IEEE Standards Interpretation for IEEE Std 344™–2004 IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations

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Interpretation Request #1

In IEEE Std 344-2004, 7.6, OBE and SSE analysis states that the equipment should be able to withstand the OBE events followed by an SSE event without failure. The discussion refers to fatigue as the cause of failure. Are there any other stress related failure criteria (other than fatigue)? In the discussion of fatigue, the term "excitation waveform" is used. What does this mean when using a response spectrum analysis?

Interpretation Response

The following is the approved response from the IEEE 344 Working Group (NPEC SC-2.5):

Question 1: Are there any other stress related failure criteria (other than fatigue)?
Yes. For seismic qualification equipment, stresses other then low cycle fatigue stress are determined through structural analysis and test using the operating basis earthquake (OBE) and safe shutdown earthquake (SSE) required response spectra (SSE) as applicable for the application. Seismic structural analysis in combination with other loads should be an integral part of the design process. By doing so, it will provide a high confidence that structural failure will not occur during seismic loading.

Question 2: In the discussion of fatigue, the term "excitation waveform" is used. What does this mean when using a response spectrum analysis?
The term "excitation waveform" is not applicable to response spectra analysis. The purpose of the response spectrum analysis is to determine the maximum member forces, displacements, reactions and stresses in the equipment due to seismic inputs defined by required response spectra for the application. Fatigue is cumulative damage to a

structure as a result of cyclic loading. Response spectrum analysis, which identifies only the maximum responses, cannot be used to assess the potential for fatigue unless the maximum stress is less than the endurance limit of the material. Assessment of crack initiation, growth, and final structural failure must be done using time history analysis. To determine the number of peak stress cycles, you will need to perform a time history analysis using time history seismic input motions which produces response spectra which envelopes the required response spectra at the mounting location of the equipment. The time history analysis will also provide you the response of the equipment as a function of time (member forces, displacements, reactions and stresses).