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Chief, Rules and Directives Branch
Office of Administration
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

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RECEIVED

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RULES AND DIRECTIVES
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USNRC

Subject: Industry Comments on Draft Regulatory Guide DG-1175, *Seismic Qualification of Electric and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants*

Project Number: 689

The Nuclear Energy Institute (NEI)¹ appreciates the opportunity to provide comments on DG-1175. The enclosure to this letter provides detailed comments and recommended changes to the text of the proposed regulatory guide. Many of these comments are similar to the feedback provided by other industry organizations, such as the IEEE Nuclear Power Engineering Committee.

The industry agrees with the comments from the IEEE Nuclear Power Engineering Committee that the proposed regulatory guide changes are contrary to national consensus standards in the area of seismic qualification. No technical or regulatory basis is provided to justify a departure from the national consensus standards.

The proposed changes in the guidance exclude any discussion of experience-based methodologies that have been endorsed by the NRC in previous revisions and successfully used in older vintage plants for several years. Without any justification, such omissions present a high potential for misinterpretation resulting in the unnecessary expenditure of NRC and industry resources on matters that have previously been resolved. Also, the proposed changes to the guidance are contrary to IEEE Std 344-2004, Annex B, Frequency Content and Stationarity, that is used to evaluate the adequacy of shake-table test motions, including high-frequency content. Without this annex, 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 entities involved in the nuclear energy industry.

SOUSI Review Complete

E-RIDS = ADM-03

Template = ADM-013

add = Ching H. Ng (Ching)

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Page 2

NRC is in effect eliminating the possibility of using existing test data to qualify many components, which would result in thousands of hours of retesting with no commensurate benefit.

Additionally, the proposed language in the draft guide is a departure from the recent understandings reached between the NEI New Plant Seismic Issues Task Force and the NRC staff regarding the necessary requirements for high frequency testing. These understandings that are documented in Interim Staff Guidance are based on the existing version of Reg. Guide 1.100. Updating Reg. Guide 1.100 based on the current draft of DG-1175 would question the regulatory stability associated with the development and review of new plant seismic designs and procurement specifications.

We request a public meeting on the comments to DG-1175 because of the major impact the proposed changes would have on the on new plant licensing reviews and applications.

We appreciate your consideration of these comments and are available to discuss them as necessary. If you have any questions about the industry comments, please contact me or Russ Bell at 202-739-8087, rjb@nei.org.

Sincerely,



Adrian P. Heymer

Enclosure

c: Dr. Jennifer L. Uhle, U.S. Nuclear Regulatory Commission
Dr. Nilesh Chokshi, U.S. Nuclear Regulatory Commission
Mr. Michael Mayfield, U.S. Nuclear Regulatory Commission
NRC Document Control Desk

Comments on DG-1175 "Seismic Qualification of Electric and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants." (Update to RG 1.100)

DG section/page number	Comment, including basis	Proposed revision or alternative
Title, General Comment, also see pages 5 through 8.	The draft RG title and scope have been changed to include functional qualification of active mechanical equipment, as compared to the two previous revisions of RG 1.100 which only discussed seismic qualification of electrical and mechanical equipment. This change is because the RG now endorses ASME QME-1-1994, which covers functional qualification of active mechanical equipment. The main discussion on pages 5 through 8 of the DG is for active, motor-operated valves. It is noted that RG 1.148 also discusses functional specification of active valves and primarily endorses ANSI N278.1-1975. Although the ANSI standard by itself does not provide complete assurance of operability, there is an overlap between DG-1175 and RG 1.148 for functional qualification of active valves. It is recommended that functional qualification of active mechanical components (which have no direct bearing on seismic qualification) should be discussed in a revision to RG 1.148. RG 1.100 should focus solely on guidance for seismic qualification of electric and mechanical equipment.	Remove functional qualification of active mechanical equipment from this DG (address in RG 1.148) such that RG 1.100 focuses solely on guidance for seismic qualification of electric and mechanical equipment. If this is not done, reconcile the overlap between DG-1175 and RG 1.148 in another manner.
Page 4, (4 th para from top—"Large...") Also C. 1.1.1 b/9 Also C. 1.1.2 b, c /11	In the SERs that NRC sent to the USI A-46 plants in the past, it was stated that older vintage plants could use the experience-based SQUG-GIP method for seismic verification of new and replacement equipment provided they revised their licensing bases. Many older plants are currently using the SQUG-GIP method. The DG is silent on this.	Add a sentence at the end of this paragraph to this effect: " <i>However, older vintage plants can, with a few exceptions, use the experience-based SQUG-GIP method for seismic verification of new and replacement equipment provided they revise their licensing bases via safety evaluations.</i> " Alternatively, reconcile the fact in the DG that NRC has previously accepted earthquake experience-based qualification of new/replacement equipment in older plants.
Page 5, B.1	The middle of the 5th paragraph in Section B.1 says "Some solid-state relays and microprocessor-based components are	This sentence should be deleted as well as the following sentence based on this conclusion.

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	<p>quite fragile in terms of withstanding earthquake excitations.”</p> <p>This is specifically counter to testing experience and counter to the experience of the April 8 IEEE SC2 meeting attendees who were not aware of any experience showing solid-state relays and microprocessor-based components to be particularly vulnerable to earthquake motions.</p>	
Page 5, B.1	<p>The end of the 5th paragraph in Section B.1 says “Third, since no new NPPs were built after the early 1980s, a number of manufacturers for electric or active mechanical equipment are no longer in business, and the appropriateness of using the test experience of old equipment made by manufacturers no longer in business for the seismic qualification of modern equipment designs made by different manufacturers is highly questionable.”</p> <p>This specific concern is addressed in IEEE 344 Section 10.3.4h and ASME QR-A7432(a); therefore, this concern is not valid for items qualified in accordance with the two standards.</p>	This sentence should be deleted.
<p>Page 5 (3rd para from top - “Another NRC ...”)</p> <p>Also, C. 1.1.1g/10</p> <p>Also, C. 1.2.1g/14</p>	<p>The high frequency content, which exists in most existing tests, whether inadvertent or deliberate, will still be imparted to an item on equipment on the shake table. Therefore, high frequency vibratory motions generated on a shake table in an inadvertent manner can be of significance. The DG should clarify that such inadvertent motions can be credited provided they are shown to meet stationarity requirements per Appendix B of IEEE Std 344-1987 or 2004 (when one of these versions of the IEEE Standard is the plant’s commitment). However, in IEEE Std 344-1975, there was no requirement for stationarity check. For example, previous seismic shake tests for BWR Mark II and III plants (committed to the 1975 version of the standard) were frequently utilized to qualify equipment for the combined seismic and hydrodynamic loads with high frequency content up to 100 Hz and were accepted by the NRC staff in SQRT audits.</p>	Revise to require the high frequency motions to be evaluated in accordance with QR-A7232 or IEEE 344 Annex B, Frequency Content and Stationarity.
Page 5 (2 nd para from top - “The	In the last sentence of this paragraph, it says that the test sample shall be subjected to simulated OBE and SSE vibrations	Revise these sections to include an option that 2 SSE tests, as an alternative to 5 OBE and 1 SSE are also

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NRC..."). Also, C. 1.1.1 i/10 Also, C. 1.2.1 j/14	per IEEE Std. 344-2004. In section C.1.1.1i (p. 10) two alternatives for the number of tests/cyclic considerations are provided. However, another alternative when OBE is defined as 1/3 or less of SSE is to use two SSE events (with 10 maximum stress cycles per event) in accordance with SRP 3.7.3 (p. 4), March 2007. The SRP considers this alternative to be equivalent to the cyclic load basis of one SSE and five OBEs. This alternative can save testing duration and should also be listed.	acceptable when the OBE is designated as 1/3 or less of the SSE.
Page 9, C.1.1.1c	This paragraph repeats the inappropriate conclusion that solid-state relays and microprocessor-based components are fragile and suggests that test-based experience performed in accordance with IEEE 344 requirements (per Section 10.3) does not adequately qualify chatter sensitive equipment. Both of these comments are incorrect.	These sentences should be deleted.
Page 9, C.1.1.1d	This paragraph as written seems to impose new requirements on the common practice of testing selected items to qualify a family of similar items in accordance with IEEE 344 Section 8.	This section should be deleted or rewritten.
Page 10, Section 1.1.1f, 1.2.1f	This section states: "The NRC staff does not generally find it acceptable to restrict the frequency range of testing up to 33 Hz. The frequency range should be continued beyond 33 Hz, in accordance with the RRS of a specific plant." This last sentence could be reworded to provide more clarity.	Reword second sentence to read as follows: " <i>For RRS with ZPA frequency in excess of 33 Hz, the frequency range of testing should be accordingly extended to match the RRS.</i> "
Page 10, C.1.1.1i	This section requires that the OBE amplitude be set to 1/2 the SSE, even if the plant license OBE is 1/3 of the SSE.	The OBE qualification level should be based on the plant license.
Page 10, C. 1.1.1 j	The IEEE Std. 344-2004 has a section on damping. While the damping values in RG 1.61 can be used when qualification is by analysis, there should be no specific requirement on damping values to be used for shake-testing, only that the equipment damping at which the RRS is developed should be the same or	Clarify the statement in this section that for qualification by shake-table testing, RRS with any reasonable damping value (such as 5% of critical damping) can be used provided that the TRS is also plotted at the same damping value or a higher

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	lower than the TRS damping value. This is not mentioned.	damping value.
Page 11, C.1.1.2a	IEEE 344 Sections 10.2.3.1 and 10.3.3.1 provide specific criteria for addressing low-cycle loads. Five OBE tests, or actual earthquakes at the same site, are not the only permitted methods to evaluating low-cycle loads. The standard as written properly imposes those requirements on the qualification.	This section should be deleted.
Page 11, C.1.1.2c	The capacity spectra are based on a weighted average of the ground motions, neglecting the in-structure amplification from the experience sites. Therefore, the use of median centered demand spectra results in a conservative capacity/demand comparison.	This section should be deleted.
Page 11, C.1.1.2d	Application of the concepts in References 32 and 33 would dramatically revise current qualification practices. For example, the 1.4 factor would have to be applied to every test qualification performed in accordance with IEEE 344 Section 8. The mixing and mismatching of these criteria between the goals of IEEE 344 and References 32 and 33 would need careful consideration and would need to be consistently applied throughout the qualification standard.	The criteria in References 32 and 33 need to be deleted from this Section or applied consistently throughout IEEE 344. Without substantial further study, it is recommended that the concepts in references 32 and 33 not be incorporated.
Page 12, C.1.1.2g	This section says that you can not use median centered demand spectra for comparison with the TES. IEEE 344 10.3.4b already requires the use of computed in-structure spectra for the demand as opposed to 10.2.4b which specifies median-centered spectra for comparison with the EES).	This section should be deleted.
Page 12, C.1.1.2k	<p>This section requires changing the coherence criteria to lower values. This was discussed in the IEEE 344 Working Group and rejected on sound technical bases as follows:</p> <p>The Working Group believes the criteria established in Annex E are acceptable. Our reasons for objecting to the suggested change are noted below:</p> <ol style="list-style-type: none"> 1. The coherence function and cross correlation coefficient were originally developed by Kana based on his review of several actual earthquakes. Some of the actual earthquakes had factors 	

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	<p>higher than 0.5/0.3. The recommendation (0.5/0.3) is slightly higher than the average of the actual earthquake results and represents real data.</p> <p>2. The earthquakes that Kana used were for free-field ground motions. They were not for motions in buildings. Kana noted that ground motions after entering buildings were likely to be more (not less) correlated, due to the multi-directional contribution of many structural modes of vibration. Therefore, it is reasonable to expect that motions on upper floors of a structure will be more, not less, correlated than 0.5/0.3.</p> <p>3. It is unrealistic and nearly impossible to have two real narrow band floor spectra to be less correlated than 0.5/0.3. Requiring motions to have less correlation is unrealistic and mathematically approaching unrealizable.</p> <p>4. We have not identified any studies that suggest that a correlation less than 0.5/0.3 results in a significantly more severe test. With current seismic shake tables it will be very difficult, if not impossible, to achieve significantly less than 0.5/0.3. This is caused by a combination of table design/control limitations and the difficulties mathematically in achieving the task. Lowering the 0.5/0.3 criteria would reduce the current seismic test capacity and not achieve any better results.</p> <p>5. The commenter cites Regulatory Guide 1.92 Revision 1 as providing the NRC staff's position related to the unacceptable nature of using a "coherence function of less than 0.5 and cross correlation coefficient of 0.3." Regulatory Guide 1.92, Revision 1 "Combining Modal Responses and Spatial Components in Seismic Response Analysis" states in footnote 2 that when using the Time-History Analysis Method, "the earthquake motions specified in the three different directions should be statistically independent." For a discussion of statistical independence, see Reference 6. The reference referred to is a paper in the February 1975 edition of the Journal of the Structural Division, ASCE, titled "Definition of Statistically Independent Time</p>	

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	<p>Histories." Regulatory Guide 1.92 Revision 1 itself does not establish a limiting value for coherence or cross correlation. ASCE standard 4-98 on seismic analysis of safety-related nuclear structures has the following requirement in Section 2.3 on time history input to structures:</p> <p>"When responses from three components of motion are calculated simultaneously on a time history basis, the input motions in the three orthogonal directions shall be statistically independent and the time histories shall be different. Shifting the starting time of a single time history shall not constitute the establishment of a different time history. Two time histories shall be considered statistically independent if the absolute value of the correlation coefficient does not exceed 0.3."</p> <p>The ASCE standard is an industry consensus standard for seismic analysis of safety-related nuclear structures and is in agreement with the intent of information provided in IEEE 344 Annex E.</p> <p>6. The commenter goes on to state that the NRC staff's position on the numerical values for the cross correlation coefficient and the coherence function for defining statistically independent motions are also reflected in Section N-1213.1 of Appendix N of the ASME Section III Code. N-1213.1 states that:</p> <p>"The peak acceleration of the three orthogonal synthetic time histories generally need not occur at the same time. In order to simulate natural earthquake occurrences, the correlation of the synthesized time histories may be evaluated by calculating the cross correlation coefficients and the coherence functions. The artificially generated time histories are acceptable if both their cross correlation coefficients and their coherence functions are approximately equal to the respective functions for past earthquake records. An absolute value of the correlation coefficient less than 0.16 is acceptable. For the coherence function the numerical values ranging between 0.0 and 0.3 with</p>	

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	<p>an average of approximately 0.2 are acceptable.”</p> <p>Note that this section of the appendix does not prohibit use of coefficients higher than 0.16 or 0.3 and focuses on the goal to have synthetic time histories that are representative of past earthquakes. The current version of IEEE 344 (to which the NRC did not object in Regulatory Guide 1.100) was based on the study of actual earthquakes.</p>	
Page 13, Section 1.2.1d	This section discusses “similarity” between the excitation documented in the experience database and the required seismic excitation. The term “similarity” is too strong as the only spectrum comparison requirement should be that the RRS be enveloped by the test spectrum used in the experience database.	Suggest deleting the last part of the last sentence that starts with “as well as similarity between....” Add a sentence to read as follows: <i>“Additionally, the test response spectrum documented in the experience database shall exceed the RRS.”</i>
Page 13, C.1.2.1e	This paragraph as written seems to impose new requirements on the common practice of testing selected items to qualify a family of similar items (e.g. valve actuators) in accordance with ASME QME QR-A7200.	This section should be deleted or rewritten.
Page 14, C.1.2.1j	This section requires that the OBE amplitude be set to 1/2 the SSE, even if the plant license OBE is 1/3 of the SSE.	The OBE qualification level should be based on the plant license.
Page 15, C.1.2.2b	Since the EES is based on free field ground motions, and ignores in-structure and in-line amplification at the earthquake site, it is reasonable and conservative to use the demand spectra at the distribution system support location. Further complications of accounting for in-line amplification of the earthquake site facility and the nuclear facility add unnecessary complexity to the qualification.	This section should be deleted.
Page 15, C.1.2.2d	QME Section QR-A7421 already requires items susceptible to low cycle fatigue failures be evaluated in accordance with QR-A6800, Fatigue and Aging Considerations.	This section should be deleted.
Page 16, C.1.2.2h	The capacity spectra are based on a weighted average of the ground motions, neglecting the in-structure amplification from the experience sites. Therefore, the use of median centered	This section should be deleted.

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	demand spectra results in a conservative capacity/demand comparison.	

Doris Mendiola

From: Ching Ng
Sent: Friday, September 05, 2008 3:15 PM
To: Doris Mendiola
Co: Michael Lesar
Subject: FW: Industry Comments on Draft Regulatory Guide DG-1175, Seismic Qualification of Electric and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants
Attachments: 07-11-08_NRC_Industry Comments on DG-1175.pdf; 07-11-08_NRC_Industry Comments on DG-1175_Enclosure.pdf

Hi, Doris,

The two attached pdf files related to DG-1175 were sent to us by NEI on July 11th, 2008. I have checked with Mr. Michael Lesar today and there is no record of these 2 files in ADAMS for DG-1175 as public record . Mr. Lesar said I should email the files to you so that they can be added to ADAMS as official agency record.

Thank you very much for your attention.

Sincerely,

Ching Ng
RES/DE/MEEB
415-8054

From: REED, Joseph [mailto:jsr@nei.org] **On Behalf Of** HEYMER, Adrian
Sent: Friday, July 11, 2008 4:16 PM
Subject: Industry Comments on Draft Regulatory Guide DG-1175, Seismic Qualification of Electric and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants

July 11, 2008

Chief, Rules and Directives Branch
Office of Administration
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Additionally, the proposed language in the draft guide is a departure from the recent understandings reached between the NEI New Plant Seismic Issues Task Force and the NRC staff regarding the necessary requirements for high frequency testing. These understandings that are documented in Interim Staff Guidance are based on the existing version of Reg. Guide 1.100. Updating Reg. Guide 1.100 based on the current draft of DG-1175 would question the regulatory stability associated with the development and review of new plant seismic designs and procurement specifications.

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Sincerely,

Adrian P. Heymer
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