## CCNPP3COLA NPEmails

**From:** Arora, Surinder
**Sent:** Friday, February 19, 2010 2:39 PM
**To:** 'Poche, Robert'; 'cc3project@constellation.com'
**Cc:** CCNPP3COL Resource; Karas, Rebecca; Wang, Weijun; Colaccino, Joseph; Steckel, James; Biggins, James; Vrahoretis, Susan; Hair, Christopher
**Subject:** DRAFT RAI No. 218 RGS1 4332
**Attachments:** DRAFT RAI 218 RGS1 4332.doc

Rob,

Attached is DRAFT RAI No. 218 (eRAI No. 4332). You have until March 5, 2010 to review it and decide whether you need a conference call to discuss any questions in this RAI before the final issuance. After the phone call or on March 5, 2010, the RAI will be finalized and sent to you for response. You will then have 30 days to provide a technically complete response or an expected response date for the RAI.

Thanks.

**SURINDER ARORA, PE**
**PROJECT MANAGER,**
**Office of New Reactors**
**US Nuclear Regulatory Commission**

Phone: 301 415-1421
FAX: 301 415-6406
Email: Surinder.Arora@nrc.gov

**Hearing Identifier:** CalvertCliffs_Unit3Cola_NonPublic_EX
**Email Number:** 3531

**Mail Envelope Properties** (B46615B367D1144982B324704E3BCEED214E52C0A5)

**Subject:** DRAFT RAI No. 218 RGS1 4332
**Sent Date:** 2/19/2010 2:39:19 PM
**Received Date:** 2/19/2010 2:39:22 PM
**From:** Arora, Surinder

**Created By:** Surinder.Arora@nrc.gov

**Recipients:**
"CCNPP3COL Resource" <CCNPP3COL.Resource@nrc.gov>
Tracking Status: None
"Karas, Rebecca" <Rebecca.Karas@nrc.gov>
Tracking Status: None
"Wang, Weijun" <Weijun.Wang@nrc.gov>
Tracking Status: None
"Colaccino, Joseph" <Joseph.Colaccino@nrc.gov>
Tracking Status: None
"Steckel, James" <James.Steckel@nrc.gov>
Tracking Status: None
"Biggins, James" <James.Biggins@nrc.gov>
Tracking Status: None
"Vrahoretis, Susan" <Susan.Vrahoretis@nrc.gov>
Tracking Status: None
"Hair, Christopher" <Christopher.Hair@nrc.gov>
Tracking Status: None
"'Poche, Robert'" <Robert.Poche@constellation.com>
Tracking Status: None
"'cc3project@constellation.com'" <cc3project@constellation.com>
Tracking Status: None

**Post Office:** HQCLSTR01.nrc.gov

| **Files** | **Size** | **Date & Time** |
|---|---|---|
| MESSAGE | 642 | 2/19/2010 2:39:22 PM |
| DRAFT RAI 218 RGS1 4332.doc | 44538 | |

**Options**
**Priority:** Standard
**Return Notification:** No
**Reply Requested:** Yes
**Sensitivity:** Normal
**Expiration Date:**
**Recipients Received:**

Request for Additional Information No. 218 (eRAI 4332)
DRAFT
2/19/2010

Calvert Cliffs Unit 3
UniStar
Docket No. 52-016
SRP Section: 02.05.04 - Stability of Subsurface Materials and Foundations
Application Section: 2.5.4

QUESTIONS for Geosciences and Geotechnical Engineering Branch 1 (RGS1)

02.05.04-3

Section 2.5.4.5.2 indicates that most Category I structures will be founded on the top of Stratum IIb cemented sand layer. In Section 2.5.4.2.1.3, the layer IIb is further divided into three sublayers: silty sand layer with SPT N value greater than 20; clayey sand layer with N value smaller than 20; and poorly-graded sand to silty sand layer with N value greater than 20. The shear wave velocity of the layer IIb shows great variation, ranging from 560 to 3,970 ft/s. In addition, the shear strength property of the IIb is only based on very limited laboratory test results (one triaxial test for sublayer IIb-1 and two tests for sublayer IIb-2). Because the properties of the load-bearing layer IIb directly affect the foundation stability, the applicant is requested to explain how specific soil parameters for this layer were incorporated into relevant calculations (such as bearing capacity, settlement, SSI and GMRS), and discuss how the soil shear strength property for this layer was characterized based on limited testing results. In addition, describe how the variability was accounted for in the soil parameters for layer IIb in the above analyses.

02.05.04-4

Section 2.5.4.5.2 presents information on the planned extent of excavation and fills to be placed in and around the Category 1 structures and indicates that the extent of excavation will be based on the observation of actual conditions at the time of the excavation. The applicant is requested to describe the procedures that will be used by field investigators to judge if in-situ soils are to be left in place.

02.05.04-5

Section 2.5.4.5.2 indicates that the excavations will be backfilled with compacted structural fill to the foundation level or, if necessary, lean concrete will be placed as a leveling mat. Since the lean concrete will be used directly underneath the Category 1 structures, please describe the properties of the concrete (such as strength and shear wave velocity), and the criteria that will be used to determine where the lean concrete leveling mat should be used. In addition, describe the controls to ensure that the concrete fill can provide adequate support of both static and dynamic loadings for the foundation.

02.05.04-6

Section 2.5.4.2.5.8 presents the low strain dynamic properties for the backfill soil and indicates that the shear wave velocity for the backfill below the EPGB is about 900 fps. This velocity is lower than the minimum shear velocity (1,000 fps) specified in the U.S.

EPR standard design and thus was identified as a departure in this COL application. In addition, the minimum shear wave velocity definition was also revised in the latest U.S. EPR standard design, which no longer uses the “best estimate” concept. Please update the corresponding ITAAC to reflect the changes of the DCD and the departure. In addition, please refer the NRC’s August 7, 2009 letter to NEI regarding the NRC staff position and standard wording for backfill ITAAC under Category I structures.

02.05.04-7

Section 2.5.4.5.3 states that structural fill will be compacted to a minimum 95 percent of its maximum dry density, and within 3 percent of its optimum moisture content, based on the Modified Proctor Compaction test procedure. Section 2.5.4.5.3 further states that the in-place density and moisture content testing frequency will be a minimum of one test per 10,000 square feet fill placed. Please justify whether the backfill field density test parameter (one test for every 10,000 $ft^2$) is adequate by itself without specifying other controls or procedures, such as no lift should be more than 8 inches in thickness and a routine acceptance control test should be conducted for at least every 200 cubic yards of compacted backfill material in critical areas

02.05.04-8

Section 2.5.4.2.2.2 states that dolomite or calcite was identified as the cementing agent for the sand soil layer and the absence of dolomite or calcite in certain parts of the layer might be due to low pH groundwater. Since most of the Category I structures will be founded on the cemented sand, please discuss the possible soil strength reduction caused by the low pH ground water entering the cemented sand layers, and subsequently breaking the soil particles bond.

02.05.04-9

Section 2.5.4.2.5.2 summarizes chemical test results and concludes that “all natural soils at the site will be considered aggressive to concrete, requiring protection if placed within these soils.” Since many Category I structures with concrete foundation will be built on Stratum IIb soil, please provide information on what measures will be taken to protect the concrete and if those measures will meet other design requirements, such as sliding coefficient parameter defined in the U.S. EPR standard design.

02.05.04-10

Table 2.5-58 referred in Section 2.5.4.2.5.7 provides the sliding coefficient for each stratum with values ranging from 0.35 to 0.45. Since the U.S. EPR FSAR Tier II Section 2.5.4.3 “Foundation Interfaces” requires that a COL applicant will confirm that the site soils have sliding coefficient of friction equal to at least 0.7, please explain why lower than the standard design values were used in this application and evaluate the effect of lower sliding coefficients on structure sliding stability.

02.05.04-11

Section 2.5.4.2.5.8, which provides low strain dynamic properties for the subsurface materials at the site, as well as for the backfill soil used, states that the groundwater level is at an approximate depth of 16 ft for the powerblock area. Once the construction is finalized, the expected depth of the groundwater is 30 ft due to new drainage patterns.

Also, Section 2.5.10.2.2 states that the post-construction groundwater elevation in the powerblock area was assumed at El. 55 ft for the settlement analysis, which is about 28 ft below grade surface (El. 83 ft). However, it is stated in Section 2.4.12.5 that the maximum pre-construction groundwater level is currently at or slightly above the proposed grade level in the nuclear island area, while post-construction groundwater level ranges from approximately 6 ft to 16 ft below ground surface. Since ground water level will affect the stability of site subsurface materials, foundations, structures and slopes, please explain the discrepancy of post-construction ground water levels provided in Section 2.4.12.5 and Section 2.5.4. If the post–construction groundwater level is as stated in Section 2.4.12.5, please discuss the impact of using higher ground water level on site seismic response, SSI, settlement and lateral earth pressure analyses.

02.05.04-12

Section 2.5.4.2.5.9 described states that "detailed description of the RCTS curve fitting process is provided in the report "Reconciliation of EPRI and RCTS Results, Calvert Cliffs Nuclear Power Plant Unit 3" (Bechtel, 2007), and is included as COLA Part 11J." Although the Bechtel report describes how the strain dependent properties were developed for Strata 1, IIa, IIb, IIc and III soils, there is no discussion for the backfill. Please describe how the strain dependent properties for backfill soil, which are presented in Figure 2.5-172, were developed.

02.05.04-13

Sections 2.5.4.5.4 and 2.5.4.10.2.2 indicate that monitoring program specifications for foundation rebound (heave) and settlement will be developed during the detailed design stage of the project. Since foundation rebound and settlement are expected at the site, and estimated differential settlement of the reactor building will exceed the standard design criterion, please provide a detailed description of the monitoring program including all basic elements, such as the settlement monitoring bench marks, locations of instruments, monitoring and recording frequency, and evaluation of the magnitude of rebound and settlement during and after excavation and construction.

02.05.04-14

Section 2.5.4.8 presents liquefaction potential analysis results and concludes that liquefaction is not a concern for this site. However, the data also show that the upper soil layer (Terrace Sand) does have some potential for liquefaction. Since seismic Category I electrical duct banks and pipes will be located at shallow depths, please discuss the liquefaction potential of soil where these components will be located.

02.05.04-15

Section 2.5.4.10.1 states that three cases were considered during bearing capacity calculations. For the general case, the bearing capacity equation for homogeneous soil was used by applying weighted average values of soil parameters in the analysis, with the weight factors based on the relative thickness of each stratum within a specific depth. For the case of a footing supported on a dense sand stratum over a soft clay stratum, Meyerhof's model (Meyerhof, et al., 1978) was used to estimate ultimate static bearing capacity. Since the results of the bearing capacity analysis were controlled by the models, assumptions and parameters, the applicant is requested to:

1. Provide details on how the weight factors were determined for all subsurface soil strata;

2. Clarify and justify if soil compressibility was considered during the analysis since a clayey sand layer (Layer IIb2) is presented;

3. Discuss whether the dimension of a structure will affect the analysis results for footing supported on a dense sand stratum overlying on a soft clay stratum, because the Meyerhof model is based on the assumption that one dimension of the rectangular foundation is much larger than the other. Also, please clarify why the equation of $q_{ult}$ presented in page 2-1252 is different from Meyerhof's equation by a factor of 2.

02.05.04-16

1. Please verify that in the last paragraph of page 2-1247, "Only data points in the upper layers resulted in FOS >1.1" should be " … FOS <1.1."

2. Please verify that the term N' used in equation for $q_{ult}$, (page 2-1251), and Ng in the note should be Ng.

3. Please verify that in equation term notes (page 2-1252), $q_u$ should be $q_{ult}$.