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GNRO-2012/00033

May 25, 2012

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

SUBJECT: Response to Request for Additional Information (RAI) dated April 25, 2012
Grand Gulf Nuclear Station, Unit 1
Docket No. 50-416
License No. NPF-29

REFERENCE: NRC Letter, "Requests for Additional Information for the Review of the Grand Gulf Nuclear Station, License Renewal Application," dated April 25, 2012 (GNRI-2012/00096)

Dear Sir or Madam:

Entergy Operations, Inc is providing in the Attachment, the response to the referenced Request for Additional Information (RAI).

This letter does not contain any commitments. If you have any questions or require additional information, please contact Christina L. Perino at 601-437-6299.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 25th day of May, 2012.

Sincerely,

MP/jas

Attachment: Response to Request for Additional Information (RAI)

cc: (see next page)

cc: with Attachment

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Attachment to

GNRO-2012/00033

Response to Request for Additional Information (RAI)

The format for the License Renewal Application (LRA) Request for Additional Information (RAI) responses below is as follows. The RAI is listed in its entirety as received from the Nuclear Regulatory Commission (NRC) with a background, issue and request subparts. This is followed by the Grand Gulf Nuclear Station (GGNS) RAI response to the individual question.

B.1.22-1

Background. SRP-LR, Appendix A.1.2.3.1, "Scope of Program," states that the scope of the program should include the specific structures and components, the aging of which the program manages.

LRA Section 3.2.2.1.2, "Low Pressure Core Spray," and Section 3.2.2.1.3, "High Pressure Core Spray," do not identify the Flow-Accelerated Corrosion Program as managing aging in either system. However, Calculation MC-Q1111-08011, "Evaluation of RF16 Flow-Accelerated Corrosion Wall Thickness Data," appears to show that this program also manages wall thinning in the low pressure core spray and high pressure core spray systems.

Issue. The Flow-Accelerated Corrosion Program manages wall thinning in systems that are not specified in the LRA.

Request.

a. For the aging effects identified in Calculation MC-Q1111-08011 in the low pressure core spray and high pressure core spray systems, either revise all the appropriate sections and tables in the LRA, to reflect that the Flow-Accelerated Corrosion Program manages aging effects in these systems, or provide the appropriate aging management program (AMP) that manages the identified aging effects.

b. Provide a discussion regarding any evaluation that will be performed to verify that there are no other systems which have aging effects being managed by the Flow-Accelerated Corrosion Program that were not identified in the LRA, or discuss why an evaluation is not required.

B.1.22-1 RESPONSE:

a. LRA Section 3.2.2.1.2, "Low Pressure Core Spray," and Section 3.2.2.1.3, "High Pressure Core Spray," correctly do not identify wall thinning due to flow accelerated corrosion (FAC) as an aging mechanism. These systems are not susceptible to this aging mechanism since they experience single-phase flow above 200 degrees Fahrenheit for less than 2 percent of the time. The referenced calculation MC-Q111-08011 listed the time in service for these systems confirming the conclusion that the FAC program is not required to manage wall thinning in the low pressure core spray and high pressure core sprays systems. As a result, wall thinning due to flow accelerated corrosion is not an aging effect requiring management for these systems, and no LRA revision is required.

b. Each plant system was evaluated for susceptibility to wall thinning due to flow accelerated corrosion. Criteria such as material, superheated steam flow, single phase flow at low temperature and limited operating time were considered. The conclusion of the evaluation for each system within the scope of license renewal was used to determine the application of this aging mechanism. No other systems have aging effects being managed by the Flow-Accelerated Corrosion Program that were not identified in the LRA.

B.1.22-2

Background. SRP-LR, Appendix A.1.2.3.5, "Monitoring and Trending," states that monitoring and trending activities should be described, and they should provide a prediction of the extent of degradation and thus effect timely corrective or mitigative actions.

Procedure EN-DC-315, "Flow-Accelerated Corrosion Program," Section 5.11, "Components Failing to Meet Initial Screening Criteria," states that a condition report shall be generated when "significant wall thinning," as defined in the procedure, is detected. A search of condition reports, which were generated during recent outages, only identified condition reports where wall thinning was reported to be below the minimum acceptable wall thickness, and none appeared to report "significant wall thinning," which could be a precursor condition when the wall thickness is slightly above the minimum acceptable value.

Issue. It is not clear that aging effects were being identified, and documented in the corrective action program, consistent with the program documents.

Request. Provide information to confirm that significant wall thinning as defined in EN-DC-315 had not been detected in recent outages and condition reports were not required to be generated, or provide actions taken if activities prescribed in EN-DC-315 were not conducted.

B.1.22-2 RESPONSE:

A review of program documentation and data from the Fall 2008 and Spring 2010 refueling outages determined that no significant wall thinning has been detected other than the wall thinning documented in the condition reports referenced in the background of this request for information, which had resulted in wall thickness below the minimum acceptable wall thickness. Thus no additional condition reports on significant wall thinning as defined in EN-DC-315 were required to be generated.

B.1.22-3

Background. The GALL Report AMP XI.M17, "Flow-Accelerated Corrosion," "scope of program" program element states that the Flow-Accelerated Corrosion Program includes procedures and controls to maintain the structural integrity of all carbon steel lines containing high-energy fluids.

Several condition reports reviewed by the staff during the audit refer to the MS-46 program for erosion/corrosion monitoring. GGNS-MS-46, "Program Plan for Monitoring Internal Erosion/Corrosion in Moderate Energy Piping Component, (Safety-Related)," states that it is applicable to components in moderate energy systems, and defines erosion/corrosion as "degradation and consequent wall thinning of piping components by a dissolution process and/or mechanical/chemical phenomenon." EN-DC-315, "Flow Accelerated Corrosion Program," defines flow-accelerated corrosion as "degradation and consequent wall thinning of a component by a dissolution phenomenon previously known as erosion/corrosion."

Issue. Based on the similarity in definitions between MS-46 and EN-DC-315, it is not clear to the staff whether MS-46 monitors wall thinning due to flow-accelerated corrosion in moderate energy systems, and how it integrates with the Flow-Accelerated Corrosion Program described in the LRA

Request. Provide information regarding aging effects being managed by GGNS-MS-46, "Program Plan for Monitoring Internal Erosion/Corrosion in Moderate Energy Piping Components, (Safety-Related)," and how this program relates to or integrates with the Flow-Accelerated Corrosion Program described in the LRA.

B.1.22-3 RESPONSE:

The inspections described in GGNS-MS-46 are not credited as an aging management program for license renewal. These inspections are not credited as part of the aging management program described in LRA B.1.22 Flow-Accelerated Corrosion Program. However, inspections specified in GGNS-MS-46 are credited as part of the aging management programs for managing loss of material described in LRA B.1.21 Fire Water System Program and LRA B.1.41 Service Water Integrity. Furthermore, the inspections described in GGNS-MS-46 may be used, where applicable, as opportunistic or periodic inspections defined in other aging management programs at GGNS.

B.1.22-4

Background. The GALL Report AMP XI.M17, Section 4 "Detection of Aging Effects," states, in part, that the schedule of inspections ensures detection of wall thinning before the loss of intended function.

EN-DC-315, "Flow-Accelerated Corrosion Program," Section 3.0, "Definitions," defines safety factor as a margin of safety used to account for inaccuracies in wear rate evaluations. Section 5.6.10 states that a 10 percent safety factor should be applied and the basis for safety factors less than 10 percent shall be documented. Calculation MC-Q1111-08011, "Evaluation of RF16 Flow-Accelerated Corrosion Wall Thickness Data," Section 4.0, "Assumptions," states that for systems which only operate part-time, it is acceptable to use the grid-synchronized hours in calculating the projected life, because it provides a valid relative measure of wear for whatever number of hours each system has actually operated. The calculation also states that these infrequently used systems are expected to operate in the future similar to how they operated in the past. The calculation assumes a safety factor of 10 percent on the wear rate in determining the remaining service life of every component, without regard to the frequency of usage.

Issue. Notes within MC-Q1111-08011 state that the reactor core isolation cooling system is assumed to operate 12 hours per year. For this and other systems that only operate part-time, it was unclear to the staff if the normally applied 10 percent safety factor was sufficient to account for inaccuracies in the wear rate evaluation, because relatively small increases in operating times (i.e., 1.2 hours for the reactor core isolation cooling system) could "consume" all of the uncertainties being applied in the 10 percent safety factor and not leave any margin for the other uncertainties (i.e., ultrasonic testing inaccuracies).

Request. Provide information which gives reasonable assurance that the 10 percent safety factor, used in wear rate evaluations to calculate the remaining life of components in systems which only operate part-time, accounts for wear rate inaccuracies due to variations in assumed operating times of the systems.

B.1.22-4 RESPONSE:

Lines that operate <2% of the operating time of the plant are typically excluded from the Flow Accelerated Corrosion program due to the limited operating time of the line. The time that these lines are in service is not adequate to initiate significant wear. However, the program does include inspection locations on these lines to identify wear, should it occur. The results of these inspections have shown that wear is not a concern on lines that operate <2% of the time. The specific system in question (reactor core isolation cooling system) has been monitored under the FAC program with multiple examination locations and multiple evaluations. The results from the evaluations have confirmed insignificant wear.

The remaining life calculated using the 10 percent safety factor is not the sole factor used to determine the need for inspections. It is only one factor among many that are used to prioritize inspections; others include personnel safety and consequence of failure, as discussed in NSAC-202L "Recommendations for an Effective Flow-Accelerated Corrosion Program." Based on evaluation of actual wear measurements on the affected systems, the 10 percent safety factor has been proven acceptable in support of determining appropriate inspection locations, and potential variation in the system operating times is not a concern.

B.1.22-5

Background. SRP-LR, Section A.1.2.3.10, "Operating Experience, " states that operating experience which results in program enhancements or additional programs, should be considered.

Calculation MC-Q1111-08011, "Evaluation of RF16 Flow-Accelerated Corrosion Wall Thickness Data," Item 809 states that the reactor water cleanup (RWCU) bottom head drain lines are an operating experience issue, and that BWRVIP-205, "Bottom Head Drain Line Inspection and Evaluation Guidelines," November 2008, changed GGNS from Category B to Category C, which requires an inspection within two outages.

Issue. BWRVIP-205 was not included in LRA Appendix C, "Response to BWRVIP Applicant Action Items," and it is unclear to the staff whether the inspections prescribed in BWRVIP-205 will be performed and whether they are being tracked under the flow-accelerated corrosion program or the reactor vessel internals management program.

Request. Provide information regarding the status of the inspections prescribed in BWRVIP-205, "Bottom Head Drain Line Inspection and Evaluation Guidelines," and either provide an enhancement for the Flow-Accelerated Corrosion Program to include these inspections or provide the bases for concluding that the prescribed inspections are not needed.

B.1.22-5 RESPONSE:

The inspections prescribed in BWRVIP-205 "Bottom Head Drain Line Inspection and Evaluation Guidelines" were performed in the Spring 2012 refueling outage. The evaluation results from the reactor water cleanup bottom head drain piping projected that the limiting location is acceptable until at least Spring 2022. The drain line is in the FAC Program, which ensures the future necessary inspections are conducted.

B.1.22-6

Background. SRP-LR, Section A.1.2.3.10, "Operating Experience, " states that operating experience should result in appropriate program enhancements and can show where an existing program has succeeded and where it has failed (if at all) in intercepting aging degradation in a timely manner.

Calculation MC-Q1111-08011, "Evaluation of RF16 Flow-Accelerated Corrosion Wall Thickness Data," Items 355 and 553, identified that the measured wall thickness was less than the specified minimum wall thickness. The projected life for each component indicated that the minimum wall thickness criterion was not met more than 3 years prior to the inspection.

Issue. While a condition report was initiated and the inspection scope was appropriately increased, based on the calculated wear rates, the staff questioned the effectiveness of the program because the planned inspections are typically scheduled to identify wall thinning and to repair or replace components before minimum wall thickness criterion is violated.

Request. Provide information discussing the circumstances surrounding the apparent weakness in scheduling inspections for Items 355 and 553 in the Flow-Accelerated Corrosion Program prior to RF16. Include information regarding any corrective actions or enhancements to the program taken as a result of these plant-specific operating experiences.

B.1.22-6 RESPONSE:

The discussion of item 355 refers to a low wall thickness measured at the first shell drain nozzle of moisture separator reheater (MSR) "A". The low thickness reading was at a localized area. The average wall thickness in this part of the nozzle was well above the minimum code required thickness. Based on this analysis, no need for specific program enhancement was indicated. The nozzle was repaired using a weld overlay.

The discussion of item 553 refers to a socket-welded fitting downstream of an orifice in a 2-inch bypass line to the high pressure condenser shell. The wear at socket welded fittings is difficult to detect and predict because of the differences in the amount of gap between the fitting and the pipe. Thus, the wear rate at this location had been closely monitored and had remained fairly constant from the Fall 1999 refueling outage to the Fall 2005 refueling outage. However, the wear rate increased significantly between the Fall 2005 refueling outage and the Fall 2008 refueling outage. Due to this increased wear rate, FAC-susceptible materials in this bypass line and a line with like operating conditions were replaced with stainless steel materials during the Spring 2010 refueling outage. This decision to apply the results of FAC Program inspections to piping components that had not yet experienced the same level of wear is an example of the use of operating experience within the FAC Program.

In each of these cases, the program activities provided for the detection of aging effects prior to the loss of intended function. This provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.22-7

Background. The GALL Report AMP XI.M17, "Flow-Accelerated Corrosion," states that the inspection schedule developed by the applicant on the basis of the results of a predictive code like CHECWORKS provides reasonable assurance that structural integrity will be maintained between inspections.

GGNS condition report CR2010-00823 described an error reported by Electric Power Research Institute (EPRI) in its CHECWORKS model software in which the wrong hours were used to calculate the predicted wear. The condition description stated that of the 122 instances where the specific software feature was used, only 7 wear rate analysis runs and components were potentially affected, and further evaluation concluded that there was no impact on the wear rate calculations. The condition report stated that CHECWORKS is only one of the tools used by the flow-accelerated corrosion engineer to determine component wear.

Issue. While other tools may be available to the flow-accelerated corrosion engineer to determine component wear, if there are errors in the CHECWORKS software, it was unclear to the staff what in-place process is used to determine component wear, such that errors in the CHECWORKS software model will be detected.

Request. Provide a description of any in-place process or verification method, which is used to determine component wear that could validate or detect errors in the CHECWORKS software, such that there is reasonable assurance structural integrity of components will be maintained between inspections.

B.1.22-7 RESPONSE:

Results of component inspections are the primary input used to calculate the next scheduled inspection. This approach provides reasonable assurance that an error in the CHECWORKS model software will not prevent the GGNS FAC Program from providing reasonable assurance that the intended function of components will be maintained. As more actual inspection data is acquired, the already limited reliance on CHECWORKS becomes less.

RAI B.1.40-1

Background. The GALL Report AMP XI.M33, "Selective Leaching," "detection of aging effects" program element recommends that one-time inspections using visual and hardness measurement techniques should be conducted to detect selective leaching. The Selective Leaching Program Evaluation Report states that the program will include visual inspection and hardness measurements; however, the implementing procedure states that hardness testing or verification is conducted where possible.

Issue. It is not clear to the staff that the implementing procedure for the Selective Leaching Program is consistent with GALL Report AMP XI.M33 because the implementing procedure does not require hardness measurements in all cases due to the "where possible" modifier.

Request. State what methods will be used to confirm the absence of selective leaching when hardness measurements are not possible.

RAI B.1.40-1 RESPONSE:

As stated in LRA Section B.1.40, the Selective Leaching Program will be consistent with the program described in NUREG-1801, Section XI.M33, Selective Leaching of Materials, without exception. Element 4 of NUREG-1801 XI.M33, indicates that acceptable alternatives to hardness testing are "other mechanical examination techniques, such as destructive testing (when the opportunity arises), chipping, or scraping." Consistent with NUREG-1801, Section XI.M33, the Selective Leaching of Materials Program will include examination techniques from among these alternatives if hardness measurements are not possible.

RAI B.1.40-2

Background. The GALL Report AMP XI.M33, "Selective Leaching," "corrective actions" program element recommends that unacceptable inspection findings will result in additional inspections being performed. The Selective Leaching Program Evaluation Report, "corrective actions" program element states that corrective actions of unacceptable inspection findings will be carried out in accordance with the corrective action program and that corrective actions will be consistent with NUREG-1801; however, the implementing procedure states that the cause evaluation and corrective actions for indications of selective leaching should include consideration of scope expansion.

Issue. It is not clear to the staff that the implementing procedure is inconsistent with GALL Report AMP XI.M33 because the implementing procedure states that scope expansion should be considered whereas the GALL Report recommends that unacceptable findings will result in further inspections.

Request. Confirm that, if selective leaching is detected in the one-time inspection proposed in the program, further inspections will be conducted to ensure that the extent of degradation is understood.

RAI B.1.40-2 RESPONSE:

The Selective Leaching Program at GGNS is a new aging management program (AMP) which will be consistent with NUREG-1801, Section XI.M33. As stated in NUREG-1801, Section XI.M33 element 5, "Follow-up of unacceptable inspection findings includes an evaluation using the corrective action program and a possible expansion of the inspection sample size and location." Furthermore, Section XI.M33 element 7 states, "Unacceptable inspection findings result in additional inspection(s) being performed, which may be on a periodic basis, or in component repair or replacement." Implementation of this program will include developing or revising procedures as necessary to ensure the GGNS program is consistent with the AMP described in XI.M33, to support performance of the inspections within the five years prior to the period of extended operation as stated in LRA B.1.40. This includes any changes to the procedure referred to in the background section of this RAI, which has not been implemented at GGNS but will be implemented within the five years prior to the period of extended operation as stated in LRA B.1.40.