

AP1000 Evaluation and Screening Process for High Frequency Sensitive Equipment

Purpose

To provide evidence that low frequency seismic qualification of safety-related equipment to the AP1000 Certified Seismic Design Response Spectra (CSDRS) produces seismic loads and accelerations that envelop the loads and accelerations generated by the high frequency seismic inputs.

Evaluation Process for HF Sensitive Equipment

- Comparative seismic analyses of typical structures housing safety-related electrical equipment.
 - Analysis of AP1000 Certified Seismic Design Response Spectra (CSDRS) seismic input and Hard Rock High Frequency (HRHF) seismic input.
 - Both time history and response spectra analyses were performed with both low and high frequency inputs.
- Reviewed existing seismic test data for high frequency (HF) content and equipment performance in the frequency range of 25 to 50 Hz. Both safety-related equipment and equipment tested for Uniform Building Code (UBC) requirements performed in compliance with IEEE Std. 344-1987.

Screening Process for HF Sensitive Equipment

- Safety-related equipment susceptibility to HRHF excitation are screened out or shown to be acceptable for their specific application.
- Susceptibility to HRHF excitation requires the following factors to be present.
 - Local HRHF response spectra need to exceed AP1000 CSDRS and have spectral acceleration greater than 2 g at 5% critical damping.
 - Equipment predominate natural frequencies in the high frequency exceedance range.
 - Equipment and components shall have potential failure modes involving change of state, chatter, signal change/drift, and connection problems.
- No additional seismic testing is required for previously tested equipment and whose qualified level envelops the HRHF seismic demand.
- Seismic testing is the preferred screening method when low frequency seismic testing does not envelop the HRHF seismic demand.
 - Supplemental test to low frequency seismic testing
 - Conducted after low frequency seismic testing
 - One SSE HRHF seismic test run is performed to demonstrate functionality of equipment in its most sensitive electrical operational state
 - Cycling fatigue effects are justified based on low frequency seismic testing
- EPRI White Paper “Seismic Screening of Components Sensitive to High Frequency Vibratory Motions” (June 2007) outlines other recommended generic screening methods.