Damping Value for Seismic Qualification Analysis of AP1000 Electrical Cabinets and Panels

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NRC Comment: RAI_SRP-3.7.1 – SEB1-16 (c)

The staff requests Westinghouse to (1) identify whether it plans to implement the RG 1.61, Rev. 1, damping values for electrical cabinets and cable trays; and (2) if damping values different from RG 1.61, Rev. 1, are used, provide the technical basis for concluding that the selected damping values will provide sufficient conservatism, including reference to recognized, readily available, and well documented test results that support the use of the selected damping values, and also addresses the uncertainty associated with scatter of the measured data.

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- Electrical cabinet and panels are an assembly of structures, subassemblies and individual components.
- Westinghouse electrical cabinets and panels are generally constructed of carbon steel framing members, angle support channels and panels with a combination of bolted and welded connections designed to support subassemblies and components mounted within.
- Structural damping of cabinets and panels will vary as a function of the materials of design construction and method of interconnection (bolted / welded).

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- NRC R.G. 1.61, Rev. 0, SSE Level Damping Values for Structure or Components:
  - Welded Steel Structures 4%
  - Bolted Steel Structures 7%
- Structural damping will increase as a function of stress level.
- Reasonable to perform the analysis to an average of the structural damping associated with the bolted or welded steel structures as defined in R.G. 1.61, Rev. 0.
- The use of 5% critical damping for structural analysis is consistent with the criteria defined in NRC Regulatory Guide (R.G.) 1.61, “Damping Values for Seismic Design of Nuclear Power Plants” (Rev.0, dated October 1973).

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- Westinghouse has employed a structural damping value of 5% damping in performance of static coefficient analyses demonstrating structural integrity of electrical cabinets and panels.
- Dynamic structural analyses performed by Westinghouse employs models validated through the use of qualification test programs.
- We believe this approach is conservative in demonstrating structural integrity of the equipment and its mounting supports.

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Conclusion

- Based on the NRC R.G. 1.61, Rev. 0, criteria and AP1000 generic seismic testing performed using 5% critical damping response spectra, it is conservative to perform analysis of electrical cabinets and panels using 5% structural damping for SSE levels.
- Westinghouse does not intend to implement the NRC R.G. 1.61, Rev. 1
  - Table 6 of NRC R.G. 1.61, Rev. 1, identifies an SSE level damping value of 3% for electrical cabinets and panels