

# PUBLIC SUBMISSION

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**Docket:** NRC-2015-0161

Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Startup Testing

**Comment On:** NRC-2015-0161-0001

Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Startup Testing

**Document:** NRC-2015-0161-DRAFT-0002

Comment on FR Doc # 2015-16284

## Submitter Information

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**Submitter's Representative:** Westinghouse Electric Company

**Organization:** Westinghouse Electric Company

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## General Comment

Please see attached file.

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## Attachments

LTR-NRC-15-72

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**SUNSI Review Complete**

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Add= *D. Garbarough (795)*



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LTR-NRC-15-72

August 25, 2015

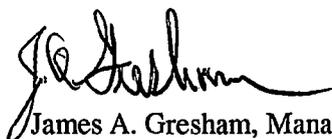
Subject: **Transmittal of Westinghouse Electric Company Comments on Draft Regulatory Guide DG-1323 [Docket ID NRC-2015-0161]**

Dear Ms. Bladey,

Thank you for the opportunity to provide comments on the proposed Revision 4 of Regulatory Guide 1.20, "Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Startup Testing."

Please find enclosed the Westinghouse Electric Company (Westinghouse) comments on the draft Regulatory Guide.

For technical questions regarding the enclosed comments, please contact Richard Vollmer at (412) 374-2559 or Karen Fujikawa at (720) 733-9753.

  
James A. Gresham, Manager  
Regulatory Compliance

Attachment

Westinghouse Comments on DG-1323

Section	Paragraph Heading	Comment
General	N/A	<p>Organization of the document is confusing. For example, there are many instances where a paragraph with general applicability includes statements specific to BWR steam dryers. Recommend reorganizing into separate sections for (1) PWRs, (2) BWRs, and (3) Small Modular Reactors.</p>
		<p>Recommend organizing the document starting with the format from Rev. 2 of the Reg. Guide, and adding new information in appendices or sub-paragraphs. In particular, background and anecdotal information should be clearly identified as such, and separated from the actual regulatory guidance.</p>
		<p>Overall readability of, and citations within, the document would be improved if subheadings were numbered.</p>
		<p>The document includes a significant amount of detailed information that is not strictly regulatory guidance. Consider publishing these details and lessons-learned in alternate documentation (i.e., IAEA FSI guidelines, ASME Section III Appendix N, etc.), or perhaps in a separate appendix to the Reg. Guide.</p>
		<p>The document includes many details, such as specific frequency ranges, damping values, fillet weld analysis methods, etc., which are not generically applicable. These details should be made more general to "consider" appropriate frequency ranges, damping values, stress analysis methods, etc. Also, the document should not conflict with ASME Section III requirements for stress evaluations.</p>
		<p>It is often unclear what text is background information vs. expectations for a predictive analysis, measurement program, or inspection program. Please rework the document to clearly define the regulatory expectations for a CVAP separately from background or lessons-learned information.</p>
		<p>Much of the guidance in the text is not tied to an FIV excitation mechanism, i.e., the organization is not phenomenological. Recommend reorganizing the document to first identify the FIV mechanisms and then, for a given mechanism (for a given type of reactor), provide the appropriate regulatory guidance.</p>
		<p>There are several instances throughout the document where terms such as "power ascension" and "power level" are used (e.g., Section C.2.1.2, pg 18; C.2.1.3, pg 24 &amp; 26; C.2.2.3.b; C.2.2.3.c; C.2.5.c). These terms imply that the associated discussion is only applicable to BWRs, since CVAP testing with reactor power is unique to BWRs. If the discussion is intended to be specific to BWRs, this should be stated explicitly. If the discussion is intended to be generic, it should be reworded accordingly (e.g., FIV loads on PWR internals are a function of flow rate, which is not dependent on power level).</p>

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Section	Paragraph Heading	Comment
Background	N/A	Page 5: Define the term “secondary welds” in the BWR steam dryers.
C.1.4	Special Considerations...	Define a “high margin of safety.”
C.2.a	FIV and AR...	Provide guidance on the approach to be utilized to determine the hydrodynamic loading on the steam dryer due to “boiling water rumbling.”
C.2.1.1	Modes of Vibration	Specifying 2.5% frequency increments is unnecessarily specific. Consider removing 2.5% frequency increment guidance.
	Frequency Response Functions	<p>Stress Concentration Factors (SCFs) should not be used to account for errors in a finite element model; rather SCFs are employed to account for geometric discontinuities or other peak stress effects that cannot be effectively modeled.</p> <p>The last paragraph of this section appears to be intended to cover all designs, but may not be generally true. This should be reworded to indicate that “ill-defined boundary conditions” should be evaluated where they have a significant impact on the response of the component. In some case, test data shows that installation/assembly does not affect the frequency response of the component.</p>
C.2.1.2	Forcing Functions	Add flexibility to utilize only on-dryer strain gauges for the end-to-end benchmarking. Pressure transducers are supplemental and can be utilized to determine the load definition but are not required.
	Flow Excitation Feedback and Lock-In Mechanisms	This section is very detailed regarding acoustics but doesn't cover other common topics like fluid-elastic instability (FEI) and vortex shedding lock-in (VSLI). Further, this level of detail would be more appropriately included in ASME Section III, Appendix N.
	Scale Model Testing	<p>Paragraph “g”: Reword to clarify that evaluation of narrowband response is important for certain situations, but not all. In some cases, broadband (total RMS) behavior with respect to flow is more relevant to the component response than individual frequency responses.</p> <p>Paragraph “j”: Reword to not require plant-specific data to demonstrate acceptability of a scale model test. Some scale model tests may be of unique configurations for which there is no comparable plant.</p>
C.2.1.2	CFD Modeling	Paragraph “b”: Reword to replace “including proper definitions and representations of the smallest flow areas” with more general guidance to appropriately consider the effect of small flow passages. Rephrase the statement to provide general guidance to use sound judgment and provide validation where necessary in CFD modeling.

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Section	Paragraph Heading	Comment
		<p>Paragraph “c”: The term “local velocity” is ambiguous, and could be misinterpreted. Further, depending on circumstances, higher local velocities may not result in more limiting flow-induced loads. Recommend rewording the guidance to ensure effects such as high local velocities are appropriately considered.</p>
C.2.1.3	<p>Computing and Benchmarking Structural and Acoustic Operational Response</p>	<p>Fourth paragraph, last sentence: Replace with “For vibration analyses governed by a response at a specific frequency, frequency-dependent bias errors and uncertainties may need to be determined.” Requiring frequency-dependent bias and uncertainty quantification in every situation is not appropriate.</p>
	<p>Computing and Benchmarking Structural and Acoustic Operational Response</p>	<p>Fifth paragraph: Please define what is meant by a cumulative stress spectrum plot. Is the last sentence in this paragraph asking for an RMS stress to be provided? Are static equivalents still acceptable for simple structures? Consider deleting this paragraph; as-written, the regulatory guidance provided by this paragraph is unnecessary and unclear.</p>
		<p>Eighth paragraph: This paragraph implies that 1% damping is generically endorsed by the NRC. However, damping ratios for certain structures/modes could be than 1%. Suggest rewording to specify the basis for the reference damping ratio (1% or otherwise).</p>
	<p>Benchmarking of Overall (End-to-End) Computed Response</p>	<p>First paragraph: Modify the requirement to “validate the simulation of intermediate quantities, such as loads....” to reflect that the load measurement/prediction comparisons are supplemental and are not required.</p>
		<p>Second paragraph: This paragraph states the standard practice is to provide 2 sigma uncertainties. Does this imply that 2 sigma stress results are required as well (this would mean using an RMS to Peak factor of less than 3-sigma)? This would impact pending revisions to ASME Section III Appendix N.</p>
	<p>Stress Convergence and High-Cycle Fatigue Evaluation</p>	<p>First paragraph: This paragraph (and paragraph “c” 3rd sub-paragraph) implies a factor of safety is required in the fatigue analysis, which is then removed after adjustment of the analysis based on power ascension test data. This appears to be applicable to BWRs only, but the first sentence implies this is expected for PWRs also. Please clarify the guidance in this section.</p>
<p>Paragraph “a” (1st sub-paragraph) states that “widely-used” software must be used. This is highly subjective. Suggest replacing “widely-used, well-verified” with “sufficiently validated and verified.”</p>		

## Westinghouse Comments on DG-1323

Section	Paragraph Heading	Comment
C.2.1.3	Stress Convergence and High-Cycle Fatigue Evaluation	Paragraph "a" (3rd sub-paragraph) states "...the intended use of the stress analysis output." Some finite element models do not supply a stress output; in some cases a displacement or force output from one model is used as a boundary condition in a (subsequent) more detailed model for calculating stress. Suggest removing "stress" from the first sentence.
		Paragraph "a" (4th sub-paragraph) states the time increment should be no larger than 0.125 times the shortest period of interest, while paragraph "c" states the time increment should be no larger than 0.25 times the shortest period of interest. This is conflicting guidance. Consider generalizing this guidance to ensure a sufficiently converged solution, for example, confirming that time steps are sufficiently small in a time-history analysis.
		Paragraph "a" (4th sub-paragraph) states that the lower bound "anchor" frequency for Rayleigh damping should be 0Hz. This is not appropriate for generic guidance, i.e., the lower anchor frequency could be appropriately greater than zero.
		Paragraph "a" (5th sub-paragraph): Modify the damping value restriction for steam dryer to "Higher damping values greater than 1.0 for BWR steam dryers can be utilized providing sufficient justification/documentation is provided." This is consistent with RG 1.20 Rev. 3 guidance.
		Paragraph "c": 1) Does this approach only apply to double fillet welds? 2) Does this override the ASME Code requirement of an FRSF of 4 for fillet welds (under Method 2)? This seems out of place; suggest removing this paragraph from the Reg. Guide and publishing in alternate documentation. Then state more generally that fatigue analysis methods must be sufficiently documented and justified, etc.
		Paragraph "c": Method 1 – Is this saying the FRSF of 4 accounts for any local stresses in the weld that are not accounted for in the plate stresses?
		Paragraph "c": Method 2 – Is there justification (e.g., publication or test data) that supports reducing the weld FRSF from 4 to 3? This is not consistent with ASME Code, Section III, subsection NG.
		Paragraph "c": There are other weld types that are not included in this discussion. Also, the additional safety factor of 2 for the design phase should be removed. ASME Code allowable/guidance should be allowed to be utilized for the design phase.
C.2.2	Vibration and Stress Measurement Program	First paragraph: Quantify the statement "less margin of safety against such effects."
		First paragraph: Revise "Instrumentation will be needed for new components that have no operating experience" to add allowance for justification for no instrumentation for this new component.

**Westinghouse Comments on DG-1323**

Section	Paragraph Heading	Comment
C.2.2.2	In-plant Measurement Issues	Consider removing this list from the Reg. Guide and publishing as best-practice guidance in alternate documentation.
		Paragraph "e": Repword to say "...result in erroneous measurements of vibration rather than surface pressure."
C.2.2.3	Vibration Measurement Program Documentation	Paragraph "b": The term "power ascension" is specific to BWRs. Some discussions within this paragraph may apply to PWRs (e.g., flow rate variation), but the paragraph mixes things that are specific to BWRs vs. general.
		Paragraph "c": Define "permissible deviations" with respect to acceptance criteria (max allowable response). Also, the first mention of "acceptance criteria" occurs in the vibration measurement program (paragraph 2.2) and not the vibration analysis program (paragraph 2.1) – is that intentional?
		Paragraph "e": This paragraph only discusses fuel assemblies, but should be generalized to address all significant differences between the CVAP test configuration and conditions and normal operating configuration and conditions.
C.4.2	Vibration Measurement Program	First paragraph: Remove "other than steam dryers."