**Public Comments on Interim Staff Guidance DC/COL-ISG-17 and Staff Resolution**

| **NEI Comments:** | | |
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| **Comments** | **Proposed Resolution** | **NRC Staff Resolution** |
| 1. Page 3, soil column, 2nd sentence: This section states that soil column properties, best estimate, and upper bound and lower bound values of each layer are obtained from the soil response motion at the MAPE of 10-4. In the previous section under Site Response Analysis, the development of design motion using the soil column responses at 10-4 and 10-5 are described. To be consistent with the design motion, the soil column properties should also be obtained from interpolation of strain-compatible soil properties corresponding to 10-4 and 10-5 MAPEs. | The best estimate soil property should be obtained from the interpolation of the median strain-compatible soil properties corresponding to the soil column analyses using 10-4 and 10-5 MAPEs rock motions. The upper bound and lower bound soil column properties are obtained from the variation of the strain-compatible soil properties from the median profile. Typically, one standard deviation is used to define the upper and lower bound values. | Accepted proposed resolution. |
| 2. Section 1, page 1, middle of paragraph, "Section 3.3" should be changed to "Section 5.0." | Change "Section 3.3" to "Section 5.0." | Accepted proposed resolution. |
| 3. Section 3, page 4, item 1, Hard rock and 9200 ft/sec is applicable to CEUS sites only and not for all sites. In addition this definition is likely to change for CEUS sites when NGA East is completed. | Change to "Rock UHS is calculated at the rock horizon under the geologic outcrop condition." | Accepted proposed resolution. |
| 4. Section 5.2.1, fist sentence, page 7, Same as the item above. | Change "hard rock" to "rock." | Accepted proposed resolution. |
| 5. Section 5.2.1, footnote 2, The PSHA analysis provides various statistical measures of the annual probability of exceedance as a function of rock spectral accelerations. Regulatory Guide 1.208 specifies that the mean annual probability of exceedance [MAPE] be used in developing the rock motions. In site response analysis, it is assumed that the soil amplification and soil response motions in terms of acceleration | Remove footnote number 2. | Staff agrees with the point and removed note 2. However, the staff notes that depending on the extent to which the site responses are due to nonlinear behavior of the site soil columns, the mean value of the site response factors from the 60 randomized soil column properties can be different from the median value. This is reflected in Section 2 under the site response analysis: "Soil |

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| response spectra are log-normally distributed, consistent with the definition of the rock ground motion attenuation relations used in the PSHA commonly being defined as median ground motions. With this assumption, the mean of the logarithmic values are used, which amounts to median values of the soil response motion. | | amplification analysis is performed, and the response motion at the free surface is obtained as the mean response motion at the two levels of the input motion $10^{-4}$ and $10^{-5}$ MAPE." |
| 6. Paragraph 3 on page 2, Effect of Overburden in the Soil Profile Properties, Paragraph 3 on page 2 requires that, in computing the GMRS at the uppermost in situ competent layer, one needs to capture the effect of soil overburden on confining pressures. The paragraph does not specifically state that the "dynamic" effect of the soil overburden should also be captured in computing the GMRS. In Section 3.1.2 of the NEI paper (ISG-17 Reference 3), an approach is proposed to include the effects of the overburden soil both in terms of the confining pressure and the dynamic effect in computing the response of the truncated soil columns. | In paragraph 3 of page 2, change the statement "However, the calculation needs to capture the effect of the weight of the soil overburden in producing confinement" to: "However, the calculation needs to capture the effect of the weight of the soil overburden in producing confinement and includes the effects of the soil column frequency of the overburden soil." | Accepted proposed resolution. |
| **J. K. Kimball Comments:** | | |
| 1.1. Site Response Methodology: "… Accurately creating soil profiles is a multi-variant problem requiring appropriate consideration of many factors including the total thickness of the soil, the nature and thickness of soil layering, the low strain properties of the layers, the strain dependent properties of the layers, the correlation between layers including layer-to-layer contrasts, the properties of the underlying bedrock, and the shear wave velocity contrast between the soil and the underlying bedrock. Simple models for creating "random" soil profiles (such as randomizing the shear wave velocity of each layer in | To correct for this deficiency, NRC should define acceptance criteria for the derivation and review of site response soil profiles, particularly if randomization of soil profiles is required." | The staff acknowledges this comment, but no change resulted from this comment. The NRC's Office Research conducted studies to produce NUREG/CR 6728 and the criteria in R. G. 1.208 in response to user requests. n order to incorporate the performance-based seismic hazard analysis into the Standard Review Plan Section 2.5.2 and Section 3.7.2 for soil-structure interaction analysis were revised in March 2007. The underlying probabilistic randomization model for shear wave velocities and site soil |

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| a systematic fashion) are likely to result in inappropriate site response if they do not properly reflect this multi-variant problem, To correct for this deficiency, NRC should define acceptance criteria for the derivation and review of site response soil profiles, particularly if randomization of soil profiles is required." | | layer thicknesses was developed by G. Toro et. al. using soil profiles from Savannah River Site (extensive in-situ site properties are known), the Gilroy array, the Rinaldi array and the Meloland array. The Toro model was again verified for the Yucca mountain project where extensive down hole measurements and SASW measurements, both deep and shallow, are available. The site response analysis methodology as applied to hazard analysis in accordance with RG 1.208 produces 60 site amplification factors. A mean value of the amplification factors is then used to obtain the free surface GMRS. This should produce an acceptable GMRS; because the mean value of the 60 results is used for the site response amplification factor. It is noted that Ref 4 of ISG 17, BNL Report N6112-051208, Revision 1, "Consistent Site Response—SSI calculations," Carl J. Costantino, BNL, July 15, 2009. (ADAMS Accession No. ML091980384)" shows a few examples of the effects of layering on the SSI analysis. It is noted in the ISG, "A very critical element of this procedure is a verification (see steps 3, 4, and 5 in Section 3.2.3 of the NEI white paper) that input seismic motions used for the SSI analysis model for the three deterministic soil conditions adequately bound the PBSRS in both the horizontal and vertical directions. This verification is a critical part of the staff review." Staff intends to examine the multi-variant nature of soil |

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| | | layering and soil properties and retaining their inter layer correlation to assess their effect on soil amplification factor. This effort is appropriate during the 10 year updating of seismic hazard estimate. |
| 2. Ensuring Proper Sequencing and Integration Between Site Response and Soil-Structure Interaction: "The challenge in ensuring proper sequencing and integration between site response and SSI stems from the fact that one approach is probabilistic (PSHA) representing a global site issue while the other approach is deterministic (SSI) representing a local foundation embedment issue. This challenge is compounded by the fact that the Ground Motion Response Spectra (GMRS) and Foundation Input Response Spectra (FIRS) are explicitly defined as performance-based ground motion response spectra at a global site level, but are expected to produce consistent input for the foundation embedment SSI issue at the local level. In general, the draft ISG obscures this distinction (global site versus local foundation) resulting in confusing guidance that is difficult to understand and follow." | None. | The staff partially accepted this comment and added text in the Section 2 in the discussion of performance based surface response spectra (PBSRS). During the site hazard analysis under the staff review guidance in Section 2.5.2 of the SRP and the ISG 1, the assessment of GMRS and the FIRS at the elevations of each seismic Category I structure is carried out on a global basis at the free field. For example, the FIRS are all consistent with the GMRS resulting from the PSHA. For the SSI analysis, PSHA consistent soil properties are modeled in the SSI profile for each structure up to the foundation elevation, then more detailed back fill information and building specific borehole data are used to model soil layers between the finished grade and the bottom of the foundation. The resulting building-specific soil column is used to generate the corresponding Performance Based Surface Response Spectra (PBSRS) and performance-based FIRS are also generated. This is a local analysis which will produce PBSRS corresponding to each structure. The revised ISG will contain additional text to clarify the distinction between the global site response and the building-specific local response. |

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| 3. Terminology (considering the issues discussed above): | None. | No change resulted from this comment. The terminology used in ISG 1 and this ISG were discussed in many public meetings and are consistent with the state of practice. Suggested changes will cause unnecessary confusion. |