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GNRO-2012/00107

September 6, 2012

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

SUBJECT: Vibration Data Report and Commitment Change

Grand Gulf Nuclear Station, Unit 1
Docket No. 50-416
License No. NPF-29

REFERENCES:
1. Entergy Operations, Inc. letter to the NRC (GNRO-2012/00079), *Summary Report of Replacement Steam Dryer Data – Responses to Requests for Additional Information*, August 7, 2012 (ADAMS Accession No. ML12221A198)
2. Entergy Operations, Inc. letter to the NRC (GNRO-2011/00033), *Supplemental Information - Extended Power Uprate*, September 9, 2011 (ADAMS Accession No. ML112521284)

Dear Sir or Madam:

In Reference 1, Entergy Operations, Inc. (Entergy) committed to provide vibration data along with acceptance limits for the main steam line (MSL) and the MSL safety relief valves (SRVs) for Grand Gulf Nuclear Station based on data collected at various power plateaus during the Extended Power Uprate (EPU) power ascension testing program. The vibration data collected at ~4306 MWt [110% of 3898 MWt, the previous licensed thermal power (PLTP)] is provided in the attachment to this letter.

In addition to transmitting the vibration data report, by this letter Entergy is notifying the NRC of a change to a commitment made in Reference 2. Specifically, the commitment previously stated:

> "EPU startup testing would be performed as described in Attachment 9, 'Extended Power Uprate Startup Test Plan,' with the exception of EPU Test 10 – IRM Performance."

The EPU Startup Test Plan specifies EPU Tests 100, "Main Steam and Feedwater Piping Vibration," and 101, "Plant Parameter Monitoring," to be performed during power ascension to EPU conditions (4408 MWt) from 100% PLTP in step increases of 2.5% reactor power.

Entergy has changed the commitment to read as follows (changes in italics):

> "EPU startup testing would be performed as described in Attachment 9, 'Extended Power Uprate Startup Test Plan,' with the exception of EPU Test 10 – IRM Performance. *In addition, performing EPU Tests 100 and 101 at Test Condition (TC) 12.5 may be delayed until TC EPU at the test director's direction provided acceptable performance is demonstrated at TC 10.*"

This change allows EPU Tests 100 and 101 to be performed at TC EPU, the final power ascension test plateau at 4408 MWt, vs. TC 12.5 at 4306 MWt, a 0.5% difference.

This change was discussed with the NRC Project Manager for GGNS on August 31, 2012. The evaluation of this change is available for review at the site.

If you have any questions or require additional information, please contact Guy Davant at (601) 368-5756.

This letter contains no new regulatory commitments.

Sincerely,

BSF/ghd

Attachment: Vibration Data for the Main Steam Line Piping and Safety Relief Valves – 4306 MWt (110% PLTP)

cc: Mr. Elmo E. Collins, Jr.
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ATTACHMENT

GRAND GULF NUCLEAR STATION

GNRO-2012/00107

VIBRATION DATA FOR THE MAIN STEAM LINE PIPING AND SAFETY RELIEF VALVES 4306 MWt (110% PLTP)

VIBRATION DATA FOR THE MAIN STEAM LINE PIPING AND SAFETY RELIEF VALVES 4306 MWt (110% PLTP)

I. Main Steam Line (MSL) Piping Vibration Data and Acceptance Limits

Table 1, below, contains the results from the MSL piping vibration testing performed as part of the GGNS Extended Power Uprate (EPU) Power Ascension Test Plan (PATP) at 4306 MWt [110% of 3898 MWt, the previous licensed thermal power (PLTP)].

The measured accelerations were taken in the major axes for each of the nodes. A band pass filter (RMS) for the test data was applied based on:

- Lower Limit – Capturing frequencies below the lowest piping frequency which corresponds to the highest piping stresses. Generally, this number is higher than 1 Hz, which typically contains voltage drift and DC signals that need to be removed.

- Upper Limit – The upper limit frequency should be sufficiently high so that there is no significant modal participation on the maximum piping stresses. Also, the intent is to remove the high frequency noise, generally above 100 Hz.

The acceptance criteria are based on applying a constant 1g acceleration spectrum to the piping model and determining the maximum stress. The maximum stress was compared with the OM criteria alternating stress allowable per ASME OM-S/G-1997, *Standards and Guides for Operation and Maintenance of Nuclear Power Plants*. The resulting ratio was used to modify the output accelerations at the location for each of the test points.

Node 1008 of MSL-A has reported data that contained intermittent high-amplitude spikes. These types of spikes were neither seen in the corresponding data for the other valves at the same valve location (top) nor in the data of at any of the nodes. For these reasons, the data at this location was deemed unusable.

Node 3010 of MSL-C has also reported data that indicates a failure in the mounting system. Two sets of data were retrieved at the 105% power plateau. One was taken directly after the plateau was reached and a subsequent set was taken before the ascension to the 107.5% plateau. While the plant data indicated a small increase in flow, there was a markedly higher increase in the X (longitudinal), Y (vertical), and Z (lateral) acceleration at Node 3010 on MSL-C. This magnitude increase for Node 3010 of MSL-C is in excess of 2 standard deviations above the response noted for the other 15 SRVs. For this reason, the data at this location was also deemed unusable.

Table 1

PIPING DESCRIPTION/ SEGMENT	MONITOR LOC./DIR.	MEASURED ACCEL (g)	ACCEL. LIMIT LEVEL 2 / LEVEL 1 (g)	POINT NUM.	ACCEL. LEVEL 2/ LEVEL 1 MARGIN (%)	NOTES
Piping associated with B21-F041A (Top of Valve) MSL-A, Node 1008	X	N/A	0.720 / 1.440	1X	N/A	Non-Operable Sensor
Piping associated with B21-F041A (Top of Valve) MSL-A, Node 1008	Y	N/A	0.160 / 0.320	1Y	N/A	Non-Operable Sensor
Piping associated with B21-F041A (Top of Valve) MSL-A, Node 1008	Z	N/A	0.671 / 1.341	1Z	N/A	Non-Operable Sensor
Piping associated with B21-F041A (Actuator) MSL-A, Node 1010	X	0.260	0.447 / 0.893	2X	41.8 / 70.9	Acceptable
Piping associated with B21-F041A (Actuator) MSL-A, Node 1010	Y	0.216	0.231 / 0.461	2Y	6.5 / 53.1	Acceptable
Piping associated with B21-F041A (Actuator) MSL-A, Node 1010	Z	0.190	0.434 / 0.868	2Z	56.2 / 78.1	Acceptable
Piping associated with B21-F051A (Actuator) MSL-A, Node 2010	X	0.180	0.349 / 0.697	3X	48.4 / 74.2	Acceptable
Piping associated with B21-F051A (Actuator) MSL-A, Node 2010	Y	0.219	0.224 / 0.447	3Y	2.2 / 51.0	Acceptable
Piping associated with B21-F051A (Actuator) MSL-A, Node 2010	Z	0.222	0.389 / 0.778	3Z	42.9 / 71.5	Acceptable
Piping associated with B21-F047A (Actuator) MSL-A, Node 4010	X	0.164	0.420 / 0.840	4X	61.0 / 80.5	Acceptable

PIPING DESCRIPTION/ SEGMENT	MONITOR LOC./DIR.	MEASURED ACCEL (g)	ACCEL. LIMIT LEVEL 2 / LEVEL 1 (g)	POINT NUM.	ACCEL. LEVEL 2/ LEVEL 1 MARGIN (%)	NOTES
Piping associated with B21-F047A (Actuator) MSL-A, Node 4010	Y	0.008	0.310 / 0.619	4Y	97.4 / 98.7	Acceptable
Piping associated with B21-F047A (Actuator) MSL-A ,Node 4010	Z	0.216	0.474 / 0.948	4Z	54.4 / 77.2	Acceptable
Piping associated with B21-F051B (Top of Valve) MSL-B, Node 1008	X	0.017	0.701 / 1.402	5X	97.6 / 98.8	Acceptable
Piping associated with B21-F051B (Top of Valve) MSL-B, Node 1008	Y	0.150	0.185 / 0.370	5Y	18.9 / 59.5	Acceptable
Piping associated with B21-F051B (Top of Valve) MSL-B, Node 1008	Z	0.422	0.756 / 1.512	5Z	44.2 / 72.1	Acceptable
Piping associated with B21-F051F (Actuator) MSL-B, Node 3010	X	0.006	0.389 / 0.778	6X	98.5 / 99.2	Acceptable
Piping associated with B21-F051F (Actuator) MSL-B, Node 3010	Y	0.039	0.212 / 0.424	6Y	81.6 / 90.8	Acceptable
Piping associated with B21-F051F (Actuator) MSL-B, Node 3010	Z	0.362	0.436 / 0.872	6Z	17.0 / 58.5	Acceptable
Piping associated with B21-F041F (Top of Valve) MSL-B, Node 4008	X	0.634	0.645 / 1.290	7X	1.7 / 50.9	Acceptable
Piping associated with B21-F041F (Top of Valve) MSL-B, Node 4008	Y	0.171	0.181 / 0.362	7Y	5.5 / 52.8	Acceptable
Piping associated with B21-F041F (Top of Valve) MSL-B, Node 4008	Z	0.733	0.800 / 1.600	7Z	8.4 / 54.2	Acceptable

PIPING DESCRIPTION/ SEGMENT	MONITOR LOC./DIR.	MEASURED ACCEL (g)	ACCEL. LIMIT LEVEL 2 / LEVEL 1 (g)	POINT NUM.	ACCEL. LEVEL 2/ LEVEL 1 MARGIN (%)	NOTES
Piping associated with B21-F041K (Top of Valve) MSL-B, Node 6008	X	0.432	0.663 / 1.326	8X	34.8 / 67.4	Acceptable
Piping associated with B21-F041K (Top of Valve) MSL-B, Node 6008	Y	0.086	0.229 / 0.457	8Y	62.4 / 81.2	Acceptable
Piping associated with B21-F041K (Top of Valve) MSL-B, Node 6008	Z	0.409	0.677 / 1.353	8Z	40.0 / 69.8	Acceptable
Piping associated with B21-F041C (Top of Valve) MSL-C, Node 1008	X	0.695	0.701 / 1.402	9X	0.9 / 50.4	Acceptable
Piping associated with B21-F041C (Top of Valve) MSL-C, Node 1008	Y	0.113	0.185 / 0.370	9Y	38.9 / 69.5	Acceptable
Piping associated with B21-F041C (Top of Valve) MSL-C, Node 1008	Z	0.696	0.756 / 1.512	9Z	7.9 / 54.0	Acceptable
Piping associated with B21-F051C (Actuator) MSL-C, Node 3010	X	N/A	0.389 / 0.778	10AX	N/A	Non-Operable Sensor
Piping associated with B21-F051C (Actuator) MSL-C, Node 3010	Y	N/A	0.212 / 0.424	10AY	N/A	Non-Operable Sensor
Piping associated with B21-F051C (Actuator) MSL-C, Node 3010	Z	N/A	0.436 / 0.872	10AZ	N/A	Non-Operable Sensor
Piping associated with B21-F047G (Top of Valve) MSL-C, Node 4008	X	0.376	0.645 / 1.290	10BX	41.7 / 70.9	Acceptable
Piping associated with B21-F047G (Top of Valve) MSL-C, Node 4008	Y	0.047	0.181 / 0.362	10BY	74.0 / 87.0	Acceptable

PIPING DESCRIPTION/ SEGMENT	MONITOR LOC./DIR.	MEASURED ACCEL (g)	ACCEL. LIMIT LEVEL 2 / LEVEL 1 (g)	POINT NUM.	ACCEL. LEVEL 2/ LEVEL 1 MARGIN (%)	NOTES
Piping associated with B21-F047G (Top of Valve) MSL-C, Node 4008	Z	0.649	0.800 / 1.600	10BZ	18.9 / 59.4	Acceptable
Piping associated with B21-F047L (Top of Valve) MSL-C, Node 6008	X	0.526	0.663 / 1.326	10CX	20.7 / 60.3	Acceptable
Piping associated with B21-F047L (Top of Valve) MSL-C, Node 6008	Y	0.212	0.229 / 0.457	10CY	7.4 / 53.6	Acceptable
Piping associated with B21-F047L (Top of Valve) MSL-C, Node 6008	Z	0.381	0.677 / 1.353	10CZ	43.7 / 71.8	Acceptable
Piping associated with B21-F047D (Top of Valve) MSL-D, Node 1008	X	0.267	0.720 / 1.440	10DX	62.9 / 81.5	Acceptable
Piping associated with B21-F047D (Top of Valve) MSL-D, Node 1008	Y	0.153	0.160 / 0.320	10DY	4.4 / 52.2	Acceptable
Piping associated with B21-F047D (Top of Valve) MSL-D, Node 1008	Z	0.291	0.671 / 1.341	10DZ	56.6 / 78.3	Acceptable
Piping associated with B21-F047D (Actuator) MSL-D, Node 1010	X	0.400	0.447 / 0.893	10EX	10.5 / 55.2	Acceptable
Piping associated with B21-F047D (Actuator) MSL-D, Node 1010	Y	0.153	0.231 / 0.461	10EY	33.8 / 66.8	Acceptable
Piping associated with B21-F047D (Actuator) MSL-D, Node 1010	Z	0.150	0.434 / 0.868	10EZ	65.4 / 82.7	Acceptable
Piping associated with B21-F014D (Actuator) MSL-D, Node 2010	X	0.198	0.349 / 0.697	10FX	43.3 / 71.6	Acceptable

PIPING DESCRIPTION/ SEGMENT	MONITOR LOC./DIR.	MEASURED ACCEL (g)	ACCEL. LIMIT LEVEL 2 / LEVEL 1 (g)	POINT NUM.	ACCEL. LEVEL 2/ LEVEL 1 MARGIN (%)	NOTES
Piping associated with B21-F014D (Actuator) MSL-D, Node 2010	Y	0.089	0.224 / 0.447	10FY	60.3 / 80.1	Acceptable
Piping associated with B21-F014D (Actuator) MSL-D, Node 2010	Z	0.170	0.389 / 0.778	10FZ	56.3 / 78.1	Acceptable
Piping associated with B21-F051D (Actuator) MSL-D, Node 4010	X	0.399	0.420 / 0.840	10GX	5.0 / 52.5	Acceptable
Piping associated with B21-F051D (Actuator) MSL-D, Node 4010	Y	0.296	0.310 / 0.619	10GY	4.5 / 52.2	Acceptable
Piping associated with B21-F051D (Actuator) MSL-D, Node 4010	Z	0.369	0.474 / 0.948	10GZ	22.2 / 61.1	Acceptable
Piping associated with Pipe Support N11G001H14 Turbine Bldg. MSL-D, Node 412	X	0.089	0.213 / 0.426	15X	58.2 / 79.1	Acceptable

II. Main Steam Safety Relief Valve (SRV) Vibration Data and Acceptance Limits

Table 2, below, contains the results from the SRV vibration testing performed as part of the GGNS EPU PATP at 4306 MWt (110% PLTP).

The resultant measured acceleration represents the combined peak accelerations reported by the tri-axial accelerometer at the particular node. This peak was gathered from the time-history data after band-pass filtering (2 - 250Hz) and DC-offset removal.

Node 1008 of MSL-A has reported data that contained intermittent high-amplitude spikes. These types of spikes were neither seen in the corresponding data for the other valves at the same valve location (top) nor in the data of at any of the nodes. For these reasons, the data at this location was deemed unusable and the other limits related to MSL-A were adjusted to account for this.

Node 3010 of MSL-C has also reported data that indicates a failure in the mounting system. Two sets of data were retrieved at the 105% power plateau. One was taken directly after the plateau was reached and a subsequent set was taken before the ascension to the 107.5%

plateau. While the plant data indicated a small increase in flow, there was a markedly higher increase in the X (longitudinal), Y (vertical), and Z (lateral) acceleration at Node 3010 on MSL-C. This magnitude increase for Node 3010 of MSL-C is in excess of 2 standard deviations above the response noted for the other 15 SRVs. For this reason, the data at this location was also deemed unusable.

PSD comparisons were made of the MSL response at SRV monitoring points on two valves at Nodes 1008 and Node 3010. The PSD comparison for X, Y, and Z response shows a large change in frequency response through much of the 1- 250Hz range at Node 3010 and only a small change in magnitude at the Node 1008 location. The three accelerometers at Node 3010 are mounted on the same block and strapped to the actuator. It is expected that the straps have loosened and the channel has shifted. Therefore, the measured response is most likely being affected by the response of the accelerometer mounting system and this measured response must be discounted. Based on the current methodology for developing limits through analytical methods, the limits for the other acceleration locations for the MSL-C do not need to be adjusted to account for the erroneous data at Node 3010 of MSL-C.

Table 2

COMP./PIPING DESCRIPTION / SEGMENT	POINT NUM.	MONITOR LOC./DIR.	ACCEL. LIMIT (g)	ACCEL. MEASURED (g)	ACCEL. MARGIN (%)	NOTES
B21-F041A		X	0.00	0.00	0	Non-Op Sensor
Top of Valve	1	Y	0.00	0.00	0	Non-Op Sensor
MSL-A, Node 1008		Z	0.00	0.00	0	Non-Op Sensor
B21-F041A		X	3.78	1.17	68.97	
Actuator	2	Y	3.77	1.15	69.46	Acceptable
MSL-A, Node 1010		Z	3.78	1.17	68.97	
B21-F051A		X	3.78	0.81	78.54	
Actuator	3	Y	3.77	0.95	74.75	Acceptable
MSL-A, Node 2010		Z	3.78	0.81	78.54	
B21-F047A		X	3.78	0.77	79.65	
Actuator	4	Y	3.77	0.01	99.75	Acceptable
MSL-A, Node 4010		Z	3.78	0.77	79.65	
B21-F051B		X				
Top of Valve	5	Y	4.03	1.57	61.06	Acceptable
MSL-B, Node 1008		Z				
B21-F051F		X	3.78	1.33	64.89	
Actuator	6	Y	3.77	1.51	60.03	Acceptable
MSL-B, Node 3010		Z	3.78	1.33	64.89	
B21-F041F		X				
Top of Valve	7	Y	4.03	3.39	15.76	Acceptable
MSL-B, Node 4008		Z				
B21-F041K		X				
Top of Valve	8	Y	4.03	1.71	57.50	Acceptable
MSL-B, Node 6008		Z				

COMP./PIPING DESCRIPTION / SEGMENT	POINT NUM.	MONITOR LOC./DIR.	ACCEL. LIMIT (g)	ACCEL. MEASURED (g)	ACCEL. MARGIN (%)	NOTES
B21-F041C		X				
Top of Valve	9	Y	4.03	4.51	-12.04	See Note 1.
MSL-C, Node 1008		Z				
B21-F051C		X	0.00	0.00	0.00	Non-Op Sensor
Actuator	10a	Y	0.00	0.00	0.00	Non-Op Sensor
MSL-C, Node 3010		Z	0.00	0.00	0.00	Non-Op Sensor
B21-F047G		X				
Top of Valve	10b	Y	4.03	2.66	34.02	Acceptable
MSL-C, Node 4008		Z				
B21-F047L		X				
Top of Valve	10c	Y	4.03	1.57	60.96	Acceptable
MSL-C, Node 6008		Z				
B21-F047D		X				
Top of Valve	10d	Y	4.03	1.47	63.53	Acceptable
MSL-D, Node 1008		Z				
B21-F047D		X	3.78	2.50	33.89	
Actuator	10e	Y	3.77	1.03	72.79	Acceptable
MSL-D, Node 1010		Z	3.78	2.50	33.89	
B21-F041D		X	3.78	1.12	70.41	
Actuator	10f	Y	3.77	0.91	75.75	Acceptable
MSL-D, Node 2010		Z	3.78	1.12	70.41	
B21-F051D		X	3.78	1.40	62.81	
Actuator	10g	Y	3.77	0.50	86.83	Acceptable
MSL-D, Node 4010		Z	3.78	1.40	62.81	

Note 1: Based on the vibration data from the SRV, the acceleration level for valve Q1B21-F041C has reached the limit established based on qualification testing of the valves and actuators with conservative assumptions for endurance limits based on the peak limits of testing performed. The original acceleration limits based on testing data from Wyle Laboratories has conservatism due to the inherent limitations related to the shaker table testing. This testing configuration resulted in higher tested lateral and longitudinal accelerations than the vertical response. Revised limits have been developed at the top of valve location with analytical results developed from the use of the original ASME NB-3500 calculation based upon critical valve components for the actuator and applying a transfer function to the limits at the top of valve location.

For the horizontal accelerations measured at the top of valve, the resultant measured horizontal (lateral and longitudinal) acceleration represents the combined peak accelerations reported by the tri-axial accelerometer at the particular node in the X and Z-directions. For the vertical accelerations measured at the top of valve, these accelerations represent the vertical peak accelerations reported by the tri-axial accelerometer at the particular node in the Y-direction. The peak accelerations were gathered from the time-history data after band-pass filtering (2-250Hz) and DC-offset

removal and compared to limits as noted above. These limits can be applied to any of the top of valve locations if needed.

These limits compared to measured values using this method are as follows:

COMP./PIPING DESCRIPTION / SEGMENT	POINT NUM.	MONITOR LOC./DIR.	ACCEL. LIMIT (g) HORIZONTAL RESULTANT (X/Z) & VERTICAL (Y)	ACCEL. MEASURED (g) HORIZONTAL RESULTANT (X/Z) & VERTICAL (Y)	ACCEL. MARGIN (%)
B21-F041C Top of Valve MSL-C, Node 1008	9	X/Z	6.62 (X/Z)	3.80 (X/Z)	42.60 (X/Z)
		Y	3.42 (Y)	2.43 (Y)	28.95 (Y)