Enclosure 10 to L-MT-08-018

Piping Flow Induced Vibration Monitoring Program

Enclosure 10

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Acronyms and Abbreviations

No.	Short Form	Description
1	ALARA	As Low As Reasonably Achievable (radiation dose concern)
2	ARS	Amplified Response Spectrum
3	ASME	American Society of Mechanical Engineers
4	BWR	Boiling Water Reactor
5	BWROG	Boiling Water Reactor Owners' Group
6	CLTP	Current Licensed Thermal Power
7	CPPU	Constant Pressure Power Uprate
8	EPU	Extended Power Uprate
9	FFT	Fast Fourier Transform
10	FIV	Flow Induced Vibration
11	FW	Feedwater
12	LTR	Licensing Topical Report
13	MNGP	Monticello Nuclear Generating Plant
14	MS	Main Steam
15	MSIV	Main Steam Isolation Valve
16	MSL	Main Steam Line
17	OE	Operating Experience
18	RMS	Root Mean Squared
19	SRSS	Square Root Sum of the Squares
20	SRV	Safety/Relief Valve
21	TSV	Turbine Stop Valve

1. Introduction

Sections 2.2.2 and 2.5.4.1 of Enclosure 5 to the Extended Power Uprate (EPU) submittal briefly discuss the EPU effects upon Flow Induced Vibration (FIV) for the Main Steam (MS) System and the Feedwater (FW) System. This Enclosure to the submittal provides a more detailed discussion of the analyses and testing program undertaken to provide assurance that unacceptable FIV issues are not experienced at Monticello Nuclear Generating Plant (MNGP) due to EPU implementation.

Increased flow rates and flow velocities during operation at EPU conditions are expected to produce increased FIV levels in some systems. As discussed in Section 3.4.1 of Licensing Topical Report (LTR) NEDC-33004P-A, Revision 4, "Constant Pressure Power Uprate," the MS and FW piping vibration levels should be monitored because their system flow rates will be significantly increased (Reference 4). While a review of industry EPU operating experience identified very few component failures that can be attributed to EPU, most of these failures were related to FIV.

In January 2007, the Boiling Water Reactor Owners' Group (BWROG) issued NEDO-33159, Revision 1, "Extended Power Uprate (EPU) Lessons Learned and Recommendations" based on operating experience (OE) and evaluations from Boiling Water Reactor (BWR) plants that have previously implemented EPUs and from plants currently performing pre-EPU evaluations (Reference 1). NEDO-33159 states:

> "Since the majority of EPU-related component failures involve flow induced vibration, the BWROG EPU Committee held a vibration monitoring and evaluation information exchange meeting of industry experts in June 2004. The committee determined that the current process of monitoring large bore piping systems in accordance with the requirements of ASME O&M Part 3 is sufficient to preclude challenges to safe shutdown. Increases in large bore piping vibration levels are a precursor to increased vibration levels in attached small bore piping and components."

During Monticello's 23rd refueling outage, in 2007, a vibration monitoring program was implemented to support the MNGP Extended Power Uprate Project. Piping systems both inside and outside the drywell are being monitored using accelerometers. Monitoring occurs inside the drywell, turbine building and steam tunnel. The following piping is being monitored for vibration to establish baseline data prior to uprate and to ensure that the vibration levels of the selected piping systems are within acceptable limits during operation at EPU conditions:

Main Steam (Drywell and Turbine Building)
Feedwater (Drywell and Turbine Building)

The current results of the EPU Vibration Monitoring Program indicate no abnormal vibration levels exist within the MS and FW systems. Continued vibration monitoring of these systems during EPU power ascension will be performed. The same acceptance criteria established at CLTP will be applied to ensure that potential effects of flow induced vibration are captured under EPU conditions.

2. Susceptibility and Monitoring

The MS System piping and the FW System piping will have higher mass flow rates and flow velocities under EPU conditions. When power is increased from CLTP to EPU conditions, steady state FIV levels are expected to be approximately proportional to the mass flow rate squared. Thus, the vibration levels of the MS and the FW system piping are expected to increase by approximately 32% based upon a steam flow increase of 14.8%. Hence, a startup vibration monitoring program using accelerometers mounted on representative portions of the MS and FW piping located inside the containment will be required during the initial implementation of EPU.

In addition, the accessible large bore MS and FW piping outside of containment will be monitored by performing visual observations and by taking vibration measurements using hand-held vibration instruments during walkdowns of this piping. These walkdowns will be performed during initial plant operation at the EPU conditions. MS and FW piping outside of containment that is inaccessible to plant personnel when the plant is at high power levels required the installation of remote vibration monitoring sensors (completed in 2007).

Small bore piping attached to the MS and FW systems is susceptible to the effects of FIV. As stated in Section 1, the small bore piping will be evaluated as a function of the large bore piping FIV results. If the vibration level in the main piping in these systems is greater than 50% of the acceptance criteria, then an engineering evaluation of the small bore piping will be performed to ensure that the steady state stresses are within the endurance limit.

3. Remote Monitoring Program

During the spring 2007 Monticello refueling outage, accelerometers were installed on the MS and FW piping (and selected components) inside and outside of the drywell to monitor the steady state vibration levels. The purpose of collecting this data was to determine the baseline vibration levels in these systems in support of planned operation at EPU conditions. The steady state vibration levels of these two systems may increase due to EPU operating conditions. The collection of baseline data enables extrapolations to EPU operating conditions for steady state vibration levels. Data was collected at several power levels during power ascension following the outage.

3.1. Inside the Drywell Monitoring Information

The MS and FW systems are to be monitored because of their significant increases in flow to achieve increases in thermal power. The current scope monitors 16 piping locations using 39 accelerometers and three components using nine accelerometers (see Table 4-1 for locations). A modal analysis was performed on the as-modeled piping system to determine natural frequencies and mode shapes. The accelerometer locations were determined based on a review of the mode shapes. The accelerometer locations correspond to node points with high-calculated modal displacements.

3.2. Outside the Drywell Monitoring Information

50 accelerometers at 21 locations are being monitored in the steam tunnel and turbine building (see Tables 4-3 and 4-5 for locations). Similar to the drywell accelerometers, the locations and number of accelerometers in the steam tunnel and turbine building were determined based on performing modal analyses of the MS and FW piping systems.

3.3. Piping Vibration Acceptance Criteria

3.3.1. Methodology

Determination of the acceptance criteria is based on the guidance of ASME OM-S/G Part 3 (OM-3) (Reference 2). The methodology provides a pass/fail mechanism for the piping system such that, if the values are met, no further justification of the measured vibration levels is required.

3.3.2. Calculation

Detailed models of the MS and FW piping systems were developed for this evaluation. A 1g broad-band amplified response spectrum (ARS) was applied up to 250 Hz in each of the three orthogonal directions. Static loads, such as weight and thermal expansion, are not considered since these loads do not contribute to cyclic loading of the piping system. Additionally, seismic (inertia and anchor movements) and turbine stop valve loads are not considered, since these loads are transient dynamic loads that do not contribute to the steady-state cyclic loading of the system.

The results of the piping analysis are provided in terms of accelerations, displacements, and stresses at each node. The overall values at each node were obtained by combining the results for all three orthogonal directions using the SRSS method. Adjustment factors (calculated using maximum stress values and the guidance of ASME O&M-S/G Part 3) and maximum stress values (from the piping analysis) for each of these segments are presented in Table 3-1.

Table 3-1: Maximum Stresses and Adjustment Factors for Various Piping Segments at CLTP

Pipe Name		Inside Containment			Outside Containment		
		Maximum Stress (psi)	Adjustment Factor	Reference	Maximum Stress (psi)	Adjustment Factor	Reference
MS	A	13,929	0.552	PS1A Max	16,603	0.463	MSSIA Max
	B	24,461	0.314	PS2A Max			
	C	18,484	0.416	PS3A Max			
	D	11,899	0.646	PS4A Max			
FW	A	21,633	0.356	FWSIA Node 364	69,452	0.111	FWSIA Node 201
	B	14,536	0.529	FWSIA Node 1			

The acceptance criteria are then calculated by multiplying the accelerations and displacements by the adjustment factors in Table 1. Sample calculations at Node 25 on the FW-B drywell piping are provided below:

$$A_x = a_{calculated} * F_{adjust} = 0.776g * 0.529 = 0.410g$$

$$A_y = a_{calculated} * F_{adjust} = 1.664g * 0.529 = 0.881g$$

$$A_z = a_{calculated} * F_{adjust} = 1.332g * 0.529 = 0.705g$$

$$D_x = d_{calculated} * F_{adjust} = 0.884in * 0.529 = 0.468in$$

$$D_y = d_{calculated} * F_{adjust} = 2.219in * 0.529 = 1.174in$$

$$D_z = d_{calculated} * F_{adjust} = 2.752in * 0.529 = 1.456in$$

3.4. Piping Vibration Data at CLTP

Baseline vibration data was obtained following the spring 2007 refueling outage, using three Structural Integrity Associates Versatile Data Acquisition Systems (SI-VersaDAS™). One SI-VersaDAS™ was used to monitor the drywell accelerometers, and the other two units monitored the steam tunnel and turbine building accelerometers independently. The data was processed as described in Section 4.2. The processed data at 100% CLTP reactor power was then compared to the calculated acceptance criteria. This comparison is provided in tabular form in Section 4.

4. Vibration Monitoring Program Results

4.1. Data Acquisition Parameters

The accelerometer data (time histories) was recorded on an SI-VersaDAS™. Each data set was recorded using a sample rate of 2500 samples per second (sps) for the duration of 2 minutes. The data is time stamped for comparison to plant process data. Data from the Drywell and Steam Tunnel are synchronized to each other as well.

4.2. Data Reduction Methodology

The accelerometer time histories were first filtered using a Chebyshev bandpass filter (data from 2-250 Hz was allowed to pass). Once the signal was bandpass filtered, each time history was converted from the time domain to the frequency domain (frequency spectra) using a Fast Fourier Transform (FFT) algorithm within MATLAB (Reference 3). An FFT was generated for each group and then all FFT groups were summed together, and divided by the number of groups to provide linearly averaged frequency spectra. Plots for each averaged frequency spectrum (amplitude, g-RMS versus frequency, Hz) were generated for each channel.

4.2.1. Drywell

Of the 48 accelerometer channels, seven are located on FW loop A, five on FW loop B, ten on main steam line (MSL) A, five on MSL B, five on MSL C, seven on MSL D, six on SRVs, and three on MSIVs. The channel number versus accelerometer location is summarized in Table 4-1. The piping accelerations versus allowable values are provided Table 4-2. The analysis of the data was done using MATLAB, and the results are summarized below:

- In all cases, the magnitude of the vibration is low. The RMS magnitudes are generally below 0.06 g with the exception of channels 14, 23, and 24 having magnitudes residing below 0.09 g, which is considered low steady state vibration levels.
- At 100% reactor power MS A, MS B, and SRV showed consistent low magnitude vibration in the 2-50 Hz range. Similarly MSIV shows a low magnitude vibration at approximately 128 Hz.
- Channel 14 experienced elevated broadband noise in upper reactor power levels, 80%-95%.
- Channel 1 shows an isolated 0.028 g-RMS response at approximately 195 Hz at 50% reactor power. Likewise, channel 11 recorded a 0.048 g-RMS response at approximately 115 Hz and 85% power.
- Channels 23 and 24 experienced an elevated response at approximately 170 Hz and 50% power with the latter at lower overall amplitude, below 0.06 g-RMS.

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Table 4-1: Drywell Accelerometer Locations

Ch No	Node No	Channel Name	Dir	System	OD (in)	Location Description
1	10	ACC-FWB-10X	X	FW, Loop B riser	10.75	6 ft 5 in upstream of support FW39B
2		ACC-FWB-10Z	Z			
3	25	ACC-FWB-25X	X	FW, Loop B header	10.75	6 ft 8 in upstream of support FW38B
4		ACC-FWB-25Y	Y			
5		ACC-FWB-25Z	Z			
6	340	ACC-FWA-340X	X	FW, Loop A header	10.75	7 ft upstream of support FW38A
7		ACC-FWA-340Y	Y			
8		ACC-FWA-340Z	Z			
9	356	ACC-FWA-356X	X	FW, Loop A riser	10.75	3 ft 1 in upstream of support FW39A
10		ACC-FWA-356Z	Z			
11	376	ACC-FWA-376X	X	FW, Loop A riser	10.75	2 ft 3 in upstream of support FW36A
12		ACC-FWA-376Z	Z			
13	111, PS1A	ACC-MSA-111X	X	MSL A riser	18	13 ft 9 in downstream of support MSH1A
14		ACC-MSA-111Z	Z			
15	177, PS1A	ACC-MSA-177X	X	MSL A, disch line	10.75	4 ft 11 in upstream of support RVH70
16		ACC-MSA-177Y	Y			
17		ACC-MSA-177Z	Z			
18	242, PS1A	ACC-MSA-242X	X	MSL A, header	10.75	9 ft 11 in downstream of support 24AH2
19		ACC-MSA-242Y	Y			
20		ACC-MSA-242Z	Z			
21	256, PS1A	ACC-MSA-256X	X	MSL A, header	10.75	1 ft 3 in upstream of support 24AH3
22		ACC-MSA-256Y	Y			
23	134, PS2A	ACC-MSB-134X	X	MSL B, riser	18	7 ft 4 in downstream of support MSH3B
24		ACC-MSB-134Z	Z			
25	241, PS2A	ACC-MSB-241X	X	MSL B, disch line	10.75	5 ft 2 in upstream of support 25H2
26		ACC-MSB-241Y	Y			
27		ACC-MSB-241Z	Z			
28	111, PS3A	ACC-MSC-111X	X	MSL C, riser	18	11 ft 1 in downstream of support MSH1C
29		ACC-MSC-111Z	Z			
30	173, PS3A	ACC-MSC-173X	X	MSL C, disch line	10.75	4 ft 1 in upstream of support RVH77
31		ACC-MSC-173Y	Y			
32		ACC-MSC-173Z	Z			
33	140, PS4A	ACC-MSD-140X	X	MSL D, header	18	7 ft 6 in downstream of support MSH4D
34		ACC-MSD-140Z	Z			
35	184, PS4A	ACC-MSD-184X	X	MSL D, disch line	10.75	7 ft 4 in downstream of support 27H6
36		ACC-MSD-184Z	Z			
37	261, PS4A	ACC-MSD-261X	X	MSL D, header	10.75	4 ft 9 in downstream of support 27AH5
38		ACC-MSD-261Y	Y			
39		ACC-MSD-261Z	Z			
40	212, PS2	ACC-SRV-212X	X	MSL B, SRV	15.5	Inlet flange of SRV RV 2-71B
41		ACC-SRV-212Y	Y			
42		ACC-SRV-212Z	Z			
43	149, PS3	ACC-SRV-149X	X	MSL C, SRV	15.5	Inlet flange of SRV RV 2-71C
44		ACC-SRV-149Y	Y			
45		ACC-SRV-149Z	Z			
46	142, PS4	ACC-MSIV-142X	X	MSL D, MSIV	6	MSIV stuffing box
47		ACC-MSIV-142Y	Y			
48		ACC-MSIV-142Z	Z			

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Table 4-2: Drywell Piping Accelerometer Data Comparison for CLTP

Channel No	Channel Name	Acceptance Criteria	Measured Value (100% Power)	Measured % of Acceptable Value
1	ACC-FWB-10X	0.9413	0.0579	6.15%
2	ACC-FWB-10Z	0.9375	0.0580	6.19%
3	ACC-FWB-25X	0.4105	0.0268	6.53%
4	ACC-FWB-25Y	0.8807	0.0492	5.58%
5	ACC-FWB-25Z	0.7050	0.0680	9.65%
6	ACC-FWA-340X	0.2441	0.0296	12.12%
7	ACC-FWA-340Y	0.5501	0.0510	9.28%
8	ACC-FWA-340Z	0.4911	0.0696	14.18%
9	ACC-FWA-356X	0.6805	0.0532	7.82%
10	ACC-FWA-356Z	0.5842	0.0616	10.55%
11	ACC-FWA-376X	0.6620	0.0591	8.93%
12	ACC-FWA-376Z	0.4566	0.0167	3.67%
13	ACC-MSA-111X	0.9147	0.0802	8.77%
14	ACC-MSA-111Z	0.8416	0.0000	N/A
15	ACC-MSA-177X	0.4952	0.0540	10.91%
16	ACC-MSA-177Y	0.3819	0.0241	6.30%
17	ACC-MSA-177Z	1.4204	0.0409	2.88%
18	ACC-MSA-242X	0.5439	0.0236	4.34%
19	ACC-MSA-242Y	0.9331	0.0311	3.33%
20	ACC-MSA-242Z	0.8315	0.0361	4.35%
21	ACC-MSA-256X	1.0117	0.0000	N/A
22	ACC-MSA-256Z	0.9335	0.0000	N/A
23	ACC-MSB-134X	0.2806	0.0907	32.32%
24	ACC-MSB-134Z	0.4843	0.0000	N/A
25	ACC-MSB-241X	0.7518	0.0009	0.12%
26	ACC-MSB-241Y	0.5216	0.0181	3.47%
27	ACC-MSB-241Z	0.3643	0.0167	4.60%
28	ACC-MSC-111X	0.5387	0.0625	11.60%
29	ACC-MSC-111Z	0.5958	0.0858	14.40%
30	ACC-MSC-173X	0.6608	0.0129	1.96%
31	ACC-MSC-173Y	0.9322	0.0109	1.16%
32	ACC-MSC-173Z	0.6516	0.0363	5.57%
33	ACC-MSD-140X	0.2929	0.0609	20.79%
34	ACC-MSD-140Z	0.7017	0.0775	11.05%
35	ACC-MSD-184X	0.7458	0.0261	3.50%
36	ACC-MSD-184Z	1.3138	0.0220	1.68%
37	ACC-MSD-261X	0.9577	0.0048	0.50%
38	ACC-MSD-261Y	1.2356	0.0180	1.45%
39	ACC-MSD-261Z	1.0258	0.0249	2.43%

Note: A field with N/A indicates that the measured value for that particular channel was invalid. Invalid values were set to zero in the tables and subsequent plots.

4.2.2. Steam Tunnel

Of the 24 accelerometer channels, two are located on FW loop A, two on FW loop B, two on MSL A, and six on each of the remaining three MSL (B, C, and D). The channel number versus accelerometer location is summarized in Table 4-3. The piping accelerations versus allowable values are provided Table 4-4. The analysis of the data was done using MATLAB, and the results are summarized below:

- In all cases, the magnitude of the vibration is low. The RMS magnitudes are all below 0.2142 g, and the Max-Min values are all below 2.0 g.
- FW RMS acceleration trends show a gradual increase in vibration from low to high power levels.
- MS A RMS acceleration trend shows almost equal vibration level at 39% and 100% power with lower levels in between.
- MS B, C, and D RMS acceleration trends show fairly constant vibration levels across all power levels with 100% vibrations being generally the highest.

Table 4-3: Steam Tunnel Accelerometer Channels and Locations

Ch No	Node No	Channel Name	Dir	System	OD (in)	Location Description
33	89	ACC-FWB-89Y	Y	FW, Loop B	14	3 ft 5 in upstream of support FW29
34		ACC-FWB-89Z	Z			
35	296	ACC-FWA-296Y	Y	FW, Loop A	14	2 ft 2 in upstream of support FW21
36		ACC-FWA-296Z	Z			
37	115	ACC-MSA-115X	X	MSL A	18	11 ft 7 in upstream of support PS-2
38		ACC-MSA-115Z	Z			
39	197	ACC-MSB-197X	X	MSL B	18	6 ft 2 in downstream of support PS-6
40		ACC-MSB-197Z	Z			
41	240	ACC-MSC-240X	X	MSL C	18	3 ft 3 in downstream of support PS-11
42		ACC-MSC-240Z	Z			
43	277	ACC-MSD-277Y	Y	MSL D	18	2 ft 6 in downstream of support PS-17
44		ACC-MSD-277Z	Z			
45	207	ACC-MSB-L1X	X	Location 1	20.5	Outboard MSIV B
46		ACC-MSB-L1Z	Z			
47		ACC-MSB-L2X	X	Location 2	20	
48		ACC-MSB-L2Z	Z			
49	247	ACC-MSC-L1X	X	Location 1	20.5	Outboard MSIV C
50		ACC-MSC-L1Z	Z			
51		ACC-MSC-L2X	X	Location 2	20	
52		ACC-MSC-L2Z	Z			
53	289	ACC-MSD-L1X	X	Location 1	20.5	Outboard MSIV D
54		ACC-MSD-L1Z	Z			
55		ACC-MSD-L2X	X	Location 2	20	
56		ACC-MSD-L2Z	Z			

Table 4-4: Steam Tunnel Piping Accelerometer Data Comparison for CLTP

Channel No	Channel Name	Acceptance Criteria	Measured Value (100% Power)	Measured % of Acceptable Value
33	ACC-FWB-89Y	0.1059	0.0452	42.63%
34	ACC-FWB-89Z	0.1479	0.0000	N/A
35	ACC-FWA-296Y	0.1143	0.0343	30.05%
36	ACC-FWA-296Z	0.2341	0.0305	13.01%
37	ACC-MSA-115X	0.4202	0.1197	28.50%
38	ACC-MSA-115Z	1.0776	0.0000	N/A
39	ACC-MSB-197X	0.4032	0.1327	32.91%
40	ACC-MSB-197Z	0.7628	0.1994	26.15%
41	ACC-MSC-240X	0.2168	0.0000	N/A
42	ACC-MSC-240Z	0.6433	0.0715	11.11%
43	ACC-MSD-277Y	0.6951	0.0000	N/A
44	ACC-MSD-277Z	1.1037	0.1086	9.84%

Note: A field with N/A indicates that the measured value for that particular channel was invalid. Invalid values were set to zero in the tables and subsequent plots.

4.2.3. Turbine Building

Of the 26 accelerometer channels, four are located on MSL A, four on MSL B, two on MSL C, and two on MSL D. Eight accelerometers are installed on the FW piping and six accelerometers are installed on turbine stop valves (TSV) (see Figure 4-1).

Table 4-5 lists the accelerometer channel numbers, description, and direction for the accelerometers installed on the MS and FW systems in the Turbine Building. The piping accelerations versus allowable values are provided Table 4-6. The analysis of the data was done using MATLAB, and the results are summarized below:

- The RMS magnitudes for all the piping locations (Channels 1 through 20) are below 0.3 g, and the corresponding maximum-minimum values at 100% power are less than 2.5 g.
- No significant acoustic response is apparent in the frequency spectra. Some channels show peaks in the 15-45 Hz range, which may be acoustic, but these are of very low magnitude. This indicates that there is sufficient separation between the acoustic and vortex shedding frequencies in the main steam safety relief valve branch lines.
- The measured acceleration values for the TSV location 1 are below 0.5 g-RMS. The measured acceleration values for TSV location 2 vertical direction decrease from 0.9 g-RMS at 39% power to 0.26 g-RMS at 100% power. The other two orthogonal directions never exceed 0.03 g-RMS. Therefore, it is suspected that the cable connections for Channel 25 may

be bad and it is planned to check these cable connections during the next outage (of sufficient duration) to confirm if the signal for Channel 25 is valid.

Table 4-5: Turbine Building Accelerometer Channels and Locations

Ch No	Channel name	System	Details	Direction	Description
1	Ch.1-FWB-94X	FW Loop B Riser	14"	X	4 ft 3 in downstream of support FW28
2	Ch.2-FWB-94Z			Z	
3	Ch.3-FWB-105X	FW Loop B	14"	X	5 ft 7 in from support FX201 downstream
4	Ch.4-FWB-105Y			Y	
5	Ch.5-FWX-147Y	Header between Loops A & B	14"	Y	4 ft 1 in from Loop A towards support FW30
6	Ch.6-FWX-147Z			Z	
7	Ch.7-FWA-152X	Riser, Loop A	14"	X	4 ft 3 in from support FW20 upstream
8	Ch.8-FWA-152Z			Z	
9	Ch.9-MSA-120Y	MSL A	18"	Y	7 ft 3 in downstream from support PS-2
10	Ch.10-MSA-120Z			Z	
11	Ch.11-MSA-126X	MSL A	18"	X	6 ft 6 in upstream of support PS-4
12	Ch.12-MSA-126Y			Y	
13	Ch.13-MSB-186X	MSL B	18"	X	6 ft downstream of support PS-8
14	Ch.14-MSB-186Y			Y	
15	Ch.15-MSB-192Y	MSL B	18"	Y	5 ft 6 in downstream of support PS-7
16	Ch.16-MSB-192Z			Z	
17	Ch.17-MSC-233Y	MSL C	18"	Y	7 ft 3.5 in downstream of support PS-12
18	Ch.18-MSC-233Z			Z	
19	Ch.19-MSD-300X	MSL D	18"	X	13 ft 3 in downstream of support PS-19
20	Ch.20-MSD-300Y			Y	
21	Ch.21-TSV1-SV4X	Location 1 SV-4	27"	X	See Figure 4-1
22	Ch.22-TSV1-SV4Y			Y	
23	Ch.23-TSV1-SV4Z			Z	
24	Ch.24-TSV2-SV4X	Location 2 SV-4	18"	X	See Figure 4-1
25	Ch.25-TSV2-SV4Y			Y	
26	Ch.26-TSV2-SV4Z			Z	

Table 4-6: Turbine Building Piping Accelerometer Data Comparison for CLTP

Channel No	Channel Name	Acceptance Criteria	Measured Value (100% Power)	Measured % of Acceptable Value
1	ACC-FWB-94X	0.1196	0.0277	23.16%
2	ACC-FWB-94Z	0.1173	0.0229	19.48%
3	ACC-FWB-105X	0.1374	0.0227	16.50%
4	ACC-FWB-105Y	0.1349	0.0253	18.73%
5	ACC-FWX-147Y	0.1438	0.0311	21.64%
6	ACC-FWX-147Z	0.1371	0.0198	14.45%
7	ACC-FWA-152X	0.1068	0.0221	20.68%
8	ACC-FWA-152Z	0.1149	0.0008	0.72%

Channel No	Channel Name	Acceptance Criteria	Measured Value (100% Power)	Measured % of Acceptable Value
9	ACC-MSA-120Y	0.9021	0.1061	11.76%
10	ACC-MSA-120Z	0.9471	0.0000	N/A
11	ACC-MSA-126X	0.7980	0.1126	14.11%
12	ACC-MSA-126Y	0.7448	0.0518	6.95%
13	ACC-MSB-186X	0.7335	0.1601	21.83%
14	ACC-MSB-186Y	0.5855	0.1156	19.74%
15	ACC-MSB-192Y	0.9248	0.0829	8.97%
16	ACC-MSB-192Z	0.5933	0.1362	22.96%
17	ACC-MSC-233Y	1.0651	0.1121	10.53%
18	ACC-MSC-233Z	0.7107	0.0135	1.90%
19	ACC-MSD-300X	0.7276	0.2472	33.98%
20	ACC-MSD-300Y	1.5793	0.1395	8.83%

Note: A field with N/A indicates that the measured value for that particular channel was invalid. Invalid values were set to zero in the tables and subsequent plots.

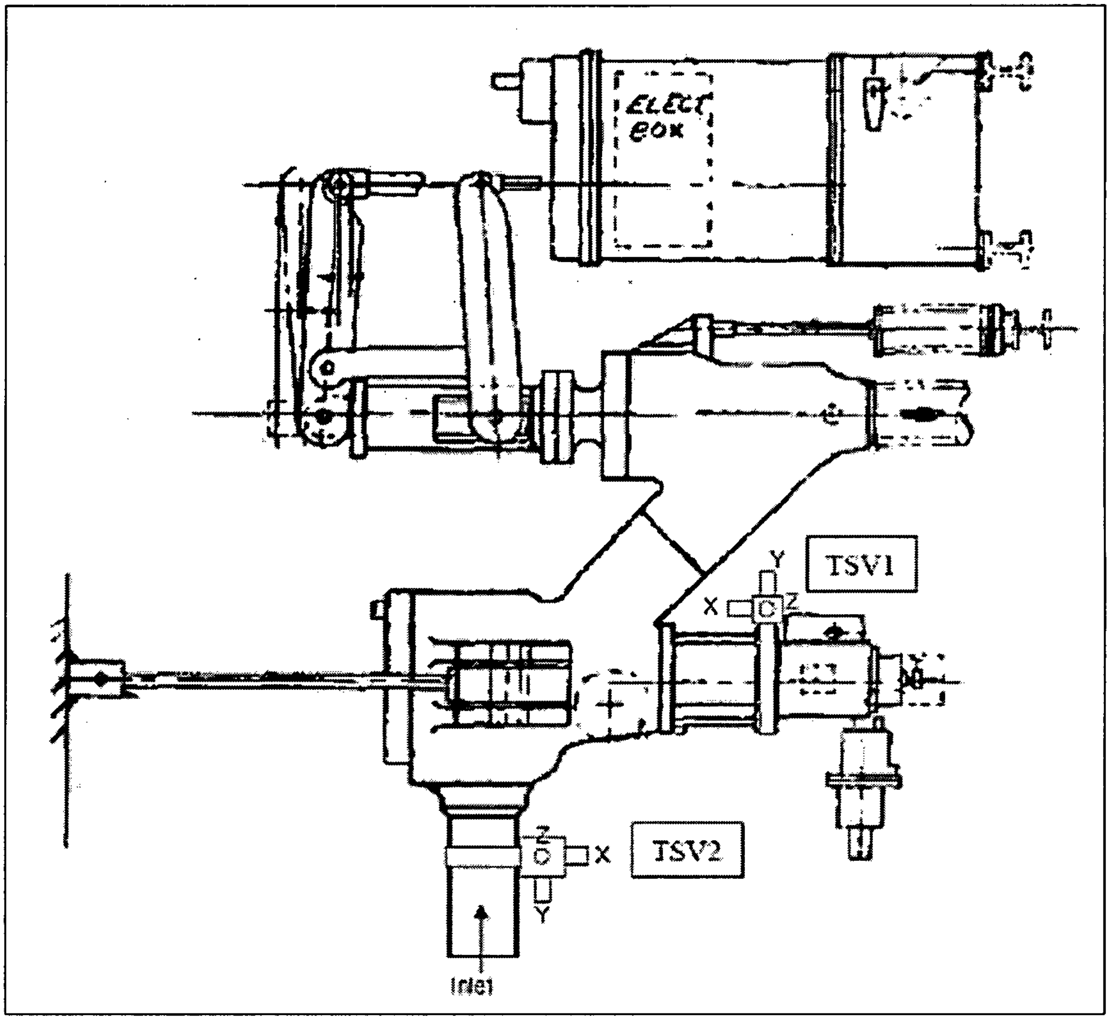
4.3. Results for All Accelerometers

In summary, the maximum acceleration observed for the 100% (CLTP) power level in the FW piping inside the containment was 14% of the criterion. The maximum acceleration of the MS piping inside the containment was 32% of the criterion. The corresponding percentages for the FW and MS systems outside the containment were 43% and 34%, respectively.

4.4. Projected Results for EPU

Applying the expected increase of approximately 32% (based upon a steam flow increase of 14.8%) to the maximum acceleration as a percentage of the acceptance criterion (43% from Section 4.3) predicts the maximum acceleration at EPU conditions will be less than 57% of the acceptance criterion. Therefore, MS and FW piping vibration levels at EPU conditions are expected to be acceptable and vibration monitoring, as part of power ascension testing, will verify acceptable vibration levels.

Figure 4-1: Accelerometer positions on TSV



5. References

1. BWR Owners' Group EPU Committee, Extended Power Uprate (EPU) Lessons Learned and Recommendations, NEDO-33159 Revision 1, January 2007
2. ASME O&M-S/G, Standards and Guides for Operation and Maintenance of Nuclear Power Plants, Part 3, 1994 Edition, "Requirements for Preoperational and Initial Start-Up Vibration Testing of Nuclear Power Plant Piping Systems."
3. MATLAB, Version 7.0.4.365, Release 14, Mathworks, January 2005 (Macro: UniPro Version 2.3.4).
4. GE Nuclear Energy, "Constant Pressure Power Uprate," Licensing Topical Report NEDC-33004P-A, Revision 4, Class III (Proprietary), July 2003; and NEDO-33004, Class I (Non-proprietary), July 2003.

Enclosure 12 to L-MT-08-018

CDI Affidavit

Continuum Dynamics, Inc.
(609) 538-0444 (609) 538-0464 fax 34 Lexington Avenue Ewing, NJ 08618-2302

AFFIDAVIT

Re: C.D.I. Report No. 07-23P "Flow-Induced Vibration in the Main Steam Lines at Monticello and Resulting Steam Dryer Loads," Revision 0, February 2008; C.D.I. Report 07-25P "Acoustic and Low Frequency Hydrodynamic Loads at CLTP Power Level on Monticello Steam Dryer to 200 Hz, Revision 1, March 2008; C.D.I. Report No. 07-26P "Stress Assessment of Monticello Steam Dryer," Revision 0, March 2008; C.D.I. Technical Note No. 08-12P "Limit Curve Analysis with ACM Rev. 4 for Power Ascension at Monticello," Revision 0, March 2008 and Enclosure 11 to L-MT-08-018 "Steam Dryer Dynamic Stress Evaluation"

I, Alan J. Bilanin, being duly sworn, depose and state as follows:

1. I hold the position of President and Senior Associate of Continuum Dynamics, Inc. (hereinafter referred to as C.D.I.), and I am authorized to make the request for withholding from Public Record the Information contained in the documents described in Paragraph 2. This Affidavit is submitted to the Nuclear Regulatory Commission (NRC) pursuant to 10 CFR 2.390(a)(4) based on the fact that the attached information consists of trade secret(s) of C.D.I. and that the NRC will receive the information from C.D.I. under privilege and in confidence.

2. The Information sought to be withheld, as transmitted to Nuclear Management LLC as attachments to C.D.I. Letter No. 08064 dated 25 March 2008 C.D.I. Report No. 07-23P "Flow-Induced Vibration in the Main Steam Lines at Monticello and Resulting Steam Dryer Loads," Revision 0, February 2008; C.D.I. Report 07-25P "Acoustic and Low Frequency Hydrodynamic Loads at CLTP Power Level on Monticello Steam Dryer to 200 Hz, Revision 1, March 2008; C.D.I. Report No. 07-26P "Stress Assessment of Monticello Steam Dryer," Revision 0, March 2008; C.D.I. Technical Note No. 08-12P "Limit Curve Analysis with ACM Rev. 4 for Power Ascension at Monticello," Revision 0, March 2008 and Enclosure 11 to L-MT-08-018 "Steam Dryer Dynamic Stress Evaluation"

3. The Information summarizes:

   (a) a process or method, including supporting data and analysis, where prevention of its use by C.D.I.'s competitors without license from C.D.I. constitutes a competitive advantage over other companies;
   (b) Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

(c) Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs 3(a), 3(b) and 3(c) above.

4. The Information has been held in confidence by C.D.I., its owner. The Information has consistently been held in confidence by C.D.I. and no public disclosure has been made and it is not available to the public. All disclosures to third parties, which have been limited, have been made pursuant to the terms and conditions contained in C.D.I.'s Nondisclosure Secrecy Agreement which must be fully executed prior to disclosure.

5. The Information is a type customarily held in confidence by C.D.I. and there is a rational basis therefore. The Information is a type, which C.D.I. considers trade secret and is held in confidence by C.D.I. because it constitutes a source of competitive advantage in the competition and performance of such work in the industry. Public disclosure of the Information is likely to cause substantial harm to C.D.I.'s competitive position and foreclose or reduce the availability of profit-making opportunities.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to be the best of my knowledge, information and belief.

Executed on this 25 day of March 2008.

Alan Belanin

Alan J. Bilanin
Continuum Dynamics, Inc.

Subscribed and sworn before me this day: March 25, 2008

Eileen P. Burmeister

Eileen P. Burmeister, Notary Public

EILEEN P. BURMEISTER
NOTARY PUBLIC OF NEW JERSEY
MY COMM. EXPIRES MAY 6, 2012