

# BWR OWNERS' GROUP

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BWROG-06048  
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Project Number 691

Document Control Desk  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

Subject: **Comments on Draft Regulatory Guidance Regarding Adverse Flow Effects**

Attachment: Comments on Draft Regulatory Guidance Provided in BWROG/NRC Public Meeting, November 8, 2006

The BWROG met with NRC staff on November 8, 2006 to discuss responses to NRC staff comments on, and revisions to, BWROG report NEDO-33159, Revision 0, "Extended Power Uprate (EPU) Lessons Learned and Recommendations."

In that meeting, the staff provided draft regulatory guidance regarding adverse flow effects on reactor vessel internals and plant systems. The draft guidance was discussed briefly and the staff invited the BWROG to provide comments.

The BWROG appreciates the opportunity to provide the attached comments. While the BWROG agrees that flow induced vibrations should be addressed in power uprate applications, the draft guidance establishes requirements for extensive analysis and testing for a substantial number of plants (applies to major modifications, all power uprates of *any* magnitude, and new plants). The scope of the increased requirements will be very costly. Given the history of operating experience at significant increases in power with relatively few significant equipment failures of the plants, the increased requirements do not appear to be necessary in all cases. The attached comments provide additional details.

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If you have questions or desire further discussion, feel free to contact me at  
(205) 992-7475, or [rbunt@southernco.com](mailto:rbunt@southernco.com).

Regards,

A handwritten signature in black ink, appearing to read "R. Bunt". The signature is fluid and cursive, with the first letter of each name being significantly larger and more stylized.

Randy Bunt (SNC)  
Chair

BWROG Owners' Group

cc: Tom Alexion, NRC Project Manager  
Michelle Honcharik, NRC Project Manager  
Doug Coleman, BWROG Vice-Chair  
Tom Hurst, BWROG Program Manager  
BWROG Extended Power Uprate Committee  
BWROG Primary Representatives  
BWROG Executive Oversight Committee

**Comments on Draft Regulatory Guidance Provided in BWROG/NRC Public  
Meeting  
November 8, 2006**

**General Comments:**

The document establishes requirements for extensive analysis and testing for a substantial number of plants (applies to major modifications, all power uprates of any magnitude, and new plants).

The experience with power uprates does not support the need for this scope of additional requirements. There have been 112 power uprates approved by NRC since 1977, with uprates ranging from 0.4% to 20% of original licensed thermal power. Extended power uprates have been implemented on 15 BWRs worldwide since 1993. These extended power uprates increased power from 6% to 20% of original licensed thermal power. This represents a long history of operating experience at significant increases in power with relatively few significant equipment failures. Thus, the scope of the increased requirements will be very costly and given the operating history of the plants, no clear nexus to safety.

The conservatism imposed on steam dryer analyses performed to date have already been shown to yield obviously overly-conservative and inappropriate results. For example, a recent finite element analysis performed for a two unit BWR/4, predicted more than a dozen dryer components to fail within the first cycle at original licensed thermal power. However, the units have been operating at current power levels for over 10 years with only one fatigue related crack. Since uncertainties and bias have to be considered in the analyses, modifications or replacement of steam dryers have resulted in significant costs and radiological dose that may not be necessary.

The proposed text appears to be too prescriptive for a typical Standard Review Plan document. The Introduction of the Standard Review Plan states:

“The Standard Review Plan (SRP) is prepared for the guidance of staff reviewers in the Office of Nuclear Reactor Regulation in performing safety reviews of applications to construct or operate nuclear power plants and the review of applications to approve standard designs and sites for nuclear power plants. The principal purpose of the SRP is to assure the quality and uniformity of staff safety reviews.”

Generally, the SRP should be the higher level issues, dictating what considerations are expected when pursuing a power uprate. The explicit detail on analytical methods appears to be inappropriate for the SRP. Specifying explicit details on the analytical and test methods for quantifying the physical phenomena and system responses may not be comprehensive and may exclude alternatives and future improvements in methodologies that may be more appropriate for the cause of the pressure fluctuations and vibration loads.

## Specific Comments

### Comments on Section titled:

#### DRAFT GUIDANCE BEING CONSIDERED REGARDING REVIEW OF POTENTIAL ADVERSE FLOW EFFECTS ON REACTOR VESSEL INTERNALS AND NUCLEAR POWER PLANT SYSTEMS

#	Page	Section	Comment
1	1	1	<p>There appears to be no lower threshold for “uprate” magnitude requiring this level of effort. This implies that the full scope is required regardless of the magnitude of the power uprate. Experience with power uprates to date<sup>1</sup> confirms that the level of analysis and testing prescribed by the draft guidance is unnecessary. Relatively few significant problems with acoustic resonance vibrations have occurred and there have been only two instances of a dryer failure (i.e., generated a loose part) as a result of flow induced vibrations. The draft guidance should be revised to limit applicability or define acceptable arguments/analyses to show that the guidance does not apply so that unnecessary analyses and testing are not imposed.</p> <p>The generic "scope" statement contains only one example of a “major modification”, a steam generator replacement. This could lead to inconsistent application by the staff. The guidance needs to include many more examples, or the qualifying criteria for a “major modification”. Conversely if a steam generator replacement is all that qualifies, state that rather than the vague "major modification".</p> <p>The last sentence of this section implies that licensees would be expected to confirm scale model testing, structural and acoustic analysis, <i>and</i> CFD results. This sentence should be reworded as follows: “Licensees of operating power plants will be expected to obtain plant-specific data to support analyses such as scale model testing, structural and acoustic analysis, and/or CFD results ...”</p>
2	1	2	<p>The expectation for all BWRs to include steam dryer instrumentation is unnecessary for power uprates with operating experience that confirms acoustic pressures are insignificant. If other analytical and/or testing methods can be used to determine the dryer response to the power uprate, dryer instrumentation should not be required. It may be appropriate to use steam dryer instrumentation as part of a benchmarking plan for the analysis methodologies.</p>

<sup>1</sup> 112 power uprates have been approved by NRC since 1977. These uprates have ranged between 0.4% and 20% reactor thermal power. NRC web site, November 28, 2006, <http://www.nrc.gov/reactors/operating/licensing/power-uprates/approved-applications.html>

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3	2	3	<p>It should be noted that the BWR steam dryer is not an ASME component. This section appears to upgrade the steam dryer to an ASME component. This is impractical since the fabrication controls and pertinent documentation for an ASME component will not be available. There should be some acknowledgement that the ASME Code is not the only acceptable criteria/methodology.</p>
4	2	4	<p>This section pertains to PWR steam generators and states, "Past operating experience and analysis may be used to support the determination of adequate design margin for the stress on PWR steam generator internal components". This is appropriate for BWRs as well, and should be identified as an option for BWRs.</p>
5	2	5 Next-to-last sentence	<p>The example is given of feedwater flow around a feedwater sample probes as an acoustic resonance source. The feedwater sample probes are more appropriately characterized as flow induced vibration concerns than acoustic.</p> <p>The only resolution provided for acoustic resonance is to make modifications to "reduce the pressure fluctuations and vibration levels". While that may be an appropriate resolution, there could be cases where only a limited number of known weak components could be modified to withstand the increased loading. This statement should revised to include this possible solution.</p>
6	3	6	<p>This requires interactions with NRC staff during power ascension hold points or when acceptance criteria are not met and staff review of information before further power ascension or continued full power operation. NRC Staff review of power ascension test plans and acceptance criteria is appropriate, however, this level of staff involvement during the testing appears unnecessary. This will result in significant increase in cost (staff resources), and is inconsistent with regulatory oversight standards.</p> <p>A summary evaluation of plant startup "<u>within 90 days of plant startup</u>" and potentially a supplemental report is required. The purpose of the report is unclear. As such, this appears to be an unnecessary administrative burden. The staff should consider the purpose of the report (i.e., how it is to be used, what will be done with it, who will see it, etc.) and determine the cost/benefit. Such a report may not be needed in all circumstances (e.g., if acceptance criteria were met at each hold point). If this summary report is required, plant startup must be clearly defined (e.g., reactor criticality, breaker closed, 100% power, etc.).</p>
7	3	7	<p>A long term monitoring plan is not appropriate for all applicants. Once the power ascension data have been shown to satisfy applicable limits, there is no further need to monitor plant data and vibration sensors. Long term monitoring should only be required if a system or component modification is</p>

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			<p>made to reduce or eliminate an existing load (e.g., addition of an acoustic damping device that reduces the magnitude of pressure fluctuations in a system). The purpose of the long term monitoring would be to ensure the modification continues to function as designed and mitigate the existing load. In these cases, long-term should be defined as one cycle of operation unless specific circumstances warranted a longer period.</p> <p>It is agreed that during power ascension testing, walkdowns should be conducted to identify potential adverse flow effects. However, for a BWR, inspections and walkdowns at “full licensed power conditions”, in some areas, will result in significant dose to workers. This should be noted in the guidance and provisions made for some of the inspections/walkdowns to be conducted during refueling outages.</p>

**Comments on Section titled:**

**DRAFT GUIDANCE BEING CONSIDERED REGARDING REVIEW OF  
DYNAMIC TESTING AND ANALYSIS FOR POTENTIAL ADVERSE FLOW  
EFFECTS**

<b>#</b>	<b>Page</b>	<b>Section</b>	<b>Comment</b>
8	4	3.a.(3)	This item specifically requires estimation of bias and uncertainties of frequency response function amplitudes based on measurements of similar structures. This requirement may not be possible or unnecessarily burdensome, since some internal structures would have to be replicated in order to perform the required hammer tests. The uncertainty and bias associated with structural difference between the finite element model and the real component can be evaluated by appropriately shifting the frequency content of the applied forcing functions.
9	6	3. b (2) (a)1	This discusses the dynamic similarity of a scale model and states "structural" parameters should be considered. Similarity of the geometrical parameters is required of the scale model, however structural similarity is not required.
10	7	3.(2) (c) 1	This section indicates that no acoustic sources should exist between measurement locations. This is a consideration in current modeling practices using two measurement locations on a steam line to imply the acoustic response at the nozzle. If three locations were measured, it would potentially be acceptable to have a source between measurement points. This option should be provided.
11	9	4	This section defines requirements for reactors that have experienced "dryer failures". This is open to interpretation. Dryer failures should be defined as failures that resulted in loose parts.
12	10	4.d. and e.	<p>These two paragraphs conflict. Part d. says the test period has to be long, inferring that adverse flow effects are an "over time issue". Part e. says that the test should include "upset transients", without defining these. "Upset transients" are of short duration and the effects of them are limited because of their duration and tend to generate only impulsive loads.</p> <p>It would seem that a test program that induces upsets could be more of a safety issue than any perceived benefit from measuring effects. The risk/benefit must be carefully considered by NRC before imposing this.</p>

**Comments on Section titled:**

**DRAFT GUIDANCE BEING CONSIDERED REGARDING VIBRATION  
ASSESSMENT PROGRAMS FOR POTENTIAL ADVERSE FLOW EFFECTS**

<b>#</b>	<b>Page</b>	<b>Section</b>	<b>Comment</b>
13	15	2.1(3) (c)(a)	This section indicates that no acoustic sources should exist between measurement locations. This is a consideration in current modeling practices using two measurement locations on a steam line to imply the acoustic response at the nozzle. If three locations were measured, it would potentially be acceptable to have a source between measurement points. This option should be provided.
14	16	2.1(3) (c)(e)	This refers to the "chimney". It is not clear what is intended by this term. Is this the steam separator tubes?
15	18	2.2 3rd paragraph	This discussion involves instrumented dryers. Fully instrumenting a steam dryer for an EPU test program does not seem justified for a EPU licensee where strain gauge data should suffice. Prior discussions with the staff indicated that this only applies to new plants. This should be clarified so there is no confusion.