

**Gilkeson October 17, 2011 Response to an Email Question about the
“Interim Report: Update of the Probabilistic Seismic Hazard Analysis and
Development of CMRR Design Ground Motions, Los Alamos National Laboratory,
New Mexico,” December 4, 2009.**

The quote is in the following memo in Appendix A of the LANL 2009 PSHA Update. Appendix A begins on page 81 in the attached 368 page pdf.

**RESPONSES TO COMMENTS
Confirmatory Studies Steering Committee
Review Dated 5 June 2009
Prepared by
Walter Silva and Ivan Wong
17 June 2009**

The quote from Silva and Wong on June 17, 2009 is the second full paragraph on page 2 as follows:

Regarding the comment of the NRC acceptance of empirical V/H ratios for new facilities, I am not aware of any NRC licensing activity with hazard similar to Los Alamos, with the site located on the hanging wall and within 5 km of an active M 6.5+ source and with 10⁻⁴ horizontal peak acceleration of about 1g. This far exceeds the maximum horizontal peak acceleration of about 0.5g in the empirical V/H ratios. I suspect (hopeful) the NRC would closely examine empirical V/H ratio at 0.5g applied at 1.0g and above (recall for the DRS at 10⁻⁴ the UHRS is required at 10⁻⁵ which is at about 2g for CMRR). Also as far as I am aware the NRC has also accepted inclusion of site-specific V/H ratios with a 50% weight.

The above statement was in response to the following comment on page 1 of the memo from the Continuing Studies Steering Committee (CSSC) :

Comment

F-1. Weighting of Empirical vs. Stochastic V/H Ratios. In Section 3.1.1 (page 3-4, paragraph 3), it is stated that the stochastically computed V/H ratios are conservative and this conservatism is appropriate to use for engineering design. Figure 11 appears to indicate that the amount of conservatism between stochastic and empirical is very large, particularly at mid-frequency ranges between 1 and 10 Hz. Since the vertical motions are so important from a structural design perspective, particularly for the CMRR facility with its large open bays, the issue of whether this conservatism is excessive should be considered [Emphasis Supplied]. Whether the weighting of 0.5 of empirical to stochastic is appropriate is not discussed anywhere. [It should be noted that the Nuclear Regulatory Commission has accepted empirical V/H ratios for new facility designs.] The report (and resulting vertical spectra) should address this sensitivity to weighting between empirical and stochastic approaches.

Please Note. the above concern about "excessive conservatism" is silly because accurate knowledge of actual ground motions does not exist due to the use of assumed values for the key parameters 1) kappa, 2) shear velocity of the dacite reference rock and 3) the use of the velocity profile from the very different geologic setting at the DOE Savannah River Site. The assumed values are because the necessary field investigations for accurate values were not performed.

An excellent example on page 4 of the June 17,2009 memo is the following comment by the CSSC and response from Silva and Wong about using the velocity profile from the Savannah River site:

Comment

O-4. On page 3-5 (first paragraph), a short description of layer correlations used in the randomization process is provided. It appears that this model is the same as the one developed from the deep soil site at the Savannah River Site. If so, its appropriateness for application to the LANL site needs to be provided.

Response

The correlation model developed from velocity data acquired at the proposed NPR facility at the Savannah River Site (SRS) was assumed to be appropriate [Emphasis Supplied] for application to LANL. With only six velocity surveys at CMRR, four to a depth of about 150 ft and only two beyond about 500 ft deep across the CMRR site preclude any meaningful statistical analysis of velocity variability and corresponding demonstration of statistical equivalence in soil variability between CMRR and the Savannah River NPR site. . . Data limitations unfortunately result in assumptions[Emphasis Supplied].. . If the Steering Committee feels such a discussion is warranted, it can be added to the text [Emphasis Supplied].

The data limitations are because the field investigations for the site-specific velocity profile at the CMRR-NF required by Presidential Executive Orders, DOE Standards, DOE Orders and NRC Regulations were not performed.

The CSSC did not require the necessary field studies. Instead, the CSSC allowed the use of the velocity profile from the Savannah River Site if proper discussion was provided in the reports. As an aside, the CSSC also accepted the use of the unreliable seismic data to calculate kappa if appropriate discussion was in the reports.

In addition, the entirely inappropriate DOE Savannah River velocity profile was used to assess ground motions at the other nuclear weapons facilities located at LANL TA-55 including the seismic upgrades for the existing TA-55 Plutonium Facility, the new RLUOB Facility, and the extensive redesign for the existing Radioactive Liquid Waste Treatment Plant.

The process of the CSSC allowing LANL to use the inappropriate velocity profile from the DOE Savannah River Site is illustrated in the memo in Appendix A dated September 17 2009 as follows:

Comment from the CSSC

O-4. Appropriateness of applying Savannah River model to LANL. In Section 3.1.1.1 (first paragraph under the title "Site Aleatory Variability), the same description of the correlation model used in the CMRR site-response calculations is provided as in the draft report. That model was based on extensive CPT velocity data taken at the Savannah River Site. It is our opinion that the final report should clearly indicate what correlation model was used in these current calculations [Emphasis Supplied].

In addition, it is not obvious that the model, based on data from a site with no significant layer variability and with relatively uniform increase in velocity with depth, is appropriate for application to a site where there are distinct layers of tuffs, formed at different geologic times by different processes, and apparent significant velocity variability. The final report should provide plots of the individual velocity realizations and comparisons made to the base case models to ensure that the profile randomizations are appropriate for the site data available.[Emphasis Supplied].

Response from Silva and Wong

In Section 3.1.1.1, the end of the second paragraph which states "...borings over a typical large footprint" was amended to "...borings over a large footprint (H Area at the DOE Savannah River Site, Silva et al., 1997)". Plots of median and $\pm 1\sigma$ profiles as well as all 30 individual profile realizations compared to the base-case have been added for CMRR profiles A and B. In reference to the added plots, the following paragraph was placed after the first paragraph in Section 3.1.1.1 following Site Aleatory Variability: For the CMRR base cases A and B, Figure 51 and Figure 52 show the suits of 30 random profiles respectively. Figures 51 and 52 each begin with the median and $\pm 1\sigma$ profiles as well as the respective base-cases. Following each plot of the statistics are the random profiles with five realizations displayed per plot.

Please Note. Both the CSSC and the seismic hazard staff at the Defense Nuclear Weapons Safety Board were aware that the velocity profile from the DOE Savannah River Site should not be used to assess the seismic hazard at the LANL Nuclear Weapons Facilities. Nevertheless, the DNFSB did not require an accurate site-specific velocity profile for the engineering design of the proposed CMRR-NF. Instead, the DNFSB described the current approach (i.e., the DOE Savannah River velocity profile) as deficient and "encouraged" LANL to improve their approach to layer-to-layer correlation in the LANL Long Term Seismic Program Plan. The DNFSB allowed the inappropriate Savannah River Velocity Profile to be used for the engineering design of the proposed CMRR-NF in the DNFSB Certification to Congress.

Other ground motion topics and issues [identified by the DNFSB:

- The response to the Peer Review Panel (Comment O-4) discusses the soil layer-to-

layer correlation model used in the Probabilistic Seismic Hazard Analysis (PSHA). While the PSHA has included two base case profiles, in part to address layer-to-layer correlation uncertainty, LANL is encouraged to improve their approach to layer-to-layer correlation. Actions to improve this correlation should be included in the LANL Long Term Seismic Program Plan.

- LANL is requested to provide a schedule for developing the LANL Long Term Seismic Program Plan.

The actions by the CSSC and the DNFSB are unsatisfactory for a safe and cost-effective design of the proposed CMRR-NF. The CSSC and the DNFSB have not provided the independent peer review process required by the Office of Management and Budget.

In fact, the DNFSB described the importance of independent peer review of the entire process to assess the seismic hazard at LANL in the February 2011 DNFSB Twentyfirst Annual Report to Congress as follows;

“The Board continues to stress to DOE the importance of adequate review, including independent peer review, of both the acquisition of site-specific data and subsequent analysis to ensure that ground motions for design basis earthquakes are based on accurate scientific knowledge” (p. 63).

The above statement shows that the DNFSB did not consider the review by the DNFSB nor the review by the CSSC to be satisfactory "to ensure that ground motions for design basis earthquakes are based on accurate scientific knowledge.”

Call or send an email with questions.

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