November 14, 2002

Mr. Michael Kansler
Sr. Vice President and Chief
Operating Officer
Entergy Nuclear Operations, Inc.
440 Hamilton Avenue
White Plains, NY 10601

SUBJECT: JAMES A. FITZPATRICK NUCLEAR POWER PLANT - REQUEST FOR RELIEF NO. RR-28 FOR THE THIRD 10-YEAR INSERVICE INSPECTION INTERVAL PROGRAM PLAN FOR THE JAMES A. FITZPATRICK NUCLEAR POWER PLANT (TAC NO. MB3750)

Dear Mr. Kansler:

By letter dated September 12, 2002, you submitted Relief Request No. RR-28, Rev. 3, under the third 10-year inservice inspection interval program plan for the James A. FitzPatrick Nuclear Power Plant. This relief request modified information in earlier submittals dated December 3, 2001, May 8, 2002, and July 10, 2002. You have proposed an alternative repair technique pursuant to the provisions of Title 10 of the *Code of Federal Regulations* 10 CFR 50.55a(a)(3)(i), which states that alternatives to the requirements of Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) may be used, when authorized by the NRC, if the proposed alternatives would provide an acceptable level of quality and safety in lieu of complying with the corresponding requirements of the ASME Code.

The Nuclear Regulatory Commission (NRC) staff has reviewed your submittals as discussed in the enclosed safety evaluation. You have proposed to use the alternative repair techniques provided in Code Case N-562-1 with additional conditions, restrictions and/or exceptions. The repair involves the application of additional weld metal on the exterior of the piping system to restore the wall thickness requirement in lieu of an ASME Code repair. The NRC staff has determined that your proposed alternative will provide an acceptable level of quality and safety for one fuel cycle in lieu of performing a Code repair on the specific systems described in the relief request. Therefore, the proposed alternative is authorized for the James A. FitzPatrick Nuclear Power Plant pursuant to 10 CFR 50.55(a)(3)(i) for one fuel cycle (until refueling outage 16 currently scheduled for the fall of 2004), at which time an ASME Code repair will be made on the affected pipe lines.

Sincerely,

***/RA/***

Richard J. Laufer, Chief, Section 1
Project Directorate I
Division of Licensing Project Managment
Office of Nuclear Reactor Regulation

Docket No. 50-333

Enclosure: Safety evaluation

cc w/encl: See next page

November 14, 2002

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST TO USE ALTERNATIVE WELD REPAIR TECHNIQUES

JAMES A. FITZPATRICK NUCLEAR POWER PLANT

ENTERGY NUCLEAR OPERATIONS, INC.

DOCKET NUMBER 50-333

## 1.0 INTRODUCTION

By letter dated September 12, 2002, Entergy Nuclear Operations, Inc. (ENO), the licensee, submitted Relief Request No. RR-28, Rev. 3 for the James A. FitzPatrick Nuclear Power Plant. This relief request modified information in earlier submittals dated December 3, 2001, May 8, 2002, and July 10, 2002. The letters dated May 8, 2002, July 10, 2002, and September 12, 2002, were in response to the Nuclear Regulatory Commission's (NRC) staff requests for additional information (RAI). ENO is proposing an alternative repair technique pursuant to the provisions of Title 10 of the *Code of Federal Regulations*, 10 CFR 50.55a(a)(3)(i), which states that alternatives to the requirements of Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) may be used, when authorized by the NRC, if the proposed alternatives would provide an acceptable level of quality and safety in lieu of complying with the corresponding requirements of the ASME Code.

## 2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(a)(2), systems and components of boiling and pressurized water cooled nuclear power reactors must meet the requirements of the ASME Code. Section XI of the ASME Code requires that repairs be reconciled to the Owners original Code of Construction or to the Owners Design Specification for the component or system, and that defects be removed or reduced in size in accordance with the repair requirements of ASME Code, Section XI Article IWA-4000.

Per the provisions of 10 CFR 50.55a(a)(3), licensees may request NRC approval of alternatives to the existing ASME Code requirements. ENO proposed to use the alternative repair technique provided in Code Case N-562-1 in lieu of meeting the requirements of paragraph IWA-4310 of ASME Code, Section XI. The licensee's request for approval of this alternative was based on their determination that the alternative meets the provisions given in 10 CFR 50.55a(a)(3)(i) as it would "provide an acceptable level of quality and safety."

## 3.0 TECHNICAL EVALUATION

### Code Requirement

ASME Code, Section XI, IWA-4310 requires that the defect be removed or reduced in size in accordance with Article IWA-4000.

### Component Identification

IWA-4000/ISI ASME Class 3 moderate energy residual heat removal (RHR) service water (SW) piping. Line numbers 16"-WS-151-30A, 16"-WS-151-30B, and 22"-WS-151-57. The bounding or “worst case” location where corrosion is occurring is in line number 16"-WS-151-30A.

### 3.1 Licensee’s Code Relief Request

Relief is requested from removing defects and repairing the components identified above in accordance with the design specification or the original construction code for internal wall thinning or pitting resulting from conditions such as, but not limited to, microbiological corrosion (MIC); cavitation induced pitting; erosion/corrosion and/or localized pitting corrosion. The relief request does not apply to the repair of corrosion-assisted cracking or any other cracking phenomena. The licensee requested relief to apply the alternative repair method specified in ASME Code Case N-562-1. This alternative repair technique permits the application of additional weld material to the outside of a piping system (a weld overlay) to restore the pipe’s wall thickness to a value greater than that specified in the ASME Code as the minimum wall thickness.

Pursuant to 10 CFR 50.55a(a)(3)(i), relief is requested on the basis that the proposed alternative will provide an acceptable level of quality and safety. ENO proposes to use the Shielded Metal Arc Welding (SMAW) process for the weld overlay on piping that cannot be drained. They also propose to use the following welding processes for the weld overlay on piping that can be drained: Gas Tungsten Arc Welding (GTAW) - (manual and/or automated); Gas Metal Arc Welding (GMAW) and Flux Cored Arc Welding (FCAW). These processes offer advantages, such as, higher deposition rates or automated remote welding over the SMAW method.

### 3.2 Licensee’s Basis for Requesting Relief

Code Case N-562-1 provides an alternative to the IWA-4000 requirements for the repair of internal piping system defects or degradation resulting from corrosion. The ASME Code, Section XI Code Committee determined that such a weld overlay would restore the minimum piping wall thickness at the flawed location and would ensure that an adequate level of quality and safety is being maintained. ENO expects these weld overlays to be approximately 8" x 8" in size, with thicknesses of up to 0.375" as may be required to restore pipe minimum wall thickness. ENO has been monitoring the affected piping sections since 1996 for wall thinning/degradation rates, and expects no more than 4 overlays will be required prior to the next scheduled piping replacement in the fall of 2004. In their September 12, 2002, submittal ENO provided a license commitment, which confirmed that the weld overlays which may be installed based upon this relief request would not be permitted after their 2004 refueling outage.

Therefore, the licensee determined that the proposed alternative is justified per 10 CFR 50.55a(a)(3)(i), as the proposed repair will provide an acceptable level of quality and safety for one cycle of operation.

Provisions for the use of this code case will be addressed in their repair and replacement program procedure. Those provisions will require that adjacent areas be examined to verify that the repair will encompass the entire flawed area and that there are no other unacceptable degraded locations within a representative area dependent on the degradation mechanism present. An evaluation of the degradation and an estimation of the remaining service life will be performed as required by ENO Design Engineering procedures for any type of wall thinning detected by Non-Destructive Examination (NDE) methods. This includes MIC, Flow Accelerated Corrosion (FAC), etc. The calculation ensures that there is adequate remaining service life and margin to the design code minimum allowable wall thickness. The licensee also stated that re-inspection of the weld overlay and the surrounding areas would be performed within a period of no greater than 6 months. For piping in which a through wall flaw has been detected, the piping shall be drained prior to performing the repair.

By letter dated September 12, 2002, ENO provided additional information regarding wall thinning rates at the locations for which they may wish to apply Code Case N-562-1. Since there is a possibility that the corrosion could reduce the pipe wall to below the Code minimum before the next outage when the pipe could be replaced, this information was requested to justify the use of the weld overlay repair for one cycle. Responses to previous requests for information had not provided enough information for the staff to determine if the data presented was representative or bounding to all forms of degradation and for all locations of the piping. ENO in this latest letter provided an example of the bounding or “worst case” result (i.e., the lowest reading) among the wall thinning locations within the Residual Heat Removal Service Water (RHRSW) system currently being monitored by Entergy. They also stated that they believe that the degradation mechanism is MIC. This latest inspection data recorded in July 2002, was performed on the bounding location and the Ultrasonic Testing thickness measurement was reported. This latest re-inspection result suggests that the localized corrosion rate might have declined to essentially zero (0) mils per year. ENO’s explanation of this phenomenon is:

1. The subject line is part of the RHR service water system. The RHR service water (RHRSW) pumps take suction from the emergency service water (ESW) bay and get makeup water through a “keep full” line from a service water pump when the RHRSW pumps are not running.

2. The service water system, including the RHRSW system, is periodically chlorinated in an effort to control MIC attacks on the piping. The RHRSW system is also run for quarterly surveillance and other plant needs. Since 2000, the RHRSW system has also been used periodically to moderate the temperature of the suppression pool. Chlorination is performed directly into the ESW bay for approximately 1 hour prior to any known runs of greater than 5 minutes of the RHRSW pumps (chlorination is performed within environmental restrictions). This practice increases the chlorine concentration (and the duration of having the higher concentration) within the RHRSW piping.

3. It is therefore believed that this chlorination practice is effective in controlling MIC degradation, and decreased the piping wall loss due to MIC to essentially zero (0) mills per year. A follow-up examination has been planned for June 2003 timeframe to further validate our conclusion, and to verify the minimum wall thickness requirement is still met. Other pitting locations on lines 30A/30B and 57 currently being monitored within the RHRSW system will be re-inspected at that time as well.

3.3 Licensee's Proposed Alternative Repair Technique

A number of alternatives (Generic Letter (GL) 90-05, Code Cases N-513 and N-523) are currently available and approved by the NRC for the evaluation and repair of pipe wall thinning and pitting (including through wall leaks). However, these alternatives have their limitations and do not always encompass the specific situations that arise from a large bore service water system (SWS) piping leak. The specific sections of SWS piping for which ENO is seeking relief are the large bore, 16" and 22" nominal pipe size (NPS), residual heat removal (RHR) service water piping from the RHR heat exchanger outlet to the last isolable valve before discharge into the lake. If and when a leak is developed, Code Case N-523 cannot be used since it only applies to piping 6" NPS and smaller. While the guidance provided by GL 90-05 and Code Case N-513 could be used to accept the leaking condition, even if the structural integrity of the piping can be ascertained, the leak would most likely continue to increase in size over time and may be impractical to permit. If the flaw exceeds the acceptance criteria provided by GL 90-05 or N-513, an emergency code repair (which may include up to full piping replacement of the affected sections) would be required. This would pose a significant hardship on plant operations and could require a plant shutdown. Therefore, Entergy requests that a relief be granted to use a weld overlay in lieu of a Code weld repair on the RHRSW piping, during operating cycle 16, so that an unscheduled plant shutdown could be avoided. Any weld overlay installed during operating cycle 16 would be replaced with an ASME Code repair at the next scheduled refueling outage (R16) in the fall of 2004.

The ASME Section XI Code Committee recognized that an alternative repair approach existed for internal wall thinning of Class 3 piping systems which have experienced degradation mechanisms such as flow-assisted corrosion and/or microbiological corrosion. This alternative repair technique as described in Code Case N-562-1 involves the application of additional weld metal on the exterior of the piping system, which restores the wall thickness requirement. Code Case N-562-1 was approved by the ASME Section XI Code Committee on July 30, 1998. However, it has not been incorporated into NRC Regulatory Guide 1.147 and, thus, is not available for application at nuclear power plants.

ENO will implement the requirements of Code Case N-562-1 in its entirety with the additional conditions, restrictions and/or exceptions as described below:

- Evaluate the use of Code Cases N-513 "Evaluation Criteria for Temporary Acceptance of Flaws in Class 3 Piping, Section XI, Division 1," or N-523 "Mechanical Clamping Devices for Class 2 and 3 Piping, Section XI, Division 1" prior to use of Code Case N-562-1, for the identified Class 3 moderate energy (i.e., less than or equal to 200°F and/or less than or equal to 275 psig maximum operating pressure) piping system repairs resulting from phenomenon such as flow-assisted corrosion and/or microbiological corrosion. These types of defects are typically identified by small leaks in the piping system or by pre-emptive non-

Code and Code-required examinations performed by the licensee to monitor the degradation mechanisms.

- When engineering evaluation determines that the aforementioned guidance or code cases are not suitable, the repair technique described in Code Case N-562-1 may be utilized for the particular defect or degradation being resolved. The Code Case N-562-1 weld overlay will only be applied to the RHR service water system piping on the specified line numbers.

- The repair will be considered to have a maximum service life of one fuel cycle (until refueling outage 16 currently scheduled for the fall of 2004 at which time an ASME Code repair will be performed).

- Provisions for use of this code case will be addressed in the repair and replacement program procedure.

- An evaluation of the degradation and an estimation of the remaining service life will be performed as required by Entergy Design Engineering procedures for any type of wall thinning detected.

- For piping in which a through wall flaw has been detected, the piping shall be drained prior to performing the repair.

- For water-backed piping, only the SMAW process shall be used as described in Code Case N-562-1.

- The initial re-inspection of the weld overlay and its surrounding areas will be performed within a period of no greater than 6 months.

3.4 Staff Evaluation

The ASME Section XI Code Committee has provided these alternative repair techniques which they believe will provide an acceptable repair in lieu of complying with the repair requirements of Section XI. The weld overlay repair technique described in Code Case N-562-1 is designed to meet ASME Code design criteria and safety margins. However, the staff has determined that Code Case N-562-1 is not acceptable. The staff has made this determination based on the facts that: 1) neither the ASME Code nor the code case have established criteria for determining the rate or extent of degradation of the repair or of the surrounding base metal and 2) reinspection requirements are not provided to verify the structural integrity of the pipe since the root cause of the degradation may not be mitigated. The staff also has concerns related to welding on leaking and/or water backed pipe. Leaking pipes have the possibility of making very porous welds, welds with lack of fusion, very hard and/or brittle welds or even cracked welds due to hydrogen embrittlement. Welds on water backed piping have a potential for lack of fusion type of defects or very hard and/or brittle welds. Lack of fusion type defects or very hard and/or brittle welds are due to the water quench-like conditions established by water backing of a weld or water leaking into or onto a weld. Porous welds and hydrogen embrittlement are due to gas evolution due to the chemical breakdown of the water in the welding arc. To satisfy

these concerns, ENO has proposed restrictions on the use of Code Case N-562-1. Therefore, with the following restrictions on the use of this code case, the staff has determined that it would provide an acceptable alternative pursuant to 10 CFR 50.55a(a)(3)(i):

- The scope of the alternative repair techniques in RR-28 is limited to repairs of ASME Class 3 moderate energy (i.e., less than or equal to 200 °F and/or less than or equal to 275 psig maximum operating conditions) carbon steel plant service water piping systems.

- Repairs are limited to internal thinning or pitting caused by general localized corrosion, such as microbiological corrosion; cavitation induced pitting; erosion/corrosion and/or localized pitting corrosion; but excluded are conditions involving corrosion-assisted cracking or any other form of cracking.

- ENO will evaluate the use of Code Cases N-513 “Evaluation Criteria for Temporary Acceptance of Flaws in Class 3 Piping, Section XI, Division 1,” or N-523 “Mechanical Clamping Devices for Class 2 and 3 Piping, Section XI, Division 1” prior to use of Code Case N-562-1, for the identified Class 3 moderate energy (i.e., ≤ 200 °F and/or ≤ 275 psig maximum operating pressure) piping system repairs resulting from phenomenon such as flow-assisted corrosion and/or microbiological corrosion. When engineering evaluation determines that the aforementioned guidance or code cases are not suitable, the repair technique described in Code Case N-562-1 may be utilized for the particular defect or degradation being resolved. The Code Case N-562-1 weld overlay will only be applied to the RHR service water system piping on Line numbers 16"-WS-151-30A, 16"-WS-151-30B, and 22"-WS-151-57 at locations for which an analysis has been performed and wall thinning rates have been verified.

- The repair will be considered to have a maximum service life of one fuel cycle (until refueling outage 16 currently scheduled for the fall of 2004 at which time an ASME Code repair will be performed).

- The SMAW, GTAW -manual or automated, GTAW and FCAW processes may be used for these repairs on piping that is empty; however, only the SMAW process may be used on water backed piping. This process, SMAW, may only be used on water backed piping with the special requirements as stated in Code Case N-562-1.

- An evaluation of the degradation mechanism will be performed to determine the reexamination schedule to be performed over the life of the repair.

- The provisions for implementing these alternative repair techniques will be addressed in the licensee's Repair and Replacement Program Procedure.

- Weld repairs shall not be performed on surfaces that are wet or exposed to water, such as those from small leaks in the piping system.

- The initial re-inspection of the weld overlay and its surrounding areas will be performed within a period of no greater than 6 months.

In a response to the staff’s RAIs, ENO submitted an example of the bounding or “worst case” inspection results. While the degradation rate data submitted in response to the staff’s RAIs

uses only one example of wall thickness thinning due to pitting corrosion, this example does show a rate that will limit corrosion to an amount that will not compromise minimum wall. The inspection of the weld overlay and surrounding areas within a period of no greater than 6 months will also provide an acceptable level of quality and safety toward maintaining minimum wall.

These provisions provide reasonable assurance that the alternative repair techniques of Code Case N-562-1, as amended, will provide an acceptable level of quality and safety in lieu of performing the required ASME Code, Section XI, repairs on ASME Class 3 moderate energy (i.e., less than or equal to 200 °F and/or less than or equal to 275 psig maximum operating conditions) carbon steel plant service water piping systems.

## 4.0 CONCLUSION

The staff has determined that ENO has proposed an acceptable alternative technique for repair of ASME Class 3 moderate energy, carbon steel plant service water piping systems which will provide an acceptable level of quality and safety in lieu of performing the ASME Code, Section XI repairs on the systems. The licensee will follow the methods proposed in Code Case N-562-1 for weld overlay, which will only be applied to the RHR service water system piping on Line numbers 16"-WS-151-30A, 16"-WS-151-30B, and 22"-WS-151-57. Therefore, the licensee's proposed alternative to use Code Case N-562-1 is authorized pursuant to 10 CFR 50.55a(a)(3)(i) for one fuel cycle (until refueling outage 16 currently scheduled for the fall of 2004), at which time an ASME Code repair will be made on the affected pipe lines. The use of this alternative repair method is subject to the restrictions noted in Section 3.4 above.

Principal Contributor: E. Andruszkiewicz

Date: November 14, 2002

FitzPatrick Nuclear Power Plant

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