

## Regulatory Guide Periodic Review

Regulatory Guide Number: **1.208, Revision 0**

Title: **A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion**

Office/Division/Branch: **RES/DE/SGSEB**

Technical Lead: **Vladimir Graizer**

Recommended Staff Action: **Revise.**

### 1. **What are the known technical or regulatory issues with the current version of the Regulatory Guide (RG)?**

The RG dates to 2007 and some references have been superseded since then. For example, the RG refers to the seismic sources identified and characterized by the Lawrence Livermore National Laboratory (LLNL) and the Electric Power Research Institute (EPRI) and states that the characterization of specific seismic sources found in these databases may still represent the latest information available at the time that a PSHA is to be undertaken. NUREG-2115, "Central and Eastern United States Seismic Source Characterization for Nuclear Facilities," (CEUS-SSC), has replaced the EPRI and LLNL models and needs to be incorporated in the RG update. The recently developed Ground Motion Models (GMMs) replaced the previous EPRI 2004 and 2006 GMMs and need to be part of the RG update. The RG also references the CEUS and WUS (Western United States) Time History databases provided in NUREG/CR-6728, "Technical Basis for Revision of Regulatory Guidance on Design Ground Motions: Hazard- and Risk- Consistent Ground Motion Spectra Guidelines," with respect to the selection of earthquake time histories for use in time history-based site response analyses. More recently updated databases, such as the Pacific Earthquake Engineering Center (PEER) Ground Motion Databases for the WUS and CEUS, need to be referenced in the guide.

The RG update should also incorporate staff experience from the reviews of early site permit (ESP) and combined license (COL) applications conducted since 2007 as well as the lessons learned from the seismic hazard re-assessments conducted as part of the Fukushima Near Term Task Force activities.

To date, the staff has identified several site response-related revisions needed in the RG. Appendix E "Seismic Wave Transmission Analysis" of the RG refers to the different approaches for developing a site-specific GMRS presented in NUREG/CR-6728. These approaches vary in complexity from simple deterministic amplification of probabilistically derived rock response spectra (Approaches 1, 2A, and 2B) to rigorous treatment of soil amplification within the probabilistic seismic hazard analysis (Approaches 3, 3A, 3B, and 4). The RG needs to be updated to provide guidance on selecting the appropriate site response approach for a particular site. In addition, guidance related to the following areas should be added to the RG: 1) Selection of kappa and representation of epistemic uncertainty; 2) Development of input motions for time domain methods or random

vibration theory (RVT) methods; 3) Development of probabilistic site-specific soil hazard curves (Approaches 3 or 4); and 5) Use of appropriate shear modulus reduction and damping curves and/or low strain damping values for materials in the site response model that are below the depth range where materials can be retrieved for testing.

In addition, Section C.3 “Evaluation of New Information Obtained from Site-specific Investigations” needs to be updated in the context of new SSHAC guidelines (e.g. NUREG-2213, “Updated Implementation Guidelines for SSHAC Hazard Studies”) and the new ground motion models, such as the recently published NGA East ground motion models.

**2. What is the impact on internal and external stakeholders of not updating the RG for the known issues, in terms of anticipated numbers of licensing and inspection activities over the next several years?**

While there are no large power reactor license applications anticipated in the near future (next 3 to 5 years), small modular reactor applications are anticipated in the next two years. Not updating the RG will hinder the progress of potential applicants.

**3. What is an estimate of the level of effort needed to address identified issues in terms of full-time equivalent (FTE) and contract resources?**

Complete revision of the RG updates will take approximately 2.0 FTEs of staff time. Contract dollars needed will be on the order of \$500K.

**4. Based on the answers to the questions above, what is the staff action for this guide (Reviewed with no issues identified, Reviewed with issues identified for future consideration, Revise, or Withdraw)?**

Based on the above the recommended action is Revise.

**5. If a RG should be revised, provide a conceptual plan and timeframe to accomplish this.**

The plan is to revise the RG reflective of short-term and long-term needs. The revision will incorporate updating references and some basic technical definitions to bring the RG to full compliance with already established staff positions. The revision will also incorporate results of the ongoing research activities in site-response calculations and methodologies.

The timeframe for the update is for staff to finish it by the end of the fourth quarter of the 2022 fiscal year, and to release for public comment in the first quarter of the 2023 fiscal year.

**NOTE: This review was conducted in December 2020 and reflects the staff’s plans as of that date. These plans are tentative and subject to change.**