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UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

March 2, 2011

Vice President, Operations  
Entergy Operations, Inc.  
Grand Gulf Nuclear Station  
P.O. Box 756  
Port Gibson, MS 39150

SUBJECT: GRAND GULF NUCLEAR STATION, UNIT 1 – REQUEST FOR ADDITIONAL  
INFORMATION REGARDING EXTENDED POWER UPRATE APPLICATION  
LICENSE AMENDMENT REQUEST (TAC NO. ME4679)

Dear Sir or Madam:

By letter dated September 8, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML102660409), Entergy Operations, Inc., submitted a license amendment request for the Grand Gulf Nuclear Station, Unit No. 1 (GGNS). The proposed amendment requests an increase in the maximum steady-state power level at GGNS from 3898 megawatts thermal (MWt) to 4408 MWt. This represents an approximate 13 percent increase above the current licensed thermal power or an approximate 15 percent increase above the original licensed thermal power.

The U.S. Nuclear Regulatory Commission (NRC) staff has determined that the following additional information is needed for the NRC staff to complete our review of this amendment. This request for additional information (RAI) was discussed with Mr. Jerry Burford of your staff on February 10, 2011, and it was agreed that a response all RAIs except RAIs 9 and 13 would be provided within 30 days of receipt of this letter. Responses to RAIs 9 and 13 are due within 45 days of receipt of this letter. If circumstances result in the need to revise the requested response date, please contact me at (301) 415-1445 or via e-mail at [Alan.Wang@nrc.gov](mailto:Alan.Wang@nrc.gov).

Sincerely,

A handwritten signature in black ink that reads "Alan Wang".

Alan B. Wang, Project Manager  
Plant Licensing Branch IV  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-416

Enclosure:  
As stated

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REQUEST FOR ADDITIONAL INFORMATION

GRAND GULF NUCLEAR STATION, UNIT NO. 1

EXTENDED POWER UPRATE LICENSE AMENDMENT REQUEST

ENTERGY OPERATIONS, INC.

DOCKET NO. 50-416

By letter dated September 8, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML102660409), Entergy Operations, Inc. (Entergy), submitted a license amendment request (LAR) for the Grand Gulf Nuclear Station, Unit No. 1 (GGNS). The proposed amendment requests an increase in the maximum steady-state power level at GGNS from 3898 megawatts thermal (MWt) to 4408 MWt. This represents an approximate 13 percent increase above the current licensed thermal power (CLTP) or an approximate 15 percent increase above the original licensed thermal power (OLTP).

The U.S. Nuclear Regulatory Commission (NRC) staff's review of the LAR has identified areas regarding the steam dryer for which additional information is required for the NRC staff to complete its review. Please note that we have determined that there is proprietary information contained in this request and we have made the document proprietary.

- 1) The GE Hitachi Nuclear Energy Americas LLC (GEH) report NEDC-33601P<sup>1</sup>, Revision 0, "Engineering Report Grand Gulf Replacement Steam Dryer Fatigue Stress Analysis Using PBLE [Plant Based Load Evaluation] Methodology," provides several comparisons between the design loading functions at the extended power uprate (EPU) level for the steam dryer of GGNS and sample loading functions from other plants. Figures 3.19 to 3.21 show that the loading on the [REDACTED] steam dryer is higher than the EPU design load for GGNS over a wide range of frequencies (up to 200 Hertz (Hz)). While the GGNS loading at the safety relief valve (SRV) resonance frequencies has been increased to envelope the [REDACTED] loading, the broadband loading function at the lower frequency range (0 to 200 Hz) has not been increased to envelope the loading of the [REDACTED]. The licensee is requested to substantiate the reasons for not increasing the GGNS low frequency loading to envelope the loading function of the [REDACTED], similar to the approach used in the high frequency range.
- 2) In NEDC-33601P, Revision 0, the licensee states that the plant measurements on the main steam lines (MSLs) of GGNS were performed at high power levels [REDACTED] in 2008 and at low power levels [REDACTED] in 2010. Based on comparisons of the noise floor of GGNS with those used to benchmark the PBLE methodology, the licensee concluded that no additional bias error due to

<sup>1</sup> Publicly available version: GE Hitachi Nuclear Energy, NEDC-33601, Revision 0, "Engineering Report Grand Gulf Replacement Steam Dryer Fatigue Stress Analysis Using PBLE Methodology," dated September 2010, Cover through Appendix A (ADAMS Accession No. ML102660401); Appendix B through Appendix D (ADAMS Accession No. ML102660406); and Appendix E through Appendix G (ADAMS Accession No. ML102660407).

Enclosure

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differences in the noise floor levels is needed in the stress analysis computations of the steam dryer of GGNS. Since the noise floor for GGNS appears to be determined from the low power measurements in 2010, while the CLTP measurements were performed in 2008, the licensee is requested to explain how the conservatism is maintained in the stress analysis computations. In addition, the licensee is requested to explain how the noise floor level measured at high power in 2008 is ensured to be similar to that determined at low power measurements during 2010.

- 3) NEDC-33601P, Revision 0, Section 3.3.4.3.1, "Weld Quality Factor," states that,

To assure high quality welds, new or replacement steam dryer fabrication employs weld processes that have been fully qualified.

[REDACTED]

The licensee is requested to confirm that the minimum detectable flaw size will be less than the critical flaw size. The licensee is also requested to confirm that the critical flaw size will be larger than the thickness of the weld bead for root and final pass.

- 4) NEDC-33601P, Revision 0, Section 5.6.1.2, "Structural FEM [Finite Element Model] Bias and Uncertainty," states that,

[REDACTED]

The licensee is requested to provide a basis or a reference in support of this statement.

- 5) Figure 3.20 in Appendix A, "Steam Dryer Integrity Analysis Methodology," of NEDC-33601P, Revision 0, shows the method of extrapolating the SRV resonance amplitudes. The licensee is requested to explain:

(a) Why the higher SRV resonance frequencies (e.g., [REDACTED]) are excited at reduced velocities, lower than those corresponding to the lower resonance frequencies (e.g., [REDACTED])?

(b) What is meant by "Total dryer pressure load," which represents the Y-axis?

- 6) In Appendix A of NEDC-33601P, Revision 0, the licensee states that CLTP Bias and Uncertainty are needed to adjust "SRV resonance load adders to observed CLTP amplitude." Since CLTP load, including SRV resonances, is measured in the plant and the SRV load adders at EPU are determined from [REDACTED] the CLTP measurements, it is not clear to the NRC staff why SRV load adders

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are needed at CLTP. The licensee is requested to clarify the need for SRV load adders at CLTP.

- 7) In Appendix A of NEDC-33601P, Revision 0, the licensee explains the procedure of determining the amplitudes of SRV load adders at EPU conditions. However, the bandwidth of these adders is not discussed in the report. The licensee is requested to explain how the bandwidth of the SRV load adders is determined.
- 8) The licensee is requested to confirm that, after accounting for all bias and uncertainties, the projected SRV load adders at EPU conditions do bound the dryer loads of similar plants (BWR6, BWR4, and ABWR) operating at conditions similar to those of GGNS.
- 9) Based on the information provided regarding EPU operation of GGNS, some or all SRVs will be continuously exposed to acoustic resonance in their standpipes at EPU operating conditions. The licensee is requested to explain the measures that will be taken to ensure safe operation of the SRVs and avoid any eventual damage such as those that occurred to the SRVs of the Quad Cities, Unit 2 plant.
- 10) In Appendix A of NEDC-33601P, Revision 0, Section 5.0, "Non-Prototype Justification," discusses the basis and method used to project the dryer load to EPU conditions. The trend lines of the [REDACTED] pressure data are based on the measured [REDACTED] amplitudes at [REDACTED]. For some frequency ranges (e.g., as shown in Figures 5.5 and 5.7), these trends are not maintained at power levels lower than [REDACTED]. In fact, the pressure amplitude is substantially higher than the trend lines over the velocity range from [REDACTED]. Please explain why the pressure data at lower power levels deviate from the trend postulated for high power levels. In addition, please explain why the projected trends at EPU conditions are considered conservative, despite the large non-conservative deviations observed at low power levels.
- 11) In Appendix A of NEDC-33601P, Revision 0, Section 5.3, "SRV Scaling Factor," describes the SRV scaling factor at CLTP and EPU conditions. It appears that the [REDACTED]. [REDACTED] It is not clear why the measured amplitudes and phases of the B-waves are not used. The licensee is requested to provide a concise step-by-step explanation of the procedure used to determine the SRV scaling factors.
- 12) On page 67 of Appendix E, "Steam Dryer Structural Analysis Methodology," of NEDC-33601P, Revision 0, it is stated that [REDACTED]. The licensee is requested to explain whether this section path, [REDACTED] provides the maximum stress intensity. If not, please explain how the section path, providing the maximum stress intensity in the fillet weld, is determined.

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- 13) On page 30 of Appendix E of NEDC-33601P, Revision 0, the licensee explains how the master degrees of freedom are selected. Please explain how the selected master degrees of freedom preserve the relevant dynamic characteristics of the model (i.e., natural frequencies in the range of 0 to 250 Hz and the corresponding mode shapes). The licensee is also requested to explain what errors are introduced in the calculated stresses because of the use of substructure analysis.
- 14) Section 9.0 of Appendix E of NEDC-33601P, Revision 0, provides templates (Tables 9.0-1 to 9.0-5) in table format for final stress processing. Only two of these tables, Tables 9.0.3 and 9.0.4, have been completed and presented in Section 4.0 of the main report as Tables 4.1 and 4.4, respectively. The licensee is requested to complete the remaining tables (Tables 9.0.1, 9.0.2, and 9.0.5) and submit them for the NRC staff's review. Additionally, the licensee is requested to confirm whether component-based and frequency-based bias and uncertainty errors have been applied to the [REDACTED] analysis results.
- 15) In Section F.2 of Appendix F, "Power Ascension Test Plan," of NEDC-33601P, Revision 0, the licensee evaluates the dryer stress response for each of the [REDACTED] different potential resonance frequencies [REDACTED] in addition to the base case for the [REDACTED] and [REDACTED] SRV resonance peaks observed in the CLTP measurements. The licensee is requested to explain why the dryer dynamic response, considering all [REDACTED] resonance peaks taking place simultaneously, is not evaluated.
- 16) In Section F.2 of Appendix F of NEDC-33601P, Revision 0, the licensee imposes three criteria (related to the [REDACTED] during power ascension for all [REDACTED] dryer regions, to provide limits to assure that the allowable stress limits are not exceeded. Tables F-2 to F-7 provide quantitative data for these criteria for Level 1 and Level 2 limit curves. The licensee is requested to provide an example of the detailed calculations performed in determining the quantitative data (for dryer region 1) presented in these tables.
- 17) Section F.2 of Appendix F of NEDC-33601P, Revision 0, states that,  
[REDACTED]

The licensee is requested to clarify the meaning of the term "load energy in frequency domain" and explain the statement.

- 18) In Appendix G, "Grand Gulf Nuclear Station Main Steam Line Test Report," of NEDC-33601P, Revision 0, the licensee states that during the primary pressurization tests at GGNS, the strain gauges were checked against the plant

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data of static pressure. However, as discussed in Section 5.3 of this appendix, the internal dynamic pressure during the tests was calculated from the strain gauge data using the formula for thick walled cylinder (with closed ends) and the MSL dimensions (diameter and wall thickness). The licensee is requested to (1) explain whether there is any variation in the wall thickness at a given strain gauge location, and (2) compare the calibration factors obtained by these two different procedures to assess any bias and uncertainties in the conversion of hoop stress to pressure.

19) The test results presented in Appendix G of NEDC-33601P, Revision 0, include plots of averaged time history data for the strain gauge pairs at various locations. The licensee is requested to elaborate on how these time averages were obtained and explain the relevance of these averaged time history spectra.

20) In Appendix G of NEDC-33601P, Revision 0, the licensee states that,

The strain gauges were wired in series, because there were a limited number of penetration cables available.

The licensee is requested to provide additional details about the wiring circuit of the strain gauges.

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March 2, 2011

Vice President, Operations  
Entergy Operations, Inc.  
Grand Gulf Nuclear Station  
P.O. Box 756  
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Sincerely,  
/RA/

Alan B. Wang, Project Manager  
Plant Licensing Branch IV  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-416

Enclosure:  
As stated

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**ADAMS Accession Nos.:** Proprietary - ML110480821; Non-proprietary - ML110550475

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