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UniStar
NUCLEAR ENERGY

10 CFR 50.4
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September 22, 2011

UN#11-258

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. 301, Other Seismic Category I Structures

References:
1) Surinder Arora (NRC) to Robert Poche (UniStar Nuclear Energy), "FINAL RAI No. 301 SEB2 5566" email dated April 14, 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 April 14, 2011 (Reference 1). This RAI addresses Other Seismic Category I Structures, as discussed in Section 3.8.4 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 7.

Reference 2 provided a September 22, 2011 response date for Question 03.08.04–22. The enclosure provides our response to RAI No. 301, Question 03.08.04–22 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 22, 2011

Greg Gibson

Enclosure: Response to NRC Request for Additional Information, RAI No. 301, Question 03.08.04-22, Other Seismic Category I Structures, 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
U.S. NRC Region I Office

GTG/FRP/mdf

Enclosure

Response to NRC Request for Additional Information,
RAI No. 301, Question 03.08.04-22,
Other Seismic Category I Structures,
Calvert Cliffs Nuclear Power Plant, Unit 3

RAI No 301

Question 03.08.04-22

SRP Sections 3.8.4.I.6 and SRP 3.8.5.I.6 discuss information on the materials used in the construction of Seismic Category I structures and their foundations. The staff reviewed the RAI response to Question 03.08.04-4 provided in UniStar Letter UN#10-193, dated July 23, 2010 (ML102100480), and found that the RAI response addressed most of the staff's concerns. However, the staff also found that both the RAI response and Rev. 7 of the CCNPP Unit 3 FSAR indicated that waterproofing is not needed for some Seismic Category I structures or some portions of below grade concrete of Seismic Category I structures. This is inconsistent with AREVA's final RAI response (to U.S. EPR Design Certification Application Question 03.08.05-21), which states that "Waterproofing and dampproofing systems are required for Seismic Category I foundations below grade." Furthermore, Section 3.4.2, Rev. 3 interim, of the U.S. EPR FSAR states that "Seismic Category I structures provide protection from external floods and groundwater by incorporating the following external flood protection measures: ...Portions of Seismic Category I structures located below grade elevation incorporate the use of waterstops and waterproofing to mitigate environmental deterioration of exposed surfaces and thereby minimize long term maintenance...Waterproofing and dampproofing systems shall be applied per the International Building Code, Sections 1805.2 and 1805.3." Therefore, the staff requests that the applicant address the inconsistency, and revise the RAI response to UniStar Question 03.08.04-4 and the CCNPP Unit 3 FSAR accordingly.

In addition, the staff noticed that reference to ACI 515.1R-79 is removed from Rev. 7 of CCNPP Unit 3 FSAR Subsections 3.8.4.6.1 and 3.8.5.6.1. The staff requests that the applicant explain the reason for the removal and indicate where the reference to this code or other related code(s) for the waterproofing system is provided in the FSAR. Also, explain whether the fluctuation of the groundwater table and flood level are considered in the design of the waterproofing system.

The staff needs the above information to determine whether FSAR Sections 3.8.4.6.1 and 3.8.5.6.1 are consistent with SRP Acceptance Criteria 3.8.4.II.6 and 3.8.5.II.6.

Response

Part 1: Revise the RAI response to UniStar Question 03.08.04-4 and the CCNPP Unit 3 FSAR to address inconsistency with AREVA's RAI response to U. S. EPR Design Certification Application Question 03.08.05-21 and U.S. EPR FSAR Revision 3 Section 3.4.2.

Waterproofing and dampproofing systems in accordance with the guidance in Sections 1805.2 and 1805.3 of the 2009 International Building Code (IBC 2009) will be applied to Seismic Category I foundations below grade at Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3, to be consistent with the final response to U.S. EPR FSAR RAI 354 Question 03.08.05-21[1], and the Revision 3 U.S. EPR FSAR Section 3.4.2. The response to CCNPP Unit 3 RAI 144 Question 03.08.04-4[2] describes the waterproofing systems that protect the structural foundations and

[1] e-mail from Martin Bryan (AREVA NP) to Getachew Tesfaye (NRC), Response to U.S. EPR Design Certification Application RAI No. 354, FSAR Ch. 3, Supplement 10, dated October 7, 2010.

[2] UniStar Nuclear Energy Letter UN#10-193, 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. 144, Other Seismic Category I Structures, and RAI No. 145, Foundations, dated July 23, 2010

buried walls of the Seismic Category I structures that are constructed below the groundwater table. These systems differ depending on structure location, because the groundwater beneath the powerblock area is aggressive and the groundwater beneath the intake area is not. Nevertheless, all or part of each waterproofing system will extend upward to about 1 foot above the ground surface as described in the response to CCNPP Unit 3 RAI 144 Question 03.08.04-4[2]. CCNPP Unit 3 COLA Revision 7 FSAR Subsection 3.8.4.6.1 describes the waterproofing system intended to protect the NI common basemat structures submerged in aggressive groundwater, and addresses other potential material exposures to aggressive groundwater or brackish water from the Chesapeake Bay. CCNPP Unit 3 COLA FSAR Subsection 3.8.5.6.1 will be updated to require the application of waterproofing and dampproofing in accordance with Sections 1805.2 and 1805.3 of the IBC 2009 to Seismic Category I foundations.

It is noted that the Seismic Category I structures other than Nuclear Island common basemat structures are not subject to low-pH groundwater, as described in COLA FSAR Revision 7, Subsection 3.8.4.6.1. The concrete mix will be suitably designed to meet the durability requirements for the applicable exposure conditions. Regardless, the waterproofing and dampproofing systems are applied in accordance with IBC 2009 guidelines mentioned above and serve as a defense in depth barrier, but do not perform any safety-related function (also refer to the response to RAI 118 Question 14.03.02-2G[3]).

Part 2: Explain the reason for removal of reference to ACI 515.1R-79 in CCNPP Unit 3 FSAR Subsections 3.8.4.6.1 and 3.8.5.6.1 and indicate where the code references for the Waterproofing System are provided in the FSAR.

ACI 515.1R-79 has been withdrawn by the American Concrete Institute (ACI) and has not been replaced. Therefore, the reference to ACI 515.1R-79 has been removed from the CCNPP Unit 3 COLA FSAR.

Part 3: Explain whether the fluctuation of the groundwater table and flood level are considered in the design of the waterproofing system.

Waterproofing and dampproofing will be applied in accordance with Sections 1805.2 and 1805.3 of the IBC 2009 to Seismic Category I foundations.

As stated in the CCNPP Unit 3 COLA FSAR Section 3.4.2, the U.S. EPR FSAR requires the Probable Maximum Flood (PMF) elevation to be 1 ft (0.3 m) below finished grade, which envelops the CCNPP Unit 3 maximum flood level for safety-related structures, except the Ultimate Heat Sink (UHS) Makeup Water Intake Structure. This maximum flood elevation is below the top of the waterproofing and dampproofing applied to the Seismic Category I foundations. The UHS Makeup Water Intake Structure is located at the shoreline and is designed to be watertight to prevent internal flooding of the buildings.

CCNPP Unit 3 COLA FSAR Subsection 3.8.4.6.1 describes that a double layer waterproofing system is used on the lower portions of the NI common basemat structures as protection from aggressive groundwater in the powerblock area. Because the maximum, steady-state, post-construction groundwater level in the powerblock area is projected to be at about elevation 55 feet (NGVD 29), the double-layer waterproofing system will be constructed up to elevation 57

[3] UniStar Nuclear Energy Letter UN#10-071, 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. 118, Structural and Systems Engineering – Inspections, Tests, Analyses, and Acceptance Criteria, dated March 31, 2010

feet before transitioning to the single layer system above this elevation. The maximum projected groundwater level is 30 feet below the finished site grade elevation of 85 feet in the powerblock area. Post-construction groundwater levels are projected on the basis of a groundwater modeling-effort, performed by Bechtel and reported in "Groundwater Model for the Calvert Cliffs Nuclear Power Plant Unit 3 Site." UniStar provided this report (Bechtel Document # 25237-000-30R-GEK-00002, Revision 000, Groundwater Model for the Calvert Cliffs Nuclear Power Plant Unit 3 Site, April 2010) in the response to RAI 101[4]. CCNPP Unit 3 COLA FSAR Subsection 2.4.12.5 provides a summary of the post-construction groundwater modeling and relevant conclusions.

As described in the referenced report, the groundwater model was developed to incorporate known site conditions, and was calibrated against pre-development groundwater levels derived from the average monthly or quarterly water levels observed in each of 36 on-site groundwater monitoring wells during 2007. The objectives of the calibration effort were: 1) minimization of the differences between groundwater level predictions from the model and the groundwater levels observed in each of the monitoring wells, and 2) optimization of the groundwater flow mass balance. Once the model was fully calibrated against the pre-development conditions, the primary CCNPP Unit 3 facilities, the backfilled power block excavation, recharge zones, and the post-construction topography were incorporated into the model. Of particular importance is the coarse, granular structural backfill in the CCNPP Unit 3 powerblock excavation, which will readily collect and discharge groundwater from the site, thereby controlling and stabilizing post-construction groundwater levels. Seven groundwater simulations were conducted with the post-construction model to conservatively determine the steady-state, post-construction groundwater levels as well as the sensitivity of the model results to differing hydraulic conductivity values, differing rates of areal and sand filter recharge, and differing conditions of base leakage to deeper aquifers. The results of these simulations are presented in Tables 13 and 14 of the referenced report, which show projected groundwater levels varying from elevation 44.5 to 54.1 (NGVD 29) in the Upper Chesapeake aquitard and the Upper Chesapeake aquifer unit beneath the powerblock. These tables illustrate that, at any given point, the model results are relatively insensitive to the broad range of conservative conditions represented by the seven different simulations.

As stated in the referenced report, the maximum projected post-construction groundwater level under the powerblock for steady-state conditions is at about elevation 55 feet. Since this maximum projected groundwater level is based on conservative considerations, transitioning the double layer waterproofing system to a single layer system at elevation 57 feet will adequately account for fluctuations in the groundwater table.

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[4] UniStar Nuclear Energy Letter UN#10-122, 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. 101, Groundwater, dated May 3, 2010.

COLA Impact

COLA FSAR Table 1.8-2 will be revised as follows (only the impacted portions are shown):

Table 1.8-2— FSAR Sections that Address COL Items

...		
3.8-10	A COL applicant that references the U.S. EPR design certification will evaluate site-specific methods for shear transfer between the foundation basemats and underlying soil for site-specific soil characteristics that are not within the envelope of the soil parameters specified in Section 2.5.4.2.	3.8.5.5
3.8-11	A COL applicant that references the U.S. EPR design certification will evaluate the use of epoxy coated rebar for foundations subjected to aggressive environments, as defined in ACI 349-01, Chapter 4. In addition, the waterproofing and dampproofing system of all Seismic Category I foundations subjected to aggressive environments will be evaluated for use in aggressive environments. Also, the concrete of Seismic Category I foundations subjected to aggressive environments will meet the durability requirements of ACI 349-01, Chapter 4 or ASME, Section III, Division 2, Article CC-2231.7, as applicable.	3.8.5.6.1
3.8-12	A COL applicant that references the U.S. EPR design certification will describe the program to examine inaccessible portions of below-grade concrete structures for degradation and monitoring of groundwater chemistry.	3.8.5.7
...		

COLA FSAR Section 3.8.4.6.1 will be revised as follows:

3.8.4.6.1 Materials

...

A majority of the buried electrical duct banks are located above the post-development groundwater level in the powerblock area and are not affected by the low-pH groundwater. For the duct banks in the utility corridor that may be exposed to the low-pH groundwater, liquid-applied or geomembrane waterproofing is applied for protection against prolonged exposure to the groundwater. Protective measures for buried pipe include protective wrapping and/or coatings that are acid-resistant.

~~Since the groundwater is non-aggressive in the intake area, waterproofing is not needed for the protection of concrete structures or duct banks.~~

As noted in Table 3.8-5, the maximum observed sulfate concentration in the groundwater is 365 ppm. According to ACI 349-01 (ACI, 2001a) Table 4.3.1, this concentration is considered a moderate exposure (also identified as "Class 1 Exposure" in ACI 201.2R-01 (ACI, 2001b)) and requires the use of ASTM C150 (ASTM, 2009) Type II or equivalent cement, a maximum water-cementitious materials ratio of 0.5, and a minimum concrete compressive strength of 4000 psi.

...

COLA FSAR Section 3.8.4.7 will be revised as follows:

3.8.4.7 Testing and Inservice Inspection Requirements

{As discussed in Section 3.8.4.6.1, although the CCNPP Unit 3 in-situ soil is aggressive to concrete, it will be replaced by non-aggressive structural fill under and around the structures and buried duct banks and buried pipes. In addition, the foundations of Seismic Category I structures, and buried utilities ~~in the powerblock area~~ are protected by waterproofing and dampproofing systems ~~or coating, if submerged in the low-pH groundwater from the Surficial aquifer~~. As a result, the structures and buried utilities are not directly exposed to the in-situ soil or the low-pH groundwater.

COLA FSAR Section 3.8.5.6.1 will be revised as follows:

3.8.5.6.1 Materials

The U.S. EPR FSAR includes the following COL Item in Section 3.8.5.6.1:

> A COL applicant that references the U.S. EPR design certification will evaluate the use of epoxy coated rebar for foundations subjected to aggressive environments, as defined in ACI 349-01, Chapter 4. In addition, the waterproofing and dampproofing system of all Seismic Category I foundations subjected to aggressive environments will be evaluated for use in aggressive environments. Also, the concrete of Seismic Category I foundations subjected to aggressive environments will meet the durability requirements of ACI 349-01, Chapter 4 or ASME, Section III, Division 2, Article CC-2231.7, as applicable.

This COL Item is addressed as follows:

{~~The~~ As described in Section 3.8.4.6.1, Seismic Category I structures other than NI common basemat structures are not exposed to low-pH groundwater and, therefore, do not require protection to perform their safety function. However, in line with good construction practices and to fulfill defense in depth requirements, waterproofing and dampproofing systems are applied in accordance with Sections 1805.2 and 1805.3 of the IBC 2009 (IBC, 2009) to Seismic Category I foundations. For NI common basemat structures, a waterproofing membrane is used to eliminate the prolonged exposure of below grade concrete from the low pH groundwater of Surficial aquifer, as described in Section 3.8.4.6.1. Discussion of concrete mix design for improved resistance to sulfate attack and chloride ion penetration is also presented in Section 3.8.4.6.1. Epoxy coated rebar is not used.}

COLA FSAR Section 3.8.5.7 will be revised as follows:

3.8.5.7 Testing and Inservice Inspection Requirements

...

As stated in Section 3.8.4.7, groundwater levels throughout the powerblock area will be monitored. The CCNPP Unit 3 geochemical groundwater monitoring program is established on the following bases:

- Recorded baseline ~~concentrations and~~ pH values ~~of~~ and groundwater geochemistry concentrations ~~chemical properties~~ prior to start of excavation.

- Recorded ~~concentrations and~~ pH values ~~of~~ and groundwater geochemistry concentrations ~~chemical properties~~ after backfill is completed and at six month intervals thereafter.

- One-year after backfill is completed:

...

COLA FSAR Section 3.8.6 will be revised as follows:

3.8.6 References

...

Dean, 1974. Evaluation and Development of Water Wave Theories for Engineering Application. Special Report No. I. Coastal Engineering Research Center, U.S. Army Corps of Engineers, November 1974.

IBC, 2009. International Building Code, International Code Council, February 2009.

IEEE, 2001. Standard Criteria for the Design, Installation, and Qualification of Raceway Systems for Class 1E Circuits for Nuclear Power Generating Stations, IEEE 628-2001, IEEE, 2001.

...