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UniStar
NUCLEAR ENERGY

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September 14, 2011

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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. 313, Probabilistic Risk Assessment and Severe Accident Evaluation

Reference:
1) Surinder Arora (NRC) to Robert Poche (UniStar Nuclear Energy), "Final RAI 313 SEB2 5395," email dated July 19, 2011

2) UniStar Nuclear Energy Letter UN#11-240, from Greg Gibson to Document Control Desk, U.S. NRC, RAI Closure Plan, dated August 23, 2011

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 July 19, 2011 (Reference 1). This RAI addresses Probabilistic Risk Assessment and Severe Accident Evaluation, as discussed in Section 19.1.5 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 provided a September 15, 2011 response date for Question 19-26. The enclosure provides our response to RAI No. 313, Question 19-26, 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.

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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) 470-4205, or Mr. Wayne A. Massie at (410) 470-5503.

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

Executed on September 14, 2011

Greg Gibson

Enclosure: Response to NRC Request for Additional Information RAI No. 313, Question 19-26, Probabilistic Risk Assessment and Severe Accident Evaluation, Calvert Cliffs Nuclear Power Plant, Unit 3

cc: Surinder Arora, NRC Project Manager, U.S. EPR Projects Branch
Laura Quinn, NRC Environmental Project Manager, U.S. EPR COL Application
Getachew Tesfaye, NRC Project Manager, U.S. EPR DC Application (w/o enclosure)
Charles Casto, Deputy Regional Administrator, NRC Region II (w/o enclosure)
Silas Kennedy, U.S. NRC Resident Inspector, CCNPP, Units 1 and 2
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GTG/JMR/mdf

Enclosure

Response to NRC Request for Additional Information,
RAI No. 313, Question 19-26,
Probabilistic Risk Assessment and Severe Accident Evaluation,
Calvert Cliffs Nuclear Power Plant, Unit 3

RAI No. 313

Question 19-26

This question is supplementary to previous RAI 160, question number 19-19.

In 10 CFR 52.79, "Contents of applications; technical information," there is a requirement that each application for combined license (COL) must include a "description of the plant-specific probabilistic risk assessment (PRA) and its results" (§52.79(a) (46)). This plant-specific PRA must use the PRA information for the referenced design certification (DC) and must be updated to account for site-specific design information and any design changes or departures (§52.79(d) (1)). Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)" includes Regulatory Position Part I, "Standard Format and Content of Combined License Applications." According to Section C.I.19.3 of this part, the scope of the assessment should be "a Level 1 and Level 2 PRA that includes internal and external events and addresses all plant operating modes."

The NRC staff developed an Interim Staff Guidance (ISG-20, ML1004912330) which provides a detailed process that a COL applicant may use to update the PRA-based seismic margin analysis (SMA) of the referenced DC. Specifically, ISG-20, Section 5.2 includes four technical activities for COL updating as follows:

1. Updating plant system and sequence analysis (Section 5.2.1)
2. Updating seismic fragility evaluation including use of generic data (Section 5.2.2)
3. Updating plant-level capacity of high confidence of low probability of failure (HCLPF) (Section 5.2.3)
4. Post COL activities (Section 5.2.4)

ISG-20, Section 5.4 provides guidance on COL documentation of the updating assessment.

Part 2, Chapter 19 of the Final Safety Analysis Report (FSAR), Section 19.1.5.1 provides the description of the seismic evaluation that stated no departures or supplements from the referenced DC. The applicant justified the no departures or supplements by the following: 1) the site-specific ground motion response spectra (GMRS) are enveloped by the EPR DC certified seismic design response spectra (CSDRS), and 2) the site-specific soil profiles are enveloped by the EPR DC site profiles. The staff believes that the justifications provided are inadequate for the following reasons.

First, the EPR DC applicant uses a set of generic site profiles and the CSDRS to establish the fragility for the structures, systems and components (SSCs) for the accident sequences. The assumption used for the generic profiles is that any site-specific soil failures such as liquefaction, slope failures, etc. are precluded, which should be addressed on the site-specific basis. Based on this assumption, the DC applicant determined the fragility leading to a HCLPF capacity of 1.67 times CSDRS for the SSCs. The issue that the COL applicant needs to address is whether its site-specific soil conditions can withstand a ground motion equal to 1.67 times CSDRS without inducing soil failures. If the answer is affirmative, the applicant only needs to address site-specific SSCs that are not part of the DC scope in the update. For sites, which cannot sustain this level of ground motion without inducing soil failures, the DC fragility needs to be updated to reflect the actual site conditions.

Second, the applicant for a soil site is also expected to assess the effect of the site soil failures on the DC accident sequences to provide an update which determines if the DC sequences

need to be modified or additional soil failure induced sequences needs to be included, as part of updating the DC system analysis.

In a response to RAI 160, Question 19-19 dated December 11, 2009, the applicant identified the site-specific SSCs that have been included in the DC system model and provided the results of HCLPF capacities for these site-specific SSCs in terms of the site GMRS. However, the applicant did not address the issues raised in the previous two paragraphs regarding the site soil effects on the DC SMA sequences and fragility analysis.

The staff requests that the applicant revise Section 19.1.5.1 of the FSAR to provide a description of the updating analysis consistent with the guidance of ISG-20, Section 5.2 to address the issues raised in this RAI.

Response

The seismic analyses performed regarding the Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 site-specific soil effects are presented in the CCNPP Unit 3 Combined License Application (COLA) Final Safety Analysis Report (FSAR) Part 2, FSAR Section 2.5 and Section 3.8.

The conclusions of these seismic analyses are as follows:

- It is evident, from the collective results of the liquefaction analyses presented in FSAR Section 2.5.4.8.9, that the foundation soils at the CCNPP Unit 3 site are over-consolidated clays and cemented sands not susceptible to liquefaction. Surface terrace sands surrounding the embedded walls of the facilities will be removed and replaced with competent engineered fill.

- Based on the analyses performed in FSAR Section 2.5.5 and the conclusions provided in Section 2.5.5.2.3, the constructed and natural slopes at the site are sufficiently stable and present no failure potential that adversely affects the safety of the proposed CCNPP Unit 3. Dynamic forces for the slope stability analyses are introduced as pseudo-static forces obtained with a seismic coefficient of 0.15g, higher than 0.13g (1.67 times ground motion response spectra (GMRS), see Seismic Margin Earthquake below).

- For static and dynamic loading conditions, and based on a factor of safety of 3.0 (static) and 2.0 (dynamic), the analyses presented in FSAR Section 2.5.4.10.1 conclude that the site provides adequate allowable bearing capacity.

- Frictional parameters at the various sliding interfaces are presented in FSAR Table 3.8-1. Based on these frictional parameters, factors of safety against sliding and overturning associated with the site-specific Safe Shutdown Earthquake (SSE) loads are presented in FSAR Table 3.8-4 for the Nuclear Island common basemat structures, Emergency Power Generation Buildings, and Essential Service Water Buildings. This evaluation is presented in FSAR Section 3.8.5.5 and concludes that the minimum required factor of safety of 1.1 is achieved for all of the buildings.

As stated in CCNPP Unit 3 COLA Part 2 FSAR Section 19.1.5.1.1.2, the PRA-based seismic margin assessment follows the guidance in SECY 93-087 and demonstrates that there is a minimum seismic margin of 1.67 times the GMRS for CCNNP Unit 3.

1.67 times the CCNNP Unit 3 GRMS produces a peak ground acceleration (PGA) of 0.13g (= 1.67 x 0.076g) and is referred to as Seismic Margin Earthquake (SME) in the combined license.

The seismic analyses performed in CCNPP Unit 3 COLA Part 2, FSAR Sections 2.5 and 3.8 considered the impact of the CCNPP Unit 3 SSE anchored to a PGA of 0.15g. It is concluded from these seismic analyses that the site-specific soil conditions can withstand a ground motion equal to the CCNPP Unit 3 SME without inducing soil failures.

Therefore, consistent with the guidance provided in DC/COL-ISG-020:

- The fragility calculations performed for Structures, Systems and Components (SSCs) in the seismic equipment list (SEL) for the U.S. EPR FSAR need not to be updated to reflect the CCNPP Unit 3 actual site conditions.

- Possible effects of site soil failures on the U.S. EPR FSAR accident sequences need not be assessed.

- Potential site soil failures can be screened out as a contributor to CCNPP Unit 3 plant-level high confidence low probability of failure (HCLPF) capacity.

The COLA will be revised as shown below.

COLA Impact

CCNPP Unit 3 FSAR Section 19.1.5.1.2.4 will be modified as shown below:

19.1.5.1.2.4 Key Assumptions and Insights

The U.S. EPR FSAR includes the following COL Item in Section 19.1.5.1.2.4:

> A COL applicant that references the U.S. EPR design certification will confirm that the ~~design-specific~~ U.S. EPR PRA-based seismic margin<u>s</u> assessment is bounding for their specific site<u>, and will update it to include site-specific SSC and soil effects (including sliding, overturning, liquefaction and slope failure).</u>

This COL Item is addressed as follows:

The PRA-based seismic margins assessment performed for the U.S. EPR FSAR is based on the assumption that the U.S. EPR is designed using the EUR-based certified seismic design response spectra (CSDRS) anchored to <u>a peak ground acceleration (PGA) of</u> 0.3g for selected generic soil profiles. The seismic margins assessment <u>for the U.S. EPR FSAR</u> used CSDRS times 1.67 to define ~~the Seismic Margin Earthquake (SME), which is~~ the targeted seismic margin. The seismic margins assessment for <u>the</u> U.S. EPR FSAR remains valid if it can be demonstrated that the U.S. EPR FSAR seismic design parameters bound those for the

site-specific seismic characteristics, including the ground motion response spectra (GMRS) and site-specific soil profiles.

{A comparison of the CCNPP Unit 3 GMRS versus the CSDRS is provided in Section 3.7.1 and demonstrates that the GMRS anchored to a PGA of 0.076g is much lower than that of the CSDRS, and when the spectra are considered in combination with the site-specific soil characteristics, it is concluded that the seismic demands for CCNPP Unit 3 are much lower than that used for the U.S. EPR FSAR. Therefore, the U.S. EPR FSAR bounds site-specific seismic characteristics and they do not have a significant impact on the CCNPP Unit 3 PRA results and insights.}

Based on the structure seismic stability analyses, the allowable bearing capacities, and the soil failure analyses performed for the 0.15g site SSE, it is concluded that the CCNPP Unit 3 site conditions can withstand a ground motion equal 1.67 x GMRS (0.13g PGA) without inducing soil failures (including sliding, overturning, liquefaction and slope instability).

Therefore, the plant-level high confidence low probability of failure (HCLPF) capacity meets the 1.67 x GMRS criterion.}

CCNPP Unit 3 FSAR Section 19.1.5.4.7 will be modified as shown below:

~~**19.1.5.4.7 Site-Specific PRA Based SMA for Soil Effects**~~

~~This section is added as a supplement to the U.S. EPR FSAR. Possible reductions in seismic capacity due to site-specific soil effects are considered when determining the HCLPF capacity of SSC and the plant-level HCLPF capacity. Geotechnical analyses were performed and show that a minimum HCLPF of 0.14g pga will be met in all cases considered, including sliding and overturning, liquefaction, and slope failure.~~

~~Therefore, plant-level HCLPF capacity meets the 1.67 x GMRS criterion.}~~