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

June 27, 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, 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 by e-mail at 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 26

RAI 4.2.3-1

Background. Generic Letter (GL) 92-01, Revision (Rev.) 1 and Regulatory Guide (RG) 1.99, Rev. 2, address the information related to reactor vessel structural integrity required of all licensees for beltline materials. The staff has maintained that the licensees should provide comparable information for all extended beltline materials as part of the license renewal process. With the increase in neutron fluence associated with license renewal, three additional plates are now above the fluence threshold (> 1E+17 n/cm^2, E > 1 MeV) and must be considered as extended beltline materials. Note (2) of license renewal application (LRA) Table 4.2-2 indicates that since information is not available for the actual measured copper content for the three plates of Shell Course 1, the maximum allowable copper content was obtained from the vessel design specification (i.e., copper content of 0.12 percent).

Issue. RG 1.99, Rev. 2, specifically considers best estimate values for the material as acceptable, which will normally be the mean of measured values for a given plate. If such values are not available, then upper limiting values given in the material specification are acceptable. The RG does not mention the design specification. Conservative estimates of the chemistry (mean plus one standard deviation) based on generic data may be used if justification is provided.

Request.

a. Provide the part of the design specification for Shell Course 1 that describes the required copper content and the material specification that was in effect when the reactor vessel for Grand Gulf Nuclear Station was built.
b. Describe the documented basis for the copper content of Shell Course 1 plates, such as available certified material test records, quality control documents, and/or other data that might be used to justify the assumed copper content.

RAI B.1.23-2

Background. LRA Section B.1.23, "Inservice Inspection," states that, "ISI Program Summary Reports between 2004 and 2010 reveal compliance and provide evidence that the program is effective for managing aging effects in accordance with the ASME Boiler Pressure Vessel Code Section XI."

Generic Aging Lessons Learned (GALL) aging management program (AMP) XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," "Detection of Aging Effects" program element states that "The extent and schedule of the inspection and test techniques prescribed by the program are designed to maintain structural integrity and ensure that aging effects are discovered and repaired before the loss of intended function of the component." In addition, "monitoring and trending" program element states that, "For Class 1, 2, or 3 components, the inspection schedule of IWB-2400, IWC-2400, or IWD-2400, respectively, and the extent and frequency of IWB-2500-1, IWC-2500-1, or IWD-2500-1, respectively, provides for timely detection of degradation."

ENCLOSURE

Issue. The staff noted that Event Notification Report No. 47880 dated April 30, 2012, indicates that the applicant detected an unacceptable indication in one of the residual heat removal (RHR) system to reactor pressure vessel nozzles (weld area of N06B-KB nozzle) during the current refueling outage. The defect has a size of 0.9 inches in length and 0.5 inches in depth. Nominal wall thickness of the weld is 1.3 inches.

The staff needs clarification regarding how this plant-specific operating experience affects the effectiveness of the applicant's AMP (e.g., detection of aging effects and directing corrective actions in a timely manner).

Request.

a. Clarify whether the defect detected in the RHR nozzle is age-related. If it is, and based on the size of the defect, provide justification that the applicant's proposed Inservice Inspection (ISI) program is still effective in timely detection of aging effects (i.e., whether inspection intervals are adequate to prevent unacceptable flaw propagation).
b. Clarify when the previous UT examination was performed on the subject RHR weld and provide the examination results.
c. Describe any corrective actions and extent of condition performed from previous examinations or as a result of the recent unacceptable indication. Provide justification that the current inspection schedule for all affected components is adequate for timely detection of aging effects.

RAI B.1.38-1

Background. The "scope of program" program element of GALL AMP XI.M31, "Reactor Vessel Surveillance," states that materials originally monitored within the scope of the licensee's existing Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix H, materials surveillance program will continue to serve as the basis for the reactor vessel surveillance AMP unless safety considerations for the term of the renewed license would require the monitoring of additional or alternative materials.

LRA Table 4.2-2 for the applicant's upper-shelf energy analysis includes "Shell Plate 1," indicating that the 1/4T fluence of this plate is 3.94E+17 n/cm^2 (E > 1 MeV) for 54 effective full power years (EFPY) in consideration of the planned extended power uprate (EPU) as addressed in LRA Section 4.2. LRA Section 4.2 also indicates that 54 EFPY corresponds to the end of the period of extended operation. The projected fluence of Shell Plate 1 exceeds 1.0E+17 n/cm^2, which is a fluence threshold for the consideration in a Reactor Vessel Surveillance Program in accordance with 10 CFR Part 50, Appendix H. During the audit, the staff also noted that Shell Plate 1 has the highest adjusted reference temperature (ART) among all the plates of the applicant's reactor vessel after 54 EFPY.

Issue. The LRA information does not permit the staff to independently verify the neutron irradiation embrittlement of all relevant beltline and extended beltline materials, including the Shell Plate 1 material, for the period of extended operation. In addition, the LRA does not clearly address how the applicant's program will monitor and use actual test data related to the new limiting material (i.e., Shell Plate 1), including the data of the Integrated Surveillance program (ISP), in order to achieve the program objective specified in the GALL Report (i.e., to

provide sufficient material data and dosimetry to monitor irradiation embrittlement, and to determine the need for operating restrictions). The staff also noted that the general description of the program includes references to Nuclear Regulatory Commission (NRC)-approved reports (Boiling Water Reactor Vessel and Internals Project (BWRVIP)-102 and BWRVIP-135) that have never been submitted to the NRC for approval.

Request.

a. Provide a new table that includes the heat numbers, material compositions (Cu and Ni contents), unirradiated reference temperature (RT_{NDT}) data, projected neutron fluences, and calculated ART values of all beltline and extended beltline materials for the period of extended operation (54 EFPY).
b. Clarify how the applicant's program will monitor and use actual test data related to the new limiting material (i.e., Shell Plate 1), including the data of the ISP, in order to achieve the program objective in the GALL Report (i.e., to provide sufficient material data and dosimetry in order to monitor irradiation embrittlement and to determine the need for operating restrictions). As part of the response, clarify whether the ISP includes the embrittlement data of a material that can reasonably represent the embrittlement of Shell Plate 1. In addition, if such data exist, discuss the implications of the currently available test data to the neutron embrittlement of Shell Plate 1. Describe how the applicant's program will communicate with the BWRVIP on the present and future changes in limiting materials in order to adequately address potential safety considerations and to perform necessary actions in response to the identification of new limiting materials.
c. Remove the reference to reports that are not approved by the NRC.

RAI B.1.38-2

Background. LRA Section B.1.38, "Reactor Vessel Surveillance," indicates the applicant's program relies on the BWRVIP ISP based on staff-approved BWRVIP documents to meet the 10 CFR Part 50, Appendix H, requirements. The LRA also refers to BWRVIP-86, Rev. 1, "BWR Vessel and Internals Project Updated BWR Integrated Surveillance Program (ISP) Implementation Plan," in the applicant's program enhancement. The ISP is an approved method for the commercial boiling-water reactor (BWR) fleet of reactors to manage the neutron embrittlement of the reactor vessel materials. Table 4-7 of BWRVIP-86, Rev. 1, indicates that the maximum fluence values (E > 1 MeV) of the tested surveillance plate and weld materials are 2.66E+18 n/cm^2 and 2.75E+18 n/cm^2, respectively. BWRVIP-86, Rev. 1 also indicates that only two additional weld materials will be withdrawn additionally in 2013 and 2039, which correspond to estimated fluence values of 1.35E+18 n/cm^2 and 2.67E+18 n/cm^2, respectively.

In comparison, LRA Sections 4.2 and 4.2.1 indicate that 54 EFPY corresponds to the end of the period of extended operation and the peak 1/4T fluence for 54 EFPY with the planned EPU is 3.02E+18 n/cm^2 as projected for the lower-intermediate shell and axial welds. These fluence values (E > 1 MeV) are compared as follows, indicating that the LRA fluence projection for the reactor vessel in consideration of the planned EPU exceeds the fluence values of tested and to-be-tested materials in the applicant's ISP:

- Maximum fluence of the tested surveillance plate materials (ISP): 2.66E+18 n/cm^2
- Maximum fluence of the tested surveillance weld materials (ISP): 2.75E+18 n/cm^2
- Fluence of the surveillance weld to be withdrawn in 2039 (ISP): 2.67E+18 n/cm^2
- Peak inside diameter (ID) fluence of the reactor vessel (LRA with EPU): 4.44E+18 n/cm^2

The "detection of aging effects" of GALL AMP XI.M31 states that:

> The plant-specific or integrated surveillance program shall have at least one capsule with a projected neutron fluence exceeding the 60-year peak reactor vessel wall neutron fluence prior to the end of the period of extended operation. The program withdraws one capsule at an outage in which the capsule receives a neutron fluence of between one and two times the peak reactor vessel wall neutron fluence at the end of the period of extended operation and tests the capsule in accordance with the requirements of ASTM E 185-82.

In addition, the program description of GALL AMP XI.M31 states, "[i]f surveillance capsules are not withdrawn during the period of extended operation, operating restrictions are to be established to ensure that the plant is operated under the conditions to which the surveillance capsules were exposed."

Issue. The LRA does not clearly address whether the peak ID fluence of the reactor vessel for 54 EFPY with the planned EPU is projected to exceed the maximum fluence of the ISP surveillance materials (for either weld or plate). In addition, the LRA states that the Reactor Vessel Surveillance Program is consistent with GALL AMP XI.M31, but does not address how the program will implement relevant operating restrictions if the peak ID fluence of the reactor vessel for 54 EFPY is projected to exceed the maximum fluence of the surveillance materials.

Request.

a. Clarify whether the peak ID fluence of the reactor vessel for 54 EFPY in consideration of the planned EPU is projected to exceed the maximum fluence of the surveillance materials (for either weld or plate).
b. If the peak ID fluence of the reactor vessel for 54 EFPY is projected to exceed the maximum fluence of the ISP surveillance materials (for either weld or plate), modify the LRA to include an exception, or explain how the Reactor Vessel Surveillance Program is consistent with the GALL Report.

RAI B.1.38-3

Background. GALL AMP XI.M31 states that the objective of the reactor vessel material surveillance program is to provide sufficient material data and dosimetry. LRA Section B.1.38 indicates that the Reactor Vessel Surveillance Program manages reduction of fracture toughness for reactor vessel beltline materials using material data and dosimetry. LRA Sections 4.2 and 4.2.1 and Table 4.2-1 indicate that 54 EFPY corresponds to the end of the period of extended operation and the peak 1/4T fluence value for 54 EFPY is 3.02E+18 n/cm^2 (E > 1 MeV) as projected for lower-intermediate shell and axial welds in consideration of the EPU. In comparison, the applicant's previous fluence projections without the consideration of EPU are described below.

The applicant's program credits ISP specified in BWRVIP-86, Rev. 1. Tables 7-2 and 7-3 and Section 7.2 in BWRVIP-86, Rev. 1 indicate that the applicant's 1/4T fluence of the target materials estimated for 48 EFPY is 1.8E+18 n/cm^2 (E > 1 MeV). This 1/4T fluence for 48 EFPY is equivalent to 2.03E+18 n/cm^2 for 54 EFPY based on linear extrapolation from 48 to 54 EFPY. This 54-EFPY neutron fluence value of the target materials in BWRVIP-86, Rev. 1 is in agreement with the fluence value in the update Final Safety Analysis Report (UFSAR) Section 5.3.1.6.2, "Neutron Fluence" because the UFSAR section indicates that the 1/4T fluence of the reactor vessel beltline region for 32 EFPY is 1.21E+18 n/cm^2 and this fluence value for 32 EFPY is converted to 2.04E+18 n/cm^2 for 54 EFPY using linear extrapolation. In addition, UFSAR Sections 5.3.1.6.1, 5.3.1.6.2 and 4.3.2.8 indicate that the updated lead factor for this fluence projection for 32 EFPY is based on 3-degree surveillance capsule dosimetry data.

In contrast, the applicant's letter dated May 5, 1994, in response to Generic Letter GL 92-01 indicates that the 1/4T fluence at the end of original 40-year license (32 EFPY) is 2.11E+18 n/cm^2 as determined from flux wire dosimetry measurements at the applicant's reactor vessel. This fluence value is converted to 3.56E+18 n/cm^2 for 54 EFPY using linear extrapolation.

With the aforementioned assumption that linear extrapolation of the fluence is applicable, these 1/4T fluence values (E > 1 MeV) projected for 54 EFPY are compared as follows:

- Projection based on the data in the 1994 letter: 3.56E+18 n/cm^2 (without EPU)
- Projection based on the data in BWRVIP-86, Rev. 1: 2.03E+18 n/cm^2 (without EPU)
- Projection based on the data in UFSAR Section 5.3.1.6.2: 2.04E+18 n/cm^2 (without EPU)
- LRA Section 4.2.1: 3.02E+18 n/cm^2 (with EPU)

Issue. The "operating experience" program element of the LRA AMP does not provide sufficient information to demonstrate the adequacy of the applicant's dosimetry monitoring activities which are part of the Reactor Vessel Surveillance Program. For example, the LRA does not clearly address why the 1/4T fluence projected for 54 EFPY based on the fluence information in the applicant's 1994 letter is greater than the other fluence values described above.

Request.

a. Provide the following information regarding the neutron dosimetry data obtained and to be obtained in the program: (1) the withdrawal schedule of the dosimetry capsules/wires (including the dosimetry data addressed in UFSAR Section 5.3.1.6.1 and applicant's letter dated May 5, 1994) and (2) the results of the benchmark of the flux calculations with the dosimetry data.
b. Clarify why the 1/4T fluence for 54 EFPY projected from the fluence information in the 1994 response significantly exceeds the other fluence values addressed in the background of this request for additional information. As part of the response, justify why the 54-EFPY fluence in the LRA that considers EPU is less than the 54-EFPY fluence projected using the dosimetry-based 32-EFPY fluence in the 1994 letter with no consideration of EPU.

c. Using the responses to the aforementioned requests and the relevant operating experience, justify why the dosimetry monitoring activities are adequate to provide sufficient dosimetry for the Reactor Vessel Surveillance Program, consistent with the GALL Report.

RAI B.1.38-4

Background. LRA Section B.1.38 addresses the applicant's Reactor Vessel Surveillance Program and indicates that an enhancement to the "monitoring and trending" program element will be implemented prior to the period of extended operation. The LRA indicates that the enhancement will ensure that any additional requirements specified in the final NRC safety evaluation (SE) for BWRVIP-86, Rev. 1, will be addressed before the period of extended operation.

The "monitoring and trending" program element of GALL AMP XI.M31 states that the program provides reactor vessel material fracture toughness data for the time-limited aging analyses on neutron irradiation embrittlement (e.g., upper-shelf energy, pressurized thermal shock and pressure-temperature limits evaluations, etc.) for 60 years.

The conclusion section of the staff's SE for BWRVIP-86, Revision 1, dated October 20, 2011, states that BWRVIP-86, Rev. 1, is acceptable subject to the conditions discussed in previous staff's SEs where such conditions have not been superseded by this SE. The staff's SE also states that the ISP and the ISP for the extended operation (ISP(E)) continue to adequately address the requirements of Appendix H to 10 CFR Part 50 for BWR licensees through the end of facility's proposed 60 year operating licenses.

Issue. There are no "additional requirements" of the staff's SE for BWRVIP-86, Revision 1, which need to be applied to the applicant's program. In addition, the LRA does not address the staff's SE for BWRVIP-116, "BWR Vessel and Internals Project, ISP Implementation for License Renewal" which is dated February 24, 2006, and includes the conditions of the approval for the ISP(E).

Request. Revise LRA B.1.38 to remove the mention of the "additional requirements" of the staff's SE for BWRVIP-86, Revision 1, and address how the Reactor Vessel Surveillance Program addresses the requirements of the staff's SE for BWRVIP-116, dated February 24, 2006, which includes the conditions of the approval for the ISP(E).

RAI B.1.38-5

Background. LRA Section A.1.38 addresses the UFSAR supplement for the Reactor Vessel Surveillance Program that is described in LRA Section B.1.38. In comparison, Standard Review Plan for License Renewal (SRP-LR), Table 3.0-1 describes a recommended summary description of the UFSAR Supplement for GALL AMP XI.M31, "Reactor Vessel Surveillance." The recommended summary describes the important program attributes of GALL AMP XI.M31.

Issue. LRA Section A.1.38 does not address all of the important program attributes included in the UFSAR Supplement described in SRP-LR, Table 3.0-1. The staff is concerned about the omission of the important program attributes from the applicant's UFSAR Supplement.

Request. Justify the absence of the following portions of the program description from the UFSAR supplement or modify LRA Section A.1.38 to include them:

a. If surveillance capsules are not withdrawn during the period of extended operation, operating restrictions are to be established to ensure that the plant is operated under the conditions to which the surveillance capsules were exposed;
b. All capsules in the reactor vessel that are removed and tested must meet the test procedures and reporting requirements of American Society for Testing and Materials (ASTM) E185-82 to the extent practicable for the configuration of the specimens in the capsule;
c. Any changes to the capsule withdrawal schedule, including spare capsules, must be approved by the NRC prior to implementation; and
d. Untested capsules placed in storage must be maintained for future insertion.

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

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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
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