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GNRO-2012/00063

June 21, 2012

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

SUBJECT: Response to Request for Additional Information (RAI) Set 16 dated May 24, 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 May 24, 2012 (GNRI-2012/00123) (ML 12123a704)

Dear Sir or Madam:

Entergy Operations, Inc is providing, in Attachment 1, the response to the referenced Request for Additional Information (RAI). Attachment 2 includes an updated listing of regulatory commitments for license renewal that includes revised commitment 10 required in response to RAIs in this letter.

This letter contains no new 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 21st day of June, 2012.

Sincerely,

MP/jas

Attachment(s): 1. Response to Request for Additional Information (RAI)
2. List of Regulatory Commitments

cc: (see next page)

cc: with Attachment(s)

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Attachment 1 to

GNRO-2012/00063

Response to Request for Additional Information (RAI)

The format for the RAI responses below is as follows. The Request for Additional Information (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.

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 4.3-1 RESPONSE

a. The basis for the projection in LRA Table 4.3-1 includes a reasonable estimate for the number of expected future transients. Plant operating data from the 10.4 year period on which this table is based is considered a more accurate representation of future transient cycle occurrence rate than data extending back to initial plant startup. This is because startup testing and initial equipment operation caused a high frequency of occurrences during 1985 to 1999. Incorporating lessons learned from operating experience has resulted in improved plant performance and a consequently lower rate of transient occurrence. The use of more recent operating history to develop transient projections was found acceptable in previous license renewal application reviews, such as the review documented in NUREG-1930 (Section 4.3). The projection used in LRA Table 4.3-1 was not used to reduce cycles assumed for any analysis including the environmentally assisted fatigue screening, does not replace the original transient cycle limits, and is not used to satisfy 54.21(c)(1)(ii).

b. The use of this projection method based on the rate of transient occurrences between 1999 and 2010 is a conservative approach for projections to 60 years of plant operation since the plant was on 18-month operating cycles during that time but will be operating on a 24-month fuel cycle in the future. In addition, these projected values are not used to satisfy 54.21(c)(1)(ii) and actions will be taken based on actual accrued cycles regardless of projected values.

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 4.3-2 RESPONSE

a. The "Design Hydro" transient is specified as having a maximum pressure of 1250 psig. An actual "Design Hydro" transient reaches a peak pressure of only1025 psig. Conservatively assuming 1050 psig for every "Design Hydro," the less severe nature of the actual transient resulted in an increase in the allowed number of cycles while ensuring the design basis usage for the worst case location would remain the same. The location analyzed to determine the new allowable value was the location with the lowest allowable number of cycles due to the "Design Hydro" transient.
b. UFSAR Table 3.9-35 contains a footnote indicating that the cycles listed are the (original) design transient limits and to see a site mechanical standard for the (current) fatigue operating cycle information. Thus, no UFSAR change is necessary.
c. LRA Table 4.3-1 lists the analyzed numbers of cycles. A comparison of this table to the UFSAR and Technical Specifications reveals that the LRA values are equivalent to the values in the UFSAR and Technical Specifications except for the "Design Hydro" transient and the following two additional transients for which the LRA values are conservative with respect to the UFSAR and Technical Specification values.

Transient	LRA Value	UFSAR Value
Single SRV Actuation	1580	1600 (UFSAR Table 3.9-1, Note 8)
Shutdown	106	111 (UFSAR Table 3.9-1, Transient 10)

Technical Specification 5.5.5 refers to UFSAR Table 3.9-35 which is a simplified grouping of the design basis transients. This grouping results in differences in the transient terminology and the cycle values in UFSAR Table 3.9-35 versus LRA Table 4.3-1. For example the 80 step changes in UFSAR Table 3.9-35 are tracked by the individual transients of turbine bypass (10) and partial FW heater bypass (70) listed in

LRA Table 4.3-1. LRA Table 4.3-1 provides additional details beyond the grouping that is presented in UFSAR Table 3.9-35, but they are not conflicting.

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 4.3-3 RESPONSE

a. The loss of feedwater pumps (LOFP) transient is a part of the design basis for Grand Gulf. Therefore, this transient was included for all Class 1 components that have an associated fatigue analysis. Based on the design basis fatigue analyses, locations were chosen for fatigue monitoring utilizing a cycle-based fatigue monitoring method which assumes that design basis transient severity will produce the design basis fatigue usage if the design basis number of cycles occurs. The method also accounts for more or fewer occurrences of a particular transient. If more than the analyzed number of LOFP events occurs, the fatigue usage for a particular location would be correspondingly higher. The fatigue usage attributed to a single LOFP transient is very small. Of those locations monitored for fatigue, the largest incremental fatigue usage is approximately 0.026 per cycle, with the average of the analyzed locations a much smaller increment (approximately 0.0001 per cycle).

For the period of extended operation, stress-based fatigue (SBF) monitoring is planned only for the feedwater nozzles. However, if a cycle-based fatigue monitoring location approaches its allowable usage, then stress-based fatigue monitoring would be an option. This option would allow considering actual transient severity and sequence of occurrence rather than the design basis transient severity and worst case transient sequencing.

b. For components that are not monitored by a stress-based fatigue monitoring method, the actual fatigue usage contribution, assuming design basis transient severity, due to actual individual transients is tracked. Therefore, the Fatigue Monitoring Program will automatically account for the incremental fatigue usage for each LOFP transient even if the design basis number of LOFP transients is exceeded.

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 4.3-4 RESPONSE

a. This statement in LRA Section 4.3.1 refers to locations (transients) listed in Table 4.3-1, not plant locations. The fourth paragraph of LRA Section 4.3.1 is revised as shown below to state " There are several transients listed in Table 4.3-1 whose cycle projections to 60 years exceed the values assumed in the fatigue analysis that are denoted in the table as 'allowable'." When an allowable value is approached, the Fatigue Monitoring Program will initiate corrective action which will require identifying the locations affected by the specific transient.

   Additions are underlined and strikethrough is used for deletions.

Class 1 Fatigue

Based on the numbers of cycles accrued to date, Entergy projected the numbers of accrued cycles expected at the end of 60 years of operation. 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. There are several ~~locations whose projections exceed design limits~~ transients listed in Table 4.3-1 whose cycle projections to 60 years exceed the values assumed in the fatigue analysis that are denoted in the table as 'allowable'. As additional operating data is accumulated, subsequent projections will refine the estimate of the numbers of cycles expected through 60 years of operation. The Fatigue Monitoring Program will ensure that the accrued numbers of cycles of all design transients will remain below the numbers of cycles evaluated in the fatigue analyses.

b. The projections to 60 years are included as part of the periodic update completed by the Fatigue Monitoring Program. The periodic updates should be completed once every two operating fuel cycles. The projections done in these periodic updates are not necessary to adequately manage the effects of metal fatigue during the period of extended operation. They are considered as inputs to optimize resource utilization when planning future activities for the program. As more operating experience in the rate of transient occurrence is accumulated, the increase in data improves the projection accuracy. With these subsequent projections and as the time horizon of the projection decreases, the accuracy of predicting future remaining transients increases. The projections are used for information only as the Fatigue Monitoring Program will ensure the fatigue usage remains within allowable limits, independent of the 60-year 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 4.3-5 RESPONSE

a. The cycles identified in the expansion joint design specifications varied by the location and use of the expansion joint as well as the level of complexity of the design specification. Seismically qualified expansion joints have cycle specifications for seismic events related to the maximum number and amplitude of postulated earthquakes. Several of these expansion joints are inside primary containment and include cycles due to the postulated shock wave from safety relief valve (SRV) lifts. For simplicity, some locations specified a large number of thermal or dynamic cycles at the maximum joint expansion expected under any conditions.

b. These components are not within the reactor coolant pressure boundary so there is no Technical Specification or UFSAR requirement to track the associated transients. Consequently, accumulated numbers of cycles are available only for cycles that must also be tracked for Class 1 components, such as SRV lifts and earthquakes. SRV lifts and earthquakes have been tracked since initial plant startup, and the 60-year projected number of occurrences of these cycles are shown in LRA Table 4.3-1. The allowable numbers of cycles for the other transients are well beyond reasonably postulated numbers of the transients, making it unnecessary to monitor these transients.

c. Expansion joints are designed and constructed to allow repeated expansion. The design specifications identified a conservative number of cycles at a given amount of expansion so that simplified analyses could be performed. The typical analysis shows the expansion joint is qualified for many more cycles than was specified with these simplified bounding assumptions. Entergy completed a review of these analyses to verify the expansion joints are adequate for 60 years. The numbers of cycles for earthquakes and SRV actuations which are tracked were not assumed to increase beyond the original number, but the large margins in allowable cycles demonstrated qualification of the expansion joints 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 occurrence for these transients in LRA Tables 4.3-1 and justify that these projections are conservative.

RAI 4.3-6 RESPONSE

a. Each of the Class 1 metal fatigue TLAA evaluated in LRA Section 4.3 used the "loss of feedwater heaters" transient as an input. The 80 step change cycles for the "loss of feedwater heaters" transient is actually the summation of two transients which have been monitored since plant startup. The two transients are turbine bypass (10) and partial FW heater bypass (70). The "control rod pattern change" transient was considered for the fatigue analyses. The control rod pattern change transient had a small effect on pressure and temperature only for the feedwater nozzle and piping system analyses. This transient has not been tracked since its affect on fatigue usage was determined to be insignificant.

b. The Fatigue Monitoring Program tracks the turbine bypass and partial FW heater bypass transients. The only locations that show any pressure or temperature change at all due to the control rod pattern change transient are the feedwater nozzle and piping system, and neither are affected significantly by this transient. The "control rod pattern change" transient is an insignificant contributor to fatigue and therefore does not require monitoring.

c. None of the Class 1 metal fatigue TLAA in LRA Section 4.3 are evaluated in accordance with 10 CFR 10 CFR 54.21 (c)(1)(i) or 54.21 (c)(1)(ii).

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 4.3-7 RESPONSE

The transients and associated design cycles used in the fatigue analysis of the reactor vessel internals are the same as those used in the fatigue analysis of the reactor coolant system pressure boundary components. These transients and associated design cycles are listed in LRA Table 4.3-1, and are included in the Fatigue Monitoring Program.

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 4.3-8 RESPONSE

a. Original design basis fatigue calculations typically include conservatism meant to simplify the analyses, such as lumping all transients together and considering them all to be as severe as the worst transient for a particular location. As a part of incorporating the effects on fatigue of the reactor water environment as discussed in LRA B.1.19, the design basis fatigue analyses may be revised to reduce the conservatism for locations that would exceed a cumulative usage factor (CUF) of 1.0. In some cases, the actual severity of historical transients can be considered to reduce assumed cyclic loads so that historical transients are not as severe as the assumed design basis transients. Conservatism may also be reduced for specific locations by considering 60-year projected cycles if the projected numbers of cycles are less than the design basis numbers of cycles. If a location cannot be qualified by reducing conservatism in the design basis fatigue calculation, a detailed NB-3200 calculation may be performed. As indicated in LRA Section A.2.2.3, CUFs will be determined using an NRC-approved

version of the ASME code or NRC-approved alternative (e.g., NRC-approved code case). Also, as indicated in LRA Section A.2.2.3, appropriate methods will be utilized for calculation of the environmental fatigue correction factor, as identified in NUREG-1801, Revision 2, Section X.M1.

b. The specific approach to refining the analysis will vary from calculation to calculation. However, each refined calculation will be performed in accordance with an NRC-approved version of the ASME code or NRC-approved alternative (e.g., NRC-approved code case). Therefore, speculating on the specific approaches in the UFSAR supplement would be inappropriate. LRA Section A.2.2.3 is revised to specifically state that the guidance in NUREG-1801 Revision 2 will be used to determine an appropriate environmental fatigue correction factor to address the effects of the reactor water environment on metal fatigue.

The last sentence of the third paragraph of LRA Section A.2.2.3 is revised as follows. Additions are shown with underline and deletions with strikethrough.

To support the license renewal application GGNS performed a screening evaluation of these six locations using the guidance provided in NUREG-1801 revision 2. This screening has determined there are locations that when the current usage factor is increased to account for the environmental effects, the resulting usage is greater than 1. Prior to the period of extended operation GGNS will update the fatigue usage calculations using refined fatigue analyses to determine valid CUFs less than 1.0 when accounting for the effects of reactor water environment. This includes applying the appropriate F_{en} factors to valid CUFs determined using an NRC-approved version of the ASME code or NRC-approved alternative (e.g., NRC-approved code case). GGNS will review design basis ASME Class 1 component fatigue evaluations to determine whether the locations that have been evaluated for the effects of the reactor coolant environment on fatigue include the limiting component within the reactor coolant pressure boundary. Environmental effects on fatigue for these critical components ~~may~~ will be evaluated using one of the following sets of formulae in accordance with the guidance in NUREG-1801, Revision 2, Section X.M1:

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 4.3-9 RESPONSE

a. The enhancement for the Fatigue Monitoring Program discussed in LRA B.1.19 will be performed using industry-accepted techniques for consideration of the effects of the reactor water environment (environmentally assisted fatigue - EAF), including techniques for incorporating the impact of dissolved oxygen concentration into the calculation of the fatigue environmental correction factor, F_{en}. The discussion related to dissolved oxygen concentrations in LRA 4.3.3 and the information in LRA Table 4.3-6 will not be used to review the effects of EAF or to accept any location as a bounding location. Thus, no justification of LRA Section 4.3.3 is required.
b. The last paragraph of LRA Section A.2.2.3 is revised as follows. Additions are shown with underline.

   GGNS will manage the effects of fatigue, including environmentally assisted fatigue, under the Fatigue Monitoring Program for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii). Industry-accepted techniques will be used for consideration of the effects on fatigue of the reactor water environment (environmentally assisted fatigue - EAF), including techniques for incorporating the impact of dissolved oxygen concentration into the calculation of fatigue environmental correction factors.

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 4.3.10 RESPONSE

a. The reanalysis of the feedwater nozzle for consideration of the effects on fatigue of the reactor water environment (environmentally assisted fatigue - EAF) will consider the effects of rapid cycling based on thermal duty maps (i.e. flow rates and time spent at different feedwater and vessel temperatures). Plant operational data will be used in the analysis to account for actual historical operation.
b. The effects of rapid cycling on the feedwater nozzle will be considered for any operating condition where there is feedwater flow.
c. LRA Section A.2.2.1 for the Reactor Vessel Feedwater Nozzle is revised as follows. Additions are shown with underline and deletions with strikethrough.

   The feedwater nozzle is one of the locations that will be reevaluated for environmental assisted fatigue, and the reanalysis will consider the effects of potential rapid cycling ~~as necessary~~. The feedwater nozzle reanalysis will include a location-specific rapid cycling fatigue usage that is added to the cycle-based fatigue usage. The usage will be postulated based on time and feedwater temperature in order to include the rapid cycling effect. This action will be completed under the Fatigue Monitoring Program. As such, the effects of fatigue on the feedwater nozzles will be managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

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.

<u>Request</u>.

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 4.3-11 RESPONSE

a. The pump case was exempt from fatigue analysis per ASME Code Section III NB-3222.4(d). The only component in the pump cover assembly requiring analysis was the seal water heat exchanger.

b. The determination was made that these locations were exempt from a fatigue analysis by meeting the criteria of NB-3222.4(d)(1) through (6). Since this determination considered the assumed number of fatigue transients specified by General Electric, the evaluation for a fatigue analysis exemption is treated as a TLAA.

c. By tracking cycles associated with the exemption against the allowable numbers of cycles, 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 an allowable number of cycles is exceeded, the exemptions for these locations will be reevaluated.

d. The seal water heat exchanger in its original configuration was analyzed in 1980 using the 1974 ASME Code Section III fatigue requirements. This analysis determined that 117 cycles of loss of seal injection would result in a usage factor of ~0.9. General Electric determined that only 22 loss of seal injection cycles could be postulated during the transients identified in the design transient set, so the design was acceptable. Following modifications to install shaft sleeves and modify the seal water heat exchanger, an allowable number of cycles was determined that would maintain the cumulative usage factor less than 1.0. Calculations determined that the sleeve could withstand 106 loss of seal injection transients and the heat exchanger could withstand 138 loss of seal injection transients. Since General Electric determined that no more than 22 design transients that would result in a loss of seal injection were expected, the margin to the allowable transients verifies these modified components are acceptable for the period of extended operation.

e. No changes were identified for LRA Section 4.3.1.4. The Fatigue Monitoring Program

enhancement in LRA Sections A.1.19 and B.1.19 is revised to ensure the recirculation pump fatigue analysis exemptions are considered in the review of relevant cycles exceeding the limits. Additions are shown with underline.

A.1.19 Fatigue Monitoring Program

The Fatigue Monitoring Program will be enhanced as follows.

Program guidance documents will be revised to provide updates of the fatigue usage calculations on an as-needed basis if an allowable cycle limit is approached, or in a case where a transient definition has been changed, unanticipated new thermal events are discovered, or the geometry of components has been modified. The program revision will include providing for the consideration of the recirculation pump fatigue analysis exemption validity if cycles that were input into the exemption evaluation exceed their limits.

B.1.19 FATIGUE MONITORING

Elements Affected	Enhancement
4. Detection of Aging Effects	The GGNS program will be enhanced to revise program documents to provide updates of the fatigue usage calculations on an as-needed basis if an allowable cycle limit is approached, or in a case where a transient definition has been changed, unanticipated new thermal events are discovered, or the geometry of components has been modified. The program revision will include providing for the consideration of the recirculation pump fatigue analysis exemption validity if cycles that were input into the exemption evaluation exceed their limits.

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 4.3-12 RESPONSE

a. The correct feedwater piping cumulative usage factor (CUF) was determined to be 0.2228. LRA Table 4.3-5 is revised as follows. Additions are shown with underline and deletions with strikethrough.

Table 4.3-5

CUF Values for Class 1 System Components

ASME Class 1 Location	CUF
Feedwater piping	~~0.4138~~ 0.2228

Thus, the value in LRA Table 4.3-6 is correct.

b. With the change identified above, the values are consistent and no further justification is required.

c. The LPCS reactor vessel nozzle, HPCS reactor vessel nozzle, and reactor vessel nozzle-RHR have the same CUF value of 0.564 since they were analyzed by a common analysis using conservative assumptions. The CUF values and results for the feedwater piping, LPCS reactor vessel nozzle, HPCS reactor vessel nozzle, and reactor vessel nozzle-RHR environmentally-assisted fatigue evaluations presented in LRA Section 4.3 are accurate.

d. Table 4.3-5 is revised as shown in the response to part "a " above. No change to LRA Section A.2.2 is 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.

RAI 4.7.2-1 RESPONSE

a. The high energy line break (HELB) TLAAs apply to all piping that utilized the criteria of CUF <0.1 to eliminate consideration of a postulated break, which includes much of the piping described in Table 3.6A-14. However, UFSAR Table 3.6A-14 does not provide the detail necessary to precisely identify what piping is included in these descriptions of high energy lines. For example, Table 3.6A-14 lists "Miscellaneous 3-inch and smaller piping." The detailed description of the postulated pipe break locations is provided in the text, tables and figures of UFSAR Section 3.6. The details on the break locations postulated for connected systems are provided in UFSAR Section 3.C including a description of the 3-inch and smaller high energy lines.

b. As stated in LRA B.1.19, a review of the high energy line break evaluations and the associated analyses of cumulative usage factors will be performed as an enhancement to the Fatigue Monitoring Program. This review will 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. Entergy will use the results of this review to ensure that the necessary transient cycles are tracked and the appropriate fatigue usage is monitored for the Class 1 systems and components for which HELB TLAAs apply. This enhancement will ensure that the Fatigue Monitoring

Program will adequately manage the effects of metal fatigue on all the high energy piping in UFSAR Table 3.6A-14 that have utilized the criteria of CUF <0.1 in HELB evaluations.

Attachment 2 to

GNRO-2012/00063

List of Regulatory Commitments

List of Regulatory Commitments

The following table identifies those actions committed to by Entergy in this document. Additions are shown with underline and deletions with strikethrough.

#	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE	RELATED LRA SECTION / AUDIT ITEM
1	Implement the 115 kilovolt (KV) Inaccessible Transmission Cable Program for Grand Gulf Nuclear Station (GGNS) as described in License Renewal Application (LRA) Section B.1.1	Prior to November 1, 2024	GNRO-2011/00093	B.1.1
2	Implement the Aboveground Metallic Tanks Program for GGNS as described in LRA Section B.1.2	Prior to November 1, 2024	GNRO-2011/00093	B.1.2
3	Enhance the Bolting Integrity Program for GGNS to clarify the prohibition on use of lubricants containing MoS_2 for bolting, and to specify that proper gasket compression will be visually verified following assembly. Enhance the Bolting Integrity Program to include consideration of the guidance applicable for pressure boundary bolting in Regulatory Guide (NUREG) 1339, Electric Power Research Institute (EPRI) NP-5769, and EPRI TR-104213. Enhance the Bolting Integrity Program to include volumetric examination per American Society of Mechanical Engineers (ASME) Code Section IX, Table IWB-2500-1, Examination Category B-G-1, for high-strength closure bolting regardless of code classification.	Prior to November 1, 2024	GNRO-2011/00093	B.1.3

#	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE	RELATED LRA SECTION / AUDIT ITEM
4	Enhance the Boraflex Monitoring Program for GGNS to perform periodic surveillances of the boraflex neutron absorbing material on at least a five year frequency using Boron-10 Areal Density Gage for Evaluating Racks (BADGER) testing. RACKLIFE analysis will continue to be performed each cycle. This analysis will include a comparison of the RACKLIFE predicted silica to the plant measured silica. This comparison will determine if adjustments to the RACKLIFE loss coefficient are merited. The analysis will include projections to the next planned RACKLIFE analysis date to ensure current Region I storage locations will not need to be reclassified as Region II storage locations in the analysis interval.	Prior to November 1, 2024	GNRO-2011/00093	B.1.4
5	Implement the Buried Piping and Tanks Inspection Program for GGNS as described in LRA Section B.1.5.	Prior to November 1, 2024	GNRO-2011/00093	B.1.5

#	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE	RELATED LRA SECTION / AUDIT ITEM
6	Enhance the Boiling Water Reactor (BWR) Vessel Internals Program for GGNS as follows. (a) Evaluate the susceptibility to neutron or thermal embrittlement for reactor vessel internal components composed of CASS, X-750 alloy, precipitation-hardened (PH) martensitic stainless steel(e.g., 15-5 and 17-4 PH steel), and martensitic stainless steel (e.g., 403, 410 and 431 steel). (b) Inspect portions of the susceptible components determined to be limiting from the standpoint of thermal aging susceptibility, neutron fluence, and cracking susceptibility (i.e., applied stress, operating temperature, and environmental conditions). The inspections will use an inspection technique capable of detecting the critical flaw size with adequate margin. The critical flaw size will be determined based on the service loading condition and service-degraded material properties. The initial inspection will be performed either prior to or within 5 years after entering the period of extended operation. If cracking is detected after the initial inspection, the frequency of re-inspection will be justified based on fracture toughness properties appropriate for the condition of the component. The sample size will be 100% of the accessible component population, excluding components that may be in compression during normal operations.	Prior to November 1, 2024	GNRO-2011/00093	B.1.11

#	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE	RELATED LRA SECTION / AUDIT ITEM
7	Enhance the Compressed Air Monitoring Program for GGNS to apply a consideration of the guidance of ASME OM-S/G-1998, Part 17; ANSI/ISA-S7.0.01-1996; EPRI NP-7079; and EPRI TR-108147 to the limits specified for air system contaminants. Enhance the Compressed Air Monitoring Program to include periodic and opportunistic inspections of accessible internal surfaces of piping, compressors, dryers, aftercoolers, and filters to apply consideration of the guidance of ASME OM-S/G-1998, Part 17 for inspection frequency and inspection methods of these components in the following compressed air systems. • Automatic Depressurization System (ADS) air • Division 1 Diesel Generator Starting Air (D1DGSA) • Division 2 Diesel Generator Starting Air (D2DGSA) • Division 3 Diesel Generator Starting Air (D3DGSA), also known as the HPCS Diesel Generator • Instrument Air (IA)	Prior to November 1, 2024	GNRO-2011/00093	B.1.12/RAI B.1.12-1

#	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE	RELATED LRA SECTION / AUDIT ITEM
8	Enhance the Diesel Fuel Monitoring Program to include a ten-year periodic cleaning and internal inspection of the fire water pump diesel fuel oil tanks, the diesel fuel oil day tanks for Divisions I, II, III, and the diesel fuel oil drip tanks for Divisions I, II. These cleanings and internal inspections will be performed at least once during the 10-year period prior to the period of extended operation and at succeeding 10-year intervals. If visual inspection is not possible, a volumetric inspection will be performed. Enhance the Diesel Fuel Monitoring Program to include a volumetric examination of affected areas of the diesel fuel tanks if evidence of degradation is observed during visual inspection. The scope of this enhancement includes the diesel fuel oil day tanks (Divisions I, II, III), the diesel fuel oil storage tanks (Divisions I, II, III), the diesel fuel oil drip tanks (Divisions I, II), and the diesel fire pump fuel oil storage tanks, and is applicable to the inspections performed during the 10-year period prior to the period of extended operation and at succeeding 10-year intervals.	Prior to November 1, 2024	GNRO-2011/00093	B.1.16
9	Enhance the External Surfaces Monitoring Program to include instructions for monitoring of the aging effects for flexible polymeric components through manual or physical manipulation of the material, including a sample size for manipulation of at least 10 percent of available surface area. Enhance the External Surfaces Monitoring Program as follows. 1. Underground components within the scope of this program will be clearly identified in program documents. 2. Instructions will be provided for inspecting all underground components within the scope of this program during each 10-year period, beginning 10 years prior to entering the period of extended operation.	Prior to November 1, 2024	GNRO-2011/00093	B.1.18

#	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE	RELATED LRA SECTION / AUDIT ITEM
10	Enhance the Fatigue Monitoring Program to monitor and track all critical thermal and pressure transients for all components that have been identified to have a fatigue Time Limited Aging Analysis (TLAA). Enhance the Fatigue Monitoring Program to perform a review of the GGNS high energy line break analyses and the corresponding tracking of associated cumulative usage factors to ensure the GGNS program adequately manages fatigue usage for these locations. Fatigue usage calculations that consider the effects of the reactor water environment will be developed for a set of sample reactor coolant system components. This sample set will include the locations identified in NUREG/CR-6260 and additional plant-specific component locations in the reactor coolant pressure boundary if they are found to be more limiting than those considered in NUREG/CR-6260. F_{en} factors will be determined using the formulae sets listed in Section 4.3.3. If necessary following this analysis, revised cycle limits will be incorporated into the Fatigue Monitoring Program documentation. Enhance the Fatigue Monitoring Program to provide updates of the fatigue usage calculations on an as-needed basis if an allowable cycle limit is approached, or in a case where a transient definition has been changed, unanticipated new thermal events are discovered, or the geometry of components have been modified. The program revision will include providing for the consideration of the recirculation pump fatigue analysis exemption validity if cycles that were input into the exemption evaluation exceed their limits.	Two years prior to November 1, 2024	GNRO-2011/00093 GNRO-2012/00063	B.1.19/ RAI B.1.19-1, RAI 4.3-11

#	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE	RELATED LRA SECTION / AUDIT ITEM
11	Enhance the Fire Protection Program to require visual inspections of the Halon/CO_2 fire suppression system at least once every fuel cycle to examine for signs of corrosion. Enhance the Fire Protection Program to require visual inspections of fire damper framing at least once every fuel cycle to check for signs of degradation. Enhance the Fire Protection Program to require visual inspection of concrete curbs, manways, hatches, manhole covers, hatch covers, and roof slabs at least once every fuel cycle to confirm that aging effects are not occurring. Enhance the Fire Protection Program to require an external visual inspection of the CO_2 tank at least once every fuel cycle to examine for signs of corrosion.	Prior to November 1, 2024	GNRO-2011/00093 GNRO-2012/00042	B.1.20/ RAI B.1.20-2

#	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE	RELATED LRA SECTION / AUDIT ITEM
12	Enhance the Fire Water Program to include inspection of hose reels for degradation. Acceptance criteria will be enhanced to verify no unacceptable degradation. Enhance the Fire Water Program to include one of the following options. (1) Wall thickness evaluations of fire protection piping using non-intrusive techniques (e.g., volumetric testing) to identify evidence of loss of material will be performed prior to the period of extended operation and at periodic intervals thereafter. Results of the initial evaluations will be used to determine the appropriate inspection interval to ensure aging effects are identified prior to loss of intended function. <u>OR</u> (2) A visual inspection of the internal surface of fire protection piping will be performed upon each entry to the system for routine or corrective maintenance. These inspections will be capable of evaluating (a) wall thickness to ensure against catastrophic failure and (b) the inner diameter of the piping as it applies to the design flow of the fire protection system. Maintenance history shall be used to demonstrate that such inspections have been performed on a representative number of locations prior to the period of extended operation. A representative number is 20% of the population (defined as locations having the same material, environment, and aging effect combination) with a maximum of 25 locations. Additional inspections will performed as needed to obtain this representative sample prior to the period of extended operation.	Prior to November 1, 2024	GNRO-2011/00093	B.1.21

#	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE	RELATED LRA SECTION / AUDIT ITEM
12 (cont.)	Enhance the Fire Water Program to include a visual inspection of a representative number of locations on the interior surface of below grade fire protection piping in at least one location at a frequency of at least once every 10 years during the period of extended operation. A representative number is 20% of the population (defined as locations having the same material, environment, and aging effect combination) with a maximum of 25 locations. Acceptance criteria will be revised to verify no unacceptable degradation. Enhance the Fire Water Program to test or replace a representative sample of sprinkler heads before the end of the 50-year sprinkler head service life and at 10-year intervals thereafter during the period of extended operation. Acceptance criteria will be no unacceptable degradation. NFPA-25 defines a representative sample of sprinklers to consist of a minimum of not less than 4 sprinklers or 1 percent of the number of sprinklers per individual sprinkler sample, whichever is greater. Enhance the Fire Water Program to include visual inspection of spray and sprinkler system internals for evidence of degradation. Acceptance criteria will be enhanced to verify no unacceptable degradation.			
13	Enhance the Flow-Accelerated Corrosion Program to revise program documentation to specify that downstream components are monitored closely to mitigate any increased wear when susceptible upstream components are replaced with resistant materials, such as high Cr material.	Prior to November 1, 2024	GNRO-2011/00093	B.1.22
14	Enhance the Inservice Inspection - IWF Program to address inspections of accessible sliding surfaces.	Prior to November 1, 2024	GNRO-2011/00093	B.1.24/ RAI B.1.24-1

#	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE	RELATED LRA SECTION / AUDIT ITEM
14 (cont.)	Enhance the Inservice Inspection - IWF Program to; clarify that parameters monitored or inspected will include corrosion; deformation; misalignment of supports; missing, detached, or loosened support items; improper clearances of guides and stops; and improper hot or cold settings of spring supports and constant load supports. Accessible areas of sliding surfaces will be monitored for debris, dirt, or indications of excessive loss of material due to wear that could prevent or restrict sliding as intended in the design basis of the support. Elastomeric vibration isolation elements will be monitored for cracking, loss of material, and hardening. Structural bolts will be monitored for corrosion and loss of integrity of bolted connections due to self-loosening and material conditions that can affect structural integrity.High-strength structural bolting (actual measured yield strength greater than or equal to 150 ksi or 1,034 MPa in sizes greater than 1 inch nominal diameter) susceptible to stress corrosion cracking (SCC) will be monitored for SCC. Enhance the Inservice Inspection - IWF Program to clarify that detection of aging will include: a) Monitoring structural bolting (American Society for Testing Materials (ASTM) A-325, ASTM F1852, and ASTM A490 bolts) and anchor bolts will be monitored for loss of material, loose or missing nuts, loss of pre-load and cracking of concrete around the anchor bolts. b) Volumetric examination comparable to that of ASME Code Section XI, Table IWB-2500-1, Examination Category B-G-1 should be performed for high strength structural bolting to detect cracking in addition to the VT-3 examination. This volumetric examination may be waived with adequate plant-specific justification.			

#	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE	RELATED LRA SECTION / AUDIT ITEM
14 (cont.)	c) Identification of component supports that contain high strength bolting (actual measured yield greater than or equal to 150 ksi) in sizes greater than 1 inch nominal diameter. The extent of examination for support types that contain high-strength bolting will be as specified in ASME Code Section XI, Table IWF-2500-1. GGNS will examine high-strength structural bolting on the frequency specified in ASME Code Section XI, Table IWF-2500-1. Enhance the Inservice Inspection - IWF Program acceptance criteria to include the following as unacceptable conditions. a) Loss of material due to corrosion or wear, which reduces the load bearing capacity of the component support; b) Debris, dirt, or excessive wear that could prevent or restrict sliding of the sliding surfaces as intended in the design basis of the support; and c) Cracked or sheared bolts, including high strength bolts, and anchors.		GNRO-2012/00055 GNRO-2011/00093	
15	Enhance the Inspection of Overhead Heavy Load and Light Load Handling Systems Program to include monitoring of rails in the rail system for the aging effect "wear", and structural connections/bolting for loose or missing bolts, nuts, pins or rivets. Additionally, the program will be clarified to include visual inspection of structural components and structural bolts for loss of material due to various mechanisms and structural bolting for loss of preload due to self-loosening. Enhance the Inspection of Overhead Heavy Load and Light Load Handling Systems Program acceptance criteria to state that any significant loss of material for structural components and structural bolts, and significant wear of rails in the rail system, is evaluated according to ASME B30.2 or other applicable industry standard in the ASME B30 series.	Prior to November 1, 2024	GNRO-2011/00093	B.1.25

#	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE	RELATED LRA SECTION / AUDIT ITEM
16	Implement the Internal Surfaces in Miscellaneous Piping and Ducting Components Program as described in LRA Section B.1.26.	Prior to November 1, 2024	GNRO-2011/00093	B.1.26
17	Enhance the Masonry Wall Program to clarify that parameters monitored or inspected will include monitoring gaps between the supports and masonry walls that could potentially affect wall qualification. Enhance the Masonry Wall Program to clarify that detection of aging effects require masonry walls to be inspected every 5 years.	Prior to November 1, 2024	GNRO-2011/00093	B.1.27/ B.1.27-1
18	Implement the Non-EQ Cable Connections Program as described in LRA Section B.1.28	Prior to November 1, 2024	GNRO-2011/00093	B.1.28
19	Enhance the Non environmentally Qualified (Non-EQ) Inaccessible Power Cables (400V to 35kV) Program to include low-voltage (400V to 2kV) power cables. Enhance the Non-EQ Inaccessible Power Cables (400V to 35kV) Program to include condition-based inspections of manholes not automatically dewatered by a sump pump being performed following periods of heavy rain or potentially high water table conditions, as indicated by river level. Enhance the Non-EQ Inaccessible Power Cables (400V to 35kV) Program to clarify that the inspections will include direct observation that cables are not wetted or submerged, that cables/splices and cable support structures are intact, and that dewatering/drainage systems (i.e., sump pumps) and associated alarms if applicable operate properly.	Prior to November 1, 2024	GNRO-2011/00093	B.1.29
20	Implement the Non-EQ Instrumentation Circuits Test Review Program as described in LRA Section B.1.30.	Prior to November 1, 2024	GNRO-2011/00093	B.1.30
21	Implement the Non-EQ Insulated Cables and Connections Program as described in LRA Section B.1.31.	Prior to November 1, 2024	GNRO-2011/00093	B.1.31

#	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE	RELATED LRA SECTION / AUDIT ITEM
22	Enhance the Oil Analysis Program to provide a formalized analysis technique for particulate counting. Enhance the Oil Analysis Program to include piping and components within the main generator system (N41) with an internal environment of lube oil.	Prior to November 1, 2024	GNRO-2011/00093	B.1.32
23	Implement the One-Time Inspection Program as described in LRA Section B.1.33.	Within the 10 years prior to November 1, 2024	GNRO-2011/00093	B.1.33
24	Implement the One-Time Inspection – Small Bore Piping Program as described in LRA Section B.1.34.	Within the 6 years prior to November 1, 2024	GNRO-2011/00093	B.1.34
25	Enhance the Periodic Surveillance and Preventive Maintenance Program to include all activities described in the table provided in LRA Section B.1.35 program description.	Prior to November 1, 2024	GNRO-2011/00093	B.1.35
26	Enhance the Protective Coating Program to include parameters monitored or inspected by the program per the guidance provided in ASTM D5163-08. Enhance the Protective Coating Monitoring and Maintenance Program to provide for inspection of coatings near sumps or screens associated with the Emergency Core Cooling System. Enhance the Protective Coating Program to include acceptance criteria per ASTM D 5163-08.	Prior to November 1, 2024	GNRO-2011/00093	B.1.36
27	Enhance the Reactor Vessel Surveillance Program to ensure that the additional requirements specified in the final NRC safety evaluation for BWRVIP-86 Revision 1 are addressed before the period of extended operation.	Prior to November 1, 2024	GNRO-2011/00093	B.1.38

#	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE	RELATED LRA SECTION / AUDIT ITEM
28	Enhance the Regulatory Guide (RG) 1.127, Inspection of Water-Control Structures Associated With Nuclear Power Plant Program to clarify that detection of aging effects will monitor accessible structures on a frequency not to exceed 5 years consistent with the frequency for implementing the requirements of RG 1.127. Enhance the RG 1.127, Inspection of Water-Control Structures Associated With Nuclear Power Plant Program to perform periodic sampling, testing, and analysis of ground water chemistry for pH, chlorides, and sulfates on a frequency of at least every 5 years. Enhance the RG 1.127, Inspection of Water-Control Structures Associated With Nuclear Power Plant Program acceptance criteria to include quantitative acceptance criteria for evaluation and acceptance based on the guidance provided in ACI 349.3R.	Prior to November 1, 2024	GNRO-2011/00093	B.1.39
29	Implement the Selective Leaching Program as described in LRA Section B.1.40.	Prior to November 1, 2024	GNRO-2011/00093	B.1.40
30	Enhance the Structures Monitoring Program to clarify that the scope includes the following: a) In-scope structures and structural components. • Containment Building (GGN 2) • Control House – Switchyard • Culvert No. 1 and drainage channel • Manholes and Ductbanks • Radioactive Waste Building Pipe Tunnel b) In-scope structural components • Anchor bolts • Anchorage / embedments • Base plates • Basin debris screen and grating • Battery racks • Beams, columns, floor slabs and interior walls • Cable tray and cable tray supports • Component and piping supports • Conduit and conduit supports • Containment sump liner and penetrations • Containment sump structures	Prior to November 1, 2024	GNRO-2011/00093	B.1.42/ RAI B.1.42-3, B.1.42-5

#	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE	RELATED LRA SECTION / AUDIT ITEM
30 (cont)	• Control room ceiling support system • Cooling tower drift eliminators • Cooling tower fill • CST/RWST retaining basin (wall) • Diesel fuel tank access tunnel slab • Drainage channel • Drywell floor slab (concrete) • Drywell wall (concrete) • Ductbanks • Electrical and instrument panels and enclosures • Equipment pads/foundations • Exterior walls • Fan stack grating • Fire proofing • Flood curbs • Flood retention materials (spare parts) • Flood, pressure and specialty doors • Floor slab • Foundations • HVAC duct supports • Instrument line supports • Instrument racks, frames and tubing trays • Interior walls • Main steam pipe tunnel • Manholes • Manways, hatches, manhole covers, and hatch covers • Metal siding • Missile shields • Monorails • Penetration sealant (flood, radiation) • Penetration sleeves (mechanical/ electrical not penetrating primary containment boundary) • Pipe whip restraints • Pressure relief panels • Reactor pedestal • Reactor shield wall (steel portion) • Roof decking • Roof hatches • Roof membrane • Roof slabs • RPV pedestal sump liner and penetrations • Seals and gaskets (doors, manways and			

#	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE	RELATED LRA SECTION / AUDIT ITEM
30 (cont)	hatches) • Seismic isolation joint • Stairway, handrail, platform, grating, decking, and ladders • Structural bolting • Structural steel, beams columns, and plates • Sumps and Sump liners • Support members: welds; bolted connections; support anchorages to building structure • Support pedestals • Transmission towers (see Note 1) • Upper containment pool floor and walls • Vents and louvers Note 1: The inspections of these structures may be performed by the transmission personnel. However, the results of the inspections will be provided to the GGNS Structures Monitoring Program owner for review. c) Clarify the term "significant degradation" to include "that could lead to loss of structural integrity". d) Include guidance to perform periodic sampling, testing, and analysis of ground water chemistry for pH, chlorides, and sulfates on a frequency of at least every 5 years. Enhance the Structures Monitoring Program to clarify that parameters monitored or inspected include: a) inspection for missing nuts for structural connections. b) monitoring sliding/bearing surfaces such as Lubrite plates for loss of material due to wear or corrosion, debris, or dirt. The program will be enhanced to include monitoring elastomeric vibration isolators and structural sealants for cracking, loss of material, and hardening. c) Include periodically inspecting the leak chase system associated with the upper containment pool and spent fuel pool to ensure the tell-tales are free of significant blockage. The inspection will also inspect concrete surfaces for degradation where leakage has been observed, in accordance with this Program.			

#	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE	RELATED LRA SECTION / AUDIT ITEM
30 (cont.)	Enhance the Structures Monitoring Program to clarify that detection of aging effects will: a) include augmented inspections of vibration isolators by feel or touch to detect hardening if the vibration isolation function is suspect.		GNRO-2012-00054	
	b) Require inspections every 5 years for structures and structural components within the scope of license renewal unless technical justification is provided to extend the inspection to a period not to exceed 10 years.		GNRO-2011/00093	
	c) Require direct visual examinations when access is sufficient for the eye to be within 24-inches of the surface to be examined and at an angle of not less than 30° to the surface. Mirrors may be used to improve the angle of vision and accessibility in constricted areas. d) Specify that remote visual examination may be substituted for direct examination. For all remote visual examinations, optical aids such as telescopes, borescopes, fiber optics, cameras, or other suitable instruments may be used provided such systems have a resolution capability at least equivalent to that attainable by direct visual examination.		GNRO-2012-00054	
	Enhance the Structures Monitoring Program acceptance criteria by prescribing acceptance criteria based on information provided in industry codes, standards, and guidelines including NEI 96-03, ACI 201.1R-92, ANSI/ASCE 11-99 and ACI 349.3R-96. Industry and plant-specific operating experience will also be considered in the development of the acceptance criteria.		GNRO-2012-00054	
			GNRO-2011/00093	

#	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE	RELATED LRA SECTION / AUDIT ITEM
31	Enhance the Water Chemistry Control – Closed Treated Water Program to provide a corrosion inhibitor for the engine jacket water on the engine-driven fire water pump diesel in accordance with industry guidelines and vendor recommendations. Enhance the Water Chemistry Control – Closed Treated Water Program to provide periodic flushing of the engine jacket water and cleaning of heat exchanger tubes for the engine-driven fire water pump diesel in accordance with industry guidelines and vendor recommendations. Enhance the Water Chemistry Control – Closed Treated Water Program to provide testing of the engine jacket water for the engine-driven fire water pump diesels at least annually. Enhance the Water Chemistry Control – Closed Treated Water Program to revise the water chemistry procedure for closed treated water systems to align the water chemistry control parameter limits with those of EPRI 1007820.	Prior to November 1, 2024	GNRO-2011/00093 GNRO-2012/00049	B.1.44/ RAI B.1.44-1, B.1.44-2

#	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE	RELATED LRA SECTION / AUDIT ITEM
31 (cont.)	Enhance the Water Chemistry Control – Closed Treated Water Program to conduct inspections whenever a boundary is opened for the following systems. • Drywell chilled water (DCW – system P72) • Plant chilled water (PCW – system P71) • Diesel generator cooling water subsystem for Division I and II standby diesel generators • Diesel engine jacket water for engine-driven fire water pump • Diesel generator cooling water subsystem for Division III (HPCS) diesel generator • Turbine building cooling water (TBCW– system P43) • Component cooling water (CCW – system P42) These inspections will be conducted in accordance with applicable ASME Code requirements, industry standards, and other plant-specific inspection and personnel qualification procedures that are capable of detecting corrosion or cracking.			

#	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE	RELATED LRA SECTION / AUDIT ITEM
31 (cont.)	Enhance the Water Chemistry Control – Closed Treated Water Program to inspect a representative sample of piping and components at a frequency of once every ten years for the following systems. • Drywell chilled water (DCW – P72) • Plant chilled water (PCW – P71) • Diesel generator cooling water subsystem for Division I and II standby diesel generators • Diesel engine jacket water for engine-driven fire water pump • Diesel generator cooling water subsystem for Division III (HPCS) diesel generator • Turbine building cooling water (TBCW – P43) • Component cooling water (CCW – P42) Components inspected will be those with the highest likelihood of corrosion or cracking. A representative sample is 20% of the population (defined as components having the same material, environment, and aging effect combination) with a maximum of 25 components. The inspection methods will be in accordance with applicable ASME Code requirements, industry standards, or other plant specific inspection and personnel qualification procedures that ensure the capability of detecting corrosion or cracking.			
32	Enhance the BWR CRD Return Line Nozzle Program to include inspection of the CRD return line nozzle inconel end cap to carbon steel safe end dissimilar metal weld once prior to the period of extended operation and every 10 years thereafter.	Prior to November 1, 2024	GNRO-2012/00029	B.1.6 / RAI B.1.6-1
33	Enhance the BWR Penetrations Program to include that site procedures which implement the guidelines of BWRVIP-47-A will be clarified to indicate that the guidelines of BWRVIP-47-A apply without exceptions.	Prior to November 1, 2024	GNRO-2012/00029	B.1.8 / RAI B.1.8-1