

2012-037 _____ BWR Vessel & Internals Project (BWRVIP)

February 3, 2012

Document Control Desk
U. S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852

Attention: Andrew Hon


Subject: Project No. 704 – BWRVIP Response to NRC Request for Additional Information
on Appendix B of BWRVIP-139

Reference: Letter from Jonathan Rowley (NRC) to David Czufin (BWRVIP Chairman),
“Request for Additional Information on Appendix B of BWRVIP-139, BWR Steam
Dryer – Demonstration of Compliance with the Technical Information Requirements
of the License Renewal Rule [10 CFR 54.21], (TAC NO. ME2188),” dated
September 10, 2010.

Enclosed are five (5) copies of the BWRVIP response to the NRC Request for Additional
Information (RAI) on Appendix B of BWRVIP-139 entitled “BWR Steam Dryer –
Demonstration of Compliance with the Technical Information Requirements of the License
Renewal Rule [10 CFR 54.21].” The RAI was transmitted to the BWRVIP by the NRC letter
referenced above.

If you have any questions on this subject please call Randy Schmidt (PSEG Nuclear, BWRVIP
Assessment Committee Technical Chairman) at 856.339.3740.

Sincerely,



Dave Czufin
Exelon
Chairman, BWR Vessel and Internals Project

Together . . . Shaping the Future of Electricity

PALO ALTO OFFICE
3420 Hillview Avenue, Palo Alto, CA 94304-1395 USA • 650.855.2000 • Customer Service 800.313.3774 • www.epri.com

Additional copies
were sent to the PM

0004
NRR

**Response to NRC Request for Additional Information on Appendix B of
BWRVIP-139 "BWR Steam Dryer – Demonstration of Compliance with the
Technical Information Requirements of the License Renewal Rule (10 CFR 54.21)**

Each item from the NRC Request for Information (RAI) is repeated below verbatim followed by the BWRVIP response to that item.

NRC RAI - BWRVIP139-APP. B-EMCB-RAI-1

Section B.3 (b) paragraph 5, Page B-3: Assessment of Aging Effects and Programs:

The TR mentions that additional guidance for demonstrating steam dryer integrity under power up rate conditions is contained in the BWRVIP-182 and BWRVIP-194 TRs. The staff notes that it has not completed the review of the BWRVIP-194 TR and has identified several issues pertaining to the steam dryer structural integrity evaluation that are yet to be resolved. Therefore, the staff requests that the BWRVIP address the following issue below:

Currently, the BWRVIP has not submitted the BWRVIP-194 TR for comprehensive technical review, and there is no firm date for its submittal. Initially, we performed an acceptance review based on a cursory review of the BWRVIP-194 TR and identified several technical issues based on current EPU reviews. After BWRVIP revises and resubmits the BWRVIP-194 TR, we will commence our technical review. The review of the BWRVIP-194 was suspended. Therefore, based on this, the staff requests that the BWRVIP propose an acceptable method to address the reference to the BWRVIP-194 TR, which is currently a non-staff endorsed TR. This RAI could likely result in placing a condition in the safety evaluation to the reference of the BWRVIP-194 TR.

BWRVIP Response to NRC RAI - BWRVIP139-APP. B-EMCB-RAI-1

For the purposes of this License Renewal Appendix to BWRVIP-139-A reference need only be made to BWRVIP-182-A which provides guidelines for demonstrating steam dryer integrity for power uprate. BWRVIP-182-A has been approved by NRC and the "-A" version will be referenced in the License Renewal Appendix to BWRVIP-139-A. The reference to BWRVIP-194 will be deleted from the Appendix.

NRC RAI – BWRVIP139-APP. B EMBC-RAI-2

Section B.3 (a) paragraph 2, Page B-2, Description of Aging Effects:

The BWRVIP is requested to provide supporting justification to confirm the statement that "the crack growth due to inter-granular stress corrosion cracking has been shown to be stable, and in many cases self-limiting".

BWRVIP response to NRC RAI – BWRVIP139-APP. B EMBC-RAI-2

Management of IGSCC in BWR internals is a primary objective of the BWR Vessel and Internals Project. For safety-related BWR internals components and important nonsafety-related internals components such as the steam dryer, the BWRVIP has published inspection and evaluation guidance that has been shown to be effective in managing IGSCC. Implementation of these guidelines has resulted in development of a significant inspection database that can be used to characterize the performance of BWR internals. Review of the historical steam dryer inspection data resulting from fleet-wide implementation of BWRVIP-139-A demonstrates that IGSCC cracks identified on steam dryers typically exhibit either very slow or no growth over many cycles of operation, see Steam Dryer Sections of [1,2,3,4]. Repair of IGSCC type cracking in steam dryers is rarely needed because growth is stable and not structurally significant. These data demonstrate that the potential for IGSCC-induced crack growth is well characterized.

1. BWRVIP Letter 2011-060, from David Czufin, BWRVIP Executive Chairman, to Document Control Desk, U.S. Nuclear Regulatory Commission, Attention Jonathan Rowley, "Project No. 704 – BWR Vessel and Internals Inspection Summaries for Spring 2010 Outages", March 24, 2011.
2. BWRVIP Letter 2010-195, from David Czufin, BWRVIP Executive Chairman, to Document Control Desk, U.S. Nuclear Regulatory Commission, Attention Jonathan Rowley, "Project No. 704 – BWR Vessel and Internals Inspection Summaries for Fall 2009 Outages", September 1, 2010.
3. BWRVIP Letter 2010-052, from Rick Libra, BWRVIP Executive Chairman, to Document Control Desk, U.S. Nuclear Regulatory Commission, Attention Michael McCoppin, "Project No. 704 – BWR Vessel and Internals Inspection Summaries for Spring 2009 Outages, February 16, 2010.
4. BWRVIP Letter 2008-292, from Rick Libra, BWRVIP Executive Chairman, to Document Control Desk, U.S. Nuclear Regulatory Commission, Attention Michael McCoppin, "Project No. 704 – BWR Vessel and Internals Inspection Summaries for Fall 2008 Outages, September 23, 2009.

NRC RAI – BWRVIP139-APP. B EMBC-RAI-3

Section B.3 (a), paragraph 3, Page B-3, Description of Aging Effects:

The BWRVIP is requested to provide supporting justification to confirm the statement that, "significant reductions in fracture toughness that would challenge the structural integrity of the steam dryer are not plausible".

BWRVIP response to NRC RAI – BWRVIP139-APP. B EMBC-RAI-3

This statement made in the License Renewal Appendix is related to thermal aging (Note that irradiation induced loss in fracture toughness is not an issue for steam dryers due to the relatively low radiation levels in the vicinity of the steam dryer). Virtually all steam

dryer components (large plates) are fabricated from wrought stainless steel (types 304 and 316) which, owing to its lack of delta-ferrite, is resistant to thermally induced loss in fracture toughness. The associated weld material (e.g., 308, 316) does contain delta-ferrite and as such could theoretically incur some level of long-term thermally-induced loss of fracture toughness. However, laboratory testing of weld metals indicates that the effect of thermal aging on the fracture toughness and tensile strength of stainless steel weld metals is relatively small and not a significant concern for license renewal [1].

Cast austenitic stainless steel (CASS) has been used in a very few instances in some new steam dryer designs. In these cases, castings are specified as CF3 (low Molybdenum) with delta ferrite less than or equal to 20%. Castings meeting these specifications are unlikely to experience significant loss of toughness due to thermal aging [2] and meet NRC screening criteria established for license renewal [3], [4].

Based on the above, the BWRVIP maintains that loss of fracture toughness is not an aging effect requiring management for BWR steam dryers.

1. NUREG/CR-6428, "Effect of Thermal Aging on Fracture Toughness and Charpy-Impact Strength of Stainless Steel Pipe Welds," November 1995.
2. Initial Assessment of the Mechanisms and Significance of Low – Temperature Embrittlement of Cast Stainless Steels in LWR Systems, NUREG/CR – 5385, ANL – 89/17 (August 1990).
3. Letter from Christopher I. Grimes, U.S. Nuclear Regulatory Commission, License Renewal and Standardization Branch, to Douglas J. Walters, Nuclear Energy Institute, License Renewal Issue No. 98-0030, Thermal Aging Embrittlement of Cast Stainless Steel Components, May 19, 2000, (ADAMS accession No. ML003717179).
4. NUREG-1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report," December 2010 (ADAMS accession No. ML103490041).

NRC RAI – BWRVIP139-APP. B EMBC-RAI-4

Section B.3 (b), paragraph 5, Page B-3, Assessment of Aging Effects and Programs:

The TR mentions that additional guidance for demonstrating steam dryer structural integrity under power uprate conditions is contained in the BWRVIP-182 and BWRVIP-194 TRs. The BWRVIP is requested to include a paragraph to address the structural integrity of the steam dryer for the combined effects of power uprate and license renewal.

BWRVIP response to NRC RAI – BWRVIP139-APP. B EMBC-RAI-4

In response to this RAI, the subject paragraph will be replaced with the paragraphs below:

"Additional guidance for demonstrating steam dryer integrity under power uprate conditions is provided in BWRVIP-182-A [Reference B.8 (8)]. BWRVIP-182-A defines

an overall approach for demonstrating steam dryer integrity in conjunction with a power uprate license application. BWRVIP-182-A defines testing, predictive method benchmarking and documentation requirements for evaluating the pressure loading on the steam dryer and consequent steam dryer stresses due to acoustic and hydrodynamic loading for any power uprate exceeding 2% of current licensed thermal power. This ensures that even after a power uprate, the stresses on the steam dryer will not approach those required for fatigue crack initiation.

In addition, BWRVIP-139-A requires that a complete baseline inspection of the steam dryer be conducted immediately before and at the completion of the first cycle of operation after a power uprate exceeding 2%. These inspections confirm that the power uprate did not result in adverse effects. After the power uprate, and required re-baseline inspection, BWRVIP-139-A requires periodic steam dryer inspections on an on-going basis. Accordingly, adherence to BWRVIP-182-A and BWRVIP-139-A guidance will provide adequate assurance of steam dryer integrity throughout the extended life of the plant.”