). This comparison shows that the CDF resulting from external hazards at shutdown is negligible (less than 0.5%) compared to the current CDF for these same external hazards.

Table 2 also compares the LPSD CDF from aircraft crash with the offsite release frequency (small and large) reported in Section 19.1.5.4.4. This shows that, even if the LPSD aircraft crash core damage sequences were to conservatively lead to offsite release, these releases would make up a small fraction (less than 2%) of offsite releases.

The risk posed by external hazards during shutdown is less than 0.5% of the at-power CDF, and less than 2% of the at-power release frequency. The assumed total duration of shutdown in the U.S. EPR PRA is 21 days, which is approximately 6% of the year. This shows that the average daily risk in shutdown due to these external events is much lower than the at-power risk. Therefore, the existing analysis, which assumes 365 days of at-power operation, is bounding.

Based on the presented results, two conclusions can be drawn:

- For both analyzed external hazards, the CDF obtained by explicitly modeling external hazards occurring during shutdown is negligible compared to the CDF presented in FSAR Section 19.
- The current risk metrics resulting from the quantitative screening of external events described in Section 19.1.5 bound the risk metrics from all modes of operation.

**Table 1: Calculation of tornado and aircraft crash CDF for Calvert Cliffs Unit 3 for LPSD operation**

Scenario	Frequency (1/year)	Frequency (1/day)	LPSD CDF (1/year)
Tornado	6.1E-05	1.7E-07	2.1E-10
Aircraft crash into SB1 or 4	1.9E-06	5.3E-09	4.8E-10
Aircraft crash into the TB	5.7E-06	1.6E-08	1.9E-11
<b>Total aircraft crash</b>			<b>5.0E-10</b>

**Table 2: Comparison of at-power and shutdown risk metrics for Calvert Cliffs Unit 3 external hazards**

External Hazard	At-power CDF (from CCNPP3 FSAR) (1/year)	At-power release frequency (1/year)	LPSD CDF (calculated for this question) (1/year)	Ratio of LPSD CDF to external hazard CDF	Ratio of LPSD CDF to release frequency
Tornado	5.4E-08	N/A	2.1E-10	0.4%	N/A
Aircraft Crash	1.1E-07	3E-08	5.0E-10	<0.5%	1.7%

**COLA Impact**

The COLA will not be revised in response to this question.