

Development of the Design Basis Earthquake for a DOE Nuclear Safety-Related Facility on a Rock Site with Dipping Layers

Authors: Albert Kottke, Chih-Cheng Chin, Farhang Ostadan, James Marrone, Lisa Anderson, Nan Deng, Nick Gregor, Thomas Ma

The methodology used to calculate the site amplification of a horizontally-layered site is well developed and established for nuclear safety-related facilities which require seismic hazard for design. This methodology is based on one-dimensional site amplification incorporating soil/rock nonlinear behavior in the analysis. However, if the layering at the site is not horizontal, seismic waves are subjected to reflection/refraction and conversion of modes. In this case, prediction of the site amplification is much more complex. Depending on the geology and inclined layering at the site, two-dimensional site amplification may be used to develop the amplification function and soil/rock surface hazard curves. In this presentation, the site geology, one-dimensional and two-dimensional site response methodology, site amplification results, and application of NUREG/CR-6728 Method 3 to develop uniform hazard response spectra for design are discussed.

The major elements of the presentation include:

1. PSHA and Hard Rock Probabilistic Seismic Hazard Results
2. Site Geology and Layering
3. Development of Design Site Profiles including Epistemic and Aleatory Uncertainties
4. One- and Two-Dimensional Site Response Analysis
5. Development of Site-Specific Spectra
6. Development of Code-Based Design Response Spectrum

Each step in the development process is outlined in this presentation with emphasis on the key innovative techniques and challenges faced in the process.