Entergy

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**Michael A. Krupa**
Director
Nuclear Safety & Licensing

May 15, 2001

U. S. Nuclear Regulatory Commission
Attn.: Document Control Desk
Mail Stop OP1-17
Washington, DC 20555-0001

Subject: Grand Gulf Nuclear Station
Docket No. 50-416
License No. NPF-29
Request for Use of ASME Code Case N-561-1

Reference: CNRO-2001-00026, "Request for Use of ASME Code Case N-561-1," dated May 11, 2001

CNRO 2001-00027

In the referenced letter, Entergy Operations, Inc. (Entergy) requested the NRC approval for the use of ASME Code Case N-561-1 at the Grand Gulf Nuclear Station. The request was for a specific application to a pinhole leak discovered in an elbow located in the minimum flow line of the Residual Heat Removal (RHR) System's "A" train.

Following a telephone conversation on May 11, 2001, the NRC granted verbal approval for using the code case as specified in the referenced letter due to the urgency of the request to prevent shutdown of the unit. Entergy is providing this supplemental letter to document the inspection of RHR piping, the evaluation of the degraded elbow, future operation of the RHR system, and other clarifications discussed in the telephone call.

Prior to discovery of the pinhole leak, Entergy was monitoring one location on the RHR "A" loop and three locations on the RHR "B" loop. Following discovery of the leak, eight additional locations were inspected on the RHR "A" loop and four additional locations inspected on the RHR "B" loop. These additional locations (12 total) have been added to the Grand Gulf Flow Accelerated Corrosion (FAC) program database and will be monitored accordingly. No other degradation as significant as that of the leaking elbow was found.

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As part of the root cause determination for the degraded elbow, Entergy will perform destructive metallurgical testing of the degraded elbow to aid in determining the actual cause of the pinhole leak. This determination will be completed six months following replacement of the elbow. As stated in the referenced letter, the elbow will be replaced during the next scheduled refueling outage.

Revised request GG-R&R-001, Rev. 0 containing the remaining requested information and clarifications is attached. This revised request replaces in its entirety the request previously submitted in the referenced letter.

Commitments made in this letter are identified in Attachment 2.

Should you have any questions regarding this submittal, please contact Guy Davant at (601) 368-5756.

Very truly yours,

MAK/GHD/baa
attachments
cc: Mr. W. A. Eaton (GGNS)
Mr. G. R. Taylor (ECH)

Mr. T. L. Hoeg, NRC Senior Resident Inspector (GGNS)
Mr. E. W. Merschoff, NRC Region IV Regional Administrator
Mr. S. P. Sekerak, NRC Project Manager (GGNS)

**ENTERGY OPERATIONS, INC.**
**GRAND GULF NUCLEAR STATION**
**2nd TEN YEAR INTERVAL**
**REQUEST NO. GG-R&R-001, Revision 0**

## I. COMPONENT/EXAMINATION

| | |
|---|---|
| Component/Number: | 4"-HBB-120 |
| Description: | Residual Heat Removal (RHR) System "A" minimum flow recirculation Line |
| Code Class: | 2 |
| References: | 1. ASME Section XI, 1992 Edition with portions of the 1993 Addenda as listed in Reference 5<br>2. ASME Section III, Subsection NC, 1974 Edition, Summer 1974 Addenda<br>3. ASME Section III, Subsection NC, 1989 Edition<br>4. ASME Section XI Code Case N-561-1, Alternative Requirements for Wall Thickness Restoration of Class 2 and High Energy Class 3 Carbon Steel Piping<br>5. GGNS-M-489.1 Program Section for ASME Section XI, Division 1 Inservice Inspection Program |
| Unit / Inspection Interval Applicability: | GGNS second (2nd) 10-Year Interval |

## II. REQUIREMENTS

ASME Section XI, Subarticle IWA-4170 states that repairs and installation of replacement items are performed in accordance with the Owner's Design Specification and the original Construction Code of the component or system. Later editions and addenda of the Construction Code or ASME Section III, either in their entirety or portions thereof, and Code Cases may be used. The original Construction Code for the RHR system is ASME Section III, Subsection NC, 1974 Edition, Summer 1974 Addenda.

The ASME Code establishes detailed requirements for performing base material repairs of items with defects and the installation of replacement items. When base material repairs are performed, the base material defects must be removed or reduced to an acceptable size. If the section thickness is reduced below the minimum design thickness, then the material must be repair welded. Repair welds are examined in

accordance with the applicable requirements of the Code. Alternatively, when replacements are performed instead of repairs, replacement items are installed in accordance with the applicable fabrication and examination requirements of the ASME Code.

## III. PROPOSED ALTERNATIVE

### Background

On May 9, 2001 an operator noted leakage coming from a 90° elbow in line 4"-HBB-120. It was determined that the leakage was coming from a pinhole located in an eroded area of the elbow. The eroded 90° elbow is a 4-inch, schedule 40, carbon steel (SA234, Grade WPB) fitting. The 4-inch elbow containing the pinhole flaw is located on the RHR "A" minimum flow line returning to the Suppression Pool. The elbow is located between valve E12F018A and an 18-inch tee in the test return line going to the Suppression Pool and within the outboard Containment isolation valve boundary.

The nominal wall thickness of the 90° elbow is 0.237", and the minimum design thickness is 0.043". To determine the amount of wall thinning in the 90° elbow, the wall thickness of the elbow was ultrasonically (UT) measured at 1" increments across an 8" x 12" grid centered on the pin hole leak. Additional measurements were also obtained on ¼" increments across a 3" x 3" grid centered on the pinhole. Except for the pinhole, the minimum design thickness is maintained. UT thickness measurements ranged from 0.070" to 0.265".

Repairs are performed in accordance with the original construction code as described in Section II of this request. However, an ASME Code repair of the inside diameter of the 90° elbow is not practical. Due to system configuration and the small diameter of the piping, the inside diameter of the elbow is inaccessible.

The installation of replacement items is also performed in accordance with the original construction code. However, a plant shutdown would be required to perform a replacement of the elbow. The elbow in question forms a part of the minimum flow line for the RHR "A" pump. It serves to protect the pump during pump starts by providing a flow path from the pump discharge to the Suppression Pool. The minimum flow line automatically isolates once sufficient flow is established to the main header. The total duration of flow through the minimum flow line on a pump start is generally less than 30 seconds. Additionally, this elbow is an ASME Class 2 pressure boundary component, which interfaces directly with the Suppression Pool without any isolation valves in between. Therefore this elbow must function to ensure Containment integrity is maintained within design allowable water leakage limits from Containment under normal and post-LOCA conditions. The elbow must also function to ensure Suppression Pool inventory requirements are met. While Entergy's preference is to replace the elbow, its removal would create an unisolatable 4-inch opening in the Containment boundary. A 4-inch size opening cannot be supported by allowable

Containment leakage limits and the calculated post accident LOCA dose analysis. Therefore, a plant shutdown is required to replace the elbow.

**Proposed Alternative**

Pursuant to 10CFR50.55a(a)(3)(ii), Entergy proposes an alternative to performing an internal repair or a replacement of the 90° elbow in accordance with IWA-4170. Specifically, Entergy requests approval to restore the wall thickness of the elbow by means of an outside diameter weld deposited carbon steel overlay in accordance with ASME Section XI Code Case N-561-1. The request for alternative is limited to the remainder of the current operating cycle and specific to the 90° elbow with the pinhole leak in line 4"-HBB-120. At the next refueling outage, the 90° elbow with the weld overlay will be replaced in accordance with the applicable requirements of ASME Section XI.

Entergy believes that compliance with the repair rules as stated in Reference 1 and as described in Section II of this request will result in hardship and unusual difficulty without a compensating increase in the level of quality and safety. Additionally, the proposed alternative provides an acceptable level of safety and quality as demonstrated by the following paragraphs.

## IV. BASIS FOR PROPOSED ALTERNATIVE

ASME Section XI Code Case N-561-1 provides an alternative to performing an internal weld repair or replacement of carbon steel piping components experiencing internal wall thinning or pitting in ASME Class 2 or high energy ASME Class 3 piping system. According to the code case, the weld metal overlay (reinforcement) is applied to the outside diameter of the piping component.

**Code Case N-561-1**

The code case contains strict requirements regarding materials, design, installation, examination, and follow-up inspections of the overlay as summarized below.

- **Materials:** This code case provides sufficient requirements to ensure that material condition of the piping components and weld overlays are appropriately evaluated and monitored. The material to which the weld overlay will be applied must be evaluated to establish the existing average thickness and the extent and configuration of degradation to be reinforced by the weld overlay. In addition, degradation of the overlaid piping and weld overlay must also be predicted, considered in the design, and monitored.

- **Design:** The code case provides sufficient requirements and detail to ensure development of a sound design. Design requirements in the code case address overlay thickness, overlay thickness after predicted degradation, minimum distance between overlays, minimum distance between weld overlays and any branch connection reinforcement, orientation of overlays, overlay configuration and dimensions, tensile strength of weld overlay filler metal, and flexibility analysis.

- **Installation:** The code case establishes detailed instructions for fabrication of the weld overlay. According to the code case, welding procedures must be qualified in accordance with ASME Section IX and the construction code. Welding procedures must also be qualified as groove welding procedures to ensure that the appropriate mechanical properties of the weld overlay meet design requirements. The code case also addresses temper bead welding applications, welding where through-wall repairs are required, and welding with water or steam backing.

- **Examination:** The code case establishes detailed inspection criteria to ensure the soundness of the weld overlay. The code case requires the following inspection requirements: (1) surface examination of the surface area to which the overlay will be applied, (2) surface examination of any required through-wall repairs, (3) surface examination of the first weld overlay layer, (4) surface and volumetric examination of the completed weld overlay, (5) UT examination to verify acceptable wall thickness, and (6) follow-up inspections to monitor degradation of weld overlay.

**Suitability of Weld Overlay Repair**

The repair to be performed to seal the leak and to restore the wall thickness will be achieved by a welding process. The welding process would deposit sufficient metal to ensure that the thinned region is re-built to the nominal wall dimension. The material used for welding is similar in composition to the low carbon steel elbow. Hence, the flow accelerated corrosion (FAC) characteristics are expected to be similar. Welding in low carbon steel is not expected to produce microstructures susceptible to enhanced corrosion since there would be no deleterious transformation products. The welding of low carbon steel is also not expected to produce welding-induced flaws owing to the soft microstructure of the base metal. The extensive nondestructive examination, required for the repair effort, would ensure that no significant welding-related defects exist and that the bond between the existing base metal and the deposited weld metal is sound. Given this scenario, the behavior of the base metal/weld metal composite should exhibit similar FAC behavior as the original base metal. Since the inside surface of the elbow has been significantly roughened by FAC, there is a possibility of a slightly higher FAC wear rate during the current operating cycle. As a result, the wall thickness of the elbow will be monitored for degradation as addressed in the **Follow-Up Inspections** section below.

The repair will be limited to the remainder of the current operating cycle with the additional requirement of periodic inspection (to monitor wall thickness) of the repair. The combination of the required inspections, limited life, restoration to nominal wall thickness, and metallurgical similarity of the repair to the base metal significantly reduces the likelihood that there would be an unanticipated leak developing during the lifetime of this repair. Therefore, it is concluded that the proposed repair does restore the elbow to a condition similar to the original elbow.

**Follow-Up Inspections**

Degradation of the 4-inch, 90° elbow in RHR "A" minimum flow recirculation line 4"-HBB-120 is a function of the operating cycle of RHR Pump "A". When the pump is running, the flow velocity through line 4"-HBB-120 is high -- approximately 25 ft/sec. Therefore, the schedule to monitor degradation of the elbow must be based upon the pump operating cycle. Based upon planned surveillance testing and usage, Entergy estimates that RHR Pump "A" will be operated approximately 21 times during the remainder of the current operating cycle.

Initially, UT measurements of the weld overlay will be obtained after each of the first two pump starts. These measurements will be evaluated to predict the maximum degradation of the weld overlay for its design life, which is the balance of the present operating cycle. Future inspections will be scheduled based upon the results of this evaluation as follows:

- UT measurements will be taken after every three pump starts provided the maximum predicted degradation results in an overlay thickness that meets minimum design thickness requirements through the present operating cycle.

- UT measurements will continue to be performed after each pump start if the maximum predicted degradation results in an overlay thickness that does not meet minimum design thickness requirements through the present operating cycle.

## V. CONCLUSION

10CFR50.55a(a)(3) states:

"Proposed alternatives to the requirements of (c), (d), (e), (f), (g), and (h) of this section or portions thereof may be used when authorized by the Director of the Office of Nuclear Reactor Regulation. The applicant shall demonstrate that:

(i) The proposed alternatives would provide an acceptable level of quality and safety, or

(ii) Compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety."

Entergy believes that compliance with the repair rules as stated in Reference 1 and as described in Section II of this request will result in hardship and unusual difficulty without a compensating increase in the level of quality and safety. Therefore, we request the proposed alternative be authorized pursuant to 10CFR50.55a(a)(3)(ii).

## IDENTIFIED COMMITMENTS

| COMMITMENT | TYPE (Check one) | | SCHEDULED COMPLETION DATE (If Required) |
|---|---|---|---|
| | ONE-TIME ACTION | CONTINUING COMPLIANCE | |
| As part of the root cause determination for the degraded elbow, Entergy will perform destructive metallurgical testing of the degraded elbow to aid in determining the actual cause of the pinhole leak. This determination will be completed six months following replacement of the elbow. | ✓ | | Six months following replacement of the elbow |
| The elbow will be replaced during the next scheduled refueling outage. | ✓ | | Prior to startup from the next scheduled refueling outage. |
| Initially, UT measurements of the weld overlay will be obtained after each of the first two pump starts. These measurements will be evaluated to predict the maximum degradation of the weld overlay for its design life, which is the balance of the present operating cycle. Future inspections will be scheduled based upon the results of this evaluation as follows:<br>• UT measurements will be taken after every three pump starts provided the maximum predicted degradation results in an overlay thickness that meets minimum design thickness requirements through the present operating cycle.<br>• UT measurements will continue to be performed after each pump start if the maximum predicted degradation results in an overlay thickness that does not meet minimum design thickness requirements through the present operating cycle. | | ✓ | Continuing compliance until replacement of the degraded component |