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

March 21, 2013

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

SUBJECT: ARKANSAS NUCLEAR ONE, UNIT 2 - REQUEST FOR RELIEF ANO2-ISI-010 FROM ASME CODE, SECTION XI, REQUIREMENTS FOR CATEGORY B-J WELDS FOR THE THIRD 10-YEAR INSERVICE INSPECTION INTERVAL (TAC NO. ME8272)

Dear Sir or Madam:

By letter dated March 26, 2012, as supplemented by letter dated February 5, 2013, Entergy Operations, Inc. (the licensee), proposed Request for Relief (RR) No. ANO2-ISI-010 (in addition to other RRs) from certain requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (ASME Code), under the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR), paragraph 50.55a(g)(6)(i), for the third 10-year inservice inspection (ISI) program for Arkansas Nuclear One (ANO), Unit 2. The ANO, Unit 2, third 10-year ISI interval ended on March 25, 2010. The licensee extended the third 10-year ISI interval by 1 year in accordance with ASME Code, Section XI, Paragraph IWA-2430 for the 2R21 (21st) refueling outage.

RR ANO2-ISI-010 covers 30 Code Class 1 pressure retaining welds in piping, examination category B-J, Item numbers B9.11, B9.21, R1.11, and R1.20.

The U.S. Nuclear Regulatory Commission (NRC) staff concludes that achieving essentially 100 percent volumetric examination is impractical for the subject welds due to the geometric configuration or materials of construction. In addition, based on the volumetric coverage obtained, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations performed. Therefore, the staff concludes that the proposed alternative will not endanger life or property or the common defense and security and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

Based on the enclosed safety evaluation, the NRC staff concludes that due to materials and geometric configuration of the subject welds at ANO, Unit 2, obtaining the ASME Code-required examination coverage is impractical. The staff further concludes that weld examination coverage that has been achieved provides reasonable assurance of the structural integrity of the subject welds. The staff concludes that granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. Therefore, the staff grants the

licensee's RR ANO2-ISI-010, pursuant to 10 CFR 50.55a(g)(6)(i) for the ANO, Unit 2, third 10-year ISI interval.

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

The NRC staff's safety evaluation is enclosed.

Sincerely,

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

Docket No. 50-368

Enclosure:
Safety Evaluation

cc w/encl: Distribution via Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST ANO2-ISI-010

EXAMINATION REQUIREMENTS FOR CATEGORY B-J WELDS

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT 2

DOCKET NO. 50-368

1.0 INTRODUCTION

By letter dated March 26, 2012, as supplemented by letter dated February 5, 2013 (References 1 and 2, respectively), Entergy Operations, Inc., (the licensee) submitted Request for Relief (RR) No. ANO2-ISI-010 requesting relief (in addition to other RRs) from certain requirements of the American Society of Mechanical Engineers (ASME),) Boiler and Pressure Vessel Code (ASME Code), under the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR), paragraph 50.55a(g)(6)(i), for the third 10-year inservice inspection (ISI) program for Arkansas Nuclear One (ANO), Unit 2. The ANO, Unit 2, third 10-year ISI interval ended on March 25, 2010. The licensee extended the third 10-year ISI interval by 1 year in accordance with ASME Code, Section XI, Paragraph IWA-2430 for the 2R21 (21st) refueling outage.

In RR ANO2-ISI-010, the licensee requested relief from required volumetric examination coverage of ASME Code, Section XI, Examination Category B-J welds under the ANO, Unit 2, Risk-Informed Inservice Inspection (RI-ISI) Program which was approved in a safety evaluation dated December 29, 1998 (Reference 3), by the Office of Nuclear Reactor Regulation.

Specifically, the licensee stated that it is impractical to obtain essentially 100 percent examination coverage of the subject welds, and to obtain additional coverage would necessitate modification and/or replacement of the component. The licensee also stated that the examinations performed on the subject areas, in addition to the examination of similar welds contained in the program, would detect generic degradation, if it existed, demonstrating an acceptable level of integrity. The licensee requested relief from the ASME Code requirements on the basis that obtaining increased examination coverage is impractical and accepting the present examination coverage will not endanger life or property or the common defense and security and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the pre-service examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection 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 inspection interval and subsequent 10-year inspection 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 inspection interval, subject to the conditions listed therein.

The regulations in 10 CFR 50.55a(g)(5)(iii) state, in part, that that licensees may determine that conformance with certain code requirements is impractical and that the licensee shall notify the Commission and submit information in support of the determination.

The regulations in 10 CFR 50.55a(g)(6)(i) state that the Commission will evaluate determinations under paragraph (g)(5) of this section that code requirements are impractical. The Commission may grant such relief and may impose such alternative requirements as it determines is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

Based on analysis of the regulatory requirements, the NRC staff concludes that the NRC has the regulatory authority to grant the requested relief under 10 CFR 50.55a(g)(6)(i).

The ASME Code of record for the ANO, Unit 2, third 10-year ISI interval program is the 2001 Edition through the 2003 Addenda of Section XI of the ASME Code. ANO, Unit 2, also uses the 1995 Edition through the 1996 Addenda for ultrasonic testing (UT) examination requirements.

3.0 TECHNICAL EVALUATION

3.1 Components for which Relief is Being Requested

Code Class 1 pressure retaining welds in piping, examination category B-J, Item numbers B9.11, B9.21, R1.11, and R1.20.

Weld No.	Item Description
02-T-082	Reactor Vessel Closure Head (RVCH) Instrument Nozzle Tube-to-Flange #82
02-T-083	RVCH Instrument Nozzle Tube-to- Flange #83
21-001	Safety Injection Loop 1A Safe End-to-Nozzle Circumferential Weld
21-007	Safety Injection Loop 1A Elbow to- Valve Circumferential Weld
22-001	Safety Injection Loop 1B Safe End to Nozzle Circumferential Weld
22-004	Safety Injection Loop 1B Valve to- Pipe Circumferential Weld

Weld No.	Item Description
22-005	Safety Injection Loop 1B Pipe to- Valve Circumferential Weld
23-001	Safety Injection Loop 2A Safe End-to-Nozzle Circumferential Weld
23-006	Safety Injection Loop 2A Valve to- Pipe Circumferential Weld
23-007	Safety Injection Loop 2A Pipe to- Valve Circumferential Weld
24-001	Safety Injection Loop 2B Safe End-to-Nozzle Circumferential Weld
24-006	Safety Injection Loop 2B Pipe to- Valve Circumferential Weld
25-024	Shutdown Cooling Pipe to-Weld-o-let Circumferential Weld
27-001	Pressurizer Spray Loop 1B Safe End-to- Nozzle Circumferential Weld
27-002	Pressurizer Spray Piping Loop 1B Safe End-to-Elbow Circumferential Weld
27-003	Pressurizer Spray Piping Loop 1B Elbow to-Pipe Circumferential Weld
27-065	Pressurizer Spray Piping Loop 1B Valve to-Pipe Circumferential Weld
27-066	Pressurizer Spray Piping Loop 1B Pipe to-Tee Circumferential Weld
40-005	Charging Piping Loop 1A Valve-to-Pipe Circumferential Weld
40-008	Charging Piping Loop 1A Pipe-to-Elbow Circumferential Weld
40-025	Charging Piping Loop 1A Elbow to- Safe End Circumferential Weld
41-003	Charging Piping Loop 2A Valve-to-Pipe Circumferential Weld
41-003C	Charging Piping Loop 2A Tee-to-Pipe Circumferential Weld
43-022	Pressurizer LTOP Tee-to- Pipe Circumferential Weld
43-023	Pressurizer LTOP Tee-to- Pipe Circumferential Weld
43-027	Pressurizer LTOP Pipe-to- Valve Circumferential Weld
43-033	Pressurizer LTOP Tee-to- Pipe Circumferential Weld
13-008	RCP 2P-32C Discharge Nozzle Safe End-to-Pipe Circumferential Weld
15-008	RCP 2P-32D Discharge Nozzle Safe End-to-Pipe Circumferential Weld
29-056	Pressurizer Auxiliary Spray Pipe-to-Tee Circumferential Weld

3.2 ASME Code Requirements

The Code of record for the ANO-2 third 10-year ISI interval program is the 2001 Edition through the 2003 Addenda of Section XI of the ASME Code. The ANO-2 third 10-year ISI interval ended on March 25, 2010, but the licensee extended the ISI interval by 1 year in accordance with ASME Code, Section XI, Paragraph IWA-2430 to encompass the spring 2011 refueling outage, 2R21.

In its letter dated March 26, 2012, the licensee, stated, in part, that

> ASME Section XI, Table IWB-2500-1, Examination Category B-J, "Pressure Retaining Welds in Piping – Inspection Program B":
>
> 1) Item B9.11, as allowed by the risk informed (RI) process, requires a volumetric examination of circumferential piping welds Nominal Pipe Size (NPS) 4 or larger, as depicted in Figures IWB-2500-8 and Risk-Informed Inservice Inspection Evaluation Procedure, Electric Power Research Institute (EPRI) Report No. TR-106706, Interim Report, June 1996.
>
> 2) Item B9.21 requires a volumetric examination of circumferential piping welds less than NPS 4, as depicted in Figures IWB-2500-8 and Risk-Informed Inservice Inspection Evaluation Procedure, EPRI Report No. TR-106706, Interim Report, June 1996.

3.3 Licensee's Proposed Alternative

No alternative testing is proposed at this time. The licensee stated that it has examined the subject items to the extent practical and will continue to perform pressure testing on the subject areas as required by the ASME Code.

3.4 Licensee's Basis for Requesting Relief (as stated by the licensee)

> During ultrasonic examination of the piping welds listed in Table 1 above, greater than 90% coverage of the required examination volume could not be obtained.
>
> Class 1 piping and components are often designed with welded joints such as nozzle-to-pipe, pipe-to-valve and pipe-to-pump which can physically obstruct a large portion of the required examination volume. For examinations performed after the 10 CFR 50.55a mandatory implementation date for Appendix VIII of Section XI, and Code coverage percentages reflect what is currently allowed by qualified Appendix VIII techniques. Appendix VIII qualified Performance Demonstration Initiative (PDI) procedures have demonstrated that sound beams may potentially be attenuated and distorted when required to pass through austenitic weld metal. Still, the PDI qualified methods employ the best available technology for maximizing examination coverage of these types of welds. Examination was extended to the far side of the weld to the extent permitted by geometry, but this portion of the examination is not included in the reported coverage for welds examined under PDI and Appendix VIII rules.
>
> These ultrasonic examinations have been performed over the course of the interval to varying code requirements and procedures. Entergy has used the best available and EPRI approved techniques to examine the subject piping welds. To improve upon these examination coverage percentages, modification and/or replacement of the component would be required. Consistent with the ASME Section XI sampling approach, examination of the subject welds, when combined with examinations that have been performed on other welds within the

same Examination Category, is adequate to detect generic degradation, if it existed, demonstrating an acceptable level of integrity.

3.5 NRC Staff Evaluation

The ASME Code, Section XI, requires essentially 100 percent volumetric and surface examinations for Examination Category B-J pressure retaining welds in piping. However, complete volumetric examinations can be restricted by component design, materials, or weld configurations. The NRC staff recognizes that these conditions can preclude the licensee from obtaining full volumetric examination coverage from both sides of welds.

By letter dated February 5, 2013, in response to the NRC staff's request for additional information (RAI) dated September 6, 2012 (Reference 4), the licensee stated, in part, that

> The component selection process purposely includes welds that have configurations to fittings such as elbows, tees, valves and nozzles. To remove these components in favor of a non-restricted component, e.g., pipe to pipe, would result in an ISI program selection process that would not be conservative or represent the piping system configurations.
>
> Review of the data sheets indicates that best effort scanning was performed on both sides of the weld joint where accessible and feasible. Generally, it is not feasible to scan from a valve side or branch connection due to material, surface condition, or part geometry.

The NRC staff recognizes that inclusion of these components results in weld examinations with less than essentially 100 percent examination coverage, but concludes that it is appropriate to include such components in an ISI program in order to sample the range of weld configurations that are in the piping system.

In response to the NRC staff's RAI, the licensee provided scale drawings of the examination coverage for each of the subject welds, and data was for the diameter, wall thickness, and materials of construction. The staff has reviewed the licensee's submittal and concludes that the limitations encountered during the performance of the UT examinations generally result from the existence of cast austenitic stainless steel (CASS) safe ends that limit axial direction scanning from the CASS-side of the weld, curvature at the transition region from the nozzle-to-safe end, pipe-to-valve and pipe-to-tee weld configuration, weld crown profile or the existence of nozzles adjacent to the weld being examined. In response to the staff's RAI, the licensee stated that best effort scanning was performed from both sides of the weld joint where accessible and feasible. Based on the above, the NRC staff concludes that the licensee has examined the subject welds to the extent practicable and that it is impractical to perform an essentially 100 percent volumetric examination without redesigning, modifying, and/or replacing the subject components.

The NRC staff has reviewed the licensee's drawings and the data in Table 1 of the licensee's RAI response and has considered the examination coverage and degradation mechanism for each of the 30 subject welds.

Weld 40-025, for which a thermal transient (TT) degradation mechanism was assigned, was missing coverage over approximately 30 percent of the intrados circumference of the elbow, resulting in a volumetric examination coverage of 85 percent. The NRC staff concludes that the high examination coverage attained would have revealed if significant service-induced degradation had occurred and, therefore, accepts the examination of this weld.

Weld 43-033, for which TT and thermal stratification and cycling and striping (TASCS) degradation mechanisms are assigned, is limited by the curvature of the adjacent tee. Double-sided examination of the root of the weld and the pipe was obtained, and single-sided coverage was obtained for the remaining examination volume. Since a high degree of double-sided examination was achieved and the single-sided examination of the remaining volume was being conducted through relatively thin wrought material thickness, the NRC staff concludes that the examination of this weld is acceptable.

The remaining welds have been placed into different categories based on the examination coverage attained and the reason for the missing examination coverage. The first category consists of those welds where UT scan coverage of the inside diameter (ID) surface of the root of the weld and heat affected zone (HAZ) was 100 percent. The NRC staff evaluated ID examination coverage because flaws resulting from degradation mechanisms would generally be expected to initiate at the ID surface. Welds included in this category are 02-T-082, 02-T-08, 21-001, 24-001, 25-024, 27-001, 40-005, 41-003, 41-003C, and 43-022. In addition to the ID scan coverage achieved for the welds in this category, two of the welds for which a degradation mechanism was assigned, welds 25-024 and 43-022, had an adjacent weld examined. The NRC staff concludes that the critical zones for this class of weld where flaws could initiate and grow have been adequately examined and therefore, accepts the examination for the subject welds in this category.

A second category of weld examination includes those welds in which the examination coverage on the ID was limited by the physical configuration, such as tees and elbows, and weld examination coverage could not be claimed past the centerline of the weld because the welds were examined under ASME Code, Section XI, Appendix VIII PDI procedures. Welds in this category are 21-007, 22-004, 22-005, 23-006, 23-007, 24-006, 27-002, 27-003, 27-065, 27-066, 40-008, 43-023, 43-027, and 29-056. For each of these welds, a single-sided examination was performed and the sound was projected into and through the weld to obtain coverage on the opposite side of the weld. In addition to the ID scan coverage achieved, for three of these welds for which a degradation mechanism was assigned, welds 22-005, 23-007, 43-023, 29-056, an adjacent weld was examined and, therefore, the NRC staff concludes that the examination of these welds is acceptable. The root of weld 40-008 was examined from both sides of the weld, but the weld crown and the intrados of the elbow configuration for approximately 20 percent on one side permitted only 78 percent examination coverage. The NRC staff concludes that the licensee has performed the UT examination of these welds to the extent possible and has obtained adequate single sided examination coverage of the ID surface for this category of welds and, therefore, accepts the examination coverage.

Four subject welds remain for which essentially 100 percent examination coverage could not be obtained: 22-001, 23-001, 13-008, and 15-008. Each of these welds is a dissimilar metal butt weld (DMBW) between a CASS safe end and a carbon steel nozzle. Welds 22-001 and 23-001 were examined in 2000 and only 70 percent examination coverage could be claimed because

most of the ferritic nozzle side was scanned from only one direction. The NRC staff concludes that this scan coverage is acceptable since the ferritic nozzle material is not subject to an active degradation mechanism. Welds 13-008 and 15-008 were examined in 2009 using a phased array UT examination that was PDI-qualified to examine the inner one-third of the root of the DMBW and the carbon steel nozzle, but was not qualified for examination of the CASS material, therefore, credit could not be claimed for examination of CASS material. The staff has recently reviewed the UT examination coverage of these two welds and has accepted the examinations in a separate relief request authorization (Reference 5) for the ASME Code Case N-770-1 baseline examination; therefore, the staff concludes that the examination of these welds is acceptable. The staff notes that these four welds are required to be removed from the RI-ISI program and now will be examined under the requirements of ASME Code Case N-770-1, as required and conditioned by 10 CFR 50.55a(g)(6)(ii)(F). Based on the examination coverage obtained for these welds, the NRC staff concludes that the examination of these welds is acceptable.

Based on the above, the NRC staff concludes that achieving essentially 100 percent volumetric examination is impractical for the subject welds due to the geometric configuration or materials of construction. In addition, based on the volumetric coverage obtained, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations performed. Therefore, the NRC staff concludes that the proposed alternative will not endanger life or property or the common defense and security and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

4.0 CONCLUSIONS

Based on the above, the NRC staff concludes that due to materials and geometric configuration of the subject welds at ANO, Unit 2, obtaining the ASME Code-required examination coverage is impractical. The staff further concludes that weld examination coverage that has been achieved provides reasonable assurance of the structural integrity of the subject welds. The staff concludes that granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. Therefore, the NRC staff grants the licensee's request for relief pursuant to 10 CFR 50.55a(g)(6)(i) for the ANO, Unit 2, third 10-year ISI interval.

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

5.0 REFERENCES

1. Pyle, S. L., Entergy Operations, Inc., letter to U.S. Nuclear Regulatory Commission, "Requests for Relief from American Society of Mechanical Engineers (ASME) Section XI Volumetric and Surface Examination Requirements – Third 10-Year Interval," dated March 26, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12086A293).

2. Pyle, S. L., Entergy Operations, Inc., letter to U.S. Nuclear Regulatory Commission, "Response to Request for Additional Information Request for Relief ANO2-ISI-010," dated February 5, 2013 (ADAMS Accession No. ML13037A050).

3. Hannon, J. N., U.S. Nuclear Regulatory Commission, letter to C. R. Hutchinson, Entergy Operations, Inc., "Safety Evaluation by the Office of Nuclear Reactor Regulation, Proposal to Use ASME Code Case N-578 as an Alternative to ASME Code Section XI, Table IWX-2500," dated December 29, 1998 (ADAMS Legacy Accession Nos. 9901050347 and 9901050353).

4. Kalyanam, N., U.S. Nuclear Regulatory Commission, electronic mail to Robert Clark, Entergy Operations, Inc., "RAI on Request for Relief No. ANO2-ISI-010," dated September 6, 2012 (ADAMS Accession No. ML12250A771).

5. Kalyanam, N., U.S. Nuclear Regulatory Commission, memorandum to file, "Arkansas Nuclear One, Unit No. 2 - Summary of Telephone Conference Re: Verbal Authorization for Revised Relief Request ANO2-ISI-007 (TAC No. MF0331)," dated December 18, 2012 (ADAMS Accession No. ML13052A470).

Principal Contributor: J. Wallace

Date: March 21, 2013

licensee's RR ANO2-ISI-010, pursuant to 10 CFR 50.55a(g)(6)(i) for the ANO, Unit 2, third 10-year ISI interval.

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

The NRC staff's safety evaluation is enclosed.

Sincerely,

/RA/

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

Docket No. 50-368

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Safety Evaluation

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