Entergy

Entergy Operations, Inc.
P. O. Box 756
Port Gibson, MS 39150

Michael Perito
Vice President, Operations
Grand Gulf Nuclear Station
Tel. (601) 437-6409

GNRO-2012/00043

May 18, 2012

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

SUBJECT: Response to Request for Additional Information (RAI) dated April 18, 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 18, 2012 (GNRI-2012/00091)

Dear Sir or Madam:

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

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 18th day of May, 2012.

Sincerely,

MP/jas

Attachment: Response to Request for Additional Information (RAI)

cc: (see next page)

A148
NRR

cc: with Attachment

Mr. John P. Boska, Project Manager
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Mail Stop O-8-C2
Washington, DC 20555

cc: without Attachment

Mr. Elmo E. Collins, Jr.
Regional Administrator, Region IV
U.S. Nuclear Regulatory Commission
1600 East Lamar Boulevard
Arlington, TX 76011-4511

U.S. Nuclear Regulatory Commission
ATTN: Mr. A. Wang, NRR/DORL
Mail Stop OWFN/8 G14
11555 Rockville Pike
Rockville, MD 20852-2378

U.S. Nuclear Regulatory Commission
ATTN: Mr. Nathaniel Ferrer NRR/DLR
Mail Stop OWFN/ 11 F1
11555 Rockville Pike
Rockville, MD 20852-2378

NRC Senior Resident Inspector
Grand Gulf Nuclear Station
Port Gibson, MS 39150

Attachment to

GNRO-2012/00043

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.

RAI B.1.34-1

Background. LRA Section B.1.34 states that the One-Time Inspection – Small-Bore Piping Program is consistent with GALL Report AMP XI.M35 and includes a statistically significant sampling approach. GALL Report AMP XI.M35 states under the "detection of aging effects" program element that the inspection sample size should be at least 3 percent of the weld population or a maximum of 10 welds of each weld type if the unit (a) has never experienced a failure of its American Society of Mechanical Engineers (ASME) Code Class 1 small-bore piping, and (b) has more than 30 years of operating history at the time when the application is submitted. Otherwise, the inspection sample size should be at least 10 percent of the weld population or a maximum of 25 welds of each weld type. The NRC issued the operating license for Grand Gulf Nuclear Station, Unit 1 (GGNS), on November 1, 1984, and the applicant submitted the LRA on October 28, 2011; therefore, GGNS had less than 27 years of operating history at the time when the application was submitted.

Issue. Based on the operating history of GGNS, the sample size for the one-time inspection should be at least 10 percent of the weld population or a maximum of 25 welds of each weld type to be consistent with GALL Report AMP XI.M35. However, LRA Section B.1.34 does not provide the total population of welds of each weld type or the total number of these welds that will be included in the volumetric inspections.

Request. Characterize the inspection sample size by completing the table below:

	Total Number of Welds at GGNS	Total Number of Welds to Be Inspected under the One-Time Inspection – Small-Bore Piping Program	Percentage of Total Welds To Be Inspected
ASME Code Class 1 Small-Bore Piping Full Penetration or Butt Welds			
ASME Code Class 1 Small-Bore Piping Partial Penetration or Socket Welds			

Provide technical justification if the sample size is less than the sample size described in the GALL Report (i.e., 10 percent of the weld population or a maximum of 25 welds of each weld type).

RAI B.1.34-1 RESPONSE:

Because this is a new program the total number of welds that will be included in the volumetric inspections, based on the total population of welds of each weld type, has not been determined but will be provided by August 31, 2012 to support the NRC review of this program. The inspection sample size of this population however, will be the sample size described in NUREG-1801. As stated in NUREG-1801 Section XI.M35, the sample size will be 10 percent, with a maximum of 25, of the socket welds, and 10 percent, with a maximum of 25, of the butt welds within the population of ASME Class 1 piping NPS less than 4 inches.

RAI B.1.34-2

Background. GALL Report AMP XI.M35 states under the "detection of aging effects" program element that the One-Time Inspection Small-Bore Piping Program does not apply to plants that have experienced cracking in ASME Code Class 1 small-bore piping due to stress corrosion, cyclical (including thermal, mechanical, and vibration fatigue) loading, or thermal stratification and thermal turbulence. LRA Section B.1.34 states that GGNS has not experienced this type of cracking.

Issue. During its onsite audit, the staff could not determine how or to what extent the applicant reviewed operating experience information in order to demonstrate that GGNS has not experienced cracking in its ASME Code Class 1 small-bore piping.

Request. With respect to the identification of cracking in ASME Code Class 1 small-bore piping, describe how operating experience was considered. In this description:

a. Identify the specific sources of information reviewed (e.g., databases and document types).
b. For each information source, describe the process or methodology used to find potential instances of cracking in ASME Code Class 1 small-bore piping. Include specific keywords or search terms, if used.
c. Provide a list of all those items found to potentially involve cracking. Identify the specific source of each item (e.g., condition report numbers and licensee event reports).
d. For each item, provide the date of occurrence, a brief summary of the circumstances, and a disposition as to whether it concerns cracking of ASME Code Class 1 small-bore piping.

If cracking of ASME Code Class 1 small-bore piping is identified, provide a plant-specific program that includes periodic inspections, or explain and justify why the One-Time Inspection Small-Bore Piping Program will adequately manage cracking.

RAI B.1.34-2 RESPONSE:

a. With respect to the identification of cracking in ASME Code Class 1 small-bore piping, the first specific source of information reviewed was the paperless condition reporting system (PCRS), which is a computer program used for tracking conditions identified within the site corrective action program.

   In addition to review of the PCRS database, Entergy reviewed Licensee Event Reports (LER) submitted from Entergy nuclear facilities.

   Interviews with plant staff were used to supplement the documentation reviews.

b. The process used to find potential instances of cracking included a review of ten years of operating experience documented in PCRS. GGNS operating experience (OE) is documented in PCRS in the form of condition reports (CRs). Keyword searches were performed which included the words crack, leak, fracture, and spray.

   Separately from PCRS, Entergy reviewed Licensee Event Reports (LER) originating from Entergy nuclear facilities for all Class 1 small-bore socket weld cracking.

The third specific source of information was interviews with plant staff concerning operating experience related to plant systems. Over time, individuals involved in the day-to-day maintenance and operation of nuclear plant structures, systems, and components acquire unique knowledge and experience regarding the performance history and degradation phenomenon affecting structures, systems, and components. For systems and structures within the scope of license renewal, system engineers were interviewed to reveal any potential aging effects requiring management that would not otherwise be identified by the aging management review process and OE documentation review. The interviews consisted of open discussions of system aging effects. Aging mechanisms, aging effects, and adverse environments identified in the industry guidance documents were reviewed with the system engineers. Interviewers prompted the system engineers to discuss unusual or unique materials, environments, and aging effects. The system engineers were also asked about system problems that may be age-related, which would include cracking of small-bore Class 1 piping.

c. With respect to the identification of cracking in ASME Code Class 1 small-bore piping, GGNS has not experienced cracking due to stress corrosion, cyclical (including thermal, mechanical, and vibration fatigue) loading, or thermal stratification and thermal turbulence.

d. Cracking of ASME Code Class 1 small-bore piping has not occurred at GGNS.

RAI B.1.34-3

Background. GALL Report AMP XI.M35 states under the "detection of aging effects" program element that the inspections should be based on susceptibility, inspectability, dose considerations, operating experience, and the limiting locations of the total population of ASME Code Class 1 small-bore piping. The GALL Report program also states that opportunistic destructive examinations of socket welds may be performed and a sampling basis should be used if more than one weld is removed from service. LRA Section B.1.34 states that the One-Time Inspection – Small-Bore Piping Program is consistent with GALL Report AMP XI.M35 and that sample selection is based on susceptibility to stress corrosion, cyclic loading (including thermal, mechanical, and vibration fatigue), or thermal stratification and thermal turbulence.

Issue. During the onsite audit, the staff reviewed the applicant's engineering report on AMPs for ASME Code Class 1 components, and found that the One-Time Inspection – Small-Bore Piping Program does not include a methodology for selecting sample locations. The staff also found that the One-Time Inspection – Small-Bore Piping Program credits opportunistic destructive examinations; however, the program does not discuss a sampling basis for these examinations when more than one socket weld is removed from service.

Request.

a. Describe the methodology for selecting the inspection sample locations. Discuss how this methodology accounts for susceptibility to cracking, inspectability, dose considerations, operating experience, and the limiting locations of the total population of ASME Code Class 1 small-bore piping.

b. Describe the sampling basis that will be used to determine which welds will be destructively examined when more than one weld is removed from service.

RAI B.1.34-3 RESPONSE:

a. As stated in LRA Section B.1.34, the new One-Time Inspection – Small-Bore Piping Program will be consistent with the program described in NUREG-1801, Section XI.M35, without exception.

   The methodology for selecting the inspection sample locations will be consistent with NUREG-1801, Section XI.M35. Sample locations will be based on the following factors.

   - susceptibility to cracking, using industry guidance and operating experience such as EPRI Report 1013389 "BWRVIP-155: BWR Vessel and Internals Project, Evaluation of Thermal Fatigue Susceptibility in BWR Stagnant Branch Lines"
   - inspectability of weld, based on weld configuration and location in the piping system
   - dose considerations, based on area dose rates at the physical location of each weld
   - limiting locations of the total population of ASME Code Class 1 small-bore piping locations

b. When more than one weld is removed from service, multiple welds may be subjected to destructive examination if appropriate based on the sample selection criteria of NUREG-1801, XI.M35. The sample selection will be based on susceptibility, inspectability, dose considerations, operating experience, and limiting locations of the total population of ASME Code Class 1 small-bore piping locations. Opportunistic destructive examination is performed when a weld is removed from service for other considerations, such as plant modifications. In the event that more than one weld is removed, the weld (or welds) considered most susceptible to cracking will be destructively examined. The sampling requirements will be 10 percent of the total population up to a maximum 25 of both butt weld and socket welds within the population of ASME Class 1 piping NPS less than 4 inches.

RAI B.1.34-4

Background. LRA Section B.1.34 states that the applicant's One-Time Inspection – Small-Bore Piping Program is consistent with GALL Report AMP XI.M35 and provides a one-time volumetric inspection of a sample of ASME Code Class 1 small-bore piping locations susceptible to cracking. GALL Report AMP XI.M35 states under the "operating experience" program element that volumetric inspection techniques should have a demonstrated capability and proven industry record to detect cracking in piping weld and base metal material. During its onsite audit, the staff reviewed the applicant's engineering report on AMPs for ASME Code Class 1 components and found that the One-Time Inspection – Small-Bore Piping Program includes volumetric examinations of full penetration welds using "demonstrated techniques."

Issue. There was insufficient information available during the audit for the staff to determine what constitutes a "demonstrated technique" for volumetric examinations of full penetration welds or whether such techniques are capable of detecting cracking.

Request. Describe how the volumetric techniques that will be used to examine full penetration welds are capable of detecting cracking.

RAI B.1.34-4 RESPONSE:

As stated in LRA Section B.1.34, the new One-Time Inspection – Small-Bore Piping Program will be consistent with the program described in NUREG-1801 XI.M35, without exception, including the use of "demonstrated techniques" described in program element 4.

An ASME Section XI qualified volumetric examination method, such as ultrasonic testing or radiography, is considered a "demonstrated technique." Both of these methods have demonstrated the ability to detect cracking in the area of interest in full penetration small-bore welds when performed by ASME qualified personnel. In performing Section XI examinations at GGNS, ultrasonic examination techniques, equipment, and personnel performing the examinations comply with the standards of ASME Section XI as described in site procedures.

RAI B.1.34-5

Background. LRA Section A.1.34 provides a summary description of the One-Time Inspection – Small-Bore Piping Program for the Updated Final Safety Analysis Report (UFSAR) supplement. This summary states that the program includes a statistically significant sampling approach and provides a one-time volumetric inspection of a sample of ASME Code Class 1 piping locations susceptible to cracking.

Issue. The UFSAR supplement does not provide sufficient information for the administrative and regulatory control of the program because it does not describe certain characteristics of the program important for managing the effects of aging. The inspection sample size is important because it is used to establish whether cracking is occurring in ASME Code Class 1 small-bore piping. However, the UFSAR supplement does not specifically state the sample size. Also, during its onsite audit, the staff reviewed the applicant's engineering report on AMPs for ASME Code Class 1 components and found that the One-Time Inspection – Small-Bore Piping Program includes opportunistic destructive tests as a method for detecting aging effects, and each destructive examination will be credited as equivalent to two volumetric examinations. The examination techniques are important because they are used to find the effects of aging. However, the UFSAR supplement does not state that the program detects aging through destructive examinations.

Request. Revise the summary description in LRA Section A.1.34 to specify (a) the inspection sample size, and (b) that the program relies on destructive examinations, in addition to volumetric examinations, to detect aging effects. Alternatively, justify how the program will have adequate administrative and regulatory controls.

RAI B.1.34-5 RESPONSE:

As stated in LRA Section B.1.34, the new One-Time Inspection – Small-Bore Piping Program will be consistent with the program described in NUREG-1801, Section XI.M35 without exception.

LRA Section A.1.34 is revised to include the following provisions.

a. GGNS will volumetrically examine 10%, with a maximum of 25, of the socket welds and 10%, with a maximum of 25, of the butt welds within the population of ASME Class 1 small bore piping welds.

b. For inspections of ASME Class 1 socket welds, volumetric or opportunistic destructive examination will be performed. For inspections of full penetration welds, volumetric examinations will be performed. For socket welds, credit for two volumetric examinations will be taken in the event a destructive examination is performed because more information can be obtained from a destructive examination.

See changes to A.1.34 shown below with additions underlined.

A.1.34 One-Time Inspection – Small-Bore Piping Program
The One-Time Inspection – Small-Bore Piping Program augments ASME Code, Section XI requirements and is applicable to small-bore ASME Code Class 1 piping and components with a nominal pipe size diameter less than 4 inches (NPS < 4) and greater than or equal to NPS 1 in systems that have not experienced cracking of ASME Code Class 1 small-bore piping. The program can also be used for systems that have experienced cracking but have implemented design changes to effectively mitigate cracking.

This program provides a one-time volumetric inspection of a sample of these Class 1 piping locations that are susceptible to cracking. The program includes pipes, fittings, branch connections, and all full and partial penetration (socket) welds.

GGNS will volumetrically examine 10%, with a maximum of 25, of the socket welds and 10%, with a maximum of 25, of the butt welds within the population of ASME Class 1 small bore piping welds.

For inspections of ASME Class 1 socket welds, volumetric or opportunistic destructive examination will be performed. For inspections of full penetration welds, volumetric examinations will be performed. For socket welds, credit for two volumetric examinations will be taken in the event a destructive examination is performed because more information can be obtained from a destructive examination.

This program includes a statistically significant sampling approach. Sample selection is based on susceptibility to stress corrosion, cyclic loading (including thermal, mechanical, and vibration fatigue), or thermal stratification and thermal turbulence.

The program includes measures to verify that degradation is not occurring, thereby either confirming that there is no need to manage aging-related degradation or validating the effectiveness of any existing program for the period of extended operation. If evidence of cracking is revealed by this one-time inspection, follow-up periodic inspection will be managed by a plant-specific program.

The inspection will be performed within the six-year period prior to the period of extended operation.

RAI B.1.37-1

Background. The "corrective actions" program element of the GALL Report AMP XI.M3, "Reactor Head Closure Bolting," states that the maximum yield strength of replacement bolting materials should be limited as recommended in NUREG-1339 (< 150 ksi). During the audit, the staff noted that the applicant's Reactor Head Closure Studs Program documentation does not clearly indicate if the "corrective actions" program element is consistent with the GALL Report, with respect to using replacement bolting materials that have measured yield strength less than 150 ksi.

Issue. Clarify if the Reactor Head Closure Studs Program "corrective actions" program element is consistent with GALL AMP XI.M3 in terms of the yield strength criterion recommended for replacement bolting materials.

Request.
a. Clarify if the "corrective actions" program element is consistent with the GALL Report in terms of using replacement bolting materials that have a measured yield strength less than 150 ksi. If the "corrective actions" program element is not consistent with the GALL Report, identify this as a program exception and provide justification why the Reactor Head Closure Studs Program with the cited exception is adequate in managing the aging effects of the replacement bolting.
b. Revise the LRA as necessary, consistent with the response.

RAI B.1.37-1 RESPONSE:

a. The exception for reactor head closure studs also applies to the corrective actions program element. The justification for this exception is the same as for the installed studs addressed in LRA B.1.37.
b. The exception in B.1.37 applies to the corrective actions program element and the Elements Affected / Exception table is revised by adding Element 7 "Corrective Action" to the "Elements Affected" column.

LRA B.1.37 is revised as shown below by adding Element 7 "Corrective Actions." Additions are shown with underline.

Exceptions to NUREG-1801

The Reactor Head Closure Studs Program is consistent with the program described in NUREG-1801, Section XI.M3, Reactor Head Closure Stud Bolting, with the following exception.

Elements Affected	Exception
2. Preventive Actions 7. Corrective Actions	NUREG-1801 recommends use of bolting material for closure studs that has an actual measured yield strength less than 1,034 megapascals (MPa) (150 kilo-pounds per square inch). GGNS uses bolting material for closure studs with a maximum reported ultimate tensile strength below 170 kilo-pounds per square inch. [1]

Exception Note

1. The criterion of actual yield strength less than 150 kilo-pounds per square inch (ksi) was recommended in Section 3 of NUREG-1339 to be used as the level for consideration of vulnerability to stress corrosion cracking (SCC). The studs, nuts and washers at GGNS are fabricated from SA 540 Grade B23 or B24 carbon steel, which has a minimum yield strength of 130 ksi. Data relative to actual yield strength for the installed reactor head closure studs is not available. However, SA 540 Grades B23 and B24 are high-strength, low alloy materials that,

when tempered to a maximum tensile strength of 170 ksi, are relatively immune to stress corrosion cracking. Therefore, the studs installed at GGNS are relatively immune to stress corrosion cracking. Nevertheless, since the actual yield strength of the installed studs is not known, the aging management review conservatively identified the stud material as "high strength low alloy steel" susceptible to the aging effect of cracking. The examination methods used for stud inspection in the Reactor Head Closure Studs Program are appropriate to identify cracking. Therefore, the 150 ksi actual yield strength preventive measure is not necessary to assure that the reactor head closure studs can perform their intended function consistent with the current licensing basis through the period of extended operation.

RAI B.1.37-2

Background. The "operating experience program" element of LRA Section B.1.37 states that surface examination of reactor pressure vessel studs, nuts, and washers from 2001 through 2010 identified no relevant indications. The LRA also states that continuing examination of the studs, washers, and nuts and evaluation of the results provide evidence that the program remains effective in managing and detecting cracking and loss of material in the bolting. In contrast, the applicant's Appendix A of its Inservice Inspection (ISI) Program dated June 26, 2000, indicates that the planned examinations used on the nuts and washers were visual examinations, consistent with ASME Code Section XI, Table IWB-2500-1.

In addition, LRA Section B.1.37 does not address the inspection results for the reactor head closure bolting components, which were obtained using the other examination methods (e.g.., visual and volumetric) specified in ASME Code Section XI.

Issue. It is not clear what examinations the applicant performs on the Reactor Head Closure Studs Program in order to ensure the effectiveness of the program. In addition, the staff needs a summary review of the inspection results of the closure bolting components that were obtained using the other examination methods specified in the ASME Code Section XI, but not discussed in the LRA in order to ensure the adequacy of the program.

Request.

a. Clarify which methods of examination are used to inspect the studs, nuts, washers and flange threads, respectively, in the applicant's program. If the examination method is not consistent with those specified in ASME Code Section XI, as referenced in the GALL Report, justify how the examination method is acceptable to detect and manage the aging effects.
b. Summarize the inspection results for the following ASME Code inspection items, for the period (2001-2010) discussed in the LRA to confirm the effectiveness of the program: (1) volumetric examination of the closure studs and reactor vessel flange threads, and (2) visual examination of the nuts and washers.

RAI B.1.37-2 RESPONSE:

a. As stated in LRA B.1.37, ASME Section XI examination and inspection requirements specified in Table IWB-2500-1 are used for reactor head closure stud bolting (studs, washers, bushings, nuts and threads in flange). The examination methods are consistent with those specified in ASME Code Section XI, as referenced in NUREG-1801.

   Specifically, the inspections are performed to ASME Section XI 2001 thru 2003 Addenda, Table IWB-2500-1, Examination Category B-G-1. Table IWB-2500-1, Category B-G-1 documents the type of examination for each part examined.

   Closure Head Nuts – Visual, VT-1
   Reactor Head Studs, in place- Volumetric
   Reactor Head Studs, when removed – Volumetric or Surface
   Threads in Flange – Volumetric
   Closure Washers, Bushings – Visual, VT-1

b. (1) Volumetric examination (UT) was performed on all 76 of the reactor vessel studs and flange threads during the period from 2001 to 2010. No indications were noted on the

76 reactor vessel studs and flange threads.

(2) Visual examination (VT-1) was performed on the nuts and washers of these 76 studs during the period from 2001 to 2010. No indications were noted on the 76 reactor vessel stud nuts or washers.

RAI B.1.37-3

Background. During the onsite audit of the applicant's operating experience, the staff noted that in 1986, the applicant discovered that two of the closure studs were undersized. The condition report that the staff reviewed did not provide further information.

Issue. It is unclear if the undersized studs, if left in service, would be subjected to higher service stresses. If they were subject to higher service stresses, they would have higher susceptibility to the following aging effects: stress corrosion cracking (SCC) and loss of material due to wear or galling. It is also unclear how the undersized studs were dispositioned, such that their intended function is maintained, and their aging effects are managed adequately during the period of extended operation.

Request.

a. Clarify if the undersized studs are in service and will continue to be in service during the period of extended operation. If the studs are in service, provide the following information on the two undersized studs:
    - Locations of the studs in the reactor vessel head flange
    - Inservice inspection results for the studs
    - Information to justify the adequacy of the undersized studs for continued use, including engineering evaluations such as stress and fatigue analyses
    - Justification of the adequacy of the program to manage the aging effects of the undersized studs

b. If the undersized studs were replaced, provide additional information to confirm whether the replacement studs are consistent with the GALL Report in terms of yield strength criterion (< 150 ksi) and use of acceptable surface coatings.

RAI B.1.37-3 RESPONSE:

a. The "undersize" condition noted in the 1986 documentation was a slight oversize condition of the stud bottom plug hole for two reactor head closure studs. The condition had been identified prior to initial plant startup. The condition was determined acceptable and the studs are still installed. There was no condition involving the outside diameter of the studs. Because the studs were in fact not undersized in any manner, the information requested in this part of the RAI is not necessary.

b. The reactor vessel closure studs that were the subject of the 1986 documentation were installed prior to initial plant startup. They have not been replaced.