PMSummerColpEM Resource

From: Ravindra Joshi
Sent: Tuesday, February 10, 2009 1:13 PM
To: A. Paglia; Amy M. Monroe; April R. Rice; Donna S. Griffin; Jerry P. Harrison; Johnnie Waller (johnnie.waller@scana.com); Julie M. Giles; Kenneth J. Browne; Tria Kibler
Cc: SummerCOL Resource
Subject: RAI letter No-030 related to SRP section 02.05.02 for Summer Units 2 and 3
Attachments: SUM-RAI-LTR-030.pdf

To All,

Attached is RAI letter No.30 related to SRP Section 02.05.02 for the Summer Units 2 and 3. The ADAMS Accession number is ML090410453.

Ravi Joshi
Project Manager
NRO/DNRL/NWE1
US NRC
301-415-6191

Hearing Identifier: VCSummer_COL_Public
Email Number: 187

Mail Envelope Properties (CEEA97CC21430049B821E684512F6E5EB70902F072)

Subject: RAI letter No-030 related to SRP section 02.05.02 for Summer Units 2 and 3
Sent Date: 2/10/2009 1:12:59 PM
Received Date: 2/10/2009 1:13:02 PM
From: Ravindra Joshi

Created By: Ravindra.Joshi@nrc.gov

Recipients:
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Tracking Status: None
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"Tria Kibler" <tkkibler@scana.com>
Tracking Status: None

Post Office: HQCLSTR01.nrc.gov

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SUM-RAI-LTR-030.pdf	150791	

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

SummerRAIsPEm Resource

From: Ravindra Joshi
Sent: Tuesday, February 10, 2009 12:51 PM
To: SummerRAIsPEm Resource
Subject: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 030 RELATED TO SRP SECTION 02.05.02 FOR THE VIRGIL C. SUMMER NUCLEAR STATION UNITS 2 AND 3 COMBINED LICENSE APPLICATION
Attachments: SUM-RAI-LTR-030.doc

Hearing Identifier: Summer_COL_eRAIs
Email Number: 31

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Subject: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 030 RELATED TO SRP SECTION 02.05.02 FOR THE VIRGIL C. SUMMER NUCLEAR STATION UNITS 2 AND 3 COMBINED LICENSE APPLICATION
Sent Date: 2/10/2009 12:51:18 PM
Received Date: 2/10/2009 12:51:18 PM
From: Ravindra Joshi

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Recipients:
"SummerRAIsPEm Resource" <SummerRAIsPEm.Resource@nrc.gov>
Tracking Status: None

Post Office: HQCLSTR01.nrc.gov

Files	**Size**	**Date & Time**
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SUM-RAI-LTR-030.doc	63994	

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

February 10, 2009

Mr. Alfred M. Paglia
Manager, Nuclear Licensing
MC P40
South Carolina Electric & Gas Company
PO Box 88
Jenkinsville, SC 29065

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 030 RELATED TO SRP SECTION 02.05.02 FOR THE VIRGIL C. SUMMER NUCLEAR STATION UNITS 2 AND 3 COMBINED LICENSE APPLICATION

Dear Mr. Paglia:

By letter dated March 27, 2008, South Carolina Electric & Gas Company submitted its application to the U. S. Nuclear Regulatory Commission (NRC) for a combined license (COL) for two AP1000 advance passive pressurized water reactors pursuant to 10 CFR Part 52. The NRC staff is performing a detailed review of this application to enable the staff to reach a conclusion on the safety of the proposed application.

The NRC staff has identified that additional information is needed to continue portions of the review. The staff's request for additional information (RAI) is contained in the enclosure to this letter.

To support the review schedule, you are requested to respond within 30 days of the date of this letter. If changes are needed to the final safety analysis report, the staff requests that the RAI response include the proposed wording changes.

If you have any questions or comments concerning this matter, you may contact me at 301-415-6191or Ravindra.Joshi@nrc.gov.

Sincerely,

/**RA**/

Ravindra G. Joshi, Lead Project Manager
AP1000 Projects Branch 1
Division of New Reactor Licensing
Office of New Reactors

Docket Nos. 52-027
52-028

Enclosure:
Request for Additional Information

CC: see next page

If you have any questions or comments concerning this matter, you may contact me at 301-415-6191or Ravindra.Joshi@nrc.gov.

Sincerely,

/**RA**/

Ravindra G. Joshi, Lead Project Manager
AP1000 Projects Branch 1
Division of New Reactor Licensing
Office of New Reactors

Docket Nos. 52-027
52-028

eRAI Tracking No. 1900

Enclosure:
Request for Additional Information

Distribution:

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NRO-002

OFFICE	RGS2/BC	NWE1/PM	OGC	NWE1/L-PM
NAME	CMunson*	RJoshi*	LGoldin*	RJoshi*
DATE	1/7/09	1/8/09	1/30/09	1/30/09

*Approval captured electronically in the electronic RAI system.

OFFICIAL RECORD COPY

Request for Additional Information
Virgil C. Summer Nuclear Station Units 2 and 3
South Carolina Electric & Gas Company
Docket No. 52-027 and 52-028
SRP Section: 02.05.02- Vibratory Ground Motion

Application Section: FSAR Section 2.5.2

QUESTIONS from Geosciences and Geotechnical Engineering Branch 2 (RGS2)

02.05.02-4

FSAR Section 2.5.2.1.2 describes the applicant's update of the EPRI seismicity catalog for the period 1985 to the present. FSAR Table 2.5.2-202 lists the parameters (including latitude, longitude, time, and magnitude) of the updated portion of the seismicity catalog. Please clarify whether or not the values for Smb (in Equation 2.5.2-3) were derived from the EPRI seismicity catalog or the updated seismicity catalog. Please also provide electronic versions of both the EPRI seismicity catalog and the updated seismicity catalog (relevant portions).

02.05.02-5

The Advanced National Seismic System (ANSS) catalog covers the site region and includes the regional South East U.S. Seismic Network (SEUSSN) catalog. Please explain why the ANSS catalog was not used as the preferred catalog instead of the SEUSSN catalog, which is the preferred catalog in the FSAR.

02.05.02-6

Page 2.5.2-3 of the FSAR states that the magnitudes in the updated seismicity catalog were converted to EPRI best-estimate values of mb based on FSAR Equations 2.5.2-1 and 2.5.2-2. Please justify the use of these formulas, which are based on magnitude data acquired more than 20 years ago. If these formulas were not adequate, please explain any inadequacy. Please also explain why newer data was not used to compute these formulas. Also, in FSAR Equation 2.5.2-3 (page 2.5.2-3), you use b=1.0. Is this b-value supported by the regional seismicity data?

02.05.02-7

FSAR Section 2.5.2.1.3 discusses the reservoir-induced seismicity associated with Monticello Reservoir. An initial surge of reservoir-induced seismicity was associated with the initial filling of the reservoir in 1977 but subsequent intervals of increased seismicity have also occurred in succeeding years. Please explain whether the reservoir seismicity correlates with changes in water impound levels. Did the recent upsurge in seismicity starting in 1996 correlate with any change in the water level?

02.05.02-8

Section 2.5.2.1.3 (page 2.5.2-5) of the FSAR explains that Unit 1 was required to have a margin of safety by design for a magnitude 5.0 event from the reservoir-induced seismicity. Please confirm if this is also the case for Units 2 and 3.

Also, the reservoir-induced seismicity events do not appear to be included in the updated seismicity catalog. The staff is concerned that ground motion from events of this size could be removed from the design process by the cumulative absolute velocity filter, but could still involve large accelerations. Please address the staff's concerns

02.05.02-9

In FSAR Section 2.5.2.1 (page 2.5.2-8), the applicant states that smaller earthquakes were modeled using an exponential magnitude distribution. Please clarify whether or not this magnitude distribution is the Gutenberg-Richter magnitude frequency relation and please make the corresponding correction in the statement. If a relation other than the Gutenberg-Richter relation was used, please provide the details for the relation and justify the relation based on observations.

02.05.02-10

FSAR Section 2.5.2.2.1.5 describes the source zones developed by the Weston Geophysical team for the EPRI PSHA. On page 2.5.2-16, the FSAR states, “The largest Mmax assigned by the Weston Geophysical team to these combination zones is mb 6.6 (**M** 6.5).” However, in FSAR Table 2.5.2-207 (page 2.5.2-69), the Mmax for combination zone C33 is listed as mb 7.2 at 10 percent weight. Please address the discrepancy between the text and the table.

02.05.02-11

In FSAR Section 2.5.2.4.1 (page 2.5.2-35), the applicant stated that it used the 1989 EPRI study as the starting point for probabilistic seismic hazard calculations. The FSAR states that “differences in hazard are also small for the median hazard, except at large ground motions (peak ground acceleration greater than or equal to 0.7 g), where differences of 20% and +30% are seen.” Please provide an explanation for the relatively large difference in seismic hazard of +20% to +30% between the 1989 EPRI analysis and the recent one done using Risk Engineering, Inc.’s FRISK88 software for the median hazard at large ground motions.

02.05.02-12

FSAR Section 2.5.2.4.5 (page 2.5.2-40) states that the applicant used the results of Abrahamson and Bommer (2006) to characterize aleatory uncertainties. Please discuss the effect of using the Abrahamson and Bommer (2006) uncertainties on the calculated hazard, as well as the differences between Abrahamson and Bommer (2006) and the EPRI (2004) study. Please also explain how the seismic hazard curves and the UHRS would change if the EPRI (2004) aleatory uncertainties had been used rather than those in Abrahamson and Bommer (2006).

02.05.02-13

In FSAR Section 2.5.2.4.5 (page 2.5.2-40), the applicant stated that it used the EPRI (2004) ground motion equations in its updated PSHA. However, the EPRI ground motion report contains many equations that are arranged in "clusters." Please provide more detail regarding how the applicant used the various equations from the EPRI ground motion report to compute the site hazard, including the weights that the applicant applied for the specific equations, if multiple equations were used in the analysis.

02.05.02-14

NUREG-0800 states that use of the EPRI ground motion models (2004) "is acceptable as long as an adequate investigation has been carried out to provide reasonable assurance that there are no significant updates or new models that may impact on the results of the PSHA." Section 2.5.2.4.5 of the FSAR does not discuss any new ground motion models. However, at least two new ground motion prediction models for the CEUS have been published in peer-reviewed literature since 2004: (1) "Empirical-stochastic ground-motion prediction for eastern North America" by Tavakoli and Pezeshk (Bulletin of the Seismological Society of America, 2005, v.95[6], 2,283-2,296) and (2) "Earthquake ground-motion prediction equations for eastern North America" by Atkinson and Boore (Bulletin of the Seismological Society of America, 2006, v.96[6], 2,181-2,205). In addition to these specific models, the latest version of the US National Seismic Hazard maps (Petersen and others, 2008) computes ground motions from a weighted combination of a number of ground-motion prediction equations. As such, these ground motions can be considered another ground-motion model. Please provide justification for not considering these new ground-motion prediction models.

02.05.02-15

In FSAR Section 2.5.2.4.5 (page 2.5.2-40), the applicant stated that it used the cumulative absolute velocity (CAV) model of Hardy et al. (2006) to model the damageability of small-magnitude earthquakes to engineered facilities. Please provide details of how the CAV filter was implemented and describe how the seismic hazard curves and the UHRS would change if CAV filtering had not been applied. In addition, please describe how the local sources and the high frequency (5-10 Hz) controlling earthquake was affected by the CAV filter.

02.05.02-16
FSAR Section 2.5.2.4.5 on page 2.5.2-41 contains the following statement: "The ground motions for frequencies other than 100 Hz are assumed to be correlated with the ground motions at 100 Hz, so that the filtering is consistent from frequency to frequency." Please clarify whether the above statement is referring to structural frequencies rather than ground motion frequencies. In addition, please provide a justification for the assumption included in the above statement.

02.05.02-17

FSAR Section 2.5.2.4.7 (page 2.5.2-43) describes the vertical spectra that were obtained by multiplying the horizontal spectra by a frequency-dependent, but magnitude and distance-independent, scaling factor. However, some studies (for example, Bozorgnia and Campbell, 2004) have found that the vertical-to-horizontal ratio can depend strongly on distance (and to a lesser extent, magnitude). Please

explain how these different dependencies would impact the modeled ground motions at the VCSNS site.

In addition, recent data show that the 14 June 2008 M 6.9 Iwate-Miyagi earthquake in Japan produced a vertical ground motion of greater than 3.8 g at the surface and 0.68 g at 260 m depth (Aoi, S. and others, 2008, Trampoline effect in extreme ground motion: Science, v.322, p. 727). This vertical ground motion is much higher than its horizontal components at the surface and about equal at depth of the basement rock over a wide range of frequencies. How do these documented observations affect the modeled ground motions at the VCSNS site?

02.05.02-18

FSAR Section 2.5.2.5 states that the site is underlain by weathered and unweathered bedrock with a high shear velocity (greater than 8,500 fps) and, therefore, a site response analysis was not performed to develop the GMRS because the S-wave velocity is consistent (i.e. within the uncertainty) with the ground motion model used in the PSHA (S-wave velocity greater than 9,200 fps). While FSAR Figure 2.5.4-226, “Shear Wave Velocity of Layer V with 5-Foot Vertical Distance Averaging” shows the mean S-wave velocity to be greater than 8,500 fps, the profile exhibits a large standard deviation particularly below Unit 2 in the 310 to 355 ft elevation range. FSAR Section 2.5.4.7.3 presents the results of site response calculations but does not discuss the impact of the site response on the GMRS.

Please provide additional justification for not performing a site response calculation as part of the development of the GMRS, in light of the significant S-wave velocity variability beneath the site and the observed S-wave velocity values that are significantly less than 8,500 fps.

02.05.02-19

Please provide the following information related to the site response calculations presented in FSAR Section 2.5.4.7.3:

1) Please provide electronic versions of the S-wave velocity data and profiles shown in FSAR Figure 2.5.4-226 and FSAR Figure 2.5.4-224.
2) Please provide electronic versions of shear modulus reduction and damping data and curves shown in FSAR Figures 2.5.4-240 (Sheets 1 to 3).
3) Please provide electronic versions of input data to the site response calculations described in FSAR Section 2.5.4.7.3 (i.e. randomized S-wave velocity profiles, input time histories, randomized shear modulus reduction and damping curves).