From: Michael Scott
To: Joseph_Hegner@dom.com
Date: 5/3/04 4:28PM
Subject: DRAFT REQUESTS FOR ADDITIONAL INFORMATION PACKAGE 5

Please find attached the NRC staff's fifth package of preliminary questions, in the form of draft requests for additional information (RAIs), for the North Anna ESP review.

As for previous transmittals of preliminary questions, Dominion may request a phone conference or meeting with the cognizant NRC staff if Dominion needs clarification of the RAIs or believes the information requested in them has already been provided or is not needed. Please let me know if you desire such a phone con or meeting.

After the phone con or meeting occurs (if requested) and planned response dates are determined, the staff will send the RAIs under cover letter with copy to the docket. The letter will also note that the phone con or meeting occurred (if it did) and the mutually agreed upon response date(s) to the RAIs.

The RAIs in this package address the areas of geology, seismology, and quality assurance. Your timely response to these RAIs will support meeting the review schedule milestones. Partial submittals would be welcome to minimize delays.

Please contact me if you have questions.

Michael L (Mike) Scott
Senior Project Manager
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Phone (301) 415-1421

CC: Clifford Munson; Dale Thatcher; Goutam Bagchi; Kamal Manoly; Kevin Coyne; Laura Dudes; Michael Dudek; Nanette Gilles; Paul Prescott; Raj Anand; Raman Pichumani; Robert Weisman

Mail Envelope Properties (4096AB81.358 : 4 : 19783)

Subject: DRAFT REQUESTS FOR ADDITIONAL INFORMATION PACKAGE 5
Creation Date: 5/3/04 4:28PM
From: Michael Scott

Created By: MLS3@nrc.gov

Recipients	Action	Date & Time
dom.com	Transferred	05/03/04 04:29PM
Joseph_Hegner (Joseph_Hegner@dom.com)		
nrc.gov		
owf2_po.OWFN_DO	Delivered	05/03/04 04:28PM
CGM1 CC (Clifford Munson)	Opened	05/05/04 10:55AM
DFT CC (Dale Thatcher)	Opened	05/04/04 07:53AM
GXB1 CC (Goutam Bagchi)	Opened	05/03/04 04:31PM
KAM CC (Kamal Manoly)		
KXC CC (Kevin Coyne)	Opened	05/03/04 04:29PM
RXP CC (Raman Pichumani)	Opened	05/04/04 09:18AM
nrc.gov		
owf4_po.OWFN_DO	Delivered	05/03/04 04:28PM
LAD CC (Laura Dudes)	Opened	05/03/04 05:08PM
MID CC (Michael Dudek)	Opened	05/10/04 07:55AM
NVG CC (Nanette Gilles)	Opened	05/04/04 09:44AM
PFP CC (Paul Prescott)	Opened	05/04/04 07:11AM
RKA CC (Raj Anand)		
nrc.gov		
owf5_po.OWFN_DO	Delivered	05/03/04 04:29PM
RMW CC (Robert Weisman)	Opened	05/03/04 04:29PM

Post Office	Delivered	Route
		dom.com
owf2_po.OWFN_DO	05/03/04 04:28PM	nrc.gov
owf4_po.OWFN_DO	05/03/04 04:28PM	nrc.gov
owf5_po.OWFN_DO	05/03/04 04:29PM	nrc.gov

Files	Size	Date & Time
railetter5draft..doc	89173	05/03/04 04:20PM
MESSAGE	2184	05/03/04 04:28PM

Options

Auto Delete:	No
Expiration Date:	None
Notify Recipients:	Yes
Priority:	Standard
Reply Requested:	No
Return Notification:	None
Concealed Subject:	No
Security:	Standard
To Be Delivered:	Immediate
Status Tracking:	Delivered & Opened

DRAFT

North Anna Early Site Permit Application
Site Safety Analysis Report (SSAR)
Requests for Additional Information (RAI)
RAI LETTER NO. 5

SSAR Section 2.5.1, Basic Geologic and Seismic Information

RAI 2.5.1-5

SSAR Subsection 2.5.1.1.4 describes the Mountain Run and Kelly's Ford scarps along the Mountain Run fault zone and states that field and aerial reconnaissance did not reveal any geologic or geomorphic features indicative of potential Quaternary activity along the Mountain Run fault zone. Please describe the relevant physiographic features associated with these two scarps and the evidence that led to the conclusion that "the scarp most likely formed due to erosion, as southeastward-migrating streams impinge against more resistant rocks of the Mountain Run fault zone."

RAI 2.5.1-6

SSAR Subsection 2.5.1.1.4 states that the Stafford fault system is not a capable tectonic source. Please elaborate on the evidence gathered from field observations and aerial reconnaissance that support this conclusion with regard to the Dumfries, Fall Hill, Hazel Run, and Brooke faults.

SSAR Section 2.5.2, Vibratory Ground Motion

RAI 2.5.2-5

SSAR Subsection 2.5.2.6.3 summarizes the use of new data to revise the recurrence interval and source geometry for the Charleston seismic source zone. Page 2-2-248 of the application states:

> The southern segment of the ECFS [East Coast Fault System] was used as an alternative source geometry for the sensitivity analysis. In this approach, the southern segment was assumed to be active with a characteristic magnitude with a mean recurrence interval of 550 years.

a) Please explain the rationale for the designation of the southern segment of the ECFS as an "alternative" source geometry for the Charleston seismic source zone.

b) Please provide a logic tree, similar to SSAR Figure 2.5-35, that covers all of the source models for the Charleston seismic source, including the weights for maximum magnitudes and recurrence intervals as well as the probabilities of activity for each of the models.

c) Please provide the contribution of the Charleston seismic source zone to the total mean and median hazard at the ESP site for the 1-2.5 Hz case. Use the three reference probability levels discussed in SSAR 2.5.2 (mean 10^{-4}, mean $5x10^{-5}$, and median 10^{-5}) and show in each magnitude and distance bin the fraction of the total hazard that is from the Charleston source. Provide a table for each of the three hazard levels similar to those shown in Appendix C of RG 1.165.

RAI 2.5.2-6

SSAR Figures 2.5-44 and 2.5-45 provide mean and median hazard curves for 1 Hz and 10 Hz spectral acceleration. Please provide the 15th and 85th percentile hazard curves for both 1 and 10 Hz spectral acceleration. In addition, please provide the mean, median, 15th, and 85th percentile hazard curves for both 2.5 and 5 Hz spectral acceleration.

RAI 2.5.2-7

Table 2.5-11 in SSAR Section 2.5.2 shows that several of the Electric Power Research Institute (EPRI) teams used a probability of activity less than 1.0 for the Central Virginia Seismic Zone (CVSZ). For each of the EPRI teams, please describe how the modern and historical seismicity of the CVSZ is distributed among either a specific source zone or a background source zone, including the probabilities of activity, recurrence and maximum magnitude information.

RAI 2.5.2-8

SSAR Subsection 2.5.2.5 provides a list of the subsurface materials at the ESP site. Please describe how these site-specific materials were factored into the determination of the SSE ground motion spectrum. Please describe the subsurface model in terms of layer thicknesses and engineering properties (e.g., density, shear wave velocity, damping ratio) and describe how the variability of each of these properties was accounted for in the site characterization of the ground motion.

RAI 2.5.2-9

SSAR Subsection 2.5.2.6 describes an alternative approach to that recommended in Regulatory Guide 1.165 for determining the Safe Shutdown Earthquake (SSE) ground motion spectrum. Please provide the following information regarding this approach:

a) The approach described in SSAR Section 2.5.2 uses a Uniform Hazard Spectrum (UHS) at the mean 10^{-4} per year probability level as its starting point. Please justify the selection of mean 10^{-4} per year as the appropriate starting point.

b) The approach described in SSAR Section 2.5.2 targets a performance goal of mean 10^{-5} per year of "unacceptable performance of nuclear structures, systems and components as a result of seismically initiated events." Please justify the selection of mean 10^{-5} per year as an appropriate performance goal and describe in detail what this probability represents.

c) The performance-based approach described in SSAR Section 2.5.2 starts with the risk equation and ends with a scale factor multiplier that is used to achieve the target performance goal. Please provide the details of the derivation of this approach and describe how the use of the scale factor achieves the target performance goal. In

addition, please provide the details (beyond those provided in NUREG/CR-6728 and the ASCE Draft Standard, SSAR References 118 and 119) of the assumptions made for each of the key parameters such as the seismic margin ratio, combined standard deviation, amplitude ratio, and hazard curve slope.

SSAR Section 2.5.3, Surface Faulting

RAI 2.5.3-2

SSAR Subsection 2.5.3.2.2 states that aerial reconnaissance, field reconnaissance, and air photo interpretation did not reveal evidence for the southwestward continuation of unnamed fault "a" beyond the ESP site as mapped by Pavlides (Reference 36), which was compiled onto the map of Mixon and others (Reference 66). Please provide support for this conclusion by describing (1) the map relations shown by Pavlides and Mixon and others that implied the extension of unnamed fault "a" beyond the ESP site, (2) the field observations that raise questions about the map relations, and (3) information on the adjacent geologic sheet, suggested as an alternative interpretation, that does not call for the extension of unnamed fault "a" beyond the ESP site.

SSAR Section 2.5.4, Stability of Subsurface Materials and Foundations

RAI 2.5.4-1

SSAR Section 2.5.4 states that additional structure-specific exploration and testing would be performed during detailed engineering and would be described in the combined license (COL) application. Regulatory Guide 1.132 recommends borings at 100 ft spacings for major structures. Please provide the basis (especially given the documented presence of severely weathered, fractured and jointed intervals in the Zone III-IV and Zone IV rock) for concluding that the subsurface conditions in the southwest part of the ESP footprint (an area roughly 1000 ft by 500 ft, in which there have apparently been no borings) do not materially differ from conditions in the adjacent areas where borings have been drilled.

RAI 2.5.4-2

SSAR Subsection 2.5.4.1 (Geologic Features) references SSAR Section 2.5.1.2.3 (Site Area Stratigraphy), which states that borings drilled for the ESP application revealed severely weathered, fractured and jointed intervals in the Zone III-IV and Zone IV rock. Section 2.5.1.2.3 further states that these severely weathered fracture zones were encountered in four of the seven borings drilled for the ESP application.

a) Please describe the extent of similar severely weathered fracture zones, if any, that were observed during the site investigation performed for the abandoned units 3 and 4.

b) Please describe the impact of the existence of the severely weathered fracture zones on the suitability of the site to host safety-related structures.

RAI 2.5.4-3

SSAR Section 2.5.4.2 (Properties of Subsurface Materials) provides the results of the extensive field and laboratory tests that were performed earlier for the abandoned Units 3 and 4, the service water reservoir (SWR), and the independent spent fuel storage installation (ISFSI) facilities at North Anna Power Station. Please discuss how the results of the site investigations for the SWR and the ISFSI, which are located away from the abandoned Units 3 and 4, were integrated with those of the ESP borings in characterizing the subsurface materials at the ESP site.

RAI 2.5.4-4

Table 2.5-29 in SSAR Section 2.5.4 compares the total thicknesses of the soil layers sampled at the locations of Units 1 and 2, abandoned Units 3 and 4, the ISFSI, the SWR, and the ESP site. Table 2.5-29 shows that the total thickness of all the soil layers sampled at the ESP site is only 105 ft, whereas the total thicknesses of soil layers sampled at the other sites mentioned range from 451 ft for the ISFSI to 2204 ft for Units 1 and 2. Please explain how the total thickness of soil layers sampled at the ESP site is sufficient to characterize the soil conditions there.

RAI 2.5.4-5

With regard to Table 2.5-45 (Summary of Geotechnical Engineering Properties) in SSAR Section 2.5.4:

a) Please explain why no shear wave velocities are given for Zone IIB saprolite and for Zones III and III-IV weathered rock.

b) Please provide the range of standard penetration test (SPT) values separately for coarse-grained and fine-grained soil zone IIA, along with the depths of the soils at which the N-values were obtained.

RAI 2.5.4-6

With regard toTable 2.5-44 (Summary of ESP Test Rest Results - Rock) in SSAR Section 2.5.4:

a) Please explain why test results were not provided for the materials at several depths, for example, between depths 25 ft and 48 ft in boring B-801, between depths 21 ft and 44 ft, 46 ft to 66 ft, and 67 ft to 85 ft in boring B-802, and several depths in borings B-803 and B-806.

b) Please explain why no test results were provided for boring B-807.

c) Please discuss the significance of the relatively low value (4.43 ksi) of the unconfined compressive strength of the Zone IV rock in Boring B-805, as compared to the values for the Zone IV rock strengths in Borings B-802, 803, and 806 at similar depths, which are much higher (by a factor 2 to 6).

RAI 2.5.4-7

SSAR Subsection 2.5.4.7.1 (Shear Wave Velocity Profile) states (on page 2.2-291) that some safety-related structures (excluding the reactors) may be founded on the Zone III weathered rock, Zone IIB saprolite, or Zone IIA saprolite. However subsection 2.5.1.2.6 (Site Engineering Geology Evaluation) of the SSAR states (on page 2.2-222) that Zone III is not a suitable material for safety-related plant structures. Please reconcile these two statements.

RAI 2.5.4-8

SSAR Subsection 2.5.4.7.2 (Variation of Shear Modulus and Damping with Strain) describes the shear modulus and damping ratio curves for Zone IIA saprolite (improved and unimproved), Zone IIB saprolite, and Zone III rock. With regard to this subsection:

a) Please provide the basis for the selected modulus reduction curves for Zone IIA saprolite, Zone IIB saprolite, and Zone III weathered rock.

b) Please explain the basis for the selected damping ratio curves for Zone IIA saprolite, Zone IIB saprolite and Zone III weathered rock.

c) Please explain the use of a damping ratio of 2% for the Zone III-IV rock.

RAI 2.5.4-9

Please elaborate further on the method used for the development of the site-specific acceleration time histories and the soil column amplification/attenuation analysis, which are briefly described in SSAR Subsections 2.5.4.7.3 and 2.5.4.7.4. Also, please provide a description of the subsurface model, showing layer thicknesses and geotechnical engineering properties for each layer. Please describe how the variability in each of these engineering properties was accounted for in the development of the site-specific ground motion. Finally, please justify the use of the mean 10^{-4} Uniform Hazard Spectrum (UHS) ground motion as the input rock motion.

RAI 2.5.4-10

SSAR Section 2.5.4.8 describes the analyses to determine the potential for soil liquefaction at the ESP site.

a) For each of the different methods used, please provide the results of any parametric evaluations of the liquefaction potential performed by varying the input of significant soil properties and the seismic parameters.

b) Please provide a copy of a sample liquefaction analysis of the Zone IIA saprolite material that showed the least factor of safety, stating and justifying all the assumptions made in the analysis.

RAI 2.5.4-11

Please provide a sample set of the calculations to substantiate the bearing capacities of soil and rock beneath major Category I structures, as shown in SSAR Table 2.5-47. Please indicate if and how the local site effects, such as the slope of the rock surface, fracture spacing, variability

in properties, and evidence of shear zones, if any, were considered in determining the allowable bearing capacities of soil and rock for different structures.

RAI 2.5.4-12

SSAR Section 2.5.4.11 (Design Criteria) states that geotechnical-related design criteria that pertain to structural design are not included in the application. Please provide the reasons for not providing the geotechnical-related design criteria that pertain to structural design (such as sliding, and overturning).

SSAR Section 2.5.5, Stability of Slopes

RAI 2.5.5-1

SSAR Section 2.5.5.2 presents an analysis of the stability of the existing slope to the north of the SWR. In view of the results of the liquefaction analysis (SSAR 2.5.4.8), which demonstrated the possibility of isolated zones of liquefaction in unimproved Zone IIA saprolite, please provide the basis for concluding that the existing slope has a "low susceptibility" to liquefaction and therefore concluding that a horizontal acceleration of 0.1g is suitable for the pseudo-static analysis. In addition, please provide the rationale for concluding that the psuedo-static analysis adequately demonstrates that the existing slope would remain stable under SSE conditions.

SSAR Section 17.1, ESP Quality Assurance

RAI 17.1-2

Sections 8 and 9 of Dominion's Early Site Permit Application Development Quality Assurance Manual and Section 4 of Bechtel's Quality Assurance Program Plan state that the safety-related scope of the development of the ESP application would not involve the use of quality assurance measures for the identification and control of materials, parts, and components and for the control of special processes. Please describe why these quality assurance measures were not applicable to the development of the ESP application. Alternatively, if these quality assurance measures were applicable to the ESP application, please describe the quality assurance measures used by Dominion and the primary contractor (Bechtel) for these activities.