Doris Mendiola - NEI Comments on Draft Regulatory Guide DG-1157, "Damping Values For Seismic Design of Nuclear Power Plant

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SUBJECT: NEI COMMENTS ON DRAFT REGULATORY GUIDE DG-1157, "DAMPING VALUES FOR SEISMIC DESIGN OF NUCLEAR POWER PLANTS"

PROJECT NUMBER: 689

The Nuclear Energy Institute wants to thank you for the opportunity to review the subject draft Regulatory Guide. This draft Regulatory Guide provides a significant increase in detail concerning damping values for use in seismic analysis over the present Regulatory Guide 1.61. In general, the provisions of DG-1157 appear to be reasonable; however, NEI does have several important comments to make concerning the draft.

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The Nuclear Energy Institute[1] wants to thank you for the opportunity to review the subject draft Regulatory Guide. This draft Regulatory Guide provides a significant increase in detail concerning damping values for use in seismic analysis over the present Regulatory Guide 1.61. In general, the provisions of DG-1157 appear to be reasonable; however, NEI does have several important comments to make concerning the draft.

1. In Section A "Introduction," footnote 1 refers to Seismic Category I SSCs as defined by RG 1.29. Since Regulatory Guide 1.29 is being considered for revision also (DG-1156), the appropriate draft Regulatory Guide should also be referenced.

2. In Section B. "Discussion" the last sentence of the first paragraph under "Background," where it states "... expected viscous damping resulting from the material of the actual structure." Damping is a function of many more phenomena than the material itself of the SSC. Viscous damping represents the

[1] The Nuclear Energy Institute (NEI) is the organization responsible for establishing unified industry policy on matters affecting the nuclear energy industry, including the regulatory aspects of generic operational and technical issues. NEI's members include all entities licensed to operate commercial nuclear power plants in the United States, nuclear plant designers, major architect/engineering firms, fuel fabrication facilities, nuclear materials licensees, and other organizations and individuals involved in the nuclear energy industry.

energy dissipation of structural and non-structural elements, including attached or supported items such as piping insulation, cables in cable trays and conduit, behavior such as large deformations of rod hung systems, connections, metal cladding, non-structural partition walls, etc. The current description is too limited.

3. On Page 5 under C.1.(2) the draft states in part "...attributable to load combinations that include SSE are at least 80% of the applicable code stress limits." The reduction from SSE damping to OBE damping at 80% of the applicable code stress limit is excessively conservative. It will have a substantial effect on computed In-Structure-Response-Spectra (ISRS) for concrete structures on stiff sites where there is limited benefit from SSI effects. Typically, the majority of structural elements will not be stressed to above 80% of the code stress limit under SSE loadings. Thus designers will most often have to use OBE damping for SSE evaluations.

   As an example, for a reinforced concrete structure the SSE damping value is 7% while the OBE damping value is 4%. The 7% damping value is appropriate once the concrete has cracked so that energy dissipation occurs due to cracking and relative displacements across cracked surfaces. The 4% damping is more appropriate prior to concrete cracking. This damping value includes the effects of non-structural energy dissipation due to non-structural contents spread throughout the structure and is not exclusively due to energy dissipation in a bare concrete structure.

   Typically, reinforced concrete structural elements begin to crack in shear or flexure at stresses equal to about 50% of code stress limits or slightly higher. In fact, concrete must crack for the reinforcing steel to become effective. Therefore, the transition for reinforced concrete structures from 7% damping to 4% damping typically occurs at about 50% of code stress limits. The 80% stress limit in DG-1157 is excessively conservative at least for reinforced concrete structures. Similar considerations also apply for other structural elements.

   Both ASCE/SEI Standard 43-05 and ASCE Standard 4-98 assign Response Level 2 damping when stresses range from about 50% to 100% of code stress limits. Response Level 1 damping is imposed only when stresses are less than 50% of code stress limits. Response Level 2 damping values in these ASCE Standards are generally consisted with DG-1157 SSE damping levels. Similarly, ASCE Response Level 1 damping values are generally consistent with DG-1157 OBE damping levels.

In summary, the 80% stress limit will result in most SSE evaluations having to use OBE damping levels. No basis exists for the 80% limit. The limits in the ASCE Standards should be used.

4. Also on Page 5 under C.1.(2), we recommend adding the following to the end of the paragraph, "When the stresses attributable to load combinations that include SSE are less than 50% of the applicable code limit, the analyst need not reanalyze the structure for SSE using the damping values of Table 2 if it can be judged that the stresses will remain within the code allowables with the lower damping values. This is not applicable for the development of in-structure response spectra." This will relieve the unnecessary burden on the analyst. This recommendation reflects ASCE 4-98 Section 3.1.2.2 (b) and (c) and ASCE 43-05 Section 3.4.3 requirements.

5. On page 6, Table 3, the damping levels for piping provided with ASME Code Section III Appendix N of 5% should be specified instead of the Table 3 values within the draft Regulatory Guide.

6. On page 6, Section C.2 "Piping Damping" in the last paragraph, the second bullet states that the specified damping values may be used only in those analyses in which the current seismic spectra and procedures have been used. It is not clear what the "current" seismic spectra and procedures are. This should be clarified. However, this bullet and the other bullets in this section that relate to the frequency-dependent damping can be removed from this draft if 5% damping is prescribed for piping, as recommended in ASME Appendix N (see item 5 above).

7. On page 9, section C.5, Table 6 for electrical cabinets, panels, and motor control centers, the damping values specified in the draft might be reasonable for cabinets with all welded connections that are welded to the support structure. However, these values are too low for cabinets with sheet metal screw connections, or cabinets bolted together or bolted to the support structure. The ASCE/SEI Standard 43-05 damping values of 4% at Response Level 2 and 3% at Response Level 1 are more appropriate for these cabinets. Therefore, the following additions (in underlined font) are recommended to Table 6, row titled, "Electrical Cabinets, Panels, and Motor Control Centers." Also a footnote should be included (as indicated by the asterisk) in the recommended Text.

Electrical Cabinets, Panels and Motor Control Centers (MCCs)* (protection, structural support)		
– Welded steel structures and bolted steel structures with friction connections	4%	3%
– Bolted steel structures with bearing connections	7%	5%

* For electrical cabinets/panels assembled as welded or bolted steel structures, the values of Tables 1 and 2 shall apply."

8. The title and date for Reference 11 of DG-1157 is not correct. Correct title and date are, NUREG/CR-6919, "Recommendations for Revision of Seismic Damping Values in Regulatory Guide 1.61," U.S. Nuclear Regulatory Commission, Washington, DC, November 2006.

These comments are being offered to improve the clarity and value of this draft Regulatory Guide. If you have any further questions regarding these comments, please contact me at 202.739.8094; aph@nei.org.

Sincerely,

Adrian P. Heymer

c: Mr. Stephen C. O'Connor
Mr. Herman L. Graves, III
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