PMNorthAnna3COLPEmails Resource

From: Thomas Kevern
Sent: Tuesday, June 17, 2008 5:19 PM
To: Regina.Borsh@dom.com
Cc: john.hayden@dom.com; Wanda.K.Marshall@dom.com
Subject: North Anna RAI Letter #010
Attachments: RAI Ltr#010ML0816906610.pdf

Gina:

Attached is the subject RAI letter - includes questions re FSAR Sections 2.5.4 and 2.5.5 - stability of subsurface materials/foundations and stability of slopes - that were previously discussed by telecon.
Please contact me if questions.

Tom

Hearing Identifier: NorthAnna3_Public_EX
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From: Thomas Kevern

Created By: Thomas.Kevern@nrc.gov

Recipients:
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Tracking Status: None
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Recipients Received:

June 17, 2008

Mr. Eugene S. Grecheck
Vice President – Nuclear Development
Dominion
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 010 (SRP SECTIONS 2.05.04 and 02.05.05) RELATED TO THE NORTH ANNA UNIT 3 COMBINED LICENSE APPLICATION

Dear Mr. Grecheck:

By letter dated November 26, 2007, Dominion Virginia Power (Dominion) submitted a combined license application for North Anna Unit 3 pursuant to 10 CFR Part 52. The Nuclear Regulatory Commission (NRC) staff is performing a detailed review of this application.

The staff has identified that additional information is needed to continue portions of the review and the request for additional information (RAI) is contained in the enclosure to this letter. To support the review schedule, Dominion is requested to respond within 30 days of the date of this letter. If the RAI response involves changes to application documentation, Dominion is requested to include the associated revised documentation with the response.

Should you have questions, please contact me at (301) 415-0224 or Thomas.Kevern@nrc.gov.

Sincerely,

/RA/

Thomas A. Kevern, Senior Project Manager
ESBWR/ABWR Projects Branch 1
Division of New Reactor Licensing
Office of New Reactors

Docket No. 52-017

Enclosure: Request for Additional Information

June 17, 2008

Mr. Eugene S. Grecheck
Vice President - Nuclear Development
Dominion
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

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Docket No. 52-017

Enclosure: Request for Additional Information

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OFFICE	TR:RGS1	BC:RGS1	PM:DNRL:NGE1	OGC	PM:DNRL:NGE1
NAME	WWang*	RKaras*	AJohnson*	RHolmes*	TKevern *
DATE	05/01/2008	05/06/2008	05/20/2008	06/3/2008	06/17/2008

*Approval captured electronically in the electronic RAI system.

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Request for Additional Information
North Anna, Unit 3
Dominion
Docket Number 52-017
SRP Section: 02.05.04 - Stability of Subsurface Materials and Foundations; 02.05.05 - Stability of Slopes
Application Section: FSAR 2.5.4 Stability of Subsurface Materials and Foundations; 2.5.5 Stability of Slopes

<u>QUESTIONS</u>

02.05.04-1

FSAR section 2.5.4.2.5, “Engineering Properties,” subsection b, “Soil Properties,” states that for Zone IIA saprolite soil, the SPT tests average N-values indicated a corresponding internal friction angle, phi', about 35 degrees; the C-U tests gave internal friction angles of 31 to 36 degrees with a median of 33 degrees and with very little effective cohesion, c'. The adopted parameters for Zone IIA soil were phi' = 33 degrees and c' = 6.0 kPa (0.125 ksf) [FSAR page 2-224]. Please justify why an effective cohesion value of 6.0 kPa was used for Zone IIA soil.

02.05.04-2

FSAR 2.5.4.4.4, “Results of Shear and Compression Wave Velocity Tests” states that “the overall shear wave velocities of the rock as defined by the three rock zones (III, III-IV and IV) are somewhat higher at the Unit 3 plant location than described in the SSAR.” The comparison of the median shear wave velocities revealed that the shear wave velocity values presented in FSAR are about 36 to 50 percent higher than that listed in the SSAR. Please explain why such different values were obtained for the same site.

02.05.04-3

FSAR section 2.5.4.5.3, “Backfill Sources, Compaction and Quality Control” (also in section 2.5.4.10.1 “Bearing Capacity”), states that concrete fill would be used to replace any moderately to severely weathered rock exposed at the bottom of excavation for Seismic Category I building foundation mats. Please provide material and engineering properties of the concrete fill.

02.05.04-4

FSAR Table 2.4.1-2, “ITAAC For Backfill Under Category I Structures,” (1) does not specify the inspections, tests, or analyses that will be used to ensure that the properties of the selected backfill meet the ESBWR design control document (DCD) Tier I requirements, (2) commits to meeting minimum density values, and (3) does not provide specific acceptance criteria. 10 CFR 100.23 (d) (4) requires that “Each applicant shall evaluate all siting factors and potential causes of failure, such as the physical properties of the materials underlying the site …” and Regulatory Guide 1.206 section C.I.2.5.4.5, “Excavations and Backfill” states that the applicant should discuss “sources and quantities of backfill and borrow, including a description of exploration and laboratory studies and the static and dynamic engineering properties of these materials." Since the only engineering property of the backfill soil was the assumed internal friction angle f' = 40 degrees (FSAR section 2.5.4.5.3, "Backfill Sources, Compaction and Quality Control"), please describe how you will ensure that static and dynamic properties of the backfill soil will meet or exceed: (1) the requirements of the ESBWR DCD, e.g., minimum shear wave velocity of 300 m/s (1000 ft/s) as listed in Tier I document; and (2) parameter values used for the site seismic response and liquefaction potential analyses, bearing capacity, settlement and earth pressure estimates.

02.05.04-5

FSAR Figure 2.5-244, Estimated Shear Wave Velocity versus Depth for Structural Fill. Please provide clarification on the difference between the values of shear wave velocity of the backfill plotted in FSAR Figure 2.5-244 (estimated shear wave velocity ranged from 152 to 724 m/s (500 to 1400 f/s)) and listed in FSAR Table 2.0-201 "Evaluation of Site/Design Parameters and Characteristics" (the minimum shear wave velocity of 1073 m/s (3520 ft/s) underneath the FWSC building).

02.05.04-6

FSAR Table 2.5-215, Summary of Allowable Bearing Capacities for the Major Structures, and Table 2.0-201, Evaluation of Site/Design Parameters and Characteristics. Please provide clarification on the difference between the values of allowable dynamic bearing capacity for the Reactor/Fuel building listed in FSAR Table 2.5-215 (214 ksf) and FSAR Table 2.0-201 (12,401 kPa (259 ksf)).

02.05.04-7

FSAR section 2.5.4.10, FSAR Figure 2.5-232, and Table 2.0-201. Since the Seismic Category I structure Fire Water Service Complex (FWSC) building is planned to be built on about 45 feet of backfill soil (FSAR Figure 2.5-232), please provide clarifications and justifications for related foundation stability analyses:

(a) The backfill soil was designed to be granular material and may be saturated as the maximum ground water level was determined to be 2.1 m (7 ft), and the maximum flood level was determined as 0.85 m (2.8ft) below design plant grade (FSAR Table 2.0-201), therefore the backfill soil may be liquefiable under seismic loadings. Regulatory Guide 1.206 section C.I.2.5.4.8, "Liquefaction Potential" states that "If the foundation materials at the site adjacent to and under safety-related structures are saturated soils or soils that have a potential to become saturated and the water table is above bedrock, the applicant should provide an appropriate state-of-the-art analysis of the potential for liquefaction occurring at the site. The applicant should indicate the extent to which the guidance provided in RG 1.198, "Procedures and Criteria for Assessing Seismic Soil Liquefaction at Nuclear Power Plant Sites," was followed." Please provide the analysis or justify why liquefaction potential analysis was not performed for the backfill soil.

(b) In FSAR section 2.5.4.10.1, "Bearing Capacity," subsection b, "Soil" it stated that "bearing capacity is based on Terzaghi's bearing capacity equations modified by Vesic." Although this method is commonly used in foundation bearing capacity analysis under the normal shear failure assumption, for nuclear power plant structures, especially for the nuclear island, bearing capacity should be estimated "particularly due to overturning forces," as stated in ESBWR DCD Tier 2, section 3.8.5.4 "Design and Analysis Procedures." Please clarify if the overturning forces were considered in the foundation allowable bearing capacity analysis.

(c) In FSAR section 2.5.4.10.2, "Settlement Analysis," the settlement was estimated using a formula where the layer elastic modulus E was involved. Please clarify and justify what type of E values - corresponding to small or large strains, were used in the settlement calculation.

(d) In FSAR section 2.5.4.10.2, "Settlement Analysis," the differential settlement for the FWSC was estimated excluding the weight of the base mat. Please justify why the weight of the base mat was not included in the settlement calculation.

(e) Please explain why the seismic settlement of the FWSC foundation was not considered.

02.05.04-8

FSAR section 2.5.4.10.3 "Earth Pressures," states that "[t]he factor of safety against a gravity wall or structure foundation sliding is normally taken as 1.1 when seismic pressures are included." The staff notes that the ESBWR DCD (Section 3.8.5.4 "Design and Analysis Procedures") states that "selected waterproofing material for the bottom of the basemat is a chemical crystalline powder that is added to the mud mat mixture forming a water proof barrier." Please clarify and justify the coefficient of friction at the interface of the basemat and underlying material used in the calculation of the factor of safety against foundation sliding.

02.05.04-9

As indicated in FSAR section 2.5.4.10.3 "Earth Pressures," the Ostadan method was used to estimate the seismic lateral at-rest pressures against the buried structure walls and active earth pressures due to the Zone IIA and IIB saprolites are included when applicable. Please provide detailed information on the analysis when both at-rest and active seismic lateral earth pressure were involved.

02.05.05-1

FSAR section 2.5.5.1.3, "Slopes Subsurface Conditions," regarding the soil properties of the new slope, states that (page 2-265) "interpretation of CPT C-916 (performed adjacent to B-947) based on friction ratio, indicated mainly silty clays and clays" (underline added); but it also states, on the same page, that "based on the results of B-947 and C-916, the new slope has the properties of Zone IIA silty sand saprolite." Please clarify why two different types of soil were identified for the same boring and same CPT data.

02.05.05-2

FSAR section 2.5.5.2, “Design Criteria and Analyses” indicates that the Bishop’s method was used in all slope stability analyses. The Bishop’s method only considers moment equilibrium and may not always be conservative depending on the geometry, the soil properties and the shape of the critical slip surface of the slopes. Regulatory Guide 1.206, section C.I.2.5.5, “Stability of Slopes” states that “[t]he results of slope stability evaluations using classic and contemporary methods of analyses should be presented.” Please explain why only analysis results based on Bishop’s method are presented.

02.05.05-3

In FSAR section 2.5.5.2 “Design Criteria and Analyses,” several assumptions were used in the seismic stability analysis. Those assumptions are 1) liquefaction was not considered, 2) average peak horizontal and vertical accelerations were used rather than peak accelerations at the ground surface, and 3) reduced peak accelerations were considered (0.1g at high frequency and 0.15g at low frequency for horizontal acceleration with zero vertical acceleration (FSAR page 2-238) as recommended by Seed in his 1979 study; and 50 percent of the peak acceleration as suggested by Kramer (1996)). Regulatory Guide 1.206, section C.I.2.5.5.2, “Design Criteria and Analyses” states that the applicant “should present valid static and dynamic analyses to demonstrate the reliable performance of these slopes throughout the lifetime of the plant. It should describe the methods used for static and dynamic analyses, and indicate the reasons for selecting them.” Accordingly, please provide the following: (1) Describe the impact of the possible maximum dynamic settlement of the slope soil (refer to FSAR section 2.5.4.8.1) on the slope stability; and (2) Describe how the assumptions used by the pseudo-static methods (such as earth materials do not undergo significant strength loss upon cyclic loading (<15 percent) and large displacement is acceptable) were verified.