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

September 14, 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 36

RAI 4.2.1-1a

Background. By letter dated July 25, 2012, the applicant responded to request for additional information (RAI) 4.2.1-1, which addresses why the applicant did not identify the reactor vessel neutron fluence calculation as a time-limited aging analysis (TLAA). The applicant stated that the neutron fluence calculation is not a TLAA since, as a stand-alone analysis, it does not meet the definition in 10 CFR 54.3(a). The applicant also stated that specifically, a neutron fluence calculation does not "consider the effects of aging," which is the second element of the six-element definition of a TLAA in 10 CFR 54.3(a).

Issue. Since the neutron fluence analysis considers the accrual of neutrons on the vessel surface as a function of the reactor operating power level, the neutron fluence analysis considers the effects of aging (i.e., neutron embrittlement of the reactor vessel). The reactor vessel neutron fluence analysis with time-limited assumptions is also integral to the neutron embrittlement TLAAs for the reactor vessel (e.g., upper-shelf energy analysis and P-T limits analysis). Therefore, the staff finds that the neutron fluence analysis should be identified as a TLAA with an adequate TLAA disposition as addressed in 10 CFR Part 54.21(c)(1)(i), (ii) and (iii).

Request.

a. Identify the reactor vessel neutron fluence analysis as a TLAA, based on the fact that the neutron fluence analysis considers the accrual of neutrons on the vessel surface as a function of the reactor operating power level and is also integral to the neutron embrittlement TLAAs for the reactor vessel. Alternatively, provide additional justification for why the reactor vessel fluence analysis is not a TLAA.

b. If the reactor vessel fluence analysis is a TLAA, describe the applicant's TLAA disposition of the reactor vessel neutron fluence analysis in terms of the dispositions described in 10 CFR Part 54.21(c)(1)(i), (ii) and (iii). In addition, ensure that LRA Section 4.2.1, Table 4.1-1 and Section A.2.1.1 are revised to include the adequate TLAA disposition.

RAI 4.2.1-2a

Background. By letter dated July 25, 2012, the applicant responded to RAI 4.2.1-2, which addresses the adequacy of combining two neutron fluence calculation methods in its neutron fluence analysis (i.e., combination of the pre-EPU MPM method and the post-EPU GEH method in the analysis). As part of its response, the applicant provided the following information:

- The post-EPU peak neutron flux values for the welds H1, V1, V2, V3, and V4 are less than the corresponding pre-EPU peak flux values approximately by an order of magnitude of 3 (i.e., approximately by a thousand times; the post-EPU peak neutron flux in the order of 1E7 n/cm^2-s in contrast with the pre-EPU peak neutron flux in the order of 1E10 n/cm^2-s, for E > 1 MeV).

- Welds H1, V1, V2, V3, and V4 are the welds on the reactor vessel internal top guide that sits above the core shroud.
- The applicant entered this discrepancy between the post-EPU neutron flux and the pre-EPU neutron flux into the corrective action program No locations evaluated in the post-EPU GEH fluence evaluation except for welds H1, V1, V2, V3, and V4 were found to have flux values lower than pre-EPU flux values.

In terms of the weld locations, Figures 3-1 and 3-9 of BWRVIP-02-A, "BWR Vessel and Internals Project BWR Core Shroud Repair Design Criteria, Revision 2," indicate that welds H1, V1, V2, V3, and V4 are core shroud horizontal (H) and vertical (V) welds, which are located in the top portion of the core shroud cylindrical shells. Figure 2-10 of BWRVIP-26-A, "BWR Vessel and Internals Project BWR Top Guide Inspection and Flaw Evaluation Guidelines," indicates that these welds are above and adjacent to the top guide.

By letter dated July 25, 2012, the applicant also provided the 40-year and 60-year neutron fluence values for the reactor vessel internals as part of its response to RAI 4.7.3-1. The fast neutron fluence data (E > 1 MeV) include the neutron fluence for the core spray spargers that are adjacent to the top portion of the core shroud cylindrical shells. The 60-year fast neutron fluence (9.04E18 n/cm^2) of the core spray spargers is less than the 40-year fast neutron fluence (1.50E21 n/cm^2) by approximately 2 orders of magnitude.

In addition, the core shroud head dome and core shroud head stud adjacent to the core spray spargers have similar fluence discrepancy between the 60-year and 40-year neutron fluence values (E > 1 MeV). The core shroud head dome and shroud head stud have a 60-year fluence value less than 9.04E18 n/cm^2 and a 40-year fluence value less than 1.50E21 n/cm^2, based on the fluence calculations for the nearest available fluence calculation node.

The NRC staff also identified an issue with the applicant's neutron fluence calculations for the period of extended operation. As addressed above, the pre-EPU fluences determined using the flux values from the Manahan method (MPM method) were added to the post-EPU fluences determined using the flux values from the GEH method. The NRC staff requested, in RAI 4.2.1 -2, request d.4, that the applicant address the analytic uncertainty associated with combining fluences in this fashion. The applicant stated, in its response dated July 25, 2012, that "...it is expected that the combination of these values is acceptable with respect to the uncertainty treatment specifications of RG 1.190."

<u>Issue</u>. Based on the staff's review as summarized above, the staff identified the following items that need additional information:

a. It is not clear whether the welds H1, V1, V2, V3, and V4 are core shroud welds in the top portion of the shroud cylindrical shells as indicated in BWRVIP-02-A, or welds in the top guide as indicted in the applicant's response.
b. The staff needs to confirm whether adequate corrective actions were taken for the fluence calculations on the welds H1, V1, V2, V3, and V4 so that the applicant's corrective actions resolved the significant difference between the pre-EPU and post-EPU fast neutron flux values of these welds.
c. The staff needs justification for why the 60-year fluence (E > 1 MeV) of the core spray sparger, core shroud dome, and core shroud head stud components are less than their 40-year fluence.

d. Given that the welds H1, V1, V2, V3, and V4 have post-EPU neutron flux (GEH method) significantly less than the pre-EPU neutron flux (MPM method), the staff needs additional information regarding the reactor vessel neutron flux (E > 1 MeV) to confirm that the reactor vessel plates, welds and nozzles have post-EPU neutron flux values that are reasonably greater than the pre-EPU neutron flux values.
e. The applicant did not provide its criteria, in terms of the difference between the pre-EPU and post-EPU neutron flux values (E > 1 MeV), to initiate a corrective action for the reactor vessel and reactor vessel internal neutron fluence analyses (e.g., a corrective action is initiated to evaluate neutron flux differences if a post-EPU neutron flux is not greater than X percent of the corresponding pre-EPU neutron flux, in view that the EPU is planned to implement approximately Y percent thermal power increase).
f. Regulatory Guide 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," Regulatory Position 1.4.1, provides guidance for analytic uncertainty analysis to support methodology qualification and uncertainty estimates (including combination of uncertainties). The applicant's response, addressing an expectation of acceptability, does not provide adequate information to determine how the new calculational method, which is based on adding the fluence values, obtained using different calculational methods, together, adheres to the guidance contained in RG 1.190.

Request.

a. Clarify whether the welds H1, V1, V2, V3, and V4 are core shroud welds in the top portion of the core shroud cylindrical shells, or welds in the top guide.
b. Provide additional information to confirm that adequate corrective actions were taken for the fluence calculations on the welds H1, V1, V2, V3, and V4 so that the applicant's corrective actions resolved the significant difference between the pre-EPU and post-EPU fast neutron flux values.
c. Provide justification for why the 60-year fluence (E > 1 MeV) of the core spray sparger, core shroud dome, and core shroud head stud components is less than the 40-year fluence of these components.
d. Provide the pre-EPU and post-EPU reactor vessel inner surface neutron flux values (E > 1 MeV) of the reactor vessel plates, welds and nozzles in order to confirm that these reactor vessel materials have post-EPU neutron flux values that are reasonably greater than the pre-EPU neutron flux values. These neutron flux comparisons should include the reactor vessel plates, welds and nozzles listed in LRA Table 4.2-2. As part of the response, include a discussion of the reactor vessel inner surfaces near the welds H1, V1, V2, V3, and V4.
e. Provide the applicant's criteria, in terms of the difference between the pre-EPU and post-EPU neutron flux values (E > 1 MeV), to initiate a corrective action for the reactor vessel and reactor vessel internal neutron fluence analyses (e.g., a corrective action is initiated to evaluate neutron flux differences if a post-EPU neutron flux is not greater than X percent of the corresponding pre-EPU neutron flux, in view that the EPU is planned to implement approximately Y percent thermal power increase).
f. Demonstrate that the combined calculational uncertainty associated with both fluence methodologies remains within RG 1.190 guidance, or provide an alternative justification for the acceptability of this method that demonstrates that it satisfies the regulations discussed in the Introduction section of RG 1.190.

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