



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

June 27, 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-015  
FROM ASME CODE, SECTION XI, FOR PERIODIC PRESSURE SEALING  
REQUIREMENTS ON THE REACTOR VESSEL FLANGE LEAK DETECTION  
PIPING (TAC NO. MF0941)

Dear Sir or Madam:

By letter dated March 1, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13063A538), as supplemented by letter dated May 10, 2013, (ADAMS Accession No. ML13133A339), Entergy Operations, Inc. (the licensee), submitted a request for relief from certain requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI. Compliance with required periodic pressure testing for the Arkansas Nuclear One, Unit 2 (ANO-2) reactor vessel flange seal leak detection piping would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, consistent with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(a)(3)(ii), the licensee requested an alternate testing approach, applicable to the fourth 10-year inservice inspection (ISI) interval, which began on March 26, 2010, and ends on March 25, 2020.

The ASME Code, Section XI, requires that the reactor vessel flange seal leak detection piping be pressure tested once each inspection cycle. The system is accessible for testing when the vessel head is removed but the piping is not sealed during this time. The piping would require modification to be sealed for testing which would result in significant induced dose to the individuals conducting the work. Alternatively, the piping could be tested by purposefully causing a minor leak in the inner gasket of the vessel head. However, this would require removing the vessel head and replacing the failed gasket, which would induce a hardship without a compensating increase in the level of quality and safety.

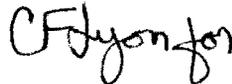
Consistent with the regulations in 10 CFR 50.55a(g)(6)(i), the licensee requested relief to use alternative requirements for inservice inspection items on the basis that the Code requirement is impractical. As an alternative, the licensee proposed to subject the leak detection piping to static pressure from the head water when the reactor cavity is filled for refueling. A visual inspection (VT-2) will be performed on the accessible areas of the leak detection piping. This alternative is based on ASME Code Case N-805, "Alternative to Class 1 Extended Boundary End of Interval or Class 2 System Leakage Testing of Reactor Vessel Flange O-ring Leak Detection Systems." This approach was issued in 2010 by ASME but has not yet been approved by the NRC.

The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that the licensee's proposed alternative provides reasonable assurance of the structural integrity and leak-tightness of the leak-off line and compliance with the ASME Code, Section XI, requirement for examination of the leak-off line constitutes a hardship without a compensating increase in quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the NRC staff authorizes the proposed alternative in Request for Relief ANO2-ISI-015. Additionally, the NRC staff authorizes the use of ASME Code Case N-805 until the code case is published in a future version of Regulatory Guide (RG) 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," and incorporated by reference in 10 CFR 50.55a(b). At that time, if the licensee intends to continue implementing ASME Code Case N-805, it must follow all provisions of the code case, with conditions as specified in RG 1.147 and limitations as specified in 10 CFR 50.55a(b)(4), (b)(5), and (b)(6), if any.

All other ASME Code, Section XI, requirements for which relief was not specifically requested and authorized herein by the NRC staff remain applicable, including the third-party review by the Authorized Nuclear Inservice Inspector.

If you have any questions, please contact the Project Manager, Kaly Kalyanam at 301-415-1480 or via e-mail at [Kaly.Kalyanam@nrc.gov](mailto:Kaly.Kalyanam@nrc.gov).

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  
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR RELIEF ANO2-ISI-015 FROM ASME CODE, SECTION XI,

FOR PERIODIC PRESSURE SEALING REQUIREMENTS ON THE

REACTOR VESSEL FLANGE LEAK DETECTION PIPING

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT 2

DOCKET NO. 50-368

1.0 INTRODUCTION

By letter dated March 1, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13063A538), as supplemented by letter dated May 10, 2013 (ADAMS Accession No. ML13133A339), Entergy Operations, Inc. (Entergy, the licensee), pursuant to Title 10 of the *Federal Code of Regulations* (10 CFR) paragraph 50.55a(a)(3)(ii), requested relief from the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, pertaining to the periodic pressure testing requirements for the Arkansas Nuclear One, Unit 2 (ANO-2), reactor vessel flange seal leak detection piping on the basis that complying with the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The licensee stated the proposed alternative is based on ASME Code Case N-805, "Alternative to Class 1 Extended Boundary End of Interval or Class 2 System Leakage Testing of Reactor Vessel Flange O-ring Leak Detection System," which was issued to the 2010 Edition of the ASME Code, Section XI, and is listed in Supplement 6 for Code Cases. However, the licensee stated that Code Case N-805 has not been approved by the U.S. Nuclear Regulatory Commission (NRC) and is not identified in Regulatory Guide 1.147, Revision 16 "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," October 2010 (ADAMS Accession No. ML101800536).

The licensee stated that the need for this relief request was identified during the NRC inservice inspection (ISI) of ANO-2 during the fall refueling outage (2R22) in September 2012. The reactor vessel flange seal leak detection piping was examined, using the proposed alternative method, during 2R22. ANO-2 was in Mode 6, the reactor vessel head was removed, and the reactor cavity was filled to its normal refueling water level. The associated ASME Code Class 2 piping system was subject to the static pressure head when the reactor cavity was filled. After a 4-hour hold time, a visual (VT-2) examination of the accessible areas of the piping system was performed and no evidence of leakage was identified.

Enclosure

## 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 to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that ISI of components and system pressure tests conducted during the 10-year intervals be in compliance 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. The regulations in 10 CFR 50.55a(g)(6)(i) state that 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, given due consideration of the burden upon the licensee.

The regulations in 10 CFR 50.55a(a)(3) state that alternatives to the requirements of paragraph (g) of 10 CFR 50.55a may be used, when authorized by the NRC, if (i) the proposed alternatives would 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. The regulations in 10 CFR 50.55a(g)(5)(iii) state that if the licensee has determined that conformance with certain code requirements is impractical for its facility, the licensee shall notify the Commission and submit, as specified in 10 CFR 50.4, information to support the determinations.

## 3.0 TECHNICAL EVALUATION

### 3.1 The licensee's Relief Request

#### ASME Code Components Affected

Code Class:	2
Component Number:	Nominal Pipe Size 3/4" Reactor Pressure Vessel (RPV) Flange Seal Leak-off Piping Line Number 2CCB-69-3/4" –Inspection Program B
Examination Category:	C-H
Item Number:	C7.10
Description:	Alternative Pressure Testing Requirements for the RPV Flange Leak-off Piping
Applicability:	Fourth 10-Year Interval (began March 26, 2010, and will conclude on March 25, 2020)

Applicable Code Edition and Addenda

The ISI Code of record is the 2001 Edition through 2003 Addenda of the ASME Code, Section XI. The Code of construction for the reactor vessel is the ASME Code, Section III, 1968 Edition through summer 1970 Addenda.

Applicable Code Requirements

ASME Code, Section XI, Table IWC-2500-1, Examination Category C-H, "Pressure Retaining Components – Inspection Program B":

Item C7.10 requires a System Leakage Test (Visual-VT2) each inspection period of all Class 2 pressure retaining components.

IWC-5220, System Leakage Test, Subparagraph IWC-5221 Pressure, requires that the system leakage test shall be conducted at the system pressure obtained while the system, or portion of the system, is in service performing its normal operating function or at the system pressure developed during a test conducted to verify system operability (e.g., to demonstrate system safety function or satisfy technical specification surveillance requirements).

Per IWC-5222(a), the pressure-retaining boundary includes the portion of the system required to operate or support the safety function up to and including the first normally closed valve.

ASME Code Requirement for Which Relief is Requested

The licensee requested relief from performing the System Leakage Test (Visual VT-2) each inspection period per ASME Code, Section XI, Table IWC-2500-1, Examination Category C-H, Item C7.10.

Licensee's Proposed Alternative (as stated by the licensee)

In lieu of the requirements of [IWC-5220, Subparagraph IWC-5221], a VT-2 visual examination of the accessible areas of the leak detection system piping will be performed while the system is subjected to the static pressure from the head of water when the reactor cavity is filled to its normal refueling water level for at least four hours. This test will be part of the reactor coolant Class 2 leakage test. The test will be performed within the frequency specified by table IWC-2500-1 for a System Leakage Test (once each inspection period).

If the inner O-ring should leak during the operating cycle it will be identified by an increase in temperature of the leak-off line above ambient temperature. This leak detection piping has a temperature indicator in the Control Room and is monitored per ANO-2 Technical Specifications 3/4.4.6 "Reactor Coolant System Leakage". This high temperature would actuate an alarm in the Control Room, which is closely monitored by procedurally controlled operator actions allowing identification of any further compensatory actions required. This piping also acts as a leak-off line to collect leakage which would be routed to the Reactor Coolant Drain Tank.

Additionally, the reactor vessel flange seal leak detection piping would only function as a Class 2 pressure boundary if the inner O-ring fails; thereby, pressurizing the line. If any significant leakage does occur in the leak detection piping during this time of pressurization, it would exhibit boric acid accumulation that would be discernible during the VT-2 visual examination to be performed as proposed in this request.

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

The ASME Code, Section XI, 2001 Edition through 2003 Addenda requires that Class 2 pressure boundary piping shall be pressure tested once each inspection period. The reactor vessel flange seal leak detection piping is separated from the reactor coolant pressure boundary by one passive metallic seal, which is the first of two O-rings. The pressure tap for the leak detection piping is located on the vessel flange mating surface. A second O-ring is located on the outside of the pressure tap in the vessel flange. Failure of the inner O-ring is the only condition under which this line is pressurized. Therefore, the line is not expected to be pressurized during the system pressure test following a refueling outage. Additionally, isolation valves 2RC-1A/B and 2RC-2 are normally open during plant operations which would prevent significant pressure build-up in the piping in the event of an inner O-ring leak.

The configuration of this piping precludes system pressure testing while the vessel head is removed because the pressure tap would have to be plugged. This would require a design modification to install a plug into the pressure tap on the vessel flange. A threaded or pressure test type plug would need to be installed in the flange face to act as a pressure boundary for each test, and then removed after the test. The installation of the mechanical modification and subsequent use would incur significant dose, which would be inconsistent with keeping dose as low as reasonably achievable. Either method of plugging would also present a foreign material exclusion issue for the handling of a very small diameter plug that would be required to be installed to complete a leakage test at pressure.

The configuration also precludes pressurizing the line externally with the head installed. The closure head contains two concentric grooves that hold the inner and outer O-rings. The O-rings are held in place by a series of retainer clips that are housed in recessed cavities in the flange face. If a pressure test were to be performed with the head installed, the inner O-ring would be pressurized in a direction opposite to its design function. This test pressure would result in a net inward force on the inner O-ring that would tend to push it into the recessed cavity that houses the retainer clips. The thin O-ring material could be damaged by the inward force.

Purposely failing or not installing the inner O-ring in order to perform a pressure test would require a new O-ring set to be installed. The time and radiation exposure associated with removing and reinstalling the closure head, replacing

the outer O-ring and re-cleaning of the vessel flange-mating surface prior to head installation would be an undue hardship. In addition, this special test would require a reactor coolant system heat-up / cool down cycle. Therefore, compliance with the [IWC-5220, Subparagraph IWC-5221] system pressure test requirements will result in an unnecessary hardship without a sufficient compensating increase in the level of quality and safety.

### 3.2 NRC Staff Evaluation

As an alternative to performing the system leakage test each inspection period as required by the ASME Code, Section XI, the licensee proposed to perform a VT-2 examination of the leak-off line while the line is under static head pressure when the reactor cavity is filled to its normal refueling water level for at least 4 hours. The licensee's proposed alternative is consistent with the provisions of Code Case N-805. To summarize the licensee's basis for the alternative, performing the ASME Code-required test constitutes a hardship because the design of the leak-off line precludes pressurization for leak testing, without a modification or the potential for damage to components such as the closure head flange O-rings, resulting in substantial radiation dose and time to replace the damaged components.

In its initial submittal, the licensee stated it was requesting relief from the requirements of IWC-5222(b). The NRC staff notes that IWC-5222(b) only states that items outside the boundaries of IWC-5222(a) and open-ended discharge piping are excluded from the examination requirements, while the licensee's proposed alternative was to use a different test pressure than required by IWC-5220. Therefore, in a request for additional information (RAI) dated April 2, 2013 (ADAMS Accession No. ML13092A340), the NRC staff requested that the licensee clarify the ASME Code paragraph(s) from which it was requesting relief. In its response to the RAI, by letter dated May 10, 2013, the licensee stated that the correct paragraph of the ASME Code from which it is requesting relief is IWC-5220 with sub-paragraph IWC-5221 only. Therefore, the subject relief request only requests an alternative to the system leakage test pressure for the leak-off line, not from the pressure retaining boundary extent to be tested.

The NRC staff reviewed the licensee's basis, and concludes that performing the pressure test required by IWC-5220 constitutes a hardship in accordance with 10 CFR 50.55a(a)(3)(ii), without a compensating increase in quality or safety. The basis for the staff's conclusion is that significant radiation dose and time would be required to disassemble, replace, and reassemble components if the licensee complies with the ASME Code requirements. Further, the leak-off line is a small-diameter line that is generally not pressurized in service, except in the case of an inner O-ring leak, which would result in indications in the control room.

The NRC staff reviewed the licensee's proposed alternative, and concludes that performing a visual VT-2 examination with the leak-off line under static pressure provides reasonable assurance of structural integrity and leak-tightness of the line because any significant through-wall flaws in the line would cause detectable leakage. Further, if a leak were present in the leak-off line, boric acid would likely be noted even if the leak were small. Code Case N-805, as an alternative to the requirements of IWC-5220, allows the Class 1 or 2 portions of the leak-detection system to be examined using the VT-2 visual examination method at ambient

conditions after the refueling cavity has been filled to its normal refueling water level for at least 4 hours. The licensee's proposed alternative is identical to the provisions of Code Case N-805.

#### 4.0 CONCLUSION

Based on the above, the NRC staff concludes that compliance with the ASME Code, Section XI, requirement for examination of the leak-off line constitutes a hardship without a compensating increase in quality and safety in accordance with 10 CFR 50.55a(a)(3)(ii), and that the licensee's proposed alternative provides reasonable assurance of the structural integrity and leak-tightness of the leak-off line. The staff therefore authorizes the licensee's proposed alternative in accordance with 10 CFR 50.55a(a)(3)(ii) for the fourth 10-year ISI interval for ANO-2, which began on March 26, 2010, and ends on March 25, 2020. Use of ASME Code Case N-805 is authorized until the code case is published in a future version of RG 1.147 and incorporated by reference in 10 CFR 50.55a(b). At that time, if the licensee intends to continue implementing ASME Code Case N-805, it must follow all provisions of the code case, with conditions as specified in RG 1.147 and limitations as specified in 10 CFR 50.55a(b)(4), (b)(5), and (b)(6), if any.

All other ASME Code, Section XI, requirements for which relief was not specifically requested and authorized herein by the NRC staff remain applicable, including the third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: J. Poehler

Date: June 27, 2013

The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that the licensee's proposed alternative provides reasonable assurance of the structural integrity and leak-tightness of the leak-off line and compliance with the ASME Code, Section XI, requirement for examination of the leak-off line constitutes a hardship without a compensating increase in quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the NRC staff authorizes the proposed alternative in Request for Relief ANO2-ISI-015. Additionally, the NRC staff authorizes the use of ASME Code Case N-805 until the code case is published in a future version of Regulatory Guide (RG) 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," and incorporated by reference in 10 CFR 50.55a(b). At that time, if the licensee intends to continue implementing ASME Code Case N-805, it must follow all provisions of the code case, with conditions as specified in RG 1.147 and limitations as specified in 10 CFR 50.55a(b)(4), (b)(5), and (b)(6), if any.

All other ASME Code, Section XI, requirements for which relief was not specifically requested and authorized herein by the NRC staff remain applicable, including the third-party review by the Authorized Nuclear Inservice Inspector.

If you have any questions, please contact the Project Manager, Kaly Kalyanam at 301-415-1480 or via e-mail at [Kaly.Kalyanam@nrc.gov](mailto:Kaly.Kalyanam@nrc.gov).

Sincerely,  
*/ra/*

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

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