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Subject: Westinghouse Comments on Draft Regulatory Guide DG-1175

Dear Sir or Madam:

Attached are Westinghouse comments on Draft Regulatory Guide DG-1175 (Proposed Revision 3 of Regulatory Guide 1.100) entitled "Seismic Qualification of Electric and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants." Westinghouse comments are being provided to request further clarification and understanding of the DG-1175 regulatory guidance.

Very truly yours,

J. A. Gresham, Manager
Regulatory Compliance and Plant Licensing

Enclosures

cc: C. Ng (NRC)
J. Parello (Westinghouse)

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Westinghouse Electric Company Review of

U.S. NRC Draft Regulatory Guide DG-1175

Seismic Qualification of Electric and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants

(Proposed Revision 3 of Regulatory Guide 1.100, dated August 1987)

This document provides Westinghouse Electric Company review and comments to the proposed revision to U.S. Nuclear Regulatory Guide (NRC) Regulatory Guide (R.G.) 1.100, "Seismic Qualification of Electric and Mechanical Equipment for Nuclear Power Plants," Revision 2.

I. Draft Regulatory Position – Section B. (DISCUSSION)

I.1 Section B. Background, 3rd Paragraph, 2nd Sentence, Page 3

"Specifically, Sections B.1 and C.1 of this regulatory guide endorse, with exceptions and clarifications, the entire IEEE Std 344-2004 and Section QR "General Requirements," and Nonmandatory Appendix QR-A, "Seismic Qualification of Active Mechanical Equipment," of ASME QME-1-2007 for the seismic qualification of electrical and active mechanical equipment, respectively."

Comment (Editorial)

The word "respectively" should be deleted since there are more than two documents and all of the documents can be used in the seismic qualification of active mechanical equipment.

Recommended Change

Delete the word "respectively."

I.2 Section B.1, 5th Paragraph, 7th Sentence, Page 5

"Some solid-state relays and microprocessor-based components are quite fragile in terms of withstanding earthquake excitations."

Comment

The following statement in our opinion has not been the case. "Some solid-state relays and microprocessor-based components are quite fragile in terms of withstanding earthquake excitations." We are not aware of any seismic issues that involve solid state relays. There are no solid-state relays and microprocessor-based components which we would consider fragile. The concern with microprocessors may be related to the connections to the buses and interfaces.

Recommended Change

The statement on solid state relays and microprocessors being sensitive should be deleted.

I.3 Section B.1, 7th Paragraph, 2nd Sentence, Page 5

"Recent studies related to the early site permit applications at certain hard-rock-based plants along the east coast of the United States indicated that the site-specific spectra may exceed the certified design spectra of those new plants in the high-frequency range (20 hertz (Hz) and above)."

Comment

DG-1175 defines high-frequency range as 20 Hz and above. It is understandable that an upper bound was not defined because it is dependent on the cutoff frequency of the hard rock site. The NRC should add a statement in this section to clarify.

Recommended Change

Further clarification should be added on how the upper limit to the high-frequency range should be defined.

I.4 Section B.1, 7th Paragraph, 8th Sentence, Page 5

"Therefore, any attempt to use such past test experience data for the seismic qualification of high-frequency-sensitive equipment or fragile components in such plants clearly is not appropriate."

Comment

This section excludes the use of previous seismic testing to address qualification of for high frequency sensitive equipment or fragile components because the high frequency motions were not intentionally input to the test. DG-1175 Section C.1.1.1.h specifies how new seismic qualification tests planned for equipment in plants with the high-frequency ground motion concern should be addressed. The criteria specified are already in IEEE Std 344-2004. Therefore, seismic test programs in compliance with IEEE Std 344-2004 (including seismic test motion) which have sufficient frequency content in the high-frequency range demonstrated through power spectral density (PSD) analysis should be acceptable.

It is unclear why does DG-1175 call out "fragile components" and what is the definition?

Recommended Change

Update section to allow pass seismic test data to permitted for addressing high frequency conditions as provided the data is in compliance with IEEE Std 344-2004 and demonstrates sufficient frequency content in the high-frequency range.

Provide addition information as to the definition and usage of the term "fragile components."

I.5 Section B.2, 1st Paragraph, Page 5

"The ASME QME-1-2007 provides functional qualification guidance for nonmetallic parts, dynamic restraints, pumps, and valves. The following sections and appendices of ASME QME-1-2007 provide the functional qualification guidance for this active mechanical equipment—(1) Section QR, (2) Nonmandatory Appendix QR-B, "Guide for Qualification of Nonmetallic Parts," (3) Section QDR, "Qualification of Dynamic Restraints," and its Nonmandatory Appendices QDR-A, "Functional Specification for Dynamic Restraints," QDR-B, "Restraint Similarity," and QDR-C, "Typical Values of Restraint Functional Parameters," (4) Section QP, "Qualification of Active Pump Assemblies," and its Nonmandatory Appendices QP-A, "Pump Specification Checklist," QP-B, "Pump Shaft-Seal System Specification Checklist," QP-C, "Pump Turbine Driver Specification Checklist," QP-D, "Pump Similarity Checklist," and QP-E, "Guidelines for Shaft-Seal System Material and Design Consideration," and (5) Section QV, "Functional Qualification Requirements for Active Valve Assemblies for Nuclear Power Plants," and its Mandatory Appendix QV-1, "Qualification Specification for Active Valves." The major change from ASME QME-1-2002 to ASME QME-1-2007 in terms of the functional qualification of mechanical equipment is a complete rewrite of Section QV and the new Mandatory Appendix QV-1."

Comment

DG-1175 Section B.2 provides information associated with functional qualification of active mechanical equipment. Regulatory Guide (RG) 1.148 also provides information on functional specification of active valves and primarily endorses ANSI N278.1-1975. Functional qualification of active mechanical equipment discuss in DG-1175 may be better suited for RG 1.148 since it presently exists.

Recommended Change

Recommend that functional qualification of active mechanical components not related to seismic qualification be discussed in a revision to RG 1.148. RG 1.100 should only provide guidance in the area of seismic qualification of electric and mechanical equipment. DG-1175 Section B.2 (Functional Qualification of Active Mechanical Equipment) should be removed and the title of DG-1175 should revert back to "Seismic Qualification of Electrical and Mechanical Equipment for Nuclear Power Plants."

II. Draft Regulatory Position – Section C.1 (Seismic Qualification of Electrical and Active Mechanical Equipment)

II.1 Section C.1.1.1c.(2), Page 9

"(2) fragile electronic components, such as solid-state relays and microprocessors-based components;..."

Comment

The phrase "fragile electronic components" in our opinion has not been observed in the seismic qualification of solid-state relays and microprocessor-based components. There are no solid-state relays and microprocessor-based components which we would consider fragile. The concern with microprocessors may be related to the connections to the buses and interfaces.

Recommended Change

The condition "(2) fragile electronic components, such as solid-state relays and microprocessors-based components: should be deleted.

II.2 Section C.1.1.1g, Page 10 (Also Section C.1.2.1g, Page 14)

"Furthermore, credit should not be taken for the inadvertent high frequencies present in some of the IEEE-344-type seismic qualification tests of equipment in the past, which may have shown the ZPA of the TRS to be up to 100 Hz."

Comment

Request further clarification as to why this position is taken in DG-1175. As written the statement would exclude the use of previous testing to address high frequency concerns since the test motion did not intentionally require input in the high frequency range. If an evaluation of the test input is performed and the data demonstrate sufficient frequency content in the high-frequency range throughout the time history through PSD analysis then the data should be acceptable. This approach is consistent with regulatory guidance in Section C.1.1.1h (also Section C.1.2.1h).

We believe IEEE Std 344-2004 provides sufficient guidance to ensure that the input is generated and in compliance with the frequency range of interest. IEEE Std 344-2004 Annex B defines how to verify the test data has sufficient content over the frequency range of interest throughout the input time history.

Recommended Change

Clarify that the subject test data is not acceptable unless further evaluation is performed and data generated to demonstrate there is sufficient frequency content over the frequency range of interest.

II.3 Section C.1.1.1i, Page 10 (also Section C.1.2.1j, Page 14)

"Electric equipment should be qualified with five one-half SSE events followed by one full SSE event (SECY-93-087) (Ref. 28) even if the OBE of a plant is defined to be one-third of SSE or less. Alternatively, a number of fractional peak cycles equivalent to the maximum peak cycle for five one-half SSE events may be used in accordance with Annex D, "Test Duration and Number of Cycles," to IEEE Std 344-2004, when followed by one full SSE."

Comment

The DG-1175 position does not recognize that some plants are licensed with an OBE that is greater or less than one-half SSE. The document SECY-93-087 addressed issues affecting Advanced Light-Water Reactors (ALWRs), for which the OBE eliminated from design certification when the OBE is established at less than or equal to one-third the SSE. It also states the following:

> *"With the elimination of the OBE, two alternatives exist that will essentially maintain the requirements provided in IEEE Standard 344-1987 to qualify equipment with the equivalent of five OBE events followed by one SSE event (with 10 maximum stress cycles per event). Of these alternatives, the staff concludes that equipment should be qualified with five one-half SSE events followed by one full SSE event. Alternatively, a number of fractional peak cycles equivalent to the maximum peak cycles for five one-half SSE events may be used in accordance with Appendix D of IEEE Standard 344-1987 when followed by one full SSE."*

Recommended Change

This section should be updated to identify the present wording is associated with qualification of equipment for new plant designs. Wording should also be added to identify for other applications the OBE requirement is based on plant specific licensing requirements.

[For Section C.1.2.1j, Page 14 the recommended change is applicable to active mechanical equipment.]

II.4 Section C.1.1.1j, Page 10

"The IEEE Std 344-2004 recommended no damping values. The damping values listed in Table 6 of NRC Regulatory Guide 1.61, Revision 1, "Damping Values for Seismic Design of Nuclear Power Plants," (Ref. 29) issued in March 2007, are recommended. These damping values are the updated values currently acceptable to the NRC staff."

Comment

DG-1175 is recommending use of NRC Regulatory Guide 1.61, Revision 1 damping values. This is not appropriate since older plants as well as AP1000 uses damping values consistent with Regulatory Guide 1.61, Rev. 0.

In addition, IEEE Std 344-2004 sub-clause 6.3.1 (Application of damping in analysis) identifies "Appropriate values of damping may be obtained from tests or other justifiable sources." IEEE Std 344-2004 sub-clause 6.3.2 (Application of damping in testing) and 8.6.1.3 (Damping selection) identify for testing "The RRS are usually specified at several levels of damping. When available, the RRS with a damping of 5% is the recommended choice for use in testing."

Recommended Change

This section should be reworded to indicate the version of Regulatory Guide 1.61 as included in the plant licensing basis. This sentence dealing with damping in IEEE Std 344-2004 should also be deleted.

II.5 Section C.1.1.2k, Page 12

"A coherence function of less than 0.5 and an absolute value of the correlation coefficient function of less than 0.3 are not acceptable. The NRC positions on the numerical values for the coherence function and the correlation coefficient function for defining statistically independent motions are the same as in Reference 34, particularly the following:

i. For the coherence function, numerical values ranging from 0.0 to a maximum of 0.3 and an average of approximately 0.2 are acceptable.

ii. An absolute value of less than 0.16 for the correlation coefficient function is acceptable."

Comment

The coherence function and correlation coefficient limits appear to be restrictive. IEEE Std 344-2004 and IEEE Std 344-1987 specifies that either coherence function and correlation coefficient limits criteria must be met for the shake table test to be valid. That is: either the coherence function must be less than or equal to 0.5 at all frequencies of interest or the correlation coefficient need be less than 0.3. Both criteria need not be passed, just one or the other. The coherence function and cross correlation coefficient were originally developed in ASME Paper 83-PVP-22 based on his review of several actual earthquakes and used in the development of requirements initially in IEEE Std 344-1987. We are not aware of any new industry data which would change this position.

In addition, Reference 34 (ASME Boiler and Pressure Vessel Code, Section III Division 1, Article N-1213.1 of Nonmandatory Appendix N) of DG-1175 is addressing the development of time history input for analysis where you are developing inputs associated with a specific instructure required response spectra. Where as, for seismic testing, the inputs are normal generic in nature (multiple plant sites/locations) and the RRS will be most likely the same in both horizontal axes as a minimum.

Recommended Change

This section should be updated to concur with the present criteria in IEEE Std 344-2004 for test input generation associated with coherence function and correlation coefficient limits and its usage.

II.6 Section C.1.2.1a, Page 13

"In endorsing the use of ASME QME-1-2007, the staff noticed that several appendices are designated as either nonmandatory or mandatory (e.g.,

Nonmandatory Appendix QR-A; Nonmandatory Appendix QR-B; Nonmandatory Appendices QDR-A, QDR-B, and QDR-C; Nonmandatory Appendices QP-A, QP-B, QP-C, QP-D, and QP-E; and Mandatory Appendix QV-1). The staff position is that, once the user commits to the use of ASME QME-1-2007 for its qualification of active mechanical equipment in NPPs, the criteria and procedures delineated in those appendices then become the requirements for its qualification program, unless the deviations are justified."

Comment

RG 1.148 may be a more correct place for the Operability portion of QME-1. Including the operability portions of ASME QME-1-2007 into DG-1175 may create a potential conflict with RG 1.148.

DG-1175 indicates that "The staff position is that, once the user commits to the use of ASME QME-1-2007 for its qualification of active mechanical equipment in NPPs, the criteria and procedures delineated in those appendices then become the requirements for its qualification program, unless the deviations are justified." ASME QME-1-2007 includes Nonmandatory Appendix QV-A "Functional Specification for Active Valves for Nuclear Power Plants." This nonmandatory appendix represents a potential for conflict with RG 1.148.

RG 1.148 Value/Impact Statement, Section Value (page 5) states, "It is anticipated that the most important contributions from ANSI N278.1-1975 will be realized when subsequent standards, which are currently being developed to address such topics as valve assembly functional qualification and production, are in place to provide a set of requirements covering various aspects of valve assembly operability." ASME QME-1-2007 represents the latest development in valve assembly functional qualification and production indicated. While it is not specifically noted that RG 1.148 will be revised to endorse these requirements it seems logical that all requirements regards functional qualification should be gathered into a single regulatory position. Because RG 1.148 already addresses some portion of functional qualification it would be the logical place for all functional qualification to be gathered. RG 1.100 has previously only addressed seismic qualification which is only a of functional qualification.

Recommended Change

Recommend regulations dealing with ASME QME-1-2207 in the area functional qualification be moved to RG 1.148.

II.7 Section C.1.2.1g, Page 14

"For certain hard-rock-based plants, the site-specific spectra may exceed the certified design spectra in the high-frequency range. This guide refers to this phenomenon as the high-frequency ground motion concern. As a result of the high-frequency ground motion, the seismic input to SSCs may also contain high-frequency excitations. For operating BWR plants, the seismic qualification of some safety-related active mechanical equipment were performed using IEEE-344-type tests with intentional high-frequency contents to account for concurrent BWR hydrodynamic loads. However, the vast majority of existing seismic

qualification tests used input frequencies up to only 33 Hz. These past test experience data are therefore not acceptable for the seismic qualification of high-frequency-sensitive equipment or fragile components. Furthermore, credit should not be taken for the inadvertent high frequencies present in some of the IEEE-344-type seismic qualification tests of equipment in the past, which may have shown the ZPA of the TRS to be up to 100 Hz. Ball joints and kinematics linkages of the shake tables could have generated these inadvertent high frequencies, and the NRC staff considers them to be noise signals that may not have the proper frequency content with sufficient energy to be compatible with the amplified region of the RRS at high frequencies."

Comment

Request further clarification as to why DG-1175 (Regulatory Positions on ASME QME-1) discusses high frequency response. The DG-1175 should limit discussions and positions to high frequency sensitive equipment. We believe that mechanical equipment is not sensitive to high frequency. DG-1175 position on high frequency sensitive equipment should only be applied to sensitive electrical component which may be attached to the mechanical equipment.

As written the statement would exclude the use of previous testing to address high frequency concerns since the test motion did not intentionally require input in the high frequency range. If an evaluation of the test input is performed and the data demonstrate sufficient frequency content in the high-frequency range throughout the time history then the data should be acceptable. This approach is consistent with regulatory guidance in Section C.1.1.1.h.

We believe IEEE Std 344-2004 provides sufficient guidance to ensure that the input is generated and in compliance with the frequency range of interest. IEEE Std 344-2004 Annex B defines how to verify the test data has sufficient content over the frequency range of interest throughout the input time history.

Therefore, seismic test programs in compliance with IEEE Std 344-2004 (including seismic test motion) which have sufficient frequency content in the high-frequency range demonstrated through PSD analysis should be acceptable.

Recommended Change

Update section to clarify that electrical component which may be attached to the mechanical equipment may be high frequency sensitive and are address by this section. Allow pass seismic test data to permitted for addressing high frequency conditions as provided the data is in compliance with IEEE Std 344-2004 and demonstrates sufficient frequency content in the high-frequency range.

III. Draft Regulatory Position – Section C.2 (Functional Qualification of Active Mechanical Equipment)

III.1 Section C.2.1 1st paragraph Page 17

"In general, the NRC staff finds ASME QME-1-2007 acceptable for the functional qualification of (1) active mechanical equipment in new NPPs; and (2) new addition or replacement of active mechanical equipment in operating NPPs, subject to the following provisions:

Comment

Section C.2 of DG-1175 provides information associated with functional qualification of active mechanical equipment. Regulatory Guide (RG) 1.148 also provides information on functional specification of active valves and primarily endorses ANSI N278.1-1975. Functional qualification of active mechanical equipment discuss in DG-1175 may be better suited for RG 1.148 since it presently exists.

Recommended Change

Recommend that functional qualification of active mechanical components not related to seismic qualification be discussed in a revision to RG 1.148. RG 1.100 should only provide guidance in the area of seismic qualification of electric and mechanical equipment. DG-1175 Section B.2 (Functional Qualification of Active Mechanical Equipment) should be removed and the title of DG-1175 should revert back to "Seismic Qualification of Electrical and Mechanical Equipment for Nuclear Power Plants."