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

May 24, 2012

Mr. Michael Perito
Vice President, Site
Entergy Operations, Inc.
P.O. Box 756
Port Gibson, MS 39150

SUBJECT: REQUESTS FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE GRAND GULF NUCLEAR STATION LICENSE RENEWAL APPLICATION (TAC NO. ME7493)

Dear Mr. Perito:

By letter dated October 28, 2011, Entergy Operations, Inc., submitted an application pursuant to Title 10 of the *Code of Federal Regulations,* Part 54, to renew the operating license for Grand Gulf Nuclear Station, Unit 1 (GGNS) for review by the U.S. Nuclear Regulatory Commission (NRC or the staff). The staff is reviewing the information contained in the license renewal application and has identified, in the enclosure, areas where additional information is needed to complete the review.

These requests for additional information were discussed with Jeff Seiter, and a mutually agreeable date for the response is within 30 days from the date of this letter. If you have any questions, please contact me at 301-415-1045 or e-mail nathaniel.ferrer@nrc.gov.

Sincerely,

Nathaniel Ferrer, Project Manager
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-416

Enclosure:
Requests for Additional Information

cc w/encl: Listserv

GRAND GULF NUCLEAR STATION
LICENSE RENEWAL APPLICATION
REQUESTS FOR ADDITIONAL INFORMATION SET 16

RAI 4.3-1

Background. LRA Section 4.3.1 states that based on the numbers of cycles accrued to date, the applicant projected the numbers of accrued cycles expected at the end of 60 years of operation. LRA Table 4.3-1 shows the projected values through the period of extended operation based on the rate of occurrence for the previous 10 years between 1999 and 2010. The staff noted that Grand Gulf Unit 1 started operation in 1985.

Issue. The applicant did not explain why the operational data from 1985 to 1999 was not also taken into account in the 60-year projections. It is not clear whether this information from 1985 to 1999 was evaluated and determined to not be relevant or if it was even considered. The applicant also did not explain and justify why it is conservative to use a projection based on the transient rate of occurrence between 1999 and 2010.

Request.

a. Justify why the 60-year projection method described in the license renewal application (LRA) does not need to consider the operational data between initial plant operation in 1985 to 1999.

b. Justify why projection methodology that is based on the transient rate of occurrence between 1999 and 2010 is a conservative approach to project to 60 years of plant operation.

RAI 4.3-2

Background. LRA Table 4.3-1, Note 3, indicates that the "Design Hydro" was originally designed to 40 cycles of pressurization with a pressure of 1250 psig. It also states that since the test was performed at less than 1050 psig, the number of allowable cycles has been recalculated as 50 cycles. The staff noted that updated final safety analysis report (UFSAR) Table 3.9-35, which is referenced by Tech Spec 5.5.5, still indicates that the allowable number of cycles for the hydrostatic test is 40.

Issue. The applicant did not explain how the number of allowable cycles for the "Design Hydro" transient was re-calculated to 50 cycles. In addition, the staff noted that the 50 cycles limit for this transient is not consistent with the current licensing basis (e.g., Tech Spec and UFSAR). Since the information between the LRA and the UFSAR is not consistent, it is not clear what limits are being used in the Fatigue Monitoring Program to manage fatigue.

Request.

a. Describe and justify the re-calculation that was performed to change the number of allowable cycles for the "Design Hydro" transient from 40 to 50.

b. Justify that the applicable UFSAR sections do not need to be updated to reflect the change in the number of allowable cycles for the "Design Hydro" transient.

c. Identify all other transients in which the number of allowable cycles identified in LRA Table 4.3-1 is not consistent with the current licensing basis (e.g., Tech Spec and UFSAR) and justify any differences.

RAI 4.3-3

Background. LRA Table 4.3-1, Note 7, indicates that the "Loss of Feedpumps" transient has not occurred in the last 10 years, but the design limit of 10 cycles is expected to be exceeded during the period of extended operation. The applicant stated that "[s]tress-based fatigue is utilized to evaluate this transient" and indicated that LRA Section 4.3.1.2 has more information. The staff noted that LRA Section 4.3.1.2 discusses the use of stress-based fatigue for the reactor vessel feedwater nozzle, but does not discuss the "Loss of Feedpumps" transient.

Issue. The staff noted that UFSAR Sections 3.9.1.1.1.2, 3.9.1.1.1.5, and 3.9.1.1.1.6 indicate that the "Loss of feedwater pumps" transient is considered in the design of control rod drive (CRD) housing and incore housing, main steam system and recirculation system, respectively. In LRA Section 4.3, the applicant did not explain how exceeding the design limit for the "Loss of Feedpumps" transient during the period of extended operation will impact the fatigue time-limited aging analysis (TLAA) of the aforementioned components. Furthermore, the applicant did not explain why exceeding the design limit for this transient would impact only the reactor vessel feedwater nozzle.

The staff noted that LRA Section 4.3.1.2 does not discuss how the fatigue TLAA of the reactor vessel feedwater nozzle, which is dispositioned in accordance with 10 CFR 54.21(c)(1)(iii), will be affected by this transient exceeding the design limit. Based on the statement in LRA Table 4.3-1, Note 7, "stress-based fatigue is utilized to evaluate this transient," it is not clear what type of fatigue monitoring will be used for these other components that included "Loss of Feedpumps" transient in its fatigue analysis.

Request.

a. Identify all components that included the "Loss of Feedpumps" transient in its fatigue analysis. Discuss how exceeding the design limit for the "Loss of Feedpumps" transient will affect the fatigue TLAA for these components. For each identified component indicate whether stress-based fatigue will be used for monitoring.

b. For components that are not monitored by stress-based fatigue, justify how the Fatigue Monitoring Program will ensure the fatigue usage remains within the allowable limit given that one of the design transients used in the fatigue analysis is expected to exceed the design limit during the period of extended operation.

RAI 4.3-4

Background. LRA Table 4.3-1 indicates that the 60-year transient cycle projection for several transients is expected to exceed the design allowable limit during the period of extended operation. LRA Section 4.3.1 states that "there are several locations whose projections exceed design limits" and "[a]s additional operating data is accumulated, subsequent projections will refine the estimate of the numbers of cycles expected through 60 years of operation."

In addition, the LRA also states that the Fatigue Monitoring Program will ensure that accrued numbers of cycles of all design transients will remain below numbers of cycles evaluated in the fatigue analyses.

Issue. The staff noted that the applicant did not identify the locations or fatigue analyses that will be affected by those design transients that are expected to exceed the design allowable limit during the period of extended operation. It is not clear how often the applicant will perform these subsequent cycle projections to refine the estimate for 60-years of operation and how the applicant will use these projections as part of the Fatigue Monitoring Program.

Request.

a. Identify the locations that will be affected by transients that have 60-year projected cycles that exceed its design cycle limit during the period of extended operation.

b. Clarify how often subsequent cycle projections to refine the estimate for 60 years of operation will be performed and whether they are part of the Fatigue Monitoring Program. If these projections are part of the Fatigue Monitoring Program, discuss how they will be used to manage metal fatigue during the period of extended operation. If these projections are not part of the Fatigue Monitoring Program, discuss the purpose of these subsequent projections.

RAI 4.3-5

Background. LRA Section 4.3.2.2 indicates that the fatigue TLAA for non-piping components is dispositioned in accordance with 10 CFR 54.21(c)(1)(i) and that the calculations remain valid for the period of extended operation. The applicant stated that the expansion joints with fatigue analyses are analyzed for a bounding number of cycles and an evaluation of these analyses determined that the number of cycles were adequate for 60 years of operation.

Issue. LRA Section 4.3.2.2 did not identify the cycles or transients that these expansion joints were analyzed for. In addition, information regarding the accumulated number of occurrences and the 60-year projected number of occurrences for these cycles or transients were not provided; therefore, the staff cannot verify the adequacy of the applicant's disposition in accordance with 10 CFR 54.21(c)(1)(i) for this TLAA.

Request.

a. Identify the cycles or transients that were considered as an input to the fatigue analyses of the expansion joints.

b. Provide the accumulated number of occurrences, up to May 2010, for each transient identified above. Confirm that these transients were monitored since initial plant startup. If not, justify how the accumulated cycles to date were reconciled. Provide the 60-year projected number of occurrences for each transient identified above and justify that these projections are conservative.

c. Discuss and justify the evaluation, referenced in LRA Section 4.3.2.2, that was performed for these expansion joint analyses that determined the number of cycles that were adequate for 60 years of operation.

RAI 4.3-6

Background. UFSAR Table 3.9-1 indicates that there are 400 design cycles for the "control rod pattern change" transient. In addition, UFSAR Table 3.9-35, which is referenced by Tech Spec 5.5.5, indicates that there are 80 step change cycles for the "Loss of Feedwater Heaters" transient.

Issue. The staff noted that these two transients were not included in LRA Tables 4.3.1-1; therefore, it is not clear whether they have been used as inputs into the TLAAs discussed in LRA Section 4. If these transients were inputs into TLAAs dispositioned in accordance with 10 CFR 54.21(c)(1)(i) or 10 CFR 54.21(c)(1)(ii), the accumulated number of cycles and the 60-years projected cycles are needed to verify the adequacy of the disposition.

However, if these transients were inputs into TLAAs dispositioned in accordance with 10 CFR 54.21(c)(1)(iii) and the Fatigue Monitoring Program is credited, the applicant needs to include these transients in the Fatigue Monitoring Program. Inclusion of these transients into the program is consistent with GALL Report AMP X.M1, to monitor all plant design transients that cause cyclic strains, which are significant contributors to the fatigue usage factor.

Request.

a. Identify the TLAAs in LRA Section 4 that used these transients as an input. Confirm that these transients were monitored since initial plant startup. If not, justify how the accumulated cycles to date were reconciled.

b. If the identified TLAA is dispositioned in accordance with 10 CFR 54.21(c)(1)(iii), clarify whether these two transients are currently included in the Fatigue Monitoring Program. If not, justify why these transients do not need to be monitored by the Fatigue Monitoring Program.

c. If the identified TLAA is dispositioned in accordance with 10 CFR 54.21(c)(1)(i) or 10 CFR 54.21(c)(1)(ii), provide the accumulated number of occurrences for each transient up to May 2010 in LRA Tables 4.3-1. Provide the 60 year projected number of occurrences for these transients in LRA Tables 4.3-1 and justify that these projections are conservative.

RAI 4.3-7

Background. LRA Section 4.3.1.3 indicates that the effects of aging due to fatigue on the reactor vessel internals will be managed with the Fatigue Monitoring Program and the TLAAs for the vessel internals are dispositioned in accordance with 10 CFR 54.21(c)(1)(iii). The staff noted that for several other TLAAs described in LRA Section 4.3, the applicant identified that the associated components for these TLAAs were analyzed for transients specified by General Electric.

Issue. LRA Section 4.3.1.3 did not identify the transients that were used for the reactor pressure vessel internals; therefore, the staff cannot verify the adequacy of the disposition of the fatigue TLAA in accordance with 10 CFR 54.21(c)(1)(iii).

Request. Identify the transients and associated design cycles that were used and confirm that these transients are included in LRA Table 4.3-1 and the Fatigue Monitoring Program. If these transients are not included into the program, justify how these TLAAs and associated components can be adequately managed for fatigue during the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

RAI 4.3-8

Background. LRA Section A.2.2.3 indicates that prior to the period of extended operation; the applicant will update the fatigue usage calculation using refined fatigue analyses to determine valid cumulative usage factors (CUF) less than 1.0 when accounting for the effects of reactor coolant environment. LRA Table 4.3-1 indicates that the applicant has not calculated the environmentally-adjusted CUF for nickel based alloy components and that there are many locations with EAF CUFs greater than 1.0.

Issue. The applicant did not provide a sufficient description of how it plans to refine the CUF values and calculate the environmental adjustment factors (F_{en}) in the LRA or its UFSAR supplement. Without this information, the staff cannot evaluate whether the applicant's Fatigue Monitoring Program will adequately manage the effects of reactor coolant environment on metal fatigue during the period of extended operation. Additionally, without a description of how the Fatigue Monitoring Program will be permitted to refine the CUF and F_{en} values; the staff does not have assurance as to how the applicant's program will manage the effects of reactor coolant environment on metal fatigue. In addition, the information in LRA Section A.2.2.3 is not a sufficient summary description of the activities for managing the effects of reactor coolant environment on metal fatigue.

Request.

a. Identify and justify the methods that will be used by the Fatigue Monitoring Program to refine the CUF and F_{en} values, to address the effects of reactor coolant environment on metal fatigue, are appropriate.

b. Revise LRA Section A.2.2.3 to provide a description of the methods that can be used to refine the CUF and F_{en} values, to address the effects of reactor water environment on metal fatigue, as necessary.

RAI 4.3-9

Background. LRA Section 4.3.3 states that hydrogen water chemistry (HWC) was fully implemented in April 2007. The applicant stated that 39.5 percent (or 23.7 years since initial operation) of the 60-year operation will be evaluated with Normal Water Chemistry (NWC) dissolved oxygen levels and 60.5 percent (or remaining 36.3 years) of the 60-year operation will have been with HWC dissolved oxygen levels. The applicant stated that the environmentally-assisted fatigue analyses included an evaluation of the water chemistry history to determine the cumulative environment for the components when determining the dissolved oxygen.

Issue. The staff noted that the use of a time-weighted percentage for NWC and HWC to evaluate environmentally-assisted fatigue is based on the assumption that transients occurred linearly from the time of initial plant operation. However, based on information the staff noted during its audit and from LRA Table 4.3-1, the following transients have accumulated more than 39.5 percent of the design cycles before the full implementation of HWC in 2007: "Start-up," "Turbine roll to rated power," "Reduction to 0 percent Power," "Initial shutdown," "Vessel Flooding," "Shutdown cooling" and "Loss of feedpumps."

Thus, if the actual number of transient occurrences prior to the full implementation of HWC was used, the contribution to environmentally-assisted fatigue from NWC would represent a larger percentage than the 39.5 percent of 60 years of operation assumed by the applicant for these transients.

For the carbon steel/low alloy steel formulae in NUREG/CR-6583 and NUREG/CR-6909, the use of NWC dissolved oxygen level results in a larger environmentally-adjustment factor (F_{en}) value than if HWC dissolved oxygen levels were used. Therefore, the use of a time-weight percentage (e.g., 60.5 percent/39.5 percent) for HWC/NWC in the formulation of F_{en} values would underestimate the environmentally-adjusted CUFs (EAF CUF), which may be potentially non-conservative for carbon steel/low alloy steel components.

The applicant did not explain why the use of a time-weight percentage (e.g., 39.5 percent/60.5 percent) for NWC/HWC is acceptable when evaluating environmentally-assisted fatigue. In addition, the staff noted that LRA Section A.2.2.3 did not provide an adequate description on the treatment of NWC and HWC in the current and future EAF CUF analyses.

Request.

a. For the calculations that support LRA Section 4.3.3 and the EAF CUF calculations that will be performed in the future, justify this time-weight percentage of HWC/NWC operation to calculate F_{en} values is appropriate or conservative, instead of incorporating available information for transient occurrences during NWC/HWC operation.

b. Revise LRA Section A.2.2.3 to provide a description of the methodology to address NWC/HWC operation for the future analyses to determine valid EAF CUF values, as necessary.

RAI 4.3.10

Background. LRA Section A.2.2.1 states that the applicant implemented a plant modification prior to plant operation to eliminate concerns identified in previous BWR designs for the feedwater nozzle. The analysis of the modified feedwater nozzle included fatigue from potential rapid cycling behind the thermal sleeves. Therefore, the feedwater nozzle analysis contains a location-specific rapid cycling fatigue usage that is added to the cycle-based fatigue usage. The usage is postulated based on time and feedwater temperature in order to include the rapid cycling effect. In addition, the feedwater nozzle will be reevaluated for environmentally-assisted fatigue and will consider the effects of potential rapid cycling as necessary.

Issue. The staff noted that the LRA does not explain how potential rapid cycling will be considered in the reanalysis and under what condition the effects of rapid cycling is considered "necessary." LRA Section A.2.2.1 did not provide an adequate summary description of the activities for managing the effects of rapid cycling for the reactor vessel feedwater nozzle.

Request.

a. Discuss how the effects of potential rapid cycling will be considered in the reanalysis of the feedwater nozzle.

b. Describe the conditions in which the effects of rapid cycling on the feedwater nozzle will be considered necessary.

c. Revise LRA Section A.2.2.1 to provide an adequate summary description of the activities for managing the effects of potential rapid cycling for the reactor vessel feedwater nozzle, as necessary.

RAI 4.3-11

Background. LRA Section 4.3.1.4 states that the fatigue analysis for the Byron-Jackson reactor recirculation pump casing considered the RCS fatigue transients specified by General Electric and this analysis justified exempting portions of the case from analysis. It also determined that the remaining locations met 1974 ASME Section III code fatigue requirements. The applicant stated that the Fatigue Monitoring Program will manage the effects of metal fatigue on the reactor recirculation pumps. LRA Section 4.3.1.4 also referenced UFSAR 3.9.1.2.1.4, which contains additional information about the recirculation pump fatigue analysis.

Issue. The staff noted that LRA Section 4.3.1.4 and UFSAR Section 3.9.1.2.1.4 did not provide information regarding the locations of the pump casing that were exempt from a fatigue analysis and the locations that met 1974 ASME Code Section III fatigue requirements.

In addition, the applicant did not explain how the locations were determined to be exempt and whether the Fatigue Monitoring Program ensures that the assumptions associated with this determination will continue to remain valid during the period of extended operation.

Request.

a. Identify the locations of the pump casing that were exempt from a fatigue analysis and, if applicable, identify the provisions in the ASME Code Section III that allowed the exemption of the required fatigue analysis for these components.

b. Explain how the determination was made that these locations were exempt from a fatigue analysis. If this exemption is dependent on the RCS fatigue transients specified by General Electric, justify whether or not this exemption for a fatigue analysis needs to be identified as a TLAA.

c. Confirm whether the Fatigue Monitoring Program will ensure that the exemption for a fatigue analysis for the specific locations on the reactor recirculation pump casing will remain valid during the period of extended operation. If not, justify how the exemptions for these locations will remain valid during the period of extended operation.

d. Identify the locations that met 1974 ASME Code Section III fatigue requirements and provide the associated CUF values. In addition, provide the usage factors that were calculated for several locations in the pump cover that were later reanalyzed due to modifications to install shaft sleeves and modify the seal water heat exchanger.

e. Revise LRA Section 4.3.1.4 and LRA Section A.2.2.1, as necessary.

RAI 4.3-12

Background. LRA Section 4.3.1.6 states that LRA Table 4.3-5 provides the highest CUF values identified in the analyses for each system containing Class 1 piping. LRA Section 4.3.3 provides the applicant's evaluation for environmentally assisted fatigue and states that the highest usage factor was evaluated in the piping in the feedwater, reactor recirculation, RHR, LPCS, and HPCS systems. The staff also noted that the following three locations in LRA Table 4.3-6 have the same CUF value of 0.564: LPCS reactor vessel nozzle, HPCS reactor vessel nozzle, and reactor vessel nozzle-RHR.

Issue. The staff noted that LRA Table 4.3-5 provides a CUF value of 0.4138 for the feedwater piping; however LRA Table 4.3-6 provides a CUF value of 0.2228 for the feedwater piping. It is not clear to the staff why there is a discrepancy between the CUF values for the feedwater piping in the LRA tables.

Based on the statement in LRA Section 4.3.3 mentioned above and the CUF value provided in LRA Table 4.3-5, it appears that the environmentally-assisted fatigue evaluation for the feedwater piping should not have used the CUF value of 0.2228. The staff noted that if the F_{en} value provided in LRA Table 4.3-6 was used with the CUF value of 0.4138, the CUF_{en} exceeds the ASME Code limit of 1.0. It is also not clear to the staff whether the occurrences of the CUF value of 0.564 for these three locations are correct.

Request.

a. Clarify the difference between the CUF values for the feedwater piping provided in LRA Table 4.3-5 and LRA Table 4.3-6.

b. Justify why the environmentally-assisted fatigue evaluation for the feedwater piping considered the lower of the two CUF values, when LRA Section 4.3.3 states that the highest usage factor was evaluated for the system.

c. Explain why the three locations discussed above have an identical CUF value. Since the presented CUF values for the feedwater piping were different in LRA, confirm whether the CUF values and results for the environmentally-assisted fatigue evaluations presented in LRA Section 4.3 are accurate. If not, explain any discrepancies that are identified.

d. Revise LRA Section 4.3 and LRA Section A.2.2, as necessary.

RAI 4.7.2-1

Background. LRA Section 4.7.2 provides the applicant's TLAA for the Class 1 systems associated with the high energy line break (HELB) analysis, which is also discussed in UFSAR Section 3.6. The disposition for this TLAA is in accordance with 10 CFR 54.21(c)(1)(iii).

UFSAR Section 3.6 provides the applicant's basis for the HELB analysis and how it complies with general design criteria No. 4, "Dynamic Effects" and Section 3.6.2 of NUREG-0800, Branch Position MEB-1, "Postulated Rupture Locations in Fluid Piping Systems Inside and Outside Containment." UFSAR Section 3.9 provides a summary of the design basis transients and the cycle limits that are applicable to these Class 1 systems.

Issue. LRA Section 4.7.2 does not identify which high energy piping systems in UFSAR Table 3.6A-14 are within the scope of the HELB TLAA. In addition, the specific Class 1 systems and components, as it relates to the HELB analysis, within the scope of the Fatigue Monitoring Program's cycle counting activities were also not identified.

Request.

a. Identify which of the high energy piping systems in UFSAR Table 3.6A-14 are within the scope of the HELB TLAA.

b. Identify the specific Class 1 systems and components within the scope of the Fatigue Monitoring Program's cycle counting activities, as it relates to the HELB TLAA discussed in LRA Section 4.7.2.

SUBJECT: REQUESTS FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE GRAND GULF NUCLEAR STATION, LICENSE RENEWAL APPLICATION

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Mr. Michael Perito
Vice President, Site
Entergy Operations, Inc.
P.O. Box 756
Port Gibson, MS 39150

SUBJECT: REQUESTS FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE GRAND GULF NUCLEAR STATION LICENSE RENEWAL APPLICATION (TAC NO. ME7493)

Dear Mr. Perito:

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These requests for additional information were discussed with Jeff Seiter, and a mutually agreeable date for the response is within 30 days from the date of this letter. If you have any questions, please contact me at 301-415-1045 or e-mail nathaniel.ferrer@nrc.gov.

Sincerely,

/RA/
Nathaniel Ferrer, Project Manager
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50- 416

Enclosure:
Requests for Additional Information

cc w/encl: Listserv

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