

**HIGH FREQUENCY EXCEEDANCE OF CERTIFIED
SEISMIC DESIGN RESPONSE SPECTRA**

**INDUSTRY / NRC MEETING
DECEMBER 20, 2007**

BOB WHORTON – SCE&G

PRESENTATIONS

- Bob Whorton – Industry Overview
 - Issue Summary and Generic Resolution
- Dr. Robert Kennedy – Industry Recommendations
 - Structure Modeling and Screening
- Dr. William LaPay (W) – Sample Evaluations
 - AP1000 Sample Selection and Evaluations
- James Parello (W) – HF Sensitive Equipment
 - AP1000 Evaluation and Screening Process

BACKGROUND SUMMARY

- Issue of high frequency spectral exceedance has been evaluated for almost 30 years:
 - Perry & Summer Experiences
 - IPEEE Evaluations
 - OBE Exceedance and Plant Shutdown
 - Updated Regulatory Guidance
 - Qualification Testing

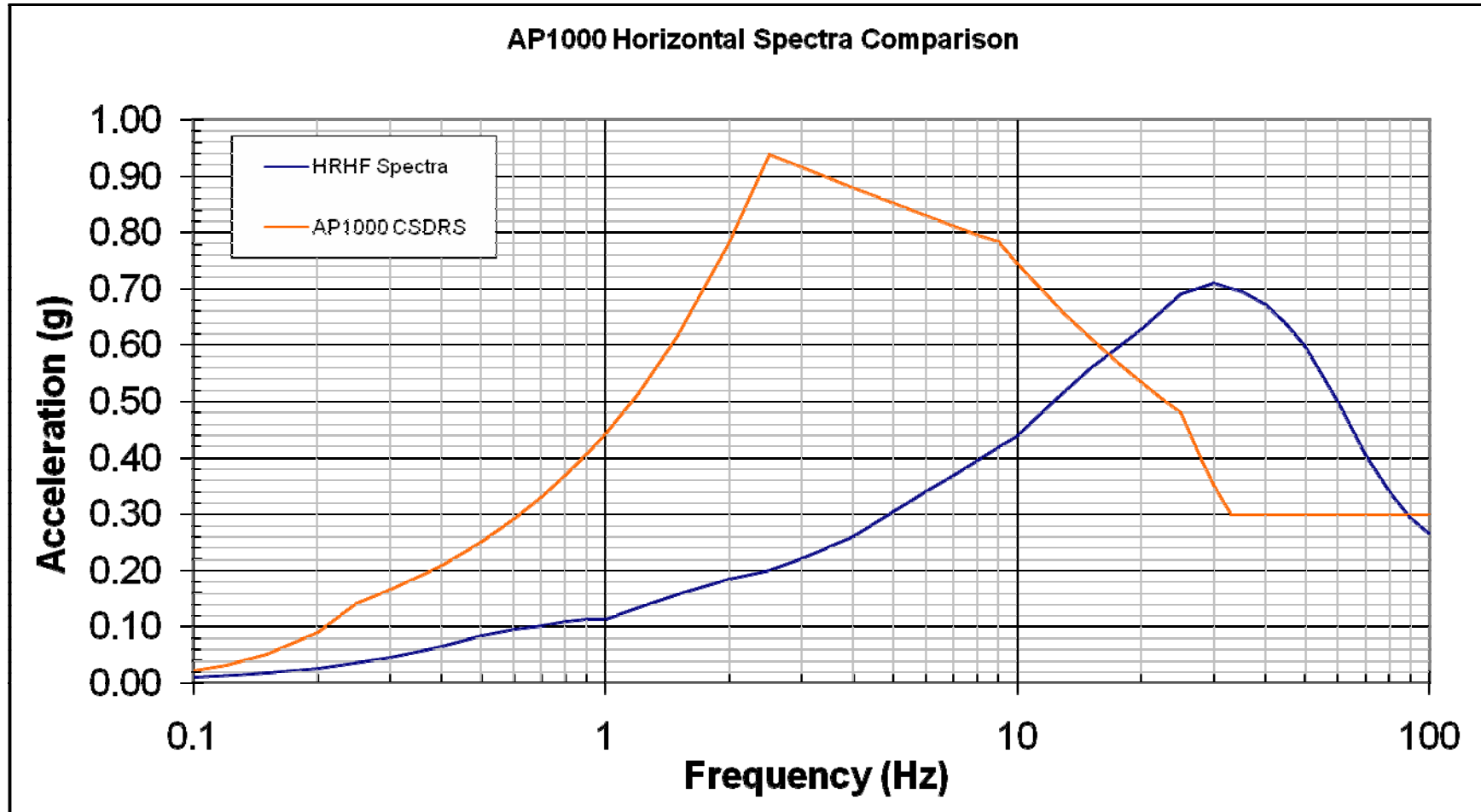
RG 1.60 SPECTRAL SHAPE

- Developed to adequately assure the safety of seismic design over the range of frequencies typical of NPP SSCs
- During development, engineering judgment was that high frequency motions exist, but have little significance on SSCs
- Achieved the level of safety required by the regulations (as incorporated by 10CFR100 Appendix A)

AP1000 SEISMIC DESIGN

- AP 1000 Certified Seismic Design Response Spectra (CSDRS) developed for free-field peak ground acceleration of 0.30g with modified RG 1.60 response spectra (maximum enhancement at 25 Hz)
- CEUS Hard Rock High Frequency (HRHF) Ground Motion Response Spectra (GMRS) exceeds CSDRS at high frequencies (approximately 15-90 Hz)

AP1000 HORIZONTAL SPECTRA COMPARISON



INDUSTRY CHALLENGE

- Demonstrate and document the lack of significance and damage potential for Structures, Systems and Components (SSCs) from high frequency seismic input motions which are typically generated by CEUS earthquakes of small-to-moderate magnitude

INDUSTRY APPROACHES TO ADDRESS HIGH FREQUENCY EXCEEDANCES

- Establish sound technical bases for reduction of high frequency motions:
 - Refined PSHA Modeling Approaches
 - Incoherency Functions
 - Validation of CLASSI/SASSI
 - Industry White Papers

1st INDUSTRY WHITE PAPER

- “The Effects of High-Frequency Ground Motion on Structures, Components, and Equipment in Nuclear Power Plants” (March 2007) [EPRI TR-1015108 – June 2007]

NRC Interim Staff Guidance (August 2007)

- “This report provides a foundation for the staff position to perform only a scoping analysis rather than a complete analysis of all Systems Structures and Components.”

2nd INDUSTRY WHITE PAPER

- “Seismic Screening of Components Sensitive to High-Frequency Vibratory Motions” (June 2007) [EPRI TR-1015109 – October 2007]

NRC Interim Staff Guidance (August 2007):

- This report addresses initial staff comments and includes proposed approaches for demonstrating the functional adequacy of components that are sensitive to high-frequency ground motions. Enclosure 4 outlines the staff position on what a COL application should contain to address this issue.
- Enclosure 4 – “The SRP process is progressive and can stop when it is clear that the design demands resulting from the GMRS are bounded by the CSDRS demands for SSCs.”

SUPPLEMENTAL EVALUATIONS

(PERFORMED IN SUPPORT OF INDUSTRY WHITE PAPERS)

- Westinghouse AP1000 DCD Revision 16:
 - Appendix 3I – Evaluation for High Frequency Seismic Input
 - Technical Report APP-GW-GLR-115 – Effect of High Frequency Seismic Content on SSCs
 - Technical Report APP-GW-GLN-144 – APP1000 Design Control Document High Frequency Seismic Tier 1 Changes

SUCCESS PATH TO RESOLUTION

- Evaluations to date provide justification for the lack of significance of high frequency motion
- Sample scoping analysis is considered adequate
- Identification of high frequency sensitive components
- Establish requirement for evaluation of high frequency sensitive components to account for rock sites with high frequency seismic input exceeding the CSDRS

CONCLUSIONS

- Industry consensus is that high frequency motions are not damaging, except for potential effects on sensitive components
- AP1000 sample analyses evaluations (DCD Appendix 3I, TR-115) conclude that the CSDRS result in a higher load and stress demand than the GMRS (HRHF) for rock sites
- Potentially high frequency sensitive components must be evaluated to account for rock sites with high frequency seismic input exceeding the CSDRS