## Callaway2COLPEm Resource

**From:** Arora, Surinder
**Sent:** Monday, June 15, 2009 2:19 PM
**To:** Shafer, David E
**Cc:** Callaway2COL Resource; Colaccino, Joseph; Hodgdon, Ann; Karas, Rebecca; Seber, Dogan; Arora, Surinder; NPUnit2-EPR@ameren.com
**Subject:** Callaway SCOLA - Draft RAI No. 27 (eRAI No. 1890) - Public
**Attachments:** RAI 1890.doc

Dave,

Attached is DRAFT RAI No. 27 (eRAI No. 1890). You have until June 29, 2009 to review it and decide whether you need a conference call to discuss it. After the call or after June 29, 2009, the RAI will be finalized and sent to you for a response. You will then have 30 days to respond. In reviewing the draft RAI, please also review and confirm that the RAI does not contain any proprietary information.

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

Phone: 301 415-1421
FAX: 301 415-6077
Email: Surinder.Arora@nrc.gov

**Hearing Identifier:** CallawayPlant_Unit2_COL_Public
**Email Number:** 77

**Mail Envelope Properties** (CB87FC66F95637428C5E0D066E756B6FC04058B591)

**Subject:** Callaway SCOLA - Draft RAI No. 27 (eRAI No. 1890) - Public
**Sent Date:** 6/15/2009 2:19:15 PM
**Received Date:** 6/15/2009 2:19:17 PM
**From:** Arora, Surinder

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

**Recipients:**
"Callaway2COL Resource" <Callaway2COL.Resource@nrc.gov>
Tracking Status: None
"Colaccino, Joseph" <Joseph.Colaccino@nrc.gov>
Tracking Status: None
"Hodgdon, Ann" <Ann.Hodgdon@nrc.gov>
Tracking Status: None
"Karas, Rebecca" <Rebecca.Karas@nrc.gov>
Tracking Status: None
"Seber, Dogan" <Dogan.Seber@nrc.gov>
Tracking Status: None
"Arora, Surinder" <Surinder.Arora@nrc.gov>
Tracking Status: None
"NPUnit2-EPR@ameren.com" <NPUnit2-EPR@ameren.com>
Tracking Status: None
"Shafer, David E" <DShafer@ameren.com>
Tracking Status: None

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

| **Files** | **Size** | **Date & Time** |
|---|---|---|
| MESSAGE | 615 | 6/15/2009 2:19:17 PM |
| RAI 1890.doc | 41978 | |

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

Draft Request for Additional Information No. 1890 Revision 2

6/15/2009

Callaway Unit 2
AmerenUE
Docket No. 52-037
SRP Section: 02.05.02 - Vibratory Ground Motion
Application Section: 2.5.2

QUESTIONS for Geosciences and Geotechnical Engineering Branch 1 (RGS1)

02.05.02-1

In Subsection 2.5.2.1.1 you described the process of updating the USGS 2002 earthquake catalog to be used in your sensitivity study. Your updated catalog (2002-2007) covers an area that is limited to a radius of 200 miles from Callaway Plant Unit 2. This update does not cover fully all the seismic sources you used in your PSHA calculations. Please provide an updated earthquake catalog that covers all of the EPRI seismic sources you used in the PSHA study, and document in detail if this latest version of the earthquake catalog necessitates any changes in seismic source model parameters used in your PSHA calculations (for example, higher Mmax values).

02.05.02-2

In Subsection 2.5.2.5 you referred to the best estimate shear wave velocity profile shown in FSAR Figure 2.5.2-19. FSAR Subsection 2.5.4.7.4 describes how you calculated the best estimate shear wave velocity profile. However, the shear wave velocity values obtained using the downhole and suspension logging techniques show strong variations within the same geologic unit (for example, the downhole measurements show an average shear wave velocity of 3500 fps within the Synder foundation, but the suspension logging shows as high as 6500 fps shearwave velocities in the same formation). Please discuss why there are significant differences in shear wave velocity measurements obtained using these two techniques and their impact on the best estimate shear wave velocity profile.

02.05.02-3

Rock motion time histories selected for the site response calculations described in FSAR Subsection 2.5.2.3.2 are from earthquakes at much shorter distances than the controlling earthquake distances shown in Table 2.5.2-18 for large magnitude earthquakes. While the controlling earthquake distances are as much as 350 km away from the Callaway site, in some cases representative rock motion time histories you selected to be used in your site response calculations correspond to earthquakes recorded at distances shorter than 150 km. Please explain why this discrepancy exists and its potential impacts on the site response calculations.

02.05.02-4

In Tables 2.5.2-4 through 2.5.2-9, you presented the Mmax values of the EPRI seismic sources you used in your PSHA calculations. It is not clear to the staff from the data shown in these tables which EPRI sources' Mmax values were updated. Please provide revised tables showing the original EPRI Mmax values and the updated Mmax values that you used in your Callaway PSHA study. Please also describe the rationale used in choosing what Mmax magnitude to use in your updates.

02.05.02-5

In FSAR Subsection 2.5.2.2.1.5, you stated that "…for all EPRI zones, the background seismicity zone has been updated to a maximum magnitude entered at M 7.0." The staff is not clear what this refers to. Did you update the background sources' Mmax values to 7.0? Tables 2.5.2-4 through 2.5.2-9 show background source Mmax values other than 7.0. Please further explain this statement.

02.05.02-6

In FSAR Subsections 2.5.2.2.2.1 and 2.5.2.2.2.2, you described the earthquake recurrence estimates for the NMSZ. You indicated that both the Poissonian and renewal models were used. Please explain what type of renewal model you used. Please also discuss the important parameters used in the renewal model and their uncertainties, such as mean recurrence interval, time since last mainshock cluster to beginning of proposed plant operations, or $t_0$, exposure time. Please also discuss how the weights shown in Table 2.5.2-16 were selected.

02.05.02-7

In FSAR 2.5.2.5.2, you stated that the sedimentary rocks below the Graydon Chert Conglomerate are assumed to behave linearly during earthquake shaking. Please further describe why you believe the Snyder formation, with shear wave velocities of less than 3000 fps in some drillhole measurements, should be assumed to behave linearly during earthquake shaking.

02.05.02-8

FSAR Subsection 2.5.2.2.3 discusses an update to Mmax values in the Wabash Valley seismic zone.

a. Please discuss how the evidence for M7 events near Mt Carmel, IL, at approximately 6000 and 12000 yrs affects the assumed recurrence interval.

b. Does the April 18, 2008, Mw=5.2 Mt. Carmel Earthquake affect a and b values in the WVSZ?

02.05.02-9

FSAR Subsection 2.5.2.3 states, “The updated catalog does not show any earthquakes within the Site Region that can be associated with a known geologic or tectonic structure,” but Figure 2.5L-5 shows a number of epicenters on mapped structures and the northern faults of the New Madrid seismic zone extend into the Site Region. Please clarify this inconsistency.

02.05.02-10

FSAR Section 2.5.2.5.1 states that “the average of laboratory test results for damping ratio in the Cotter-Jefferson City Formation, 1.41%, was assigned to the deep rock column above the hard rock horizon.” The Cotter-Jefferson City Formations are massive Ordovician dolomites. Please further discuss the basis for assigning a high 1.41% damping ratio for these deep rocks.

02.05.02-11

Please provide the following data in digital format

a. Updated earthquake catalog
b. Geographic coordinates of all seismic source geometries used in the Callaway PSHA study
c. Mean total hazard curves for 0.5, 1, 2.5, 5, 10, 25, and 100 Hz as well as the hazard curves of all individual seismic sources
d. The best estimate shear modulus and damping degradation curves shown in FSAR Figure 2.5.2-22
e. Soil UHRS (the envelope spectra) electronically for $10^{-4}$ and $10^{-5}$ annual exceedance frequencies (Figure 2.5.2.-29)

02.05.02-12

The following is a list of editorial corrections and/or a request for basic clarifications that the staff has identified. Please provide updated texts/figures that address these issues

a. FSAR Section 2.5.2.2.2 provides information about Characterization of the New Madrid Fault System. Although you stated that the logic tree used is based on the Clinton ESP, some basic information and further explanation would be useful.
    i. Please explain all fault abbreviations upon first usage and be consistent among the text, Figures 2.5.2-8 and 2.5.2-9, and Tables 2.5.2-10 and 2.5.2-11
    ii. The text refers to the Blytheville Arch (in the literature, the Blytheville Arch usually refers to a subsurface feature, not an active fault), the Blytheville Fault Zone, and the Bootheel Lineament. Given the unconventional naming of these features, please explain the differences and the extent of each in the application

iii. Figure 2.5.2-9 shows the Blytheville Fault Zone where the Bootheel Lineament is generally accepted to be located. Please check this and label all features used in the text and Figure 2.5.2-8

iv. It is not clear if there is a relationship between fault length and magnitude for the various segments. If so, please state it and/or explain how the characteristic magnitudes in Figure 2.5.2-8 and Table 2.5.2-11 are derived

v. Please add explanation of the use of "Fault Arms" and "Rupture Sets" to Tables 2.5.2-10 and 2.5.2-11 and label them clearly on Figure 2.5.2-9.

b. FSAR Table 2.5.2-11 has a title of "Earthquake Frequencies for Repeating New Madrid Earthquake Sequences." This is not what is shown in the table.

c. Please provide a reference for the "postulated Springfield, Illinois earthquake" and its magnitude discussed in FSAR 2.5.2.2.3.