Entergy

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Attachment 1 contains proprietary information.

GNRO-2011/00053

July 6, 2011

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

SUBJECT: Request for Additional Information Regarding
Extended Power Uprate
Grand Gulf Nuclear Station, Unit 1
Docket No. 50-416
License No. NPF-29

REFERENCES:
1. Correspondence from the NRC to Entergy dated June 6, 2011, Grand Gulf Nuclear Station, Unit 1 - Request for Additional Information Regarding Extended Power Uprate Application License Amendment Request (TAC NO. ME4679) (NRC ADAMS Accession No. ML111530439)
2. License Amendment Request, Extended Power Uprate, dated September 8, 2010 (GNRO-2010/00056, NRC ADAMS Accession No. ML102660403)

Dear Sir or Madam:

The Nuclear Regulatory Commission (NRC) requested additional information (Reference 1) regarding certain aspects of the Grand Gulf Nuclear Station, Unit 1 (GGNS) Extended Power Uprate (EPU) License Amendment Request (LAR) (Reference 2). Attachment 1 provides responses to the additional information requested by the Mechanical and Civil Engineering Branch related to the Steam Dryer.

GE-Hitachi Nuclear Energy Americas, LLC (GEH) considers portions of the information provided in support of the responses to the request for additional information (RAI) in Attachment 1 to be proprietary and therefore exempt from public disclosure pursuant to 10 CFR 2.390. An affidavit for withholding information, executed by GEH, is provided in Attachment 3. The proprietary information was provided to Entergy in a GEH transmittal that is referenced in the affidavit. Therefore, on behalf of GEH, Entergy requests to withhold Attachment 1 from public disclosure in accordance with 10 CFR 2.390(b)(1). A non-proprietary version of the RAI responses is provided in Attachment 2.

No change is needed to the no significant hazards consideration included in the initial LAR (Reference 2) as a result of the additional information provided. There are new commitments included in this letter.

If you have any questions or require additional information, please contact Jerry Burford at 601-368-5755.

I declare under penalty of perjury that the foregoing is true and correct. Executed on July 6, 2011.

Sincerely,

M. A Krupa

MAK/FGB/dm

Attachments:

1. Response to Request for Additional Information, Mechanical and Civil Engineering Branch, Steam Dryer (Proprietary)
2. Response to Request for Additional Information, Mechanical and Civil Engineering Branch, Steam Dryer (Non-Proprietary)
3. GEH Affidavit for Withholding Information from Public Disclosure
4. List of Regulatory Commitments

cc: Mr. Elmo E. Collins, Jr.
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NRC Senior Resident Inspector
Grand Gulf Nuclear Station
Port Gibson, MS 39150

Attachment 2

GNRO-2011/00053

Grand Gulf Nuclear Station Extended Power Uprate

Response to Request for Additional Information

Mechanical and Civil Engineering Branch, Steam Dryer (Non-Proprietary)

This is a non-proprietary version of Attachment 1 from which the proprietary information has been removed. The proprietary portions that have been removed are indicated by double square brackets as shown here: [[ ]].

Response to Request for Additional Information
Mechanical and Civil Engineering Branch, Steam Dryer (Proprietary)

By letter dated September 8, 2010, Entergy Operations, Inc. (Entergy) submitted a license amendment request (LAR) for an Extended Power Uprate (EPU) for Grand Gulf Nuclear Station, Unit 1 (GGNS). By letter dated March 30, 2011, Entergy submitted responses to the initial request for additional information (RAI) from the Mechanical and Civil Engineering Branch related to the Steam Dryer (NRC ADAMS Accession No. ML110900275). Subsequently, the U.S. Nuclear Regulatory Commission (NRC) staff has determined that the following additional information related to the March 30, 2011 RAI responses is needed for the NRC staff to complete their review of the amendment. Entergy's response to each item is also provided below.

RAI # 1

In response to RAI 3, the licensee stated that the steam dryer welds are fabricated according to the rules of American Society of Mechanical Engineers Boiler and Pressure Code (ASME Code), Section III, Subsection NG, which includes visual and liquid penetrant examination of the root and final passes of the welds. However, these examinations cannot detect the flaws that are not penetrating the surface of the root pass or final pass. The licensee further stated that the maximum thickness of the root pass is ~3/16 inch. It is likely that a flaw as large as 3/16-inch can be present and remain undetected. Please evaluate the potential growth of a 3/16-inch flaw in a weld that is subjected to the maximum alternating stress intensity at extended power uprate (EPU).

Response

To ensure high quality welds, replacement steam dryer fabrication employs weld processes that have been fully qualified. [[

]]

Limiting surface discontinuities are of particular importance to structures subjected to fatigue where the root side of the weld is not easily inspected (such as fillet welds, partial penetration welds, and some full penetration welds). Robust weld procedure and performance qualifications are conducted to prevent weld defects from occurring during fabrication.
[[

]] These tests provide assurance that no defects are present at the root of the production welds.

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ASME code subsection NG does not require a specific evaluation of fatigue crack growth analysis for hidden flaws in newly constructed steam dryers. However, in response to the Staff's supplemental RAI request the evaluation of potential growth of a 3/16 inch deep flaw at the weld locations [[
]] was performed.

[[

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Table 1-1: [[ ]]

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[[

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This assessment confirms that an undetected 3/16-inch deep weld flaw would not grow by fatigue when subjected to the maximum alternating stress intensity under EPU loading conditions.

References:

1. NEDC-33601P, "Engineering Report Grand Gulf Replacement Steam Dryer Fatigue Stress Analysis Using PBLE Methodology," September 2010

2. P.K.Liaw, M.G. Peck and H. Mehta, "Fatigue Crack Propagation Behavior of Stainless Steels," Final Report, Contract No.529-88B860X, General Electric Company, April 1990

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RAI # 2

In response to RAI 9, the licensee stated that four safety relief valves (SRVs) will be instrumented and monitored to maintain acceleration levels within the acceptance limits. Please explain how the licensee will ensure that the valve with the maximum vibration level will be among those that are selected for vibration monitoring. Also, please provide the plan for mitigating excessive vibration (should it occur) and/or replacing valves with designs that are more resistant to the vibrations.

Response

Methodology for Selecting MSL/SRV Monitoring Points

At GGNS, the main steam line (MSL) piping and SRV branch locations for MSL A and D (short lines) and the MSL B and C (long lines) are symmetrical within the drywell. Therefore, the MSL-A analytical model was used to represent the structural response of the A and D lines and the MSL-C analytical model was used to represent the structural response of the B and C lines.

Based on the 2008 MSL strain gage measurement data at current licensed thermal power (CLTP) conditions, the B and D lines had the higher acoustic/ flow induced vibration (FIV) loads. With the potential for acoustic branch line resonance at EPU and the potential for associated narrow band response, it would be difficult to analytically predict the MSL that would have the maximum structural response at EPU. Therefore, GGNS will instrument all four main steam lines and appropriate SRVs to ensure piping and valve integrity is maintained.

The 2008 test data provided in EPU LAR Attachment 11 (NRC ADAMS Accession No. ML102660401) demonstrated that the GGNS MSLs have broad band excitation from [[

]].

SRV acceptance limits at multiple valve locations were developed from dynamic aging testing performed on the SRVs. In calculating the SRV acceptance limits, the SRV test accelerations were reduced to reflect the increase in potential FIV cycles over test cycles used in the dynamic environmental testing. A dynamic model of the SRV was developed and incorporated in the piping dynamic models to capture the combined dynamic response of the piping and valves. The SRV model includes nodes coincident with SRV acceptance limits to facilitate comparison.

With the updated piping/SRV model, the “1g” broad-band uniform amplified response spectrum (ARS) was recalculated and the maximum stress adjustment factors were determined as described in EPU LAR, Attachment 10 (NRC ADAMS Accession No. ML102660400). All combined SRV/piping modes in the 2 to 260 Hz band were used. After applying the stress adjustment factor, the valve resultant response spectra accelerations at all SRVs were

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compared with SRV resultant acceptance limits. The maximum values of the ratio of projected acceleration to allowable acceleration were then used to define an additional reduction factor, "SRV Broad-Band Factor" for each pair of steam lines. The values are summarized in the following table.

Table 2-1: Monitoring Point Acceleration Reduction Factors

Acceleration Reduction Factors from Analytical Model MSL-A		
MSL A&D	Stress Factor	0.505
MSL A&D	SRV Broad-Band Factor	0.881

Acceleration Reduction Factors from Analytical Model MSL-C		
MSL-B&C	Stress Factor	0.522
MSL-B&C	SRV Broad-Band Factor	0.758

Following this broad band evaluation, a narrow band assessment of each analytical model was performed. It is conservatively assumed that the piping/SRV response is concentrated in one response mode. Potential combinations of four monitoring locations on each combined piping/SRV analytical model were evaluated to determine appropriate monitoring points (MP). Three direction accelerometers at these MPs will provide comprehensive monitoring of all piping/SRV modes in the projected FIV frequency bands.

The analytical model frequency uncertainty was addressed by widening the FIV bands from [[ ]] in the modal assessment performed. Upon final selection of the FIV data acquisition system (DAS) and instruments, instrument bias and uncertainty will be addressed by appropriate adjustment of the acceptance limits.

Then for each potential combination of MPs that will provide good monitoring for FIV modes, the projected accelerations at all SRVs are compared with SRV acceptance limits for each mode shape. It is again conservatively assumed that the piping/SRV response is concentrated in one response mode. This comparison is performed with each component of the SRV acceptance limits. The selected combination of MPs were the locations best suited for monitoring valve accelerations on all valves for all modes and assuring SRV accelerations remain below SRV acceptance limits.

The best combination of monitoring points for the combined piping/SRV model included four points which were all located on SRVs. Therefore, four SRV locations on each of the four MSLs will be used for piping and SRV monitoring. Each location will have three orthogonal accelerometers.

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In summary, the monitoring point acceptance limits were appropriately reduced from the SRV acceptance limits to maintain pipe stress values to within the piping FIV limit described in EPU LAR, Attachment 10 and wide band and narrow band SRV response at all SRV locations to acceptable amplitude. A comparison of the ratio of the current monitoring limits to SRV acceptance values is presented in Table 2-2.

Attachment 10 to the GGNS EPU LAR has been modified to reflect the broad band and narrow band SRV assessments described here. The modified sections are included in Enclosure A. These modified sections supersede changes provided in Entergy's letter to the NRC dated March 30, 2011 (NRC ADAMS Accession No. ML110550475).

Table 2-2: Monitoring Point Acceptance Limit as a Percentage of the SRV Acceptance Limit

MP Acceptance Limit / SRV Acceptance Limit (x 100, %)				
MSL	SRV Node	G-limit, Longitudinal (local X)	G-limit, Vertical (local Y)	G-limit, Latitudinal (local Z)
MSL-A & D	1008	100%	58%	72%
MSL-A & D	1010	96%	68%	72%
MSL-A & D	2010	75%	66%	64%
MSL-A & D	4010	90%	91%	78%
MSL-B & C	1008	97%	67%	81%
MSL-B & C	3010	84%	62%	72%
MSL-B & C	4008	90%	66%	86%
MSL-B & C	6008	92%	83%	73%

Plan for Mitigating Excessive Vibration

In the event GGNS observes excessive vibration during the power ascension, the steam dryer and FIV monitoring limits will ensure that the EPU power ascension is stopped at a level where the valve and dryer loads are acceptable. If this occurs, GGNS will perform a detailed assessment of the FIV loads and piping and SRV responses and provide the NRC with an updated plan to mitigate the excessive vibration or the resulting stresses.

At GGNS, the initial onset of second shear layer resonance was observed at 203 and 208 Hz. If excessive valve vibration should occur at EPU conditions, the following actions will be pursued:

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If the MSL strain gage data indicates that acoustic loads are of low to medium amplitude, the sensitive piping and valve modal response would be identified using the accelerometer data and piping/SRV models and piping/SRV support modifications would be identified to shift or eliminate the piping/SRV response mode.

If the MSL strain gage data indicates that acoustic loads are of high amplitude, indicative of a second shear wave being the primary cause of the excessive vibration, the acoustic data will be used to define the acoustic mode shape in the RPV/piping/SRV system. Then GGNS would:

- mitigate the acoustic loads by employing an acoustic load mitigation device upstream of the SRV branch connections with contributing acoustic sources or
- modify the SRV-piping geometry to mitigate the acoustic response.

Scale testing has been performed on an acoustic load mitigation device. As shown in Figure 2-1, this device has been demonstrated to be an effective means of mitigating the [[ ]].

Another alternative would be to shorten the SRV branch connection and thus increase the branch fundamental acoustic resonance frequency. This would result in the Strouhal number ((branch frequency)*(branch diameter) / (MSL velocity)) at EPU being equal to or higher than the Strouhal number at CLTP where excessive valve vibration has not been observed. The steam line velocity at CLTP is approximately [[ ]] (See EPU LAR, Attachment 11, Appendix A). Figure 2-2 depicts the existing GGNS SRV branch geometry. It would be possible to replace the reducing flange with a design that would reduce the branch length by approximately 3.5 inches and increase the branch line resonance enough to offset the increase in velocity.

The amplitude of loads driven by [[ ]].

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[[

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Figure 2-1: Load Mitigation Device Performance, Scale Testing

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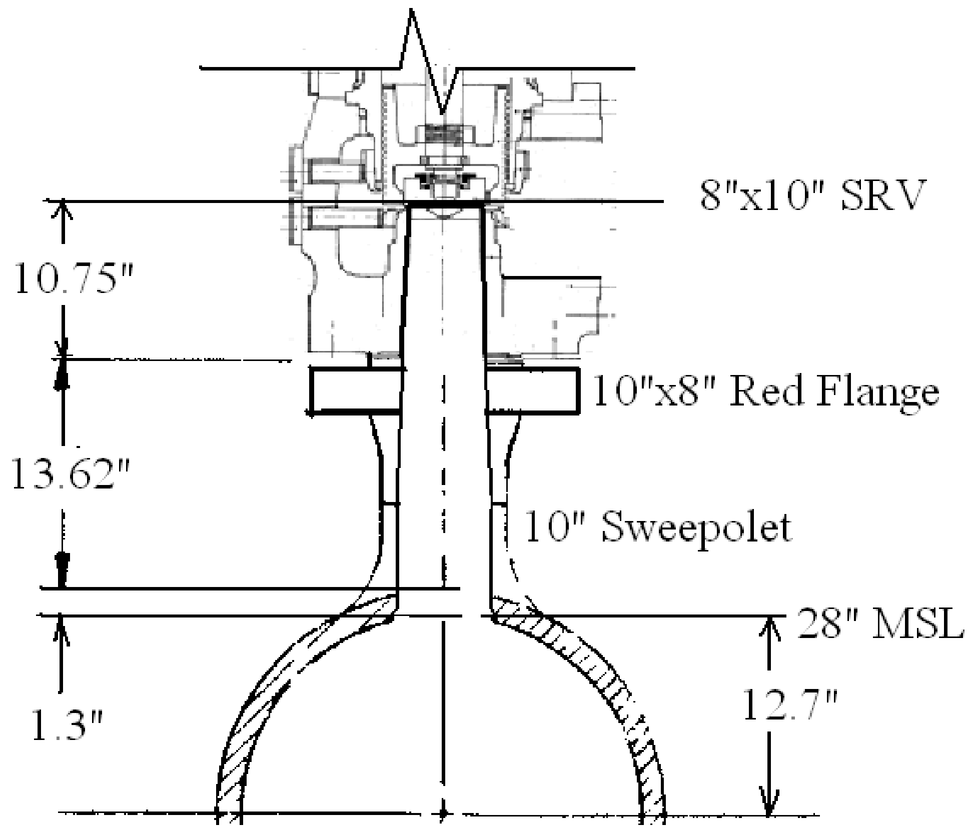

Figure 2-2: GGNS SRV Branch Line Configuration

RAI # 3

In response to RAI 12, the licensee explained that it evaluated stresses at [[ ]] to determine the maximum stress at the fillet weld. The licensee further stated that [[ ]] to move the peak stress away from the return fillet weld. Please describe [[ ]] Also, please identify whether there are any other welds in the steam dryer where the peak stress location is similarly shifted.

Response

As shown in Figure 3-1, the bank end plate panel [[ ]] corners. A ½-inch gap is present between the bank end plate (on the side that is welded to the outlet end plate) and base plate to allow for liquid to drain from the top of the base plate. Due to this gap, this location is unique because all other plates that exhibit higher stress are supported on all sides. For the original design, the bank end plate attachment to the trough and the trough attachment to the base plate were so [[ ]]. It is noted that the motion of the dryer bank [[ ]], and the motion of the outlet end plate [[ ]]. The design modification [[ ]] was implemented [[ ]]. The combined stress is greatly reduced [[ ]].

[[ ]] using a finite element submodel to evaluate the effect [[ ]] on the final stress. Table 3-17 of EPU LAR Attachment 11 (NEDC-33601P) provides the [[ ]].

The [[ ]]. No other panels in the GG replacement dryer apply a similar design improvement.

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Figure 3-1: Pictorial Representation Showing [[ ]]

RAI # 4

Regarding RAI 13:

(a) In response to RAI 13, the licensee stated that, [[

]] Please explain

why [[ ]] Also, please explain whether the vane assemblies can experience fatigue failure due to FIV loading and generate loose parts. Please provide information on the magnitude of the fundamental frequency of the vane assembly substructure.

(b) In response RAI 13, the licensee showed that for the instrumented boiling-water reactor (BWR) 4 steam dryer, [[ ]] Please provide a comparison between the predicted results, modified predicted results and the measurements in the high-frequency range [[ ]].

Response

a) The purpose of the chevron-shaped dryer vanes is to remove the moisture from steam. The vane assemblies are housed within the dryer hoods. They are contained within the bank end plates, the top cap, the bank trough, and the inlet and outlet perforated plates. The individual tie rod sections holding the vane plates and spacers in place are 4½ - 5 feet long and joined together with intermediate fittings to form continuous rods that run the entire length of the dryer bank. The tie rod end nuts are then welded to the bank end plates, capturing the tie rods, vane plates, and spacers. The chevron-shaped vanes and their associated tie rods are shown in Figure 4-1. [[ ]] The "stacked plate" assembly of the vanes and spacers on the tie rods rest in the bank trough. This configuration has a large number of [[ ]]

The vane assemblies represent a significant part of the overall dryer mass [[ ]] and their structural interaction with the dryer has been modeled. [[ ]]

[[

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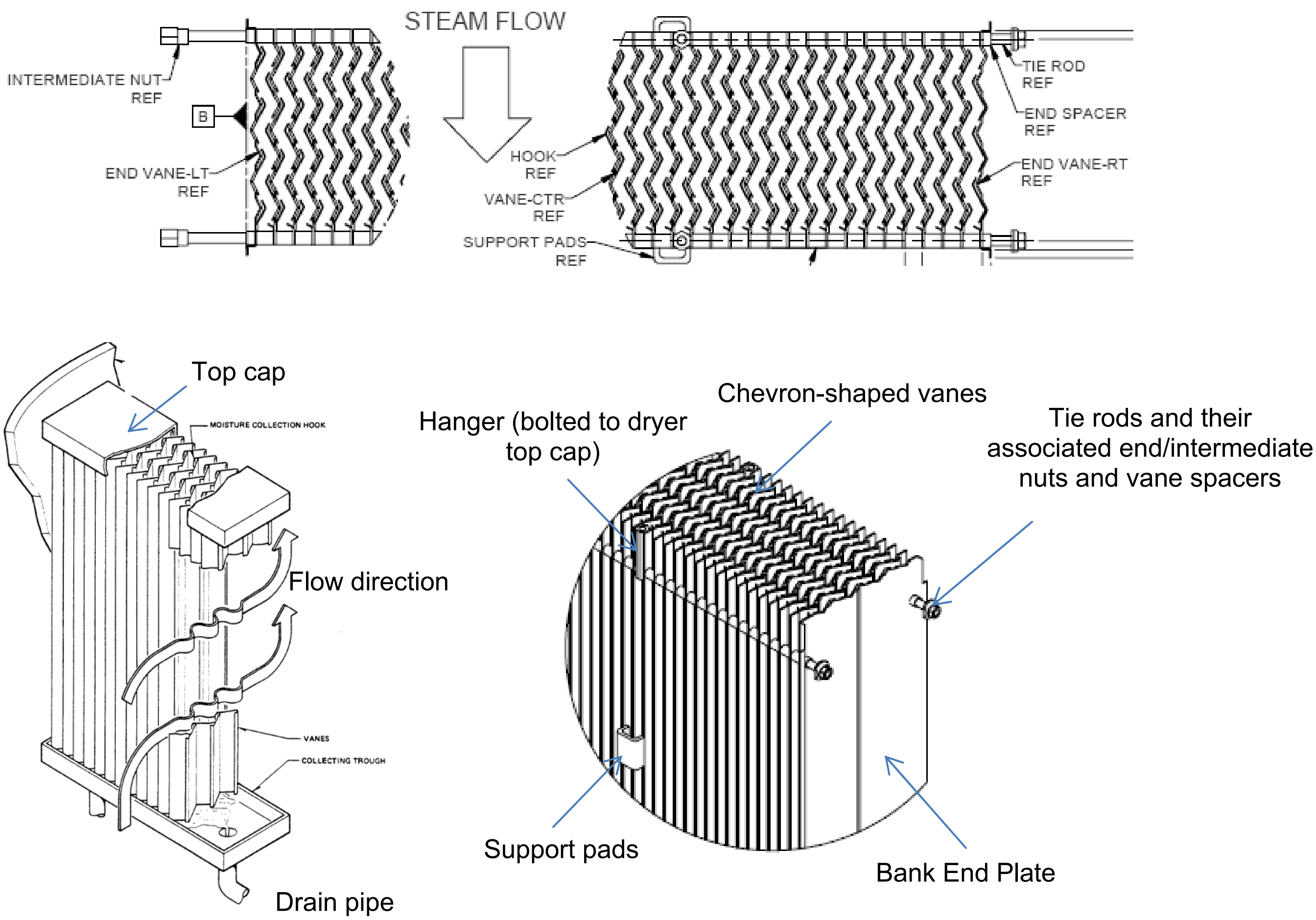

Figure 4-1 Schematics of a Vane Assembly

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Figure 4-2 Support Pad

[[

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Figure 4-3 Mode Shape of Fundamental Frequency

b) [[

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[[

]]

Figure 4- 4 Measured vs. Predicted Maximum Strains and Acceleration

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RAI # 5

21) As stated in the license amendment request, the licensee is replacing the existing steam dryer with a new steam dryer. Another licensee (PPL) also replaced its steam dryers for both units of Susquehanna for EPU operation. Based on recent operating experience, the NRC staff was informed of steam dryer cracking that was discovered in both units of the newly replaced steam dryers (RSD) during the first refueling outage after the EPU operation at Susquehanna. Three cracks were observed in the dryer skirt tee in Susquehanna Unit 1, and cracks were observed in the dryer skirt panel and at the bottom of the upper support ring in Susquehanna Unit 2. In light of the cracking observed in the RSDs, please describe the measures taken or planned to be taken during fabrication, installation, quality control, pre-installation inspection enhancements, or any design improvements to ensure that similar cracking of the new replacement steam dryers would not occur during EPU operation for the GGNS.

Response

The cause of the indications in the Susquehanna Unit 1 dryer skirt tees was determined to be Inter-Granular Stress Corrosion Cracking (IGSCC) related to surface finish of the Heat Affected-Zones (HAZ) associated with welding. Similar indications were also found in the skirt tees on the Susquehanna Unit 2 dryer. The cause for those indications was determined to be the same as for the indications on the Susquehanna Unit 1 dryer skirt tees. In response to the IGSCC concerns, additional controls have been placed on the manufacturing process:

1. The drain channel to skirt tee welds have been relocated away from the base of the skirt tee in the GGNS dryer. This will prevent any inadvertent grinding wheel contact with the base of the skirt tee.

2. The steam dryer fabrication specification was revised to impose a training requirement on all steam dryer fabrication vendors for surface preparation of the base material, weld metal, and the weld HAZ. The training plan and subsequent training records are part of the vendor's submittal for GEH acceptance.

3. Additional inspection requirements have been imposed. All fabrication vendors must inspect the surface finish during visual weld examinations and document acceptance in the inspection documentation. The inspection criteria is in accordance with the GEH fabrication specification and the requirements of BWRVIP-181, "BWR Vessel and Internals Project, Steam Dryer Repair Design Criteria," for finish criteria.

4. Additional quality assurance surveillance witness points and oversight have been established to observe overall weld and surface finish quality. A Pre-Service Inspection (PSI) of the newly fabricated steam dryer is required to be performed during the

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manufacturing process. This PSI will include video recording of all accessible welds during manufacturing for future In-Vessel Visual Inspections (IVVI) reference.

The evaluations of the cracks observed in the dryer skirt panel at the bottom of the dryer support ring in Susquehanna Unit 2 have not yet been completed. [[

]]

The most likely cause of the indications in the Susquehanna Unit 2 dryer skirt–seismic block attachment point crack was determined to be a fabrication anomaly (poor fillet weld) of the seismic block to skirt weld. [[ ]] The seismic block attachment to the skirt may have increased the stresses in this area of the skirt above the analyzed values, and the additional stress intensification associated with a defective weld at this location may have initiated this cracking. [[ ]] The GGNS seismic block design details eliminate the stress concentration introduced by the Susquehanna configuration and is expected to eliminate the potential for high stresses in this region.

The design of the GGNS replacement dryer is being reviewed to determine if there are any other areas that need to be further analyzed based on the final results and conclusions of the Susquehanna evaluations.

Enclosure A

to

Attachment 2 of

GNRO-2011/00053

Grand Gulf Nuclear Station Extended Power Uprate

Response to Request for Additional Information

Mechanical and Civil Engineering Branch, Steam Dryer

There is no proprietary information in Enclosure A.

2.0 ACCEPTANCE CRITERIA

Acceptance criteria for evaluating the alternating stress due to flow induced vibration is based on the guidance of the ASME OM-S/G Part 3 (Reference 7.3), which stated that for steady state vibration, the maximum calculated alternating stress shall not exceed S_{el}/α. The governing equation from OM-S/G Part 3 for the alternating stress criteria is given below:

$$S_{alt} = C_2 K_2 M / Z \leq S_{el} / \alpha$$

Where:

S_{alt} =Alternating stress intensity

C_2 =Secondary stress index as defined in ASME III Code

K_2 =Local stress intensification factor as defined in ASME III Code

M =Maximum zero to peak dynamic moment loading due to vibration only

Z =Section modulus of the pipe

S_{el} =0.8 S_A, where S_A is the alternating stress at 10^6 cycle from Figure I-9.1, or S_A at 10^{11} cycles from Figure I-9.2.2 of the ASME Code, Section III

α =Allowable stress reduction factor, 1.3 for material covered by Figure I-9.1 or 1.0 for material covered by Figure I-9.2.1 or 9.2.2 of ASME Code, Section III

For ASME III Class 2 and 3 Piping, or ANSI B31.1, the $C_2 K_2$ = 2*i and " i " is the stress intensification factor, as defined in Sub-Section NC and ND of the ASME Code, Section III or ANSI B31.1. The maximum allowed alternating stress intensity is:

- Carbon steel material, S_A = 12,500 psi, α is 1.3, then, S_{alt} =0.8*12,500/1.3= 7,692 psi
- Stainless steel material, S_A = 13,600 psi, α is unity, then, S_{alt} =0.8*13,600= 10,880 psi

Acceleration acceptance limits for the main steam safety relief valves will be established at amplitudes that will ensure operability and preclude fatigue damage.

guidance of ASME O&M-S/G Part 3) and the maximum stress values (from the piping analysis) for each of the maximum alternating stress intensity locations.

Allowable displacement (inches zero-peak) and acceleration (g's-peak) limits at the selected measurement locations were calculated based on the analysis results and ASME endurance stress limits for steady state vibration per ASME O&M-S/G Standards and Guidelines Part 3 (Reference 7.3). The primary acceptance criteria are in terms of displacement, which is directly proportional to pipe stress. Secondary acceptance criteria in terms of acceleration were determined for use in the event of difficulties that may occur in accurately double-integrating the measured accelerations to displacements.

The displacement limits are applicable for vibration frequencies up to 250 Hz, which covers the frequency range in which the most significant structural displacement responses are expected. Piping displacements due to excitation frequencies above 50 Hz are typically insignificant relative to the lower frequency displacements. The MSS and FWS acceleration limits are applicable for frequencies up to 250 Hz. However, significant forcing frequencies and structural responses above 50 Hz are not expected in the FWS system.

Main Steam and Feedwater System - Inside Containment

Detailed models of the MSS and FWS piping inside containment were developed for this evaluation. A "1g" broad-band uniform amplified response spectrum (ARS) was applied up to 250 Hz in each three orthogonal directions for MSS and FWS piping inside containment. Adjustment factors (calculated using the maximum endurance stress values and the guidance of ASME O&M-S/G Part 3) and the maximum stress values (from the piping analysis) for each of the maximum alternating stress intensity locations are as follows:

Table 5.1: Stress and SRV Adjustment Factors for MSS and FWS Piping Segments -- Inside Containment

System Name	Node Point	Piping Location	Max Alternating stress, psi	Adjustment Factor, F_{adjust}
MSS-Loop A and D	45	Node in RCIC Branch Line	15,245	0.505
MSS-Loop A and D	4005	MSL-A:Q1B21-V11-F047A, MSL-D: Q1B21-V10-F051D	SRV Adjustment Factor	0.881
MSS-Loop B and C	15	Sweepolet at Main Steam Pipe Loop C & Q1B21-V17-F047G inlet pipe	14,741	0.522
MSS-Loop B and C	4005	MSL-B:Q1B21-V4-F041F, MSL-C: Q1B21-V17-F047G	SRV Adjustment Factor	0.758
FWS-Loop B	335	At 12"-DBA-17 and RPV nozzle Interface (HL-1328J)	11,058	0.696

The acceptance criteria are then calculated by multiplying the accelerations and the displacements by the adjustment factors in Table 5.1. Sample of calculations for maximum accelerations (A_{calc}) and maximum displacements (D_{calc}) at Node 30 on Feedwater piping Loop B, are provided below.

Node point 30, accelerations (g):

$A_x = A_{xcalc} * F_{adjust}$ = 1.144 g * 0.696 = 0.796 g

$A_y = A_{ycalc} * F_{adjust}$ = 1.573 g * 0.696 = 1.094 g

$A_z = A_{zcalc} * F_{adjust}$ = 1.952 g * 0.696 = 1.358 g

Node point 30, displacements (inches);

$D_x = D_{xcalc} * F_{adjust}$ = 0.014 * 0.696 = 0.010 inches

$Dy = D_{ycalc} * F_{adjust}$ = 0.031 * 0.696 = 0.022 inches

$D_z = D_{zcalc} * F_{adjust}$ = 0.080 * 0.696 = 0.056 inches

The feedwater piping vibration monitoring locations were selected where, based on the "1g" spectra analysis results, significant displacements or accelerations occurred relative to other locations. The measurement locations were also selected such that the general overall piping responses were high such that significant vibrations would not be missed. Where applicable, symmetry between trains or loops was considered to remove redundancy to reduce the overall number of monitoring locations. The EPU vibration monitoring locations determined for the FWS piping inside containment from the analyses are summarized in Table 5.3.

For the Main Steam Piping, GGNS has performed analyses and testing which investigated and addressed the potential for acoustic resonance due to the increased steam flow past the safety relief valve (SRV) standpipe, as well as other branch connections, and concluded that the onset of second shear layer vortex shedding is present at CLTP and could be expected to intensify through full EPU power steam flow rates.

With the potential for acoustic branch line resonance at EPU, additional work was performed in selecting the monitoring points for SRVs and Main Steam lines in containment. A dynamic model of the SRV was developed and incorporated in the piping dynamic models to capture the combined dynamic response of the piping and valves. The SRV model includes nodes coincident with SRV acceptance limits to facilitate comparison. The "1g" broad-band uniform amplified response spectrum (ARS) was calculated and the maximum stress adjustment factors were determined as presented in Table 5.1. After applying the stress adjustment factor, the valve resultant response spectra accelerations at all SRVs were compared with SRV resultant acceptance limits. The highest minimum ratio of projected allowable acceleration was then used to define an additional reduction factor, "SRV Adjustment Factor." These values are also included in Table 5.1.

With the potential for associated narrow band response associated with acoustic branch line resonance, it would be difficult to analytically predict the MSL that would have the maximum structural response at EPU. Therefore, GGNS will instrument the 4 main steam lines and SRVs to ensure piping and valve integrity is maintained. The monitoring points were also selected to be sensitive in monitoring piping/SRV responses for piping modes in the observed FIV band and in the projected SRV resonance band (Attachment 11 to GNRO- 2010/00056). The MP limits were appropriately adjusted to maintain each component of the SRV response within SRV acceptance limits. The selected combination of MPs were the locations best suited for maintaining valve accelerations on all valves and for all modes in the SRV resonance band below SRV acceptance limits.

The EPU vibration monitoring locations determined for the MSS piping inside containment from the analyses are summarized in Table 5.2.

Final monitoring locations and applicable limits at those locations could be changed as a result of in situ conditions at the proposed locations or further analytical assessments of piping and valve responses to projected FIV conditions at EPU flow rates.

Table 5.2: EPU Monitoring Locations for MSS Inside Containment

System	Piping Segment	Monitoring Location-Direction	EPU Allowable Acceleration, g	Max Allowable Acceleration, g	Description
MSS	MSL-A, Node 1008	Longitudinal	1.080	1.440	Q1B21-V14-F041A Top of Valve
MSS	MSL-A, Node 1008	Vertical	0.240	0.320	Q1B21-V14-F041A Top of Valve
MSS	MSL-A, Node 1008	Lateral	1.006	1.341	Q1B21-V14-F041A Top of Valve
MSS	MSL-A, Node 1010	Longitudinal	0.670	0.893	Q1B21-V14-F041A Actuator
MSS	MSL-A, Node 1010	Vertical	0.346	0.461	Q1B21-V14-F041A Actuator
MSS	MSL-A, Node 1010	Lateral	0.651	0.868	Q1B21-V14-F041A Actuator
MSS	MSL-A, Node 2010	Longitudinal	0.523	0.697	Q1B21-V13-F051A Actuator
MSS	MSL-A, Node 2010	Vertical	0.335	0.447	Q1B21-V13-F051A Actuator
MSS	MSL-A, Node 2010	Lateral	0.583	0.778	Q1B21-V13-F051A Actuator
MSS	MSL-A, Node 4010	Longitudinal	0.630	0.840	Q1B21-V11-F047A Actuator
MSS	MSL-A, Node 4010	Vertical	0.464	0.619	Q1B21-V11-F047A Actuator
MSS	MSL-A, Node 4010	Lateral	0.711	0.948	Q1B21-V11-F047A Actuator
MSS	MSL-B, Node 1008	Longitudinal	1.052	1.402	Q1B21-V1-F051B Top of Valve
MSS	MSL-B, Node 1008	Vertical	0.277	0.370	Q1B21-V1-F051B Top of Valve
MSS	MSL-B, Node 1008	Lateral	1.134	1.512	Q1B21-V1-F051B Top of Valve
MSS	MSL-B, Node 3010	Longitudinal	0.583	0.778	Q1B21-V3-F051F Actuator
MSS	MSL-B, Node 3010	Vertical	0.318	0.424	Q1B21-V3-F051F Actuator
MSS	MSL-B, Node 3010	Lateral	0.654	0.872	Q1B21-V3-F051F Actuator
MSS	MSL-B, Node 4008	Longitudinal	0.968	1.290	Q1B21-V4-F041F Top of Valve
MSS	MSL-B, Node 4008	Vertical	0.271	0.362	Q1B21-V4-F041F Top of Valve
MSS	MSL-B, Node 4008	Lateral	1.200	1.600	Q1B21-V4-F041F Top of Valve
MSS	MSL-B, Node 6008	Longitudinal	0.995	1.326	Q1B21-V6-F041K Top of Valve
MSS	MSL-B, Node 6008	Vertical	0.343	0.457	Q1B21-V6-F041K Top of Valve
MSS	MSL-B, Node 6008	Lateral	1.015	1.353	Q1B21-V6-F041K Top of Valve
MSS	MSL-C, Node 1008	Longitudinal	1.052	1.402	Q1B21-V20-F041C Top of Valve
MSS	MSL-C, Node 1008	Vertical	0.277	0.370	Q1B21-V20-F041C Top of Valve
MSS	MSL-C, Node 1008	Lateral	1.134	1.512	Q1B21-V20-F041C Top of Valve
MSS	MSL-C, Node 3010	Longitudinal	0.583	0.778	Q1B21-V18-F051C Actuator
MSS	MSL-C, Node 3010	Vertical	0.318	0.424	Q1B21-V18-F051C Actuator
MSS	MSL-C, Node 3010	Lateral	0.654	0.872	Q1B21-V18-F051C Actuator
MSS	MSL-C, Node 4008	Longitudinal	0.968	1.290	Q1B21-V17-F047G Top of Valve
MSS	MSL-C, Node 4008	Vertical	0.271	0.362	Q1B21-V17-F047G Top of Valve
MSS	MSL-C, Node 4008	Lateral	1.200	1.600	Q1B21-V17-F047G Top of Valve
MSS	MSL-C, Node 6008	Longitudinal	0.995	1.326	Q1B21-V15-F047L Top of Valve
MSS	MSL-C, Node 6008	Vertical	0.343	0.457	Q1B21-V15-F047L Top of Valve
MSS	MSL-C, Node 6008	Lateral	1.015	1.353	Q1B21-V15-F047L Top of Valve
MSS	MSL-D, Node 1008	Longitudinal	1.080	1.440	Q1B21-V7-F047D Top of Valve
MSS	MSL-D, Node 1008	Vertical	0.240	0.320	Q1B21-V7-F047D Top of Valve
MSS	MSL-D, Node 1008	Lateral	1.006	1.341	Q1B21-V7-F047D Top of Valve
MSS	MSL-D, Node 1010	Longitudinal	0.670	0.893	Q1B21-V7-F047D Top of Valve

System	Piping Segment	Monitoring Location-Direction	EPU Allowable Acceleration, g	Max Allowable Acceleration, g	Description
MSS	MSL-D, Node 1010	Vertical	0.346	0.461	Q1B21-V7-F047D Actuator
MSS	MSL-D, Node 1010	Lateral	0.651	0.868	Q1B21-V7-F047D Actuator
MSS	MSL-D, Node 2010	Longitudinal	0.523	0.697	Q1B21-V8-F041D Actuator
MSS	MSL-D, Node 2010	Vertical	0.335	0.447	Q1B21-V8-F041D Actuator
MSS	MSL-D, Node 2010	Lateral	0.583	0.778	Q1B21-V8-F041D Actuator
MSS	MSL-D, Node 4010	Longitudinal	0.630	0.840	Q1B21-V10-F051D Actuator
MSS	MSL-D, Node 4010	Vertical	0.464	0.619	Q1B21-V10-F051D Actuator
MSS	MSL-D, Node 4010	Lateral	0.711	0.948	Q1B21-V10-F051D Actuator

Table 5.4: Maximum Stress and Adjustment Factors for MSS and FWS Piping Segments - Outside Containment

System Name	Node Point	Piping Location	Max Alternating stress, psi	Adjustment Factor, F_{adjust}
MSS	952	At the end of the valve 1N11F001B on line 18”- DBD-59 (HL-1320C)	41,205	0.1867
FWS	910	At 12”-GBD-69 and HP condenser shell Nozzle (HL-1323A)	175,920	0.0437

The acceptance criteria are then calculated by multiplying the accelerations and the displacements by the adjustment factors in Table 5.4

The EPU vibration monitoring locations determined for the MSS and FWS piping outside containment from the analyses are summarized in Tables 5.5 and 5.6 respectively.

Final monitoring locations and applicable limits at those locations could be changed as a result of in situ conditions at the proposed locations or further analytical assessments of piping responses to projected FIV conditions at EPU flow rates.

Attachment 3

GNRO-2011/00053

Grand Gulf Nuclear Station Extended Power Uprate

Response to Request for Additional Information

Mechanical and Civil Engineering Branch, Steam Dryer

GEH Affidavit for Withholding Information from Public Disclosure

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, Edward D. Schrull, PE state as follows:

(1) I am the Vice President, Regulatory Affairs, Services Licensing, GE-Hitachi Nuclear Energy Americas LLC ("GEH"), and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in Enclosure 1 of GEH letter, 173280-JB-034, "Grand Gulf Steam Dryer: Transmittal of Supplement RAI Responses," dated July 6, 2011. The GEH proprietary information in Enclosure 1, which is entitled "GEH Responses to NRC RAIs 3, 9, 12, 13, & 21" is identified by a dotted underline inside double square brackets. [[This sentence is an example.{3}]] Figures containing GEH proprietary information are identified with double square brackets before and after the object. In each case, the superscript notation {3} refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GEH relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for trade secrets (Exemption 4). The material for which exemption from disclosure is here sought also qualifies under the narrower definition of trade secret, within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975 F2d 871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704 F2d 1280 (DC Cir. 1983).

(4) The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b. Some examples of categories of information that fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH's competitors without license from GEH constitutes a competitive economic advantage over other companies;

b. Information that, if used by a competitor, would reduce their expenditure of resources or improve their competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information that reveals aspects of past, present, or future GEH customer-funded development plans and programs, resulting in potential products to GEH;

d. Information that discloses trade secret and/or potentially patentable subject matter for which it may be desirable to obtain patent protection.

(5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GEH, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, not been disclosed publicly, and not been made available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary and/or confidentiality agreements that provide for maintaining the information in confidence. The initial designation of this information as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in the following paragraphs (6) and (7).

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, who is the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or who is the person most likely to be subject to the terms under which it was licensed to GEH. Access to such documents within GEH is limited to a “need to know” basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist, or other equivalent authority for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary and/or confidentiality agreements.

(8) The information identified in paragraph (2), above, is classified as proprietary because it contains detailed GEH design information of the methodology used in the design and analysis of the steam dryers for the GEH Boiling Water Reactor (BWR). Development of these methods, techniques, and information and their application for the design, modification, and analyses methodologies and processes was achieved at a significant cost to GEH.

The development of the evaluation processes along with the interpretation and application of the analytical results is derived from the extensive experience databases that constitute major GEH asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GEH's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GEH. The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial. GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

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

Executed on this 6th day of July 2011.

Edward D. Schrull, PE
Vice President, Regulatory Affairs
Services Licensing
GE-Hitachi Nuclear Energy Americas LLC
3901 Castle Hayne Rd.
Wilmington, NC 28401
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Attachment 4

GNRO-2011/00053

List of Regulatory Commitments

List of Regulatory Commitments

The following table identifies those actions committed to by Entergy in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments.

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE (If Required)
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
1. Four safety relief valve (SRV) locations on each of the four main steam lines will be used for piping and SRV monitoring. Each location will have three orthogonal accelerometers.	x		
2. Upon final selection of the FIV data acquisition system (DAS) and instruments, instrument bias and uncertainty will be addressed by appropriate adjustment of the acceptance limits.	x		
3. In the event GGNS observes excessive vibration during the power ascension, the steam dryer and FIV monitoring limits will ensure that the EPU power ascension is stopped at a level where the valve and dryer loads are acceptable. If this occurs, GGNS will perform a detailed assessment of the FIV loads and piping and SRV responses and provide the NRC with an updated plan to mitigate the excessive vibration or the resulting stresses. At GGNS, the initial onset of second shear layer resonance was observed at 203 and 208 Hz. If excessive valve vibration should occur at EPU conditions, the following actions will be pursued: If the MSL strain gage data indicates that acoustic loads are of low to medium amplitude, the sensitive piping and valve modal response would be identified using the accelerometer data and piping/SRV models and piping/SRV support modifications would be identified to shift or eliminate the piping/SRV response mode. If the MSL strain gage data indicates that acoustic loads are of high amplitude, indicative of a second shear wave being the primary cause of the excessive vibration, the acoustic data will be used to define the acoustic mode shape in the RPV/piping/SRV system. Then GGNS would: • mitigate the acoustic loads by employing an acoustic load mitigation device upstream of the SRV branch connections with contributing acoustic sources or • modify the SRV-piping geometry to mitigate the acoustic response.	x		