



Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402-2801

August 28, 2009

10 CFR 50.90

U. S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, D.C. 20555-0001

Browns Ferry Nuclear Plant, Unit 1  
Facility Operating License No. DPR-33  
NRC Docket No. 50-259

Subject: **Technical Specifications (TS) Change TS-431 – Extended Power Uprate (EPU) – Response to Round 24 Request for Additional Information (RAI) EMCB.208 Regarding Steam Dryer Analyses (TAC NO. MD5262)**

- References:
1. Letter from TVA to NRC, "Browns Ferry Nuclear Plant (BFN) - Unit 1 - Proposed Technical Specifications (TS) Change TS - 431 - Request for License Amendment - Extended Power Uprate (EPU) Operation," dated June 28, 2004
  2. Letter from NRC to TVA, "Browns Ferry Nuclear Plant, Unit 1 - Request for Additional Information for Extended Power Uprate - Round 24," dated June 9, 2009
  3. Letter from TVA to NRC, "Browns Ferry Nuclear Plant (BFN) - Units 1, 2, and 3 - Technical Specifications (TS) Changes TS-418 and TS-431 - Extended Power Uprate (EPU) - Response to Round 24 Request for Additional Information (RAI) EMCB.209 Regarding Steam Dryer Analyses," dated May 29, 2009

The Tennessee Valley Authority (TVA) submitted a license amendment application to NRC for the EPU of BFN Unit 1 on June 28, 2004 (Ref. 1). The proposed amendment would modify the operating license to increase the maximum authorized core thermal power level by approximately 14 percent to 3952 megawatts.

NRC issued a Round 24 RAI regarding the EPU steam dryer analyses on June 9, 2009 (Ref. 2) and indicated that TVA had agreed to provide the requested additional information by June 5, 2009. TVA provided the response to RAI EMCB.209 on May 29, 2009 (Ref. 3). Subsequently, TVA representatives discussed plans for addressing RAI EMCB.208 with the NRC Project Manager for the BFN. Enclosure 1

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provides the response for RAI EMCB.208 which completes the responses to the Round 24 RAI.

As discussed during the meeting with the NRC staff on August 11, 2009, TVA is revising the stress analysis for the BFN Unit 1 steam dryer to not credit low flow noise removal. The revised steam dryer stress analysis will show that the BFN Unit 1 steam dryer meets acceptable stress criteria at EPU conditions with the added planned modifications. Also, a steam dryer stress analysis has been performed that shows the BFN Unit 1 steam dryer meets acceptable stress criteria at 110% of original licensed power (OLTP) with the currently modified BFN Unit 1 steam dryer. This analysis was performed to support 110% OLTP operation (approximately 5% increase from current licensed power level) prior to the implementation of the planned steam dryer modifications needed for EPU operation. The steam dryer stress analyses are further discussed in the response to RAI EMCB.208 in Enclosure 1. The revised BFN Unit 1 steam dryer reports for 110% OLTP conditions are provided in Enclosures 2, 3, and 4. TVA is finalizing the revised steam dryer reports for EPU conditions (i.e., 120% OLTP) and plans to submit these reports by August 31, 2009.

Note that Enclosures 1, 2, 3, and 4 contain information that Continuum Dynamics, Inc. (CDI) considers to be proprietary in nature and subsequently, pursuant to 10 CFR 2.390(a)(4), CDI requests that such information be withheld from public disclosure. Enclosure 9 provides an affidavit from CDI supporting this request. Enclosures 5, 6, 7, and 8 contain the redacted versions of the proprietary enclosures with the CDI proprietary material removed, which are suitable for public disclosure.

TVA has determined that the additional information provided by this letter does not affect the no significant hazards considerations associated with the proposed TS change. The proposed TS change still qualifies for a categorical exclusion from environmental review pursuant to the provisions of 10 CFR 51.22(c)(9).

No new regulatory commitments are made in this submittal. Please direct any questions concerning this matter to J. D. Wolcott at (256) 729-2495.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 28<sup>th</sup> day of August, 2009.

Respectfully,



R. M. Krich  
Vice President  
Nuclear Licensing

Enclosures: Enclosure 1 - Response to Round 24 Request for Additional Information (RAI) EMCB.208 Regarding Steam Dryer Analyses (Proprietary Version)

- Enclosure 2 - CDI Report No. 09-24P, "Stress Assessment of Browns Ferry Nuclear Unit 1 Steam Dryer to 110% OLTP Power Level," Revision 0 (Proprietary Version)
- Enclosure 3 - CDI Report No. 09-22P, "Acoustic and Low Frequency Hydrodynamic Loads at CLTP Power Level to 110% OLTP Power Level on Browns Ferry Nuclear Unit 1 Steam Dryer to 250 Hz," Revision 0 (Proprietary Version)
- Enclosure 4 - CDI Technical Note No. 09-11P, "Limit Curve Analysis with ACM Rev. 4 for Power Ascension to 110% OLTP at Browns Ferry Nuclear Unit 1," Revision 0 (Proprietary Version)
- Enclosure 5 - Response to Round 24 Request for Additional Information (RAI) EMCB.208 Regarding Steam Dryer Analyses (Non-proprietary Version)
- Enclosure 6 - CDI Report No. 09-24NP, "Stress Assessment of Browns Ferry Nuclear Unit 1 Steam Dryer to 110% OLTP Power Level," Revision 0 (Non-proprietary Version)
- Enclosure 7 - CDI Report No. 09-22NP, "Acoustic and Low Frequency Hydrodynamic Loads at CLTP Power Level to 110% OLTP Power Level on Browns Ferry Nuclear Unit 1 Steam Dryer to 250 Hz," Revision 0 (Non-proprietary Version)
- Enclosure 8 - CDI Technical Note No. 09-11NP, "Limit Curve Analysis with ACM Rev. 4 for Power Ascension to 110% OLTP at Browns Ferry Nuclear Unit 1," Revision 0 (Non-proprietary Version)
- Enclosure 9 - CDI Affidavit

cc (Enclosures):

Regional Administrator – Region II

NRC Senior Resident Inspector – Browns Ferry Nuclear Plant

State Health Officer – Alabama Department of Public Health

**PROPRIETARY INFORMATION**

**ENCLOSURE 1**

**TENNESSEE VALLEY AUTHORITY  
BROWNS FERRY NUCLEAR PLANT (BFN)  
UNIT 1**

**TECHNICAL SPECIFICATIONS (TS) CHANGE TS-431  
EXTENDED POWER UPRATE (EPU)**

**RESPONSE TO ROUND 24 REQUEST FOR ADDITIONAL INFORMATION (RAI) EMCB.208  
REGARDING STEAM DRYER ANALYSES**

**(PROPRIETARY VERSION)**

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Attached is the proprietary version of the Response to Round 24 RAI EMCB.208 Regarding Steam Dryer Analyses.

CDI proprietary information is identified by double square brackets. TVA has added superscript notation "<sup>(3)</sup>" to the applicable text of NRC RAI EMCB.208 in accordance with 10 CFR 2.390(b)(1)(i)(B). In each case, the superscript notation "<sup>(3)</sup>" refers to Paragraph (3) of the affidavit provided, which documents the basis for the proprietary determination. [[This sentence is an example.<sup>(3)</sup>]] Specific information that is not so marked is not considered to be CDI proprietary information.

An affidavit attesting to the proprietary nature of this enclosure is contained in Enclosure 9.

## PROPRIETARY INFORMATION

### **NRC RAI EMCB.208 (Unit 1)**

It appears that the main steam line (MSL) strain gage measurements in Unit 1 were reduced by subtracting:

- [[1. Electrical interference check signals measured at low input voltages to the strain gage arrays;
2. 'exclusion' tones caused by plant machinery, such as pumps;
3. the incoherent portion of the signals between upper and lower arrays, where coherence is adjusted using the methodology described in Chapter 7 of CDI Report 07-09P, Rev. 0; and,
4. data acquired at Low Flow (LF) conditions in the Unit 1 plant. <sup>(3)</sup>]]

In Enclosure 3 of a letter dated July 27, 2007, the licensee provide acoustic circuit model (ACM), Rev. 4 (described in CDI Report 07-09P, Rev. 0) which was benchmarked using Quad Cities 2 (QC2) MSL and steam dryer measurements. The licensee used the QC2 benchmark data to compute the frequency dependent bias errors and uncertainties for Unit 1. [[However, the MSL strain gage measurements used for the QC2 benchmark were only adjusted using items 1-3 in the list above. No LF data was subtracted from the MSL QC2 benchmark measurements. <sup>(3)</sup>]]

Address the apparent inconsistency with the conclusion that the CDI 07-09 bias and uncertainties are conservative [[given that the benchmarked code (QC2) did not subtract the LF data. Demonstrate by analyses that the bias and uncertainties assumed in CDI Report 07-09P are applicable to Unit 1 when LF is subtracted. <sup>(3)</sup>]]

### **TVA Response to EMCB.208 (Unit 1)**

The benchmarking of ACM Rev. 4 was performed by comparing predicted pressure loads based upon QC MSL measurements against actual pressure measurements on the QC dryers. No signal conditioning was performed by CDI on either the MSL data or the steam dryer pressure data. However, it is apparent from examination of the data plots in CDI Report No. 07-09P that a 60 Hertz notch filter was present on both sets of data. The presence of noise in each of the signals would have opposite effects on the benchmarking bias and uncertainty values. Depending on the relative magnitude of noise in the data sets, the effect of low flow noise could increase or decrease the conservatism of the pressure load prediction. Determining the effect of signal noise on the conservatism of the pressure load prediction would involve analysis of additional low flow data from an instrumented steam dryer.

To facilitate the review and approval of EPU for BFN Unit 1, TVA has designed additional modifications that will allow the steam dryer to meet the alternating stress ratio (SR-a) criteria of SR-a > 2.0 at EPU conditions without crediting low flow noise removal. TVA is finalizing the revised steam dryer reports for EPU conditions and plans to submit these reports by August 31, 2009.

The planned steam dryer modifications to support EPU operation will require vessel disassembly and, thus, will be scheduled to be implemented during the next refueling outage currently scheduled for Fall 2010. TVA anticipates that approval of the EPU license amendment for Unit 1 could be obtained in advance of the next refueling outage (contingent on NRC staff review). Accordingly, TVA has performed an additional Unit 1 steam dryer stress analysis

## PROPRIETARY INFORMATION

based on the currently modified steam dryer at 110% original licensed thermal power (OLTP) which meets the criteria of SR-a > 2.0 without crediting low flow noise removal. This analysis supports operation of Unit 1 at 110% OLTP (approximately 105% of current licensed thermal power (CLTP)) prior to the completion of the additional steam dryer modifications which would be implemented during the refueling outage.

The 110% OLTP steam dryer analysis, CDI Report No. 09-24P, "Stress Assessment of Browns Ferry Nuclear Unit 1 Steam Dryer to 110% OLTP Power Level," is provided in Enclosure 2 and includes the following aspects:

- Steam dryer finite element model is based upon the current modified steam dryer.
- No credit is taken for low flow noise removal in determining the steam dryer stress results.
- Bump-up factors associated with 110% OLTP are used in determining stress results at 110% OLTP.

The Unit 1 results based on the above changes indicate a minimum SR-a with frequency shifts and no credit for low flow noise removal of SR-a = 2.33 at CLTP and SR-a = 2.01 at 110% OLTP with bump-up factors applied.

Enclosure 3 provides the associated load report, CDI Report No. 09-22P, "Acoustic and Low Frequency Hydrodynamic Loads at CLTP Power Level to 110% OLTP Power Level on Browns Ferry Nuclear Unit 1 Steam Dryer to 250 Hz," and Enclosure 4 provides the associated limit curve report, CDI Technical Note 09-11P, "Limit Curve Analysis with ACM Rev. 4 for Power Ascension to 110% OLTP at Browns Ferry Nuclear Unit 1."

**ENCLOSURE 5**

**TENNESSEE VALLEY AUTHORITY  
BROWNS FERRY NUCLEAR PLANT (BFN)  
UNIT 1**

**TECHNICAL SPECIFICATIONS (TS) CHANGE TS-431  
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REGARDING STEAM DRYER ANALYSES**

**(NON-PROPRIETARY VERSION)**

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## NON-PROPRIETARY INFORMATION

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]]

Address the apparent inconsistency with the conclusion that the CDI 07-09 bias and uncertainties are conservative [[

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### TVA Response to EMCB.208 (Unit 1)

The benchmarking of ACM Rev. 4 was performed by comparing predicted pressure loads based upon QC MSL measurements against actual pressure measurements on the QC dryers. No signal conditioning was performed by CDI on either the MSL data or the steam dryer pressure data. However, it is apparent from examination of the data plots in CDI Report No. 07-09P that a 60 Hertz notch filter was present on both sets of data. The presence of noise in each of the signals would have opposite effects on the benchmarking bias and uncertainty values. Depending on the relative magnitude of noise in the data sets, the effect of low flow noise could increase or decrease the conservatism of the pressure load prediction. Determining the effect of signal noise on the conservatism of the pressure load prediction would involve analysis of additional low flow data from an instrumented steam dryer.

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The Unit 1 results based on the above changes indicate a minimum  $SR-a$  with frequency shifts and no credit for low flow noise removal of  $SR-a = 2.33$  at CLTP and  $SR-a = 2.01$  at 110% OLTP with bump-up factors applied.

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