UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

August 17, 2011

Vice President, Operations
Arkansas Nuclear One
Entergy Operations, Inc.
1448 S.R. 333
Russellville, AR 72802

SUBJECT: ARKANSAS NUCLEAR ONE, UNIT 1 - RELIEF REQUEST ANO1-R&R-014 - REQUEST FOR USE OF NON-ASME CODE REPAIR TO SERVICE WATER PIPING IN ACCORDANCE WITH GENERIC LETTER 90-05 (TAC NO. ME4942)

Dear Sir/Madam:

By letter dated October 26, 2010, as supplemented by letter dated June 9, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML102990523 and ML111610444, respectively), Entergy Operations, Inc. (Entergy, the licensee), submitted Relief Request ANO1-R&R-014 to the U.S. Nuclear Regulatory Commission (NRC) for approval. In its submittal, the licensee requested relief from the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI, to make a temporary, non-Code repair to an ASME Code Class 3 moderate energy Service Water pipe at Arkansas Nuclear One, Unit 1 (ANO-1). Specifically, the licensee proposed to leave the piping in a non-Code-compliant condition until a Code-compliant repair is made at the next refueling outage, currently scheduled to begin on September 25, 2011. The licensee also placed a clamp device over the leaking defect to limit the leakage for housekeeping purposes.

In its submittal, the licensee stated that the ASME Code requirement is impractical and, pursuant to the guidance of NRC Generic Letter (GL) 90-05, "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping," dated June 15, 1990, requested the NRC staff's approval of this relief request in accordance with the provisions of paragraph 50.55a(g)(6)(i) of Title 10 of the *Code of Federal Regulations* (10 CFR).

The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that the impracticality of compliance with the Code requirements for performing an online Code repair of the subject piping is not demonstrated by this request for relief. However, compliance with Code repair of the subject degraded pipe during the current operating cycle would result in hardship without a compensating increase in the level of quality and safety and the proposed alternative provides reasonable assurance that the structural integrity of the subject pipe will be maintained until Code-compliant repair is made. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(ii). Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the NRC staff authorizes the licensee's proposed alternative at ANO-1, until the next refueling outage, currently scheduled to begin on September 25, 2011.

All other ASME Code, Section XI, requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

The NRC staff's safety evaluation is enclosed. If you have any questions, please contact Kaly Kalyanam at (301) 415-1480 or via e-mail at kaly.kalyanam@nrc.gov.

Sincerely,

Mohan Thadani /for

Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-313

Enclosure:
Safety Evaluation

cc w/encl.: Distribution via Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE NUCLEAR REACTOR REQULATION

RELIEF REQUEST ANO1-R&R-014

TEMPORARY NON-CODE REPAIR OF SERVICE WATER PIPING

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT 1

DOCKET NO. 50-313

1.0 INTRODUCTION

By letter dated October 26, 2010, as supplemented by letter dated June 9, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML102990523 and ML111610444, respectively), Entergy Operations, Inc. (Entergy, the licensee), submitted Relief Request ANO1-R&R-014 to the U.S. Nuclear Regulatory Commission (NRC) for approval. In its submittal, the licensee requested relief from the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI, to make a temporary, non-Code repair to an ASME Code Class 3 moderate energy Service Water (SW) pipe at Arkansas Nuclear One, Unit 1 (ANO-1). Specifically, the licensee proposed to leave the piping in a non-Code-compliant condition until a Code-compliant repair is made at the next refueling outage, currently scheduled to begin on September 25, 2011. The licensee also placed a clamp device over the leaking defect to limit the leakage for housekeeping purposes.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection (ISI) of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the conditions listed therein.

Pursuant to 10 CFR 50.55a(a)(3), alternatives to requirements of 10 CFR 50.55a(g) may be authorized by the NRC if the licensee demonstrates that: (i) the proposed alternatives provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements

would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. While the licensee requested the relief from the requirements of 10 CFR 50.55a(g), using the provision of 10 CFR 50.55a(g)(6)(i) for a temporary Non-Code repair to an ASME Code Class 3 pipe in accordance with the guidance provided in NRC Generic Letter (GL) 90-05, "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping," dated June 15, 1990, the NRC staff has evaluated the proposed alternative on the basis that compliance with the specified requirements would result in a hardship without a compensating increase in the level of quality or safety, 10 CFR 50.55a(a)(3)(ii).

The ASME Section XI Code of record for the current, fourth 10-year ISI interval at ANO-1, which began on May 31, 2008, and ends on May 30, 2017, is the 2001 Edition through the 2003 Addenda.

3.0 TECHNICAL EVALUATION

3.1 ASME Code Components Affected

P-4A SW pump discharge piping, which was constructed with the requirements of United States of America Standards (USAS) B31.1, is now treated as safety-related Class 3 "moderate energy" piping.

3.2 Applicable Code Requirement

ASME Code, Section XI, Paragraph IWA-4420, "Defect Removal Requirements," requires that defects be removed or mitigated.

3.3 Licensee's Proposed Alternative

Instead of performing a Code-compliant repair of the defect found in the P-4A SW pump discharge piping, the licensee proposed, in accordance with GL 90-05, to leave the system in a non-Code compliant condition until a Code-compliant-repair can be completed during the next refueling outage and to install a mechanical clamp device over the defect in the piping to limit leakage for housekeeping purposes. The clamp device will be a temporary, non-Code repair with no structural credit taken. The licensee has performed a flaw evaluation in accordance with the through-wall approach in GL 90-05 and has shown that the defect meets the guidelines of GL 90-05 for a temporary repair. Augmented inspections, including a weekly walkdown and an ultrasonic examination (UT) every 90 days at the leak location, will be performed until the Code-compliant repair is made.

3.4 The Licensee's Basis for Relief

The licensee stated that the small defect found in the piping does not challenge the structural integrity of the pipe and does not present an equipment spray, a flooding, or a reduction in system flow concern. By letter dated October 26, 2010, the licensee stated, in part, that,

> It was determined that conducting a code qualified repair [of the P-4A SW piping defect] during power operation is not feasible since the loop of SW that contains

the flaw would have to be declared inoperable and removed from service. The inoperable loop is required to be restored to service within 72 hours or the unit must be placed in Hot Shutdown within 6 hours per ANO-1 [Technical Specification (TS) 3.7.7, "Service Water System (SWS)"]. Based on the insignificance of the leak, it appears inappropriate to challenge the operation of the plant to support a code repair.

3.5 NRC Staff Evaluation

The NRC staff notes that impracticality for the purpose of GL 90-05 is defined to exist if the flaw is detected during plant operation in a section of Class 3 piping that cannot be isolated for completing ASME Code repair within the time period permitted by the limiting condition for operation specified in the plant TSS, and performance of AN ASME Code repair necessitates a plant shutdown. However, it is the staff's position that shutting down the plant to perform a mid-cycle repair is a hardship rather than impractical. Therefore, the NRC staff has evaluated the licensee's proposed alternative pursuant to 10 CFR 50.55a(a)(3)(ii), hardship or unusual difficulty without a compensating increase in the level of quality or safety, per the considerations of GL 90-05. The NRC staff has evaluated only the condition of the piping and the acceptability of delay of the Code-compliant repair until the next refueling outage. The acceptability of the clamp device is the responsibility of the licensee under 10 CFR 50.59.

The ANO-1 SW system consists of two independent, full-capacity, 100 percent redundant loops, with each loop capable of supplying cooling water to the required components during normal and emergency conditions. This redundancy allows continued plant operation when a single SW loop is removed from service. ANO-1 TS 3.7.7 requires that two SW loops be operable and powered from independent essential buses to provide redundant and independent flow paths. The licensee states that conducting a Code-compliant repair during power operation is not desirable since the SW loop that contains the flaw would have to be declared inoperable and removed from service. While the ANO-1 TS 3.7.7 permits 72 hours to affect repairs to the system, isolating, draining, and repairing the SW loop during power operation could take longer than the 72-hour allowed outage period, potentially requiring the unit to be placed in Hot Shutdown within 6 hours. The NRC staff concludes, based on the insignificance of the leak, that challenging the operation of the plant to support a Code-compliant repair would present a hardship.

The licensee states that the subject component is Class 3 moderate energy carbon steel piping, and that a defect with a leak rate of approximately 2 milliliters per minute was detected during plant operation on May 26, 2010. The licensee further states that the leak is the result of a pit initiating on the pipe inside diameter of the pipe, and that there is no equipment in close proximity to the leak location that would be adversely affected by water spray, the local floor drains are expected to mitigate any potential for flooding, and there is no appreciable impact on flow to other components in the SW system. The licensee proposes to perform a Code-compliant repair during the next scheduled outage exceeding 30 days, but no later than the next refueling outage. Based on the above, the NRC staff concludes that the licensee has met the requirements for a temporary repair to be considered under the provisions of Enclosure 1 of GL 90-05.

Enclosure 1 of GL 90-05 specifies evaluation guidelines for evaluating temporary non-Code repairs on moderate energy piping:

1. Root cause determination and flaw characterization

2. Flaw evaluation

3. Augmented inspection

The licensee states that ultrasonic thickness (UT) measurements have been performed on a 360-degree band around the circumference of the pipe at the defect location, and that a more detailed ultrasonic thickness mapping was conducted immediately around the leak. In response to the NRC staff's request for additional information (RAI) dated February 10, 2011 (ADAMS Accession No. ML110410702), the licensee stated that ultrasonic thickness measurements determined an average wall thickness away from the flaw of 0.371 inches, and that ultrasonic thickness examinations at the flaw recorded the lowest reading obtainable of 0.072 inches in successive measurements on May 26, 2010, and February 17, 2011. A visual surface examination of the flaw location following paint removal found a defect of approximately 0.20 inches by 0.050 inches. As a result of these examinations, the licensee concludes that the through-wall leak is a highly localized pit-like defect which is characteristic of Microbiologically Influenced Corrosion (MIC). The NRC staff notes that ANO-1 has a history of leaks in the SW piping, and that these leaks have been determined to be the result of MIC. Based on the licensee's ultrasonic thickness measurements, visual evaluation of the defect after paint removal, and prior operating experience, the NRC staff concludes that the licensee's determination that the defect is most likely the result of MIC is reasonable, and concludes that the root cause has been adequately determined and that the flaw has been adequately characterized.

By letter dated June 9, 2011, in response to the NRC staff's RAI dated February 10, 2011, the licensee submitted a flaw evaluation in accordance with the through-wall approach in GL 90-05. The licensee stated that, although the dimensions of the pit could not be determined using ultrasonic thickness because of the irregular surface of the edge of the weld, a "value for the through-wall flaw length, "2a", is conservatively assumed to be 0.5 inches." This value is larger than the maximum surface dimension determined by visual examination (0.2 inches). In addition, a 0.5-inch flaw would have produced a visible, steady spray at the operating pressure of 120 pounds per square inch (psi), gauge, of the SW line and only 40 drops per minute (2 milliliters per minute or 0.0005 gallons per minute (gpm)) is seen. The NRC staff concludes that the likely MIC pit dimension would be bounded by the 0.5-inch assumed pit size, thus the assumed flaw length of 0.5 inches is acceptable.

The assumed 0.5-inch size is less than the maximum size specified in GL 90-05, the lesser of 3 inches or 15 percent or the 18-inch diameter pipe circumference (0.15*3.14*18) = 8.48 inches), thus the through-wall flaw evaluation can be used. The licensee's calculation of the stress intensity factor, K, resulting from internal pressure, deadweight, seismic and thermal loading, along with the minimum measured wall thickness (0.370 inches) yields a stress intensity factor, K, of 26,902 psi$\sqrt{in}$, which is less than the maximum K of 35,000 psi$\sqrt{in}$ specified

by GL 90-05 for ferritic components. On the basis of this calculation, the NRC staff concludes that the flaw evaluation criteria of GL 90-05 have been fulfilled.

In its letter dated October 26, 2010, the licensee made two regulatory commitments regarding augmented inspections to take place until the Code-compliant repair is performed: examine the leak location every 90 days using ultrasonic thickness per the requirements of GL 90-05; and perform a weekly walkdown of the leak location. The third regulatory commitment that the licensee made is to perform a Code-compliant repair during the next scheduled outage exceeding 30 days, but no later than the next scheduled refueling outage. The NRC staff concludes that these commitments meet the guidelines of GL 90-05 and are, therefore, acceptable.

GL 90-05 also requires the evaluation of specific considerations such as:

- System interactions such as the consequences of flooding and spraying water on equipment.

In its letter dated October 26, 2010, the licensee stated, in part, that:

> Due to the small size of the leak, 2 milliliters/minute (0.0005 gpm) in the worst observed case, there was minimal spray and no flooding concerns. The leakage at present is insignificant and does not present a flooding concern. No equipment susceptible to water damage is under or adjacent to the leakage site. The magnitude of the water loss can easily be accommodated by the room drainage system and does not pose a flooding concern. Even if the leak increased several orders of magnitude, there are no flooding or spray impingement concerns. The leak is located in a well lighted area (ANO-1 Intake Structure Building) that is frequented by Operations personnel on rounds. Thus if the leak rate experienced a rapid increase it would be quickly identified and addressed. A floor drain is located approximately 3 feet from the leak and is sized to remove normal leakage from this area of the plant. However, based on the structural assessment and engineering experience with respect to flaw growth, no significant leak rate increase is expected to occur.

Due to the small leak magnitude, absence of equipment susceptible to damage by water spray or spray impingement, location of floor drains to handle flooding due to normal leakage (much higher than the existing leakage), periodic inspection of the area to watch out for an increase in the leakage, and augmented inspection of the subject pipe, the NRC staff concludes that the consequences of flooding and/or effects of water spray are very minimal and are, therefore, acceptable.

- Potential significance of a reduction or loss of flow to the system.

In its letter dated October 26, 2010, the licensee stated, in part, that:

> Due to the small leak magnitude there is no appreciable impact on flow to other components in the ANO-1 SW System. The flow margin above that required for

> the minimum margin component is 1 gpm which is bounded, assuming all leakage in this condition was taken from that component, per the latest SW flow test.

The NRC staff concludes that, considering the design rating of one SW pump (6,500 gpm), the reduction or flow loss due to the leakage is very miniscule and the potential significance of a reduction or loss of flow to the system is negligible and is, therefore, acceptable.

- Potential concerns on the inventory of the source (in this case, the emergency cooling pond (ECP)).

In its letter dated October 26, 2010, the licensee stated, in part, that:

> The ECP inventory analysis accounts for leakage from the SW boundary valves and sluice gates for both units. Per the Performance Monitoring maintained by the site, the current measured boundary leakage on ANO-2 is 8.3 gpm and on ANO-1 (and common) is 7.3 gpm for a total leakage of 15.5 gpm. The total ECP leakage assumed in the ECP inventory loss analysis is 80 gpm. The current leak is essentially imperceptible relative to ECP inventory (< 1 gpm) and thus has no impact on ECP inventory.

The NRC staff considers the current leak of less than 1 gpm, compared to the total leakage assumed in the ECP inventory loss analysis of 80 gpm, is very small, even after including the total current measured boundary leakage of 15.6 gpm. The NRC staff concludes that the additional inventory loss from the ECP because of the leak is negligible and is, therefore, acceptable.

- Evaluation of temporary non-Code repairs for design loading conditions.

The NRC staff concludes that the proposed augmented inspection program and temporary repair provide reasonable assurance of structural integrity until a Code-compliant repair can be made at the next scheduled outage. In addition, the NRC staff concludes that the licensee has demonstrated that compliance with ASME Code requirements to perform a Code-compliant repair of the P-4A SW piping defect during power operation would present a hardship without a compensating increase in the level of quality or safety.

3.6 Regulatory Commitments

In its letter dated October 26, 2010, the licensee made the following commitments:

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE (If Required)
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
Perform a code repair on Service Water line HBD-2-18"	X		During the next scheduled outage exceeding 30 days, but no later than the next scheduled refueling outage which is scheduled to begin September 25, 2011
Weekly walk down the leak location		X	This walkdown will be performed until the code repair is implemented
Re-exam the leak location every 90 days using UT per the requirements of GL 90-05		X	This examination will be performed until the code repair is implemented

The NRC staff concludes that reasonable controls for the implementation and for subsequent evaluation of proposed changes pertaining to the regulatory commitments are best provided by the licensee's administrative processes, including its commitment management program. The regulatory commitments do not warrant the creation of regulatory requirements (items requiring prior NRC approval of subsequent changes).

3.7 Hardship

The SW system consists of three independent, full capacity, and 100 percent redundant loops, with each SW loop capable of supplying cooling water to the required components during normal and emergency conditions. This redundancy allows continued plant operation when a single component failure occurs. The ANO-1 TS 3.7.7 requires that two SW loops be operable and powered from independent essential buses to provide redundant and independent flow paths.

Implementing the ASME Code repair while the plant is operating would require removing the degraded section of piping from service, which would require the entire SW loop to be secured and drained. While the ANO-1 TS permits 72 hours to effect repairs to the system, isolation and draining of a SW loop during power operation is complex and would expend a significant portion of the 72-hour allowed outage period.

In summary, the NRC staff concludes that the impracticality of compliance with the Code requirements for performing an online Code repair of the subject piping is not demonstrated by this request for relief; however, the staff concludes that compliance with a Code repair of the subject degraded pipe during the current operating cycle would result in hardship without a compensating increase in the level of quality and safety.

4.0 CONCLUSION

Based on the above, the NRC staff concludes that the impracticality of compliance with the Code requirements for performing an online Code repair of the subject piping is not demonstrated by this request for relief. However, the staff concludes that compliance with a Code repair of the subject degraded pipe during the current operating cycle would result in hardship without a compensating increase in the level of quality and safety and the proposed alternative provides reasonable assurance that the structural integrity of the subject pipe will be maintained until Code-compliant repair is made. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(ii). Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the NRC staff authorizes the licensee's proposed alternative at ANO-1, until the next refueling outage, currently scheduled to begin on September 25, 2011.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributors: J. Wallace
D. Hoang

Date: August 17, 2011

All other ASME Code, Section XI, requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

The NRC staff's safety evaluation is enclosed. If you have any questions, please contact Kaly Kalyanam at (301) 415-1480 or via e-mail at kaly.kalyanam@nrc.gov.

Sincerely,

/ra/ (MThadani for)

Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-313

Enclosure:
Safety Evaluation

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