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UniStar
NUCLEAR ENERGY

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August 25, 2011

UN#11-239

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. 308, Foundations

Reference:
1) Surinder Arora (NRC) to Robert Poche (UniStar Nuclear Energy), "FINAL RAI 308 SEB2 5748, dated May 23, 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 May 23, 2011 (Reference 1). This RAI addresses Foundations, as discussed in Section 3.8 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.

A schedule for the response to RAI 308 Question 03.08.05-7 was provided in Reference 2. The enclosure provides our response to RAI No. 308, Question 03.08.05-07, 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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NRD

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 August 25, 2011

for Greg Gibson

Enclosure: Response to NRC Request for Additional Information RAI No. 308, Question 03.08.05-7, Foundations, 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/AJF/mdf

Enclosure

Response to NRC Request for Additional Information
RAI No. 308, Question 03.08.05-7, Foundations
Calvert Cliffs Nuclear Power Plant, Unit 3

RAI No. 308

Question 03.08.05-7

SRP acceptance criteria 3.8.5.II.5 discusses the allowable design limits for the foundation design. In RAI number 03.08.05-1, the staff requested that the applicant provide additional information on how to address the U.S. EPR FSAR Section 3.8.5.5 COL item regarding site-specific methods for shear transfer under the foundation basemats.

The staff reviewed the RAI response to Question 03.08.05-1 provided in UniStar Letter UN#10-193 dated July 23, 2010 (ML102100480), and also reviewed Rev. 7 of Calvert Cliffs Unit 3 FSAR Sections 1.1, 1.2, 1.8.2, 2.5.4, and 3.8. As indicated in Item 5 of the RAI response, the coefficients of friction given in CCNPP Unit 3 FSAR Table 3.8-1 for the interfaces of concrete-soil/soil-soil are based on laboratory tests described in updated CCNPP Unit 3 FSAR Section 2.5.4. However, the staff cannot correlate the values in Table 3.8-1 with Section 2.5.4. For example, Table 2.5.58 shows coefficients of 0.4 and 0.45, which do not appear in Table 3.8-1. Therefore, explain how the coefficients of friction given in Table 3.8-1 for the interfaces of concrete-soil/soil-soil correlate with the corresponding coefficients shown in Table 2.5-58. Also, provide references to the laboratory test reports and the specific locations in the reports that provide the technical basis for the coefficients of friction and adhesion values provided in Table 3.8-1, in case that the staff needs to review the reports in a future audit. The staff needs the information to be able to conclude in the SER that there is reasonable assurance that the foundation design of the Seismic Category I structures sufficiently meets SRP Acceptance Criteria 3.8.5 II.5 and has been adequately addressed in the CCNPP Unit 3 FSAR.

Response

There is no correlation between the coefficient of friction values given in Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 COLA FSAR, Revision 7, Tables 3.8-1 and 2.5-58. As described in COLA FSAR Section 2.5.4.2.5.7, the coefficients of friction given in COLA FSAR Table 2.5-58 are based solely on recommendations provided in NAVFAC Design Manual 7.02 (Reference 1) for similar materials in contact with mass concrete. These values were based on visual descriptions only, with no regard to specific strengths developed empirically or from laboratory testing.

COLA FSAR Table 3.8-1 was prepared as a direct result of the site-specific sliding analysis, which incorporated specific knowledge of the interfaces required for the analysis for each Seismic Category I structure. The values provided in COLA FSAR Table 3.8-1 are based on strengths developed from site-specific laboratory testing and empirical relationships developed from site-specific correlations. Thus, COLA FSAR Table 3.8-1 contains the site-specific and interface-specific coefficients of friction. A geotechnical calculation was prepared to formally document the friction coefficient values provided in COLA FSAR Table 3.8-1. The properties of structural backfill and in-situ soils used in the calculation are based on the laboratory testing reports that are referenced in COLA FSAR Section 2.5.4. Table 1 below provides a reference to the specific locations within the laboratory test reports (References 2-4) where the design information pertaining to the soil properties is provided.

Table 1: Reference Information for Laboratory Test Reports

Soil Type	Reference
Structural Fill	Ref. 2, Table 1 [Laboratory Test Summary (Structural Fill) Rev. 4] on Page 3.
Stratum IIb	Ref. 3, Laboratory Test Summary on Pages 2 to 13. Test details are provided in rest of report. Ref. 4, Section titled 'Summary of Soil Laboratory Test Results.' Test details are provided in rest of report.
Stratum IIc	Ref. 3, Laboratory Test Summary on Pages 2 to 13. Test details are provided in rest of report.

The geotechnical calculation includes a summary of the recommended parameters for sliding stability evaluation, based on a detailed literature review, and provides the calculation of the friction coefficient and soil adhesion values at the applicable interfaces in the powerblock and intake areas, based on References 2, 3, and 4. For sliding stability evaluation of the Emergency Service Water Building (ESWB) and Emergency Power Generation Building (EPGB), the friction coefficient for mud mat/backfill interface is conservatively taken as the lowest value among the mud mat/sand, sand/waterproofing membrane, and sand/backfill interfaces.

References used in this response:

1. Design Manual 7.02, Foundations and Earth Structures, Naval Facilities Engineering Command, 1986
2. MACTEC (2009), Structural Fill Static Laboratory Testing Results, Rev. 1, June 17, 2009, Calvert Cliffs Nuclear Power Plant Unit 3
3. MACTEC (2009), Revised Laboratory Testing Results, Rev. 2, March 11, 2009, Calvert Cliffs Nuclear Power Plant Unit 3
4. Schnabel Engineering Inc. (2007), Geotechnical Subsurface Investigation Final Data Report, Binder 3 of 3, Rev. 01, April 13, 2007, Calvert Cliffs Nuclear Power Plant

COLA Impact

FSAR Section 2.5.4. will be updated as follows:

2.5.4.2.5.7 ~~Sliding Coefficient~~ Coefficient of Friction

~~The sliding coefficient is tangent δ, where δ is the friction angle between the soil and the material it is bearing against, in this case concrete.~~ Values for the coefficient of friction between the soil and the material it is bearing against (concrete) are provided in Section 3.8 Table 3.8-1. ~~Based on "Foundations & Earth Structures" (NFEC, 1986), the sliding coefficient, tangent δ, for each stratum is provided in Table 2.5-58.~~

FSAR Table 2.5-58 will be updated as follows:

Table 2.5-58— {Earth Pressure Coefficients}

Stratum			K_a	K_P	K_0	~~tan δ(1)~~	~~FOS against Sliding(2)~~
POWERBLOCK AREA	I - Terrace Sand		0.36	2.76	0.53	~~0.40~~	~~2.7~~
	IIa - Chesapeake Clay/Silt		0.31	3.20	0.48	~~0.35~~	~~2.3~~
	IIb - Chesapeake Cemented Sand	L1	0.29	3.46	0.45	~~0.45~~	~~3.0~~
		L2	0.30	3.30	0.47	~~0.45~~	~~3.0~~
		L3	0.29	3.46	0.47	~~0.45~~	~~3.0~~
	IIc - Chesapeake Clay/Silt(2)		0.31	3.25	0.47	~~0.40~~	~~2.7~~
	III - Nanjemoy Sand		Not Required				
INTAKE AREA	I - Terrace Sand		NP	NP	NP	~~NP~~	
	IIa - Chesapeake Clay/Silt		NP	NP	NP	~~NP~~	
	IIb - Chesapeake Cemented Sand	L1	NP	NP	NP	~~NP~~	
		L2	NA	NA	NA	~~NA~~	
		L3	0.29	3.41	0.45	~~0.45~~	~~3.0~~
	IIc - Chesapeake Clay/Silt		0.32	3.14	0.48	~~0.40~~	~~2.7~~
	III - Nanjemoy Sand		Not Required				
BACKFILL			0.22	4.60	0.36	~~0.40~~	~~2.7~~

Notes:
- ~~(1) tan δ is sliding resistance~~
- NP: Not Present; NA: Not Available
- values of φ are used to determin K coefficients
$K_a = \tan^2(45-\varphi'/2)$; $K_p = \tan^2(45-\varphi'/2)$; $K_0 = 1 - \sin(\varphi')$
- ~~(2) Factor of Safety is tan d divided by SSE acceleration, 0.15 g.~~
~~The FOS does not account for passive earth pressure on the sides of the buildings.~~

FSAR Section 2.5.4.13 will be updated as follows:

2.5.4.13 References

~~**NFEC, 1986.** Foundations and Earth Structures, Design Manual 7.02, Naval Facilities Engineering Command, pp 7.02-63, Table 1 [Report] - 1986.~~