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UniStar
NUCLEAR ENERGY

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January 8, 2010

UN#10-007

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. 195, Question 02.05.04-1, Request for Liquefaction Potential Evaluation Related Data

Reference:
1) Surinder Arora (NRC) to Robert Poche (UniStar Nuclear Energy), "Final RAI 195 RGS2 3908," email dated December 02, 2009

2) UniStar Nuclear Energy Letter UN#10-002, from Greg Gibson to Document Control Desk, U.S. NRC, Response to RAI No. 195, Question 02.05.04-1, Request for Liquefaction Potential Evaluation Related Data, dated January 04, 2010

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 December 2, 2009 (Reference 1). This RAI requests data used for the evaluation of liquefaction potential presented in Section 2.5.4.8 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 6.

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Reference 2 provided a January 8 schedule for the response to RAI No. 195, Question 02.05.04-1.

Enclosure 1 provides the response to RAI 195, Question 2.05.04-1. Enclosure 2 contains a CD that provides the requested data.

This letter does not include any new regulatory commitments and 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. Michael J. Yox at (410) 495-2436.

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

Executed on January 8, 2010

Greg Gibson

Enclosure: 1 Response to NRC Request for Additional Information, RAI 195, Question 02.05.04-1, Request for Liquefaction Potential Evaluation Related Data

2 CD containing Cone Penetrometer Test data for 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 (w/o enclosure)
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 (w/o enclosure)
U.S. NRC Region I Office (w/o enclosure)

GTG/SJS/mdf

Enclosure 1

Response to NRC Request for Additional Information
RAI 195, Question 02.05.04-1 Request for Liquefaction Potential Evaluation Related Data

RAI No. 195 Question 02.05.04-1

In order for staff to perform confirmatory analysis of the site liquefaction potential analysis provided in FSAR Section 2.5.4.8, the CPT data collected during the site investigation is needed.

The data need to be in Excel format and include:

- Uncorrected cone tip resistance (qc)
- Sleeve resistance (fs)
- Pore pressure (as measured with piezocone – PCPT)

with associated depth, elevation, pore water pressure corrected tip resistance (qt), as well as cyclic Resistance Ratio (CRR) values.

Response

The attached CD includes the following data in Excel format:

Corrected cone tip resistance (qt) and Cyclic Resistance Ratio (CRR) as a function of depth (and elevation) are provided in the file:

Calvert Cliffs NPP RAI 195 – Tip Resistance and CRR.xls.

Sleeve resistance (fs) and pore pressure (u) versus depth and elevation are provided in the file:

Calvert Cliffs NPP RAI 195 - Sleeve Resistance and Pore Pressures.xls

The approach used to evaluate the liquefaction potential from CPT data was based on the proposed methodology by Youd[1]. Corrected cone tip resistance was used in the calculations. The following assumptions were adopted for the estimation of the CRR:

1. Correction for grain characteristics (Kc) was conservatively assigned as 1 (minimum value)
2. The exponent that varies with soil type (n) was assigned based on the fines content, soil types, and subsurface layering discretization.

Therefore:

$$(q_{t1N})_{cs} = q_{t1N} = (P_a / \sigma'_{vo})^n (q_t / P_a)$$

Where:

$(q_{t1N})_{cs}$	→	Clean-sand cone penetration resistance normalized to approximately 100 kPa (1 atm)
q_{t1N}	→	Cone penetration resistance normalized to approximately 100 kPa (1atm)
P_a	→	1 atm = 100 kPa
σ'_{vo}	→	Effective vertical stress

[1] **Youd, et al, 2001.** Youd T. L. [et al.] Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction of Soils, ASCE Journal of Geotechnical and Geoenvironmental Engineering, Volume 127, Number 10, pp 817-833 [Journal] - 2001.

q_c → Measured tip resistance
n → See the following tables

The sleeve resistance was not used to estimate n. As stated above, n values were assigned based on the stratum, fines content, and soil types.

For the Powerblock Area:

Stratum	Fines Content [%]	USCS	n
I	21.8	SM, SP-SM	0.61
IIA	79.5	CH, MH	0.90
IIB-1	26.2	SM, SP	0.63
IIB-2	23.3	SM, SP-SM	0.62
IIB-3	23.7	SM	0.62
IIC	59.9	MH, SM	0.80
III	23.3	SC, SM	0.62

For the Intake Area:

Stratum	Fines Content [%]	USCS	n
IIB-1	16.5	SM, SP	0.58
IIB-2	18.9	SM, SP-SM	0.59
IIB-3	25.9	SM	0.63
IIC	49.0	MH, SM	0.74

Uncorrected cone tip resistance (qc), sleeve resistance (fs), and pore pressure (u) were not used in the CPT-based liquefaction analysis in the CCNPP Unit 3 COLA.

For this RAI response, sleeve resistance and pore pressure were obtained from data plots in the field investigation report: Geotechnical Subsurface Investigation Data Report (Revision No. 1), April 13, 2007, Schnabel Engineering North, LLC, Gaithersburg, MD (Specifically, Appendix F in file 002_Schnabel_2007a_Part_02.pdf. in COLA Part 11J). The information in these plots was manually digitized and incorporated into the spreadsheet named Calvert Cliffs NPP RAI 195 - Sleeve Resistance and Pore Pressures.xls. For convenience, a copy of that file is also included on the CD.

The uncorrected cone tip resistance (qc) was not calculated, but can be obtained with the following expression:

$$qc = qt - (1-a)u$$

Where:

qt → Corrected tip resistance
n → Net area ratio for cone (0.8, from the Geotechnical Subsurface Investigation Data Report),
u → Measured pore pressure

COLA Impact

None

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Enclosure 2

CD containing Cone Penetrometer Test data for Calvert Cliffs Nuclear Power Plant, Unit