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GNRO-2012/00113

September 18, 2012

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

SUBJECT: Vibration Data Report

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

REFERENCE: 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 #ML12221A198)

Dear Sir or Madam:

In the referenced letter, Entergy Operations, Inc. (Entergy) committed to provide vibration data along with acceptance limits for the main steam line (MSL) piping 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 or near the current licensed thermal power of 4408 MWt (113% of 3898 MWt, the previous licensed thermal power) is provided in the attachment to this letter.

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,

A handwritten signature in black ink, appearing to read "Bryan S. Ford".

BSF/ghd

Attachment: Vibration Data for the Main Steam Line Piping and Safety Relief Valves – 4408 MWt

cc: Mr. Elmo E. Collins, Jr.  
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U. S. Nuclear Regulatory Commission  
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NRC Senior Resident Inspector  
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**ATTACHMENT**

**GRAND GULF NUCLEAR STATION**

**GNRO-2012/00113**

**VIBRATION DATA FOR THE**  
**MAIN STEAM LINE PIPING AND SAFETY RELIEF VALVES -**  
**4408 MWt**

**VIBRATION DATA FOR THE  
MAIN STEAM LINE PIPING AND SAFETY RELIEF VALVES -  
4408 MWt**

In a letter to the NRC staff<sup>1</sup>, Entergy Operations, Inc. (Entergy) committed to provide vibration data along with acceptance limits for the main steam line (MSL) piping 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 or near the current licensed thermal power of 4408 MWt (113% of 3898 MWt, the previous licensed thermal power) is provided in Sections I and II, below.

Node 1008 on MSL-A has reported data that contained intermittent high-amplitude spikes. These types of spikes were not seen in the corresponding data for the other valves at the same valve location (top) nor were they seen in the data at any of the nodes. For these reasons, the data at this location were deemed unusable.

Node 3010 on 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 main steam flow, there was a markedly higher increase in the X (longitudinal), Y (vertical), and Z (lateral) accelerations at Node 3010 on MSL-C. This magnitude increase for Node 3010 is in excess of 2 standard deviations above the response noted for the other 15 SRVs. PSD comparisons were made to the MSL response at SRV monitoring points on two valves at Nodes 1008 and 3010 on MSL-C. The PSD comparison for X, Y, and Z responses shows a large change in frequency response through much of the 1 – 250-Hz 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 valve actuator. It is expected that the mounting straps have loosened and the sensor has shifted. The measured response is most likely being affected by the response of the accelerometer mounting system; therefore, this measured response is unusable.

**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 ~4408 MWt.

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.

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<sup>1</sup> 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 #ML12221A198)

- Upper Limit – The upper limit frequency should be sufficiently high so 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 1-g 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.

**Table 1**

PIPING DESCRIPTION/ SEGMENT	MONITOR LOC./DIR.	POINT NUM.	MEASURED ACCEL (g)	ACCEL. LIMIT LEVEL 2 / LEVEL 1 (g)	ACCEL. LEVEL 2 / LEVEL 1 MARGIN (%)	NOTES
Piping associated with B21-F041A (Top of Valve) MSL-A, Node 1008	X	1X	N/A	0.720 / 1.440	N/A	Non-Operable Sensor
Piping associated with B21-F041A (Top of Valve) MSL-A, Node 1008	Y	1Y	N/A	0.160 / 0.320	N/A	Non-Operable Sensor
Piping associated with B21-F041A (Top of Valve) MSL-A, Node 1008	Z	1Z	N/A	0.671 / 1.341	N/A	Non-Operable Sensor
Piping associated with B21-F041A (Actuator) MSL-A, Node 1010	X	2X	0.363	0.447 / 0.893	18.8 / 59.4	Acceptable
Piping associated with B21-F041A (Actuator) MSL-A, Node 1010	Y	2Y	0.157	0.231 / 0.461	32.0 / 65.9	Acceptable
Piping associated with B21-F041A (Actuator) MSL-A, Node 1010	Z	2Z	0.212	0.434 / 0.868	51.2 / 75.6	Acceptable
Piping associated with B21-F051A (Actuator) MSL-A, Node 2010	X	3X	0.200	0.349 / 0.697	42.7 / 71.3	Acceptable
Piping associated with B21-F051A (Actuator) MSL-A, Node 2010	Y	3Y	0.193	0.224 / 0.447	13.8 / 56.8	Acceptable

PIPING DESCRIPTION/ SEGMENT	MONITOR LOC./DIR.	POINT NUM.	MEASURED ACCEL (g)	ACCEL. LIMIT LEVEL 2 / LEVEL 1 (g)	ACCEL. LEVEL 2 / LEVEL 1 MARGIN (%)	NOTES
Piping associated with B21-F051A (Actuator) MSL-A, Node 2010	Z	3Z	0.248	0.389 / 0.778	36.2 / 68.1	Acceptable
Piping associated with B21-F047A (Actuator) MSL-A, Node 4010	X	4X	0.171	0.420 / 0.840	59.3 / 79.6	Acceptable
Piping associated with B21-F047A (Actuator) MSL-A, Node 4010	Y	4Y	0.031	0.310 / 0.619	90.0 / 95.0	Acceptable
Piping associated with B21-F047A (Actuator) MSL-A, Node 4010	Z	4Z	0.217	0.474 / 0.948	54.2 / 77.1	Acceptable
Piping associated with B21-F051B (Top of Valve) MSL-B, Node 1008	X	5X	0.004	0.701 / 1.402	99.4 / 99.7	Acceptable
Piping associated with B21-F051B (Top of Valve) MSL-B, Node 1008	Y	5Y	0.098	0.185 / 0.370	47.0 / 73.5	Acceptable
Piping associated with B21-F051B (Top of Valve) MSL-B, Node 1008	Z	5Z	0.706	0.756 / 1.512	6.6 / 53.3	Acceptable
Piping associated with B21-F051F (Actuator) MSL-B, Node 3010	X	6X	0.040	0.389 / 0.778	89.7 / 94.9	Acceptable
Piping associated with B21-F051F (Actuator) MSL-B, Node 3010	Y	6Y	0.093	0.212 / 0.424	56.1 / 78.1	Acceptable
Piping associated with B21-F051F (Actuator) MSL-B, Node 3010	Z	6Z	0.166	0.436 / 0.872	61.9 / 81.0	Acceptable
Piping associated with B21-F041F (Top of Valve) MSL-B, Node 4008	X	7X	0.254	0.645 / 1.290	60.6 / 80.3	Acceptable

PIPING DESCRIPTION/ SEGMENT	MONITOR LOC./DIR.	POINT NUM.	MEASURED ACCEL (g)	ACCEL. LIMIT LEVEL 2 / LEVEL 1 (g)	ACCEL. LEVEL 2 / LEVEL 1 MARGIN (%)	NOTES
Piping associated with B21-F041F (Top of Valve) MSL-B, Node 4008	Y	7Y	0.120	0.181 / 0.362	33.7 / 66.9	Acceptable
Piping associated with B21-F041F (Top of Valve) MSL-B, Node 4008	Z	7Z	0.572	0.800 / 1.600	28.5 / 64.3	Acceptable
Piping associated with B21-F041K (Top of Valve) MSL-B, Node 6008	X	8X	0.176	0.663 / 1.326	73.5 / 86.7	Acceptable
Piping associated with B21-F041K (Top of Valve) MSL-B, Node 6008	Y	8Y	0.155	0.229 / 0.457	32.3 / 66.1	Acceptable
Piping associated with B21-F041K (Top of Valve) MSL-B, Node 6008	Z	8Z	0.505	0.677 / 1.353	25.4 / 62.7	Acceptable
Piping associated with B21-F041C (Top of Valve) MSL-C, Node 1008	X	9X	0.218	0.701 / 1.402	68.9 / 84.5	Acceptable
Piping associated with B21-F041C (Top of Valve) MSL-C, Node 1008	Y	9Y	0.127	0.185 / 0.370	31.4 / 65.7	Acceptable
Piping associated with B21-F041C (Top of Valve) MSL-C, Node 1008	Z	9Z	0.156	0.756 / 1.512	79.4 / 89.7	Acceptable
Piping associated with B21-F051C (Actuator) MSL-C, Node 3010	X	10AX	N/A	0.389 / 0.778	N/A	Non-Operable Sensor
Piping associated with B21-F051C (Actuator) MSL-C, Node 3010	Y	10AY	N/A	0.212 / 0.424	N/A	Non-Operable Sensor
Piping associated with B21-F051C (Actuator) MSL-C, Node 3010	Z	10AZ	N/A	0.436 / 0.872	N/A	Non-Operable Sensor

PIPING DESCRIPTION/ SEGMENT	MONITOR LOC./DIR.	POINT NUM.	MEASURED ACCEL (g)	ACCEL. LIMIT LEVEL 2 / LEVEL 1 (g)	ACCEL. LEVEL 2 / LEVEL 1 MARGIN (%)	NOTES
Piping associated with B21-F047G (Top of Valve) MSL-C, Node 4008	X	10BX	0.565	0.645 / 1.290	12.4 / 56.2	Acceptable
Piping associated with B21-F047G (Top of Valve) MSL-C, Node 4008	Y	10BY	0.046	0.181 / 0.362	74.6 / 87.3	Acceptable
Piping associated with B21-F047G (Top of Valve) MSL-C, Node 4008	Z	10BZ	0.724	0.800 / 1.600	9.5 / 54.8	Acceptable
Piping associated with B21-F047L (Top of Valve) MSL-C, Node 6008	X	10CX	0.540	0.663 / 1.326	18.6 / 59.3	Acceptable
Piping associated with B21-F047L (Top of Valve) MSL-C, Node 6008	Y	10CY	0.221	0.229 / 0.457	3.5 / 51.6	Acceptable
Piping associated with B21-F047L (Top of Valve) MSL-C, Node 6008	Z	10CZ	0.408	0.677 / 1.353	39.7 / 69.8	Acceptable
Piping associated with B21-F047D (Top of Valve) MSL-D, Node 1008	X	10DX	0.304	0.720 / 1.440	57.8 / 78.9	Acceptable
Piping associated with B21-F047D (Top of Valve) MSL-D, Node 1008	Y	10DY	0.143	0.160 / 0.320	10.6 / 55.3	Acceptable
Piping associated with B21-F047D (Top of Valve) MSL-D, Node 1008	Z	10DZ	0.349	0.671 / 1.341	48.0 / 74.0	Acceptable
Piping associated with B21-F047D (Actuator) MSL-D, Node 1010	X	10EX	0.432	0.447 / 0.893	3.4 / 51.6	Acceptable
Piping associated with B21-F047D (Actuator) MSL-D, Node 1010	Y	10EY	0.176	0.231 / 0.461	23.8 / 61.8	Acceptable



PIPING DESCRIPTION/ SEGMENT	MONITOR LOC./DIR.	POINT NUM.	MEASURED ACCEL (g)	ACCEL. LIMIT LEVEL 2 / LEVEL 1 (g)	ACCEL. LEVEL 2 / LEVEL 1 MARGIN (%)	NOTES
Piping associated with B21-F047D (Actuator) MSL-D, Node 1010	Z	10EZ	0.132	0.434 / 0.868	69.6 / 84.8	Acceptable
Piping associated with B21-F014D (Actuator) MSL-D, Node 2010	X	10FX	0.297	0.349 / 0.697	14.9 / 57.4	Acceptable
Piping associated with B21-F014D (Actuator) MSL-D, Node 2010	Y	10FY	0.186	0.224 / 0.447	17.0 / 58.4	Acceptable
Piping associated with B21-F014D (Actuator) MSL-D, Node 2010	Z	10FZ	0.255	0.389 / 0.778	34.4 / 67.2	Acceptable
Piping associated with B21-F051D (Actuator) MSL-D, Node 4010	X	10GX	0.247	0.420 / 0.840	41.2 / 70.6	Acceptable
Piping associated with B21-F051D (Actuator) MSL-D, Node 4010	Y	10GY	0.142	0.310 / 0.619	54.2 / 77.1	Acceptable
Piping associated with B21-F051D (Actuator) MSL-D, Node 4010	Z	10GZ	0.450	0.474 / 0.948	5.1 / 52.5	Acceptable
Piping associated with Pipe Support N11G001H14 Turbine Bldg. MSL-D, Node 412	X	15X	0.092	0.213 / 0.426	56.8 / 78.4	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 ~4408 MWt.

The measured acceleration (ACC. ACTUAL) represents the peak acceleration reported by the tri-axial accelerometer in that particular direction for the individual node. This peak was gathered from the time-history data after band-pass filtering (2 – 250 Hz) and DC-offset removal.

The methodology for developing the acceleration limits (ACC. LIMIT) below was through analytical methods involving ASME NB-3500 calculations as well as structural sub-models of individual components. For both the top-of-valve and actuator locations, the horizontal limits (X and Z) seen below are a resultant limit calculated through the square root sum of the squares (SRSS) method. The vertical limit (Y) is an individual limit that is not used to calculate any resultant limits.

**Table 2**

COMP./PIPING DESCRIPTION / SEGMENT	MONITOR. LOC./DIR.	PT. NUM.	MEASURED ACCEL (g)	ACCEL LIMIT (g)	MARGIN (%)	NOTES
B21-F041A Top of Valve MSL-A, Node 1008	X	1	N/A	N/A	N/A	Non-Op Sensor Non-Op Sensor Non-Op Sensor
	Y					
	Z					
B21-F041A Actuator MSL-A, Node 1010	X	2	1.20	3.78	68.28	Acceptable
	Y		1.09	3.77	71.04	
	Z		1.20	3.78	68.28	
B21-F051A Actuator MSL-A, Node 2010	X	3	1.19	3.78	68.47	Acceptable
	Y		1.11	3.77	70.49	
	Z		1.19	3.78	68.47	
B21-F047A Actuator MSL-A, Node 4010	X	4	0.70	3.78	81.58	Acceptable
	Y		0.01	3.77	99.76	
	Z		0.70	3.78	81.58	
B21-F051B Top of Valve MSL-B, Node 1008	X	5	1.32	6.62	80.05	Acceptable
	Y		2.08	3.42	39.27	
	Z		1.32	6.62	80.05	
B21-F051F Actuator MSL-B, Node 3010	X	6	1.57	3.78	58.50	Acceptable
	Y		1.20	3.77	68.15	
	Z		1.57	3.78	58.50	
B21-F041F Top of Valve MSL-B, Node 4008	X	7	5.01	6.62	24.29	Acceptable
	Y		0.12	3.42	96.57	
	Z		5.01	6.62	24.29	
B21-F041K Top of Valve MSL-B, Node 6008	X	8	1.40	6.62	78.80	Acceptable
	Y		0.72	3.42	79.02	
	Z		1.40	6.62	78.80	
B21-F041C Top of Valve MSL-C, Node 1008	X	9	3.50	6.62	47.18	Acceptable
	Y		3.27	3.42	4.31	
	Z		3.50	6.62	47.18	
B21-F051C Actuator MSL-C, Node 3010	X	10a	N/A	N/A	N/A	Non-Op Sensor Non-Op Sensor Non-Op Sensor
	Y					
	Z					
B21-F047G Top of Valve MSL-C, Node 4008	X	10b	2.93	6.62	55.71	Acceptable
	Y		0.08	3.42	97.81	
	Z		2.93	6.62	55.71	

COMP./PIPING DESCRIPTION / SEGMENT	MONITOR. LOC./DIR.	PT. NUM.	MEASURED ACCEL (g)	ACCEL LIMIT (g)	MARGIN (%)	NOTES
B21-F047L Top of Valve MSL-C, Node 6008	X	10c	1.50	6.62	77.40	Acceptable
	Y		0.85	3.42	75.23	
	Z		1.50	6.62	77.40	
B21-F047D Top of Valve MSL-D, Node 1008	X	10d	1.43	6.62	78.35	Acceptable
	Y		0.76	3.42	77.69	
	Z		1.43	6.62	78.35	
B21-F047D Actuator MSL-D, Node 1010	X	10e	2.66	3.78	29.63	Acceptable
	Y		1.07	3.77	71.63	
	Z		2.66	3.78	29.63	
B21-F041D Actuator MSL-D, Node 2010	X	10f	1.33	3.78	64.79	Acceptable
	Y		0.85	3.77	77.57	
	Z		1.33	3.78	64.79	
B21-F051D Actuator MSL-D, Node 4010	X	10g	1.46	3.78	61.23	Acceptable
	Y		0.59	3.77	84.31	
	Z		1.46	3.78	61.23	