

Seismic Design Analysis Approach



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Background

- Seismic analysis required to ensure nuclear plant safety is a complex process.
- New tools and methods, increasing amounts of seismic and geotechnical data, and emergent events results in analysis methods that are evolving.
- NuScale design philosophy espouses a generic plant design that can be safely located in a broad geographic range of possible seismic activities and soil profiles.

Approach

NuScale's seismic analysis follows ASCE 43-05:

1. Establishment of two sets of Response Spectra
 - a) Certified Seismic Design Response Spectra (CSDRS) and
 - b) Generic High Frequency Hard Rock Spectra (GHFHRS)

Both created by enveloping a number of site specific spectra submitted in prior DCDs
2. Establish generic soil profiles – To cover most EUS, CUS sites, and some WUS site except west coastal sites
3. Synthetic time history generation for both Response Spectra
4. Perform soil response dynamic analysis
5. Soil-Structure Interaction (SSI) for all soil profiles
6. Generate In Structure Response Spectra

Issues

The NuScale design and methodology results in certain topics that require early interaction with the NRC, including

- development of generic seismic envelope and soil profiles.
 - CSDRS is relatively high peak ground acceleration = .5g
- analysis of soil-structure interaction for deeply embedded reactor building.
- analysis of seismically induced hydrodynamic forces on the modules due to reactor pool.

Pre-Application Outcomes

- NRC is familiar with NuScale's approach to seismic analysis.
- NRC and NuScale have agreed on what the issues are and NuScale's approach to address them.

Pre-Application Engagement

Workshop(s) to familiarize the NRC with and obtain feedback on

- method used to create CSDRS and GHFHRS and resultant curves.
- method used to select Generic Soil Profiles to be used for our design.
- seismic methodology to analyze Soil-Structure Interaction for deeply embedded structure.
- methods to include seismically induced hydrodynamic forces on reactor module loading analysis.
- ensuring awareness of emerging seismic issues and regulatory changes.