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

CNL-19-041

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10 CFR 50.4

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

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

Subject: **Extended Power Uprate – Unit 1 Flow Induced Vibration Summary Report**

Reference: NRC Letter to TVA, "Browns Ferry Nuclear Plant, Units 1, 2, and 3 – Issuance of Amendments Regarding Extended Power Uprate (CAC Nos. MF6741, MF6742, and MF6743)," dated August 14, 2017 (ML17032A120)

In accordance with 10 CFR 50.92, the NRC issued Reference 1, License Amendment Nos. 299, 323 and 283 to the Browns Ferry Nuclear Plant (BFN) Units 1, 2 and 3 Renewed Facility Operating Licenses (RFOLs) to increase the authorized maximum power level from 3458 megawatts thermal (MWt) to 3952 MWt. This change to power level is considered an extended power uprate (EPU).

The amended RFOLs contain specific license conditions that control the monitoring, evaluating, and taking prompt action in response to potential adverse flow effects as a result of the EPU on plant structures, systems, and components during initial EPU power ascension. This letter satisfies BFN Unit 1 License Condition 2.C(18)(f) by providing, within 90 days following completion of EPU power ascension testing, a flow induced vibration summary report for certain specified BFN Unit 1 piping and valve locations, including the vibration data and evaluation of the measured data compared to acceptance limits. BFN Unit 1 completed EPU power ascension testing for vibration monitoring of piping and valves on January 31, 2019. As a result, the due date for this submittal is May 1, 2019.

There are no new regulatory commitments associated with this submittal. If there are any questions or if additional information is needed, please contact Michael A. Brown at (423) 751-3275.

Respectfully,

E. K. Henderson
Director, Nuclear Regulatory Affairs

Enclosure: Browns Ferry Nuclear Plant Unit 1 Flow Induced Vibration Summary Report

cc (Enclosure):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant
State Health Officer, Alabama State Department of Public Health

Enclosure

Browns Ferry Nuclear Plant Unit 1 Flow Induced Vibration Summary Report

Introduction

This summary report provides an evaluation of flow induced vibration (FIV) data obtained at approximately 3630 MWt (91.9% power), 3803 MWt (96.2% power) and 3952 MWt (100% power) compared against vibration acceptance limits as required by Browns Ferry Nuclear Plant (BFN) Unit 1 License Condition 2.C(18)(f) issued with License Amendment No. 299, dated August 14, 2017.

FIV monitoring of piping and valves was performed during power ascension to extended power uprate (EPU) operating conditions per the BFN Unit 1 EPU Power Ascension Test Plan (PATP) – Vibration Monitoring, Rev. 3, dated February 2019. The following systems that could experience increased vibration due to higher flow rates resulting from EPU implementation were included in the scope of the FIV monitoring program:

- Main Steam (MS) – piping and selected valves
- High Pressure Coolant Injection (HPCI) – valve on steam supply line
- Reactor Core Isolation Cooling (RCIC) - valve on steam supply line
- Feedwater (FW) – piping
- Condensate (CD) – piping
- Heater Drain (HD) – piping
- Extraction Steam (ES) – piping

The above systems were instrumented with temporarily installed sensors to obtain vibration measurements at specified power plateaus per the PATP. Two minutes of vibration data were recorded at each plateau. The vibration data was processed to obtain vibration amplitudes in terms that could be directly compared to pre-established acceptance criteria (e.g., peak-to-peak displacement or rms acceleration). In addition to the monitoring locations required by the Unit 1 License Condition 2.C(18)(f), vibration data was collected for supplemental monitoring locations. This data was collected for information and plant trending purposes and therefore is not included in this report.

Some of the monitored locations on the FW piping inside containment have both primary acceptance criteria in terms of displacement and secondary acceptance criteria in terms of acceleration. Because displacement is directly proportional to pipe stress it is the primary method of evaluating flow induced vibration.

The acceptance criteria were categorized as Level 1 and Level 2. The Level 1 criteria correspond to the acceptable steady-state vibration limits for the monitored piping and valves. The Level 2 limits, which were generally 80% or 85% of the Level 1 limits, were established to provide advance indication that measured vibrations were approaching the Level 1 limits during power ascension. The PATP specified required actions to follow if Level 2 or Level 1 limits were exceeded during power ascension. When required, changes to Level 1 limits were made in accordance with the guidelines of NEI 99-04, Guidelines for Managing NRC Commitments, issued July 1999. Changes to acceptance criteria and the associated technical justifications are summarized in Appendix A, Summary of Changes to Acceptance Criteria.

Evaluation of Results

100% EPU power (approximately 3952 MWt) was attained on January 31, 2019. The measured vibration amplitudes at approximately 3630 MWt, 3803 MWt and 3952 MWt and corresponding Level 1 and Level 2 acceptance limit for each monitoring location are provided in Tables 1 through 6. The Level 1 and Level 2 limits provided in the tables include updated values that were incorporated in Revisions 2 and 3 of the PATP.

The results provided in each table are evaluated below. Changes made to Level 1 and Level 2 limits that were incorporated in the PATP are also discussed in the applicable sections.

Table 1: Reactor Building MS and FW Piping

Table 1 includes resultant limits for MS Locations 15, A3A and 246 that were incorporated in Revision 2 of the PATP. The resultant limits were established to account for symmetry in the piping configuration at these locations, since the maximum stress is determined by the resultant of the displacements in the R and T measurement directions (see Appendix A for further discussion).

All of the measured MS vibration amplitudes or associated resultant vibration amplitudes are less than the Level 1 and Level 2 limits. At 3952 MWt, no measured vibration amplitude for the MS piping, or resultant vibration amplitude where that is governing per Table 1, exceeded 62% of the Level 1 limit (Location 40 resultant).

All of the measured FW vibration amplitudes are less than the Level 1 and Level 2 limits. At 3952 MWt, no measured vibration amplitude for the FW piping exceeded 47% of the Level 1 limit (Location 55BQ-T).

Based on the results provided in Table 1, the MS and FW piping vibrations in the reactor building are acceptable.

Table 2: MS, HPCI and RCIC Valves

All of the measured valve vibration amplitudes or associated resultant vibration amplitudes are less than the Level 1 and Level 2 limits. Because an SRV standpipe resonance near 110 Hz was not observed, the higher Level 2 limits shown in parentheses were applicable for the monitoring locations covered by Note 2 in the table. At 3952 MWt, no resultant vibration amplitude for any valve exceeded 44% of the Level 1 limit (PCV-1-4). Therefore, the MS, HPCI and RCIC valve vibrations are acceptable.

Table 3: Turbine Building MS Piping

Table 3 includes updated limits for all locations, which were incorporated in Revision 2 of the PATP. The updated limits were the result of changes made to the piping analytical model to more accurately reflect the plant configuration (see Appendix A for further discussion).

All of the measured vibration amplitudes or associated resultant vibration amplitudes are less than the Level 1 limits. All of the measured vibration amplitudes or associated resultant vibration amplitudes are less than the Level 2 limits except for the Location N30 XZ Resultant at 3630 MWt. At 3952 MWt, no measured vibration amplitude, or resultant vibration amplitude where that is governing per Table 3, exceeded 67% of the Level 1 limit (Location G99 XY Resultant).

At Location G55-Z, valid data was not obtained at 3952 MWt. Location G55-Z is on one of the MS control valve leakoff lines. Three other sensors were installed on the MS control valve leakoff lines (at Locations G99-X, G99-Y and G22-X), which are all connected to one another. The data from the three other sensors on the leakoff lines at 3952 MWt was valid and below the Level 2 limits, as was the data for Location G55-Z at 3630 MWt and 3803 MWt. In addition, the displacement amplitudes at the monitoring locations on the leakoff lines, including at Location G55-Z, were on downward trends as power was increased from 3458 MWt to 3952 MWt. Finally, the vibration amplitudes at all of the other monitoring locations on the MS piping are acceptable as discussed above. Therefore, there is sufficient data to conclude that the vibration amplitudes of the MS control valve leakoff lines, including at Location G55-Z, are acceptable at 3952 MWt.

Based on the results provided in Table 3 and the above discussion, the MS piping vibrations in the turbine building are acceptable.

Table 4: Turbine Building FW Piping

Table 4 includes updated limits for Locations G20/G40-X and G38-Z, which were incorporated in Revision 2 of the PATP. The updated limits for Locations G20/G40-X and G38-Z are the same as the limits for Locations F20/F40-X and F38-Z, respectively. The piping containing Locations G20/G40-X and G38-Z has the same configuration as the piping containing Locations F20/F40-X and F38-Z. The limits for Locations F20/F40-X and F38-Z were determined to be applicable for Locations G20/G40-X and G38-Z based on a review the frequency content of the measured vibrations during power ascension (see Appendix A for further discussion).

All of the measured vibration amplitudes are less than the Level 1 and Level 2 limits. At 3952 MWt, no measured vibration amplitude at any location exceeded 68% of the Level 1 limit (Location 135-Z). Therefore, the FW piping vibrations in the turbine building are acceptable.

Table 5: CD, HD and ES Piping

Table 5 includes a provision for HD Location 110-130 to allow use of a stress evaluation methodology, which was incorporated in Revision 3 of the PATP. The stress evaluation methodology considers the contribution of the measured displacements in all three (X, Y and Z) measurement directions (see Appendix A for further discussion).

All of the measured CD vibration amplitudes are less than the Level 1 and Level 2 limits. At 3952 MWt, no measured vibration amplitude for the CD piping exceeded 34% of the Level 1 limit (Location BB45-Z).

All of the measured vibration amplitudes at HD Location 380-385-Y & -Z are less than the Level 1 and Level 2 limits, and do not exceed 5% of the Level 1 limit. The measured vibration amplitudes at HD Location 110-130-X, -Y & -Z are less than the Level 1 limits at 3630 MWt and 3803 MWt. The measured vibration amplitudes at Location 110-130 at 3952 MWt were evaluated by determining the corresponding maximum pipe stress and comparing that value to the allowable vibration stress per Note 1 to Table 5. The stress evaluation demonstrated that the maximum pipe stress corresponding to the measured displacements in the X, Y and Z directions is approximately 89% of the allowable vibration stress and, thus, the measured displacements are acceptable.

All of the measured ES vibration amplitudes are less than the Level 1 and Level 2 limits. At 3952 MWt, no measured vibration amplitude for the ES piping exceeded 56% of the Level 1 limit (Location X253-Z).

Based on the results provided in Table 5 and the above discussion, the CD, HD and ES piping vibrations are acceptable.

Table 6: Reactor Building FW Piping Supplemental Data

All of the measured FW vibration amplitudes are less than the Level 1 and Level 2 limits. At 3952 MWt, no measured vibration amplitude for the FW piping exceeded 18% of the Level 1 limit (Location 16-T).

Based on the results provided in Table 6, the supplemental FW piping vibration measurements in the reactor building are acceptable.

Conclusion

The piping and valve vibration data provided in Tables 1 through 6 have been evaluated as required by BFN Unit 1 License Condition 2.C(18)(f). The evaluation results demonstrate that the piping and valve vibration amplitudes are less than the associated acceptance limits and, thus, are acceptable.

Table 1. FIV Monitoring Results for Reactor Building MS and FW Piping

Description	Location-Direction	Measured Displacement (mils pk-pk)			Level 2 Limit (mils pk-pk)	Level 1 Limit (mils pk-pk)
		3630 MWt	3803 MWt	3952 MWt		
MS Line A	15-R	16	22	23	61	76
	15-T	9	11	11	61	76
	15 Resultant(2)	18	25	25	86	107
	85-R	8	11	13	40	50
	85-V	11	12	13	40	50
MS Line B	A3A-R	9	8	9	33	41
	A3A-T	15	19	16	41	51
	A3A Resultant(2)	17	21	18	52	65
	19-V	3	3	4	44	55
MS Line C	246-R	10	7	8	38	48
	246-T	24	25	28	24	30
	246 Resultant(2)	26	26	29	46	57
	40-X	12	12	14	10	12
	40-Z	7	7	8	18	23
	40 Resultant(1)	14	14	16	21	26
	36/37-V	9	11	12	32	40
FW Loop A, Nozzle A	ATA-R	3	3	4	100	125
	19A-V	3	3	4	54	67
FW Loop A, Nozzle B	BT-X	3	4	4	67	84
	BT-Z	8	8	8	34	42
FW Loop A, Nozzle C	16-R	11	11	11	63	79
	16-T	8	9	10	53	66
FW Loop A, FCV-3-562 SB	55BQ-V	4	4	4	20	25
	55BQ-T	5	5	6	10	13
FW Loop B, Nozzle F	8A-R	3	4	4	79	99
	15D-V	4	4	5	40	50
FW Loop B, Nozzle E	24A-X	5	5	5	32	40
	24A-Z	5	5	5	119	149
FW Loop B, Nozzle D	42A-R	11	10	12	66	83
	42-AT	9	11	11	78	97

1. The measured displacements in the X and Z directions are acceptable if the resultant of the measured displacements in the X and Z directions is less than the Level 1 limit.
2. The measured displacements in the R and T directions are acceptable if the resultant of the measured displacements in the R and T directions is less than the Level 1limit.

Table 2. FIV Monitoring Results for MS, HPCI and RCIC Valves

Description	Direction	Measured Acceleration (g-rms)			Level 2 Limit (g-rms)	Level 1 Limit (g-rms)
		3630 MWt	3803 MWt	3952 MWt		
MS Line A Inboard Isolation Valve (FCV-1-14)	X	0.039	0.046	0.051	0.058 $(0.221)^2$	0.260
	Y	0.050	0.054	0.060	0.090 $(0.116)^2$	0.136
	Z	0.067	0.073	0.079	0.089 $(0.328)^2$	0.386
	Resultant(1)	0.092	0.102	0.112	0.140 $(0.412)^2$	0.485
MS Drain Header Inboard Isolation Valve (FCV-1-55)	X	0.045	0.051	0.051	0.110 $(0.140)^2$	0.165
	Y	0.035	0.039	0.043	0.140 $(0.182)^2$	0.214
	Z	0.056	0.059	0.064	0.100 $(0.133)^2$	0.157
	Resultant(1)	0.080	0.087	0.092	0.200 $(0.266)^2$	0.313
RCIC Steam Supply Line Inboard Isolation Valve (FCV-71-2)	X	0.042	0.044	0.046	0.110 $(0.141)^2$	0.166
	Y	0.031	0.033	0.036	0.140 $(0.183)^2$	0.215
	Z	0.050	0.053	0.059	0.100 $(0.133)^2$	0.157
	Resultant(1)	0.072	0.076	0.083	0.200 $(0.267)^2$	0.314
HPCI Steam Supply Line Inboard Isolation Valve (FCV-73-2)	X	0.049	0.055	0.055	0.200 $(0.318)^2$	0.374
	Y	0.035	0.040	0.042	0.130 $(0.199)^2$	0.234
	Z	0.081	0.088	0.088	0.130 $(0.199)^2$	0.234
	Resultant(1)	0.101	0.111	0.112	0.270 $(0.424)^2$	0.499
MS Line A SRV (PCV-1-4)	X	0.24	0.28	0.28	0.59	0.69
	Y	0.38	0.39	0.42	0.77	0.90
	Z	0.09	0.11	0.11	0.34	0.40
	Resultant(1)	0.46	0.49	0.52	1.03	1.20
MS Line B SRV (PCV-1-22)	X	0.05	0.06	0.06	0.59	0.69
	Y	0.12	0.10	0.11	0.77	0.90
	Z	0.08	0.08	0.09	0.34	0.40
	Resultant(1)	0.15	0.14	0.15	1.03	1.20
MS Line C SRV (PCV-1-34)	X	0.11	0.13	0.14	0.59	0.69
	Y	0.09	0.10	0.11	0.77	0.90
	Z	0.10	0.11	0.13	0.34	0.40
	Resultant(1)	0.17	0.20	0.22	1.03	1.20
MS Line D SRV (PCV-1-180)	X	0.05	0.06	0.06	0.59	0.69
	Y	0.09	0.07	0.07	0.77	0.90
	Z	0.08	0.08	0.09	0.34	0.40
	Resultant(1)	0.13	0.12	0.13	1.03	1.20

1. The measured accelerations are acceptable if the resultant of the measured accelerations is less than the Level 1 limit.
2. The Level 2 limit can be increased to the value in parentheses if an SRV standpipe resonance near 110 Hz is not occurring.

Table 3. FIV Monitoring Results for Turbine Building MS Piping

Description	Location-Direction	Measured Displacement (mils pk-pk)			Level 2 Limit (mils pk-pk)	Level 1 Limit (mils pk-pk)
		3630 MWt	3803 MWt	3952 MWt		
Main Steam Line B 24"	B125-X	16	19	14	36	45
Main Steam Line D 24"	D125-X	29	28	25	139	174
Bypass Valves 8" Line	L75-Y	20	21	25	158	197
	L75-Z	13	11	12	182	228
Main Steam Line A 28"	A310-X	34	50	52	30	38
	A310-Y	43	39	28	121	151
	A310-Z	58	49	48	99	124
	XZ Resultant(1)	67	70	71	104	130
Main Steam Line C 28"	C290-X	41	36	32	70	87
	C290-Y	28	29	23	114	142
	C290-Z	122	124	82	192	240
	XZ Resultant(1)	129	129	88	204	255
Main Steam Line A 1" Line	M30-X	42	41	39	65	81
	M30-Z	78	92	61	142	178
	XZ Resultant(1)	89	101	72	157	196
Main Steam Line C 1" Line	N30-X	45	33	36	65	81
	N30-Z	153	146	104	142	178
	XZ Resultant(1)	159	150	110	157	196
Stop Valve 1C	F37-X	49	52	37	150	187
	F37-Z	47	38	33	134	167
Control Valve 1A 1" Line	G99-X	29	25	19	90	113
	G99-Y	92	90	85	54	67
	XY Resultant(2)	96	93	87	105	131
Control Valve 1C 2.5" Line	G55-Z	49	42	(3)	69	86
Control Valve 1D 1" Line	G22-X	33	20	10	61	76

1. The measured displacements in the X and Z directions are acceptable if the resultant of the measured displacements in the X and Z directions is less than the Level 1 limit.
2. The measured displacements in the X and Y directions are acceptable if the resultant of the measured displacements in the X and Y directions is less than the Level 1 limit.
3. See "Evaluation of Results" section.

Table 4. FIV Monitoring Results for Turbine Building FW Piping

Description	Location-Direction	Measured Displacement (mils pk-pk)			Level 2 Limit (mils pk-pk)	Level 1 Limit (mils pk-pk)
		3630 MWt	3803 MWt	3952 MWt		
RFP 1A 18" Discharge	A38-X	19	17	19	114	142
	A38-Y	9	8	13	57	71
	47-Z	31	33	31	338	423
RFP 1B 18" Discharge	142A-X	8	6	6	68	85
	142-DY	13	10	13	82	102
	132A-Z	21	20	18	203	254
RFP 1C 18" Discharge	80A-Y	29	24	26	82	102
Heater String A2 18" Line	215-DX	5	4	4	67	84
	215B-Z	32	33	31	105	131
Heater String A1 18" Line	95A-X	10	12	12	32	40
	95A-Y	9	10	9	18	23
Heater String C1 18" Line	32-Y	4	4	4	21	26
	32-Z	2	3	3	26	32
RFW 24" Disch Return	135-DX	8	9	9	25	31
	135-DZ	15	18	23	27	34
FW Item No. 40	E30/E40-X	6	5	7	357	446
	E29-Z	4	4	4	749	936
FW Item No. 42	F20/F40-X	9	12	15	58	73
	F38-Z	39	40	42	230	287
FW Item No. 52	G20/G40-X	17	11	19	58	73
	G38-Z	65	53	48	230	287
FW Item No. 55	H31-Y	4	4	5	58	73
	H31-Z	6	6	6	24	30

Table 5. FIV Monitoring Results for CD, HD and ES Piping

Description	Location-Direction	Measured Displacement (mils pk-pk)			Level 2 Limit (mils pk-pk)	Level 1 Limit (mils pk-pk)
		3630 MWt	3803 MWt	3952 MWt		
CD-01	50-X	17	21	25	105	131
	50-Y	12	14	11	118	148
	50-Z	22	24	33	158	198
CD-02	BB45-X	24	27	25	170	213
	BB45-Y	14	13	14	90	112
	BB45-Z	43	56	57	135	169
HD-01	380-385-Y	8	8	7	139	174
	380-385-Z	5	5	5	98	122
HD-02	110-130-X	29	47	56	40	50[(1)]
	110-130-Y	20	23	26	33	41[(1)]
	110-130-Z	46	52	55	54	68[(1)]
ES-01	CB37-X	8	10	10	146	183
	CB37-Y	2	3	3	86	107
	CB37-Z	7	7	7	79	99
ES-02	HA02-X	8	11	10	87	109
	HA02-Y	4	4	5	142	178
	HA02-Z	8	10	7	105	131
ES-03	X253-X	19	23	27	63	79
	X253-Y	12	16	15	62	78
	X253-Z	22	25	29	42	52

1. The measured displacement is acceptable if analysis demonstrates the maximum pipe stress is below the allowable vibration stress limit (i.e., endurance limit). See "Evaluation of Results" section.

Table 6. Supplemental FIV Monitoring Results for Reactor Building FW Piping

Description	Location-Direction	Measured Displacement (g's pk)			Level 2 Limit (g's pk)	Level 1 Limit (g's pk)
		3630 MWt	3803 MWt	3952 MWt		
FW Loop A, Nozzle A	ATA-R	0.07	0.08	0.09	2.85	3.56
	19A-V	0.07	0.07	0.07	1.32	1.65
FW Loop A, Nozzle B	BT-X	0.07	0.08	0.09	2.02	2.53
	BT-Z	0.11	0.13	0.12	1.14	1.43
FW Loop A, Nozzle C	16-R	0.17	0.16	0.16	1.66	2.08
	16-T	0.11	0.13	0.15	0.70	0.87
FW Loop A, FCV-3-562 SB	55BQ-V	0.07	0.06	0.08	0.67	0.84
	55BQ-T	0.05	0.05	0.04	0.35	0.44
FW Loop B, Nozzle F	8A-R	0.09	0.11	0.10	2.41	3.01
	15D-V	0.09	0.10	0.10	0.98	1.22
FW Loop B, Nozzle E	24A-X	0.10	0.12	0.12	1.18	1.48
	24A-Z	0.10	0.12	0.12	3.74	4.67
FW Loop B, Nozzle D	42A-R	0.15	0.16	0.15	1.92	2.40
	42-AT	0.13	0.15	0.16	1.91	2.39

Appendix A, Summary of Changes to Acceptance Criteria

Description:

Table 1, FIV Monitoring Results for Reactor Building MS and FW Piping, added resultant acceptance criteria to clarify acceptance for six sensors (3 locations). The points affected are MS A3A - MS Line B, MS 15 - MS Line A, and MS 246 - MS Line C.

Justification:

The measurements at Locations A3A, 15 and 246 are taken in two orthogonal directions (R & T). The measured values in the two orthogonal directions may not be in the same proportional relationship as those determined by the analysis (e.g. the measured values in the R direction may be slightly higher and the measured values in the T direction may be slightly lower, or vice versa). Due to symmetry in the piping configuration at these locations, the maximum stress is determined by the resultant of the vibration in the R and T directions. A piping segment is acceptable if the resultant remains within stress/displacement limits. Note 2 recognizes that motion in a particular direction may be higher or lower than anticipated while still meeting analysis limits reflected by the added resultant acceptance criteria.

Description:

Table 3, FIV Monitoring Results for the Turbine Building MS Piping, revised the acceptance criteria for all locations.

Justification:

The revised limits are the result of changes made to the piping analytical model. The changes more accurately and precisely model actual plant configuration. The sample line piping model used to establish the acceptance criteria for Locations M30 and N30 was a stand-alone model and not part of the turbine building main steam model. The turbine building main steam model did include this small bore piping, but did not include the tie back supports and attached tubing, and was not used to establish the sample line acceptance criteria. The changes to the turbine building main steam model incorporate the configuration of small bore piping nodes M30 - MS Line A 1” sample line, and N30 - MS Line C 1” sample line including tie back supports and attached tubing. Additionally, the model was updated to include incorporation of the actual LVDT attachment point for small bore piping nodes G99 - Control Valve 1A 1” line, G55 - Control Valve 1C 2.5” line, and G22 - Control Valve 1D 1” line. The updated turbine building main steam model was then used to determine the level 1 acceptance criteria for the small bore piping. Changes to the model had a collateral effect on the acceptance criteria for small bore monitoring location MS F37 - Stop Valve 1C. As a result, the acceptance criteria changed for small bore monitoring locations M30, N30, G22, G55, G99 and F37.

For the large bore piping in Table 3, the acceptance criteria are analytically determined using the same piping model. The large bore piping revised limits are the result of the collateral effects of the changes made to this analytical piping model discussed above. As a result, the acceptance

criteria for large bore piping locations MS B125 - MS Line B 24", MS D125 - MS Line D 24", MS L75 - Bypass Valves 8" Line, MS A310 - MS Line A 28", and MS C290 - MS Line C28" also changed.

Description:

Table 4, FIV Monitoring Results for the Turbine Building FW Piping, revised the acceptance criteria for nodes FW G20/40 and FW G38, RFP 1C discharge vent 1" line.

Justification:

Monitoring locations G20/G40-X and G38-Z are on a 1" vent line attached to the FW Pump 1C discharge line. Monitoring locations F20/F40-X and F38-Z are on an identical 1" vent line attached to the FW Pump 1A discharge line. Although the two vent line configurations are identical, the original Level 1 limits for G20/G40-X and G38-Z were lower than for F20/F40-X and F38-Z, respectively. The differences in the displacement limits were due to differences in the frequency content of the header and branch line vibrational responses in the analysis used to establish the limits. However, the frequency content of the measured vibration in the two vent lines is the same. The frequency content of the measured vibration in both lines is also in agreement with the frequency content of the F20/F40-X and F38-Z vibrational responses in the analysis. Therefore, it is appropriate to use the allowable displacement limits established for F20/F40-X and F38-Z for G20/G40-X and G38-Z, respectively.

Description:

Table 5, FIV Monitoring Results for CD, HD, and ES Piping, revised the acceptance criteria for Nodes 110-130, vertical piping from FW Heater 2B to FW Heater 3B, to allow the use of a stress evaluation methodology.

Justification:

The Level 1 acceptance limits are calculated based on the maximum stress in the piping analysis used to determine the acceptance criteria. Monitoring location 110-130 measures displacements in the X, Y, and Z directions on the vertical riser between FW heater 2B and FW heater 3B. The contribution of the measured displacement in each direction to the stress at the maximum stress location is calculated and used to determine the actual maximum stress. If the maximum stress due to the measured displacements is below the allowable stress (i.e., the endurance limit), the measured displacements are acceptable.