Non-Proprietary Technical Presentation Slides

Presentations #2 & #3

Enclosure 2

Presentation #2: Westinghouse Presentation on Equipment Qualification

TR-115 Hard Rock High Frequency (HRHF) Response Effect on Equipment Qualification

NRC Public Meeting – July 29, 2010

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Introduction / History

- RAI-SRP3.10-EMB-11
  - NRC request WEC to "demonstrate that all safety-related mechanical and electrical equipment is qualified to the required response spectra at the equipment/device locations to meet the requirements of GDC-2 as a result of TR-115, Rev. 2"

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TR-115, Revision 2

- The AP1000 plant Certified Seismic Design Response Spectra (CSDRS) has its dominant energy content in the frequency range of 2 Hz to10 Hz and is based on Regulatory Guide (R.G.) 1.60 with an increase in the 25 Hz region.
- The hard rock high frequency (HRHF) seismic response spectra are associated with significantly less displacement and lower response spectra values in the low frequency (less than 10 Hz)
- The HRHF ground motion response spectra (GMRS) exceeds the CSDRS at frequencies above approximately 10 Hz in the horizontal and 15 Hz in the vertical directions.

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TR-115, Revision 2

- Susceptibility of safety-related equipment to HRHF excitation requires the following factors to be present:
  - HRHF floor response spectra need to exceed the AP1000 CSDRS in the high frequency range
  - Equipment must have modes or natural frequencies in the HF range
  - Safety-related components must have potential failure modes involving change of state, chatter, signal change/drift, and/or connection problems

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TR-115, Revision 2

- The technical study demonstrates:
  - HRHF response spectra is non damaging for plant structures and housed equipment.
  - Equipment exhibiting natural frequencies below the HRHF exceedance range or above 50 Hz do not require any additional treatment for qualification to high frequency seismic requirements.
  - Equipment that exhibits dominant natural frequencies which coincide with the peak spectral acceleration of the HRHF response spectra is consider high frequency sensitive and will require HRHF seismic testing/analysis.

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TR-115, Revision 2

- At locations where HRHF response spectra show exceedance of the CSDRS and there is a likelihood of equipment damage, then further evaluations would be performed to verify the existing qualification is adequate.
  - Safety-related equipment must have modes or natural frequencies in the range of interest
  - Applies only to equipment that is not already evaluated for HRHF
  - Apply the same acceptance criteria and evaluation methodologies used in CSDRS qualification

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TR-115, Revision 2

- In the event that the CSDRS and/or HRHF response spectra would be revised after the qualification program has been completed, a reconciliation effort would be performed to verify the CSDRS and HRHF seismic testing is still valid. The reconciliation effort may result in re-qualification activities and qualification documentation revisions.

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TR-115, Revision 2

- Qualification document packages will be used to satisfy the equipment's Seismic Category I ITAACs described in Tier 1 of the AP1000 DCD
- The Westinghouse approach for HRHF evaluation and screening are in compliance with NRC COL/DC-ISG-1.

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Presentation #3: Westinghouse Presentation on Piping

TR-115 Hard Rock High Frequency (HRHF) Response Effect on Piping

NRC Public Meeting – July 29, 2010

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Types of Packages Analyzed

- Screening based on Modal Mass participation is eliminated.
- 48 NRC Risk Significant packages are reduced to the following 6 representative packages due to their pipe sizes, pipe routings, ASME and B31.1 classification, building locations, and attachment locations/elevations.

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Packages Analyzed (cont.)

Package	Safety Class	Pipe Sizes	Building	Elevations	Attachment Points	Number of Valves	Number of Supports
APP-PXS-PLR-030	ASME Class 1	14", 18"	Containment	102' to 141'	Hot Leg, PRHR heat exchanger, Containment Internal Structures	5	14
APP-RNS-PLR-170	ASME Class 3, ASME B31.1	10", 8", 6", 4", 3", 1", ¾"	Auxiliary	68' to 115'	Pump MP01A/B, HX ME01A/B, SCV, Auxiliary Shield Building	16	61, plus 2 pipe anchors
APP-RNS-PLR-010	ASME Class 2 and Class 3	1", 3", 4", 10", 12", 20"	Containment	89' to 110'	Hot Leg, SCV, Containment Internal Structures	14	47, plus 3 pipe anchors
APP-RCS-PLR-020	ASME Class 1, ASME Class 2, 3, and ASME B31.1	1", 2", 3", 4"	Containment	102' to 165'	Cold leg, Steam Generator, Pressurizer , Containment Internal Structures	17	51
APP-CVS-PLR-530	ASME Class 2, ASME B31.1	3", 1"	Auxiliary	83' to 110'	SCV, Auxiliary Shield Building	3	13, plus 1 pipe anchor
APP-RCS-PLR-510	ASME Class 2	1"	Containment	120' to 160'	Pressurizer, Containment Internal Structures	1	11

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Analysis Philosophy

- Comparison between AP1000 CSDRS and HRHF is performed with Uniform Support Motion (USM) methodology.
- Further analysis techniques (independent support motion (ISM), time-history, gapped response spectra, or gapped time-history analysis) may be used to show qualification for HRHF response spectra

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Study Results

- The following results are considered to show qualification to HRHF response spectra:
  - Equation 9F stress ratios
  - Support loads
  - Equipment nozzle loads
  - Valve End stresses
  - Valve Accelerations
  - Leak-Before-Break (LBB)
  - Fatigue
  - Pipe-Rupture Hazards

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Conclusion

- The effects of HRHF response spectra on piping have been studied and for the typical sample evaluated, all packages that were qualified for CSDRS were also qualified for HRHF. Changes to the design spectra can be accommodated by available margins in the piping design and can be shown to be non-damaging.

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Action Item List from July 29 Meeting

Item	Westinghouse or NRC Action	Date
OI-SRP3.10-EMB2-11	Westinghouse will provide their final RAI response to NRC.	Westinghouse August 6th
OI-SRP3.12-EMB1-09	Westinghouse will provide their final RAI response to NRC.	Westinghouse August 6th
OI-SRP3.9.1-EMB2-05	No revision will be made to OI-SRP3.9.1-EMB-05. Westinghouse will issue the draft as final.	Westinghouse August 6th
OI-SRP3.9.1-EMB2-06	No revision will be made to OI-SRP3.9.1-EMB-06. Westinghouse will issue the draft as final.	Westinghouse August 6th
OI-SRP3.9.1-EMB2-07	WESTEMS (OI-SRP3.9.1-EMB2-07) discussion was being tabled and the staff would further review the documentation package sent to Twinbook on 7/26 to determine by mid-week (~8/4) what further information, if any, is necessary to close these open items.	NRC August 4th