Xcel Energy®

**WITHHOLD ENCLOSURE 3 FROM PUBLIC DISCLOSURE
UNDER 10 CFR 2.390**

August 26, 2009

L-MT-09-083
10 CFR 50.90

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Monticello Nuclear Generating Plant
Docket 50-263
Renewed Facility Operating License No. DPR-22

Monticello Extended Power Uprate: Limit Curves Requested by The Mechanical and Civil Review Branch (EMCB) Associated With Requests For Additional Information (RAIs) dated March 20, 2009 (TAC No. MD9990)

References:
1. NSPM letter to NRC, License Amendment Request: Extended Power Uprate (L-MT-08-052) dated November 5, 2008, (TAC MD9990) Accession No. ML083230111
2. Email P. Tam (NRC) to G. Salamon, K. Pointer (NSPM) dated March 20, 2009, "Monticello - Draft RAIs from Mechanical & Civil Engineering Branch re: proposed EPU amendment (TAC MD9990)" Accession No. ML090820015
3. Email P. Tam (NRC) to G. Salamon, L. Gunderson, K. Pointer (NSPM)dated June 26, 2009, "Monticello - Proposed EPU Amendment, additional draft question re: steam dryer (TAC MD9990)" Accession No. ML091800009

Pursuant to 10 CFR 50.90, the Northern States Power Company, a Minnesota corporation (NSPM), requested in Reference 1, an amendment to the Monticello Nuclear Generating Plant Renewed Operating License and Technical Specifications to increase the maximum authorized power level from 1775 megawatts thermal (MWt) to 2004 MWt.

Subsequent to a review of the license amendment request, the U.S. Nuclear Regulatory Commission (NRC) Mechanical and Civil Review Branch provided nineteen RAIs dated March 20, 2009 (Reference 2) then an additional RAI dated June 26, 2009 (Reference 3). In Reference 2 EMCB requested that NSPM provide updated power ascension limit curves that will be utilized in the evaluation of the MNGP EPU License Amendment Request.

2807 West County Road 75 • Monticello, Minnesota 55362-9637
Telephone: 763.295.5151 • Fax: 763.295.1454

Enclosure 1 contains the proprietary version of the limit curves report provided by Continuum Dynamics Incorporated (CDI). CDI requests that proprietary information be withheld from public disclosure in accordance with 10CFR 2.390(a) 4. An affidavit supporting this request is contained in Enclosure 2. A non proprietary version of Enclosure 1 is contained in Enclosure 3.

In accordance with 10 CFR 50.91, a copy of this letter is being provided to the designated Minnesota Official without the proprietary enclosure.

Summary of Commitments

No new commitments or changes to any existing commitments are proposed by this letter.

I declare under penalty of perjury that the foregoing is true and correct.
Executed on August 26, 2009.

Timothy J. O'Connor
Site Vice President, Monticello Nuclear Generating Plant
Northern States Power Company – Minnesota

cc: Administrator, Region III, USNRC
Project Manager, Monticello, USNRC
Resident Inspector, Monticello, USNRC
Minnesota Department of Commerce

ENCLOSURE 3

LIMIT CURVE ANALYSIS WITH ACM REV. 4

FOR POWER ASCENSION AT MONTICELLO

REVISION 3

NON PROPRIETARY

C.D.I. Technical Note No. 08-12NP

Limit Curve Analysis with ACM Rev. 4 for Power Ascension at Monticello

Revision 3

Prepared by

Continuum Dynamics, Inc.
34 Lexington Avenue
Ewing, NJ 08618

Prepared under Purchase Order No. 00013758 for

Northern States Power Company, a Minnesota Corporation (NSPM)
Monticello Nuclear Generating Plant
2807 W County Road 75
Monticello, MN 55362

Approved by

Alan J. Bilanin

Prepared by

Milton E. Teske

August 2009

Table of Contents

1. Introduction

During power ascension of Monticello Nuclear Generating Plant (MNGP), from Current Licensed Thermal Power (CLTP) to Extended Power Uprate (EPU), Northern States Power Company, a Minnesota Corporation (NSPM), is required to monitor the dryer stresses at plant power levels that have not yet been achieved. Limit curves provide an upper bound safeguard against the potential for dryer stresses becoming higher than allowable, by estimating the not-to-be-exceeded main steam line pressure levels. In the case of MNGP, in-plant main steam line data have been analyzed at CLTP conditions to provide steam dryer hydrodynamic loads [1]. EPU is 120% of Original Licensed Thermal Power (OLTP); CLTP is 106.3% of OLTP. A finite element model stress analysis has been undertaken on the CLTP loads [2]. These loads provide the basis for generation of the limit curves to be used during MNGP power ascension.

Continuum Dynamics, Inc. (C.D.I.) has developed an acoustic circuit methodology (ACM) that determines the relationship between main steam line data and pressure on the steam dryer [3]. This methodology and the use of a finite element model analysis provide the computational algorithm from which dryer stresses at distinct steam dryer locations can be tracked through power ascension. Limit curves allow NSPM to limit dryer stress levels, by comparing the main steam line pressure readings – represented in Power Spectral Density (PSD) format – with the upper bound PSD derived from existing in-plant data.

This technical note summarizes the proposed approach that will be used to track the anticipated stress levels in the MNGP steam dryer during power ascension, utilizing Rev. 4 of the ACM [4], and the options available to NSPM should a limit curve be reached.

2. Approach

The limit curve analysis for MNGP, to be used during power ascension, is patterned after the approach followed by Entergy Vermont Yankee (VY) in its power uprate [5]. In the VY analysis, two levels of steam dryer performance criteria were described: (1) a Level 1 pressure level based on maintaining the ASME allowable alternating stress value on the dryer, and (2) a Level 2 pressure level based on maintaining 80% of the allowable alternating stress value on the dryer. The VY approach is summarized in [6].

To develop the limit curves for MNGP, the stress levels in the dryer were calculated for the current plant acoustic signature, at CLTP conditions, and then used to determine how much the acoustic signature could be increased while maintaining stress levels below the stress fatigue limit. During power ascension, strain gage data will be converted to pressure in PSD format at each of the eight main steam line locations, for comparison with the limit curves. The strain gage data will be monitored throughout power ascension to observe the onset of discrete peaks, if they occur.

The finite element analysis of in-plant CLTP data found a lowest alternating stress ratio of 3.05 [2] as summarized in Table 1. The minimum stress ratios include the model bias and uncertainties for specific frequency ranges as suggested by the NRC [7]. The results of the ACM Rev. 4 analysis (based on Quad Cities Unit 2, or QC2, in-plant data) are summarized in Table 2 (a negative bias is conservative). The standpipe excitation frequency of the main steam safety relief valves in MNGP is anticipated to be 160 Hz [8], and thus the uncertainty determined around the QC2 Electromatic excitation frequency of 135 Hz has been applied to the 158 to 162 Hz frequency interval [9]. The additional bias and uncertainties, as identified in [10], [11], [12], [13], [14], and [15], are shown in Table 3. SRSS of the uncertainties, added to the ACM bias, results in the total uncertainties shown in Table 4. These uncertainties were applied to the finite element analysis, resulting in the minimum stress ratio of 3.05 for ASME Level A load combinations.

Table 1. Peak Stress Limit Summary for ACM Rev. 4

Peak Stress Limit	13,600 psi (Level 1)	10,880 psi (Level 2)
Minimum Stress Ratio	3.05	2.44

Table 2. Bias and uncertainty for ACM Rev. 4

[[

(3)]]

Table 3. MNGP additional uncertainties (with references cited)

[[

(3)]]

Table 4. MNGP total uncertainty

[[

(3)]]

3. Limit Curves

Limit curves were generated from the in-plant CLTP strain gage data reported in [1]. These data were filtered across the frequency ranges shown in Table 5 to remove noise and extraneous signal content, as suggested in [16, 17]. The resulting PSD curves for each of the eight strain gage locations were used to develop the limit curves, shown in Figures 1 to 4. Level 1 limit curves are found by multiplying the main steam line pressure PSD base traces by the square of the corrected limiting stress ratio ($3.05^2 = 9.30$), while the Level 2 limit curves are found by multiplying the PSD base traces by 0.64 of the square of the corrected limiting stress ratio (recovering 80% of the limiting stress ratio, or $(0.80 \times 3.05)^2 = 2.44^2 = 5.95$), as PSD is related to the square of the pressure.

Table 5. Exclusion frequencies for MNGP at CLTP conditions
(Recirc = recirculation pumps)

Frequency Range (Hz)	Exclusion Cause
0.0 – 2.0	Mean
58.5 – 61.5	Line Noise
119.7 – 120.3	Line Noise
179.6 – 180.4	Line Noise
51.2 – 52.3	Recirc Pump B Electrical Single Phase
128.6 – 130.2	Recirc Pump B Speed (5x)
133.8 – 134.2	Recirc Pump A Speed (5x)
154.9 – 155.4	Recirc Pump B Electrical Three Phase
14.0 – 34.0	Pipe Vibration

[[

(3)]]

Figure 1. Level 1 (black) and Level 2 (red) limit curves for main steam line A, compared against the base curves (blue) over the frequency range of interest: A upper strain gage location (top); A lower strain gage location (bottom).

[[

[3]]]

Figure 2. Level 1 (black) and Level 2 (red) limit curves for main steam line B, compared against the base curves (blue) over the frequency range of interest: B upper strain gage location (top); B lower strain gage location (bottom).

[[

(3)]]

Figure 3. Level 1 (black) and Level 2 (red) limit curves for main steam line C, compared against the base curves (blue) over the frequency range of interest: C upper strain gage location (top); C lower strain gage location (bottom).

[[

(3)]]

Figure 4. Level 1 (black) and Level 2 (red) limit curves for main steam line D, compared against the base curves (blue) over the frequency range of interest: D upper strain gage location (top); D lower strain gage location (bottom).

4. References

1. Continuum Dynamics, Inc. 2008. Acoustic and Low Frequency Hydrodynamic Loads at CLTP Power Level on Monticello Steam Dryer to 200 Hz (Rev. 2). C.D.I. Report No. 07-25 (Proprietary).

2. Continuum Dynamics, Inc. 2008. Stress Assessment of Monticello Steam Dryer (Rev. 1). C.D.I. Report No. 07-26 (Proprietary). Also: NSPM Draft Response to RAI 11, Table 11.5.

3. Continuum Dynamics, Inc. 2005. Methodology to Determine Unsteady Pressure Loading on Components in Reactor Steam Domes (Rev. 6). C.D.I. Report No. 04-09 (Proprietary).

4. Continuum Dynamics, Inc. 2007. Methodology to Predict Full Scale Steam Dryer Loads from In-Plant Measurements, with the Inclusion of a Low Frequency Hydrodynamic Contribution (Rev. 1). C.D.I. Report No. 07-09 (Proprietary).

5. Entergy Nuclear Northeast. 2006. Entergy Vermont Yankee Steam Dryer Monitoring Plan (Rev. 4). Docket 50-271. No. BVY 06-056. Dated 29 June 2006.

6. State of Vermont Public Service Board. 2006. Petition of Vermont Department of Public Service for an Investigation into the Reliability of the Steam Dryer and Resulting Performance of the Vermont Yankee Nuclear Power Station under Uprate Conditions. Docket No. 7195. Hearings held 17-18 August 2006.

7. NRC Request for Additional Information on the Hope Creek Generating Station, Extended Power Uprate. 2007. RAI No. 14.67.

8. Continuum Dynamics, Inc. 2008. Flow-Induced Vibration in the Main Steam Lines at Monticello and Resulting Steam Dryer Loads (Rev. 0). C.D.I. Report No. 07-23 (Proprietary).

9. BWRVIP-194: BWR Vessel and Internals Project, Methodologies for Demonstrating Steam Dryer Integrity for Power Uprate. EPRI, Palo Alto, CA, and Continuum Dynamics, Inc., Ewing, NJ: 2008. 1016578.

10. Structural Integrity Associates, Inc. 2007. Evaluation of Monticello Strain Gage Uncertainty and Pressure Conversion (Rev. 0). SIA Calculation Package No. MONT-11Q-302.

11. Continuum Dynamics, Inc. 2005. Vermont Yankee Instrument Position Uncertainty. Letter Report Dated 01 August 2005.

12. Exelon Nuclear Generating LLC. 2005. An Assessment of the Effects of Uncertainty in the Application of Acoustic Circuit Model Predictions to the Calculation of Stresses in the Replacement Quad Cities Units 1 and 2 Steam Dryers (Rev. 0). Document No. AM-21005-008.

13. Continuum Dynamics, Inc. 2007. Finite Element Modeling Bias and Uncertainty Estimates Derived from the Hope Creek Unit 2 Dryer Shaker Test (Rev. 0). C.D.I. Report No. 07-27 (Proprietary).

14. NRC Request for Additional Information on the Hope Creek Generating Station, Extended Power Uprate. 2007. RAI No. 14.79.

15. NRC Request for Additional Information on the Hope Creek Generating Station, Extended Power Uprate. 2007. RAI No. 14.110.

16. Structural Integrity Associates, Inc. 2007. Monticello Main Steam Line 100% CLTP Strain Data Transmission. SIA Letter Report No. KKF-07-013 with inclusion of Channel 29.

17. J. Ferrante Email Correspondence: “Logic for Declaring Piping Vibrations.” 02 February 2008.