



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

June 6, 2014

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

SUBJECT: ARKANSAS NUCLEAR ONE, UNIT 2 – AMENDED ALTERNATIVE REQUEST ANO2-ISI-004, PROPOSING TO EXTEND THE THIRD 10-YEAR INSERVICE INSPECTION INTERVAL FOR CERTAIN REACTOR VESSEL WELD EXAMINATIONS (TAC NO. MF2319)

Dear Sir or Madam:

By letter dated April 24, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13115A015), as supplemented by letter dated November 11, 2013 (ADAMS Accession No. ML13316C078), Entergy Operations, Inc. (the licensee), proposed to add one additional weld to a previously approved reactor pressure vessel (RPV) examination alternative, ANO2-ISI-004, at Arkansas Nuclear One, Unit 2 (ANO-2). The additional weld was inadvertently omitted from the licensee's original proposed alternative submittal dated October 29, 2009 (ADAMS Accession No. ML093030136). By letter dated September 21, 2010 (ADAMS Accession No. ML102450654), the U.S. Nuclear Regulatory Commission (NRC) staff authorized an alternative to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Code (Code), Section XI, Paragraph IWB-2412, Inspection Program B, where volumetric examination of essentially 100 percent of the RPV pressure-retaining Examination Category B-A and B-D welds is required once during each 10-year inservice inspection (ISI) interval. In the letter dated September 21, 2010, the NRC staff authorized extension of the ANO-2 ISI requirements for the Category B-A and B-D RPV welds to once every 20 years.

The licensee's amended alternative request, ANO2-ISI-004, dated April 24, 2013, proposed the addition of Weld Number 02-001, the RPV closure head-to-flange weld, to the previously approved alternative pursuant to Section 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations* (10 CFR). Weld Number 02-001 is a Category B-D weld that was not specifically addressed by the alternative authorized by the NRC's letter dated September 21, 2010.

The NRC staff has reviewed the licensee's updated proposed alternative ANO2-ISI-004 and concludes that the plant-specific information provided by the licensee to include Weld Number 02-001 is bounded by the data in the Pressurized Water Reactor Owners Group's topical report WCAP-16168-NP-A, Revision 3, "Risk-Informed Extension of the Reactor Vessel In-Service Inspection Interval" (WCAP-16168). Additionally, the NRC staff concludes that the request meets all applicable conditions and limitations described in WCAP-16168 and that increasing the ISI interval for the additional Category B-D component from 10 years to 20 years shows no appreciable increase in risk. Therefore, the NRC staff concludes that the licensee

has demonstrated an acceptable level of quality and safety with the proposed alternative. The NRC staff further concludes that the amended alternative request, ANO2-ISI-004, meets all of the regulatory requirements in 10 CFR 50.55a(a)(3)(i) and authorizes the extension of the examination interval for Weld Number 02-001, until the end of the third ISI interval at ANO-2, which is March 25, 2020, for the welds covered by ANO2-ISI-004. The NRC staff notes that the examination of Weld Number 02-001 is scheduled to occur in 2018.

All other requirements of the ASME Code, Section XI 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 and addresses Weld Number 002-01 only. The NRC staff's letter and safety evaluation dated September 21, 2010, which authorized the original alternative ANO2-ISI-004, remains in effect regarding the originally requested welds.

If you have any questions, please contact Peter Bamford at (301) 415-2833 or via e-mail at Peter.Bamford@nrc.gov.

Sincerely,



Michael T. Markley, Chief
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-368

Enclosure:
Safety Evaluation

cc w/encl: Distribution via Listserv



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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

AMENDED REQUEST FOR RELIEF ANO2-ISI-004, REGARDING

THE THIRD 10-YEAR INSERVICE INSPECTION PROGRAM INTERVAL

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT 2

DOCKET NO. 50-368

1.0 INTRODUCTION

By letter dated April 24, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13115A015), as supplemented by letter dated November 11, 2013 (ADAMS Accession No. ML13316C078), Entergy Operations, Inc. (Entergy, the licensee), proposed to add one additional weld to a previously approved reactor pressure vessel (RPV) examination alternative, ANO2-ISI-004, at Arkansas Nuclear One, Unit 2 (ANO-2). The additional weld was inadvertently omitted from the licensee's original proposed alternative submittal dated October 29, 2009 (ADAMS Accession No. ML093030136). By letter dated September 21, 2010 (ADAMS Accession No. ML102450654), the U.S. Nuclear Regulatory Commission (NRC) staff authorized an alternative to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Code (Code), Section XI, paragraph IWB-2412, Inspection Program B, where volumetric examination of essentially 100 percent of the RPV pressure-retaining Examination Category B-A and B-D welds is required once during each 10-year inservice inspection (ISI) interval. In the letter dated September 21, 2010, the NRC staff authorized extension of the ANO-2 ISI requirements for the Category B-A and B-D RPV welds to once every 20 years. The licensee's submittal dated April 24, 2013, identified that the previously approved alternative inadvertently omitted Weld Number 02-001, which is the RPV closure head-to-flange weld. As a result of this omission, the inspection interval extension for Weld Number 02-001 was not previously requested by the licensee, nor authorized by the NRC.

The licensee's amended alternative, ANO2-ISI-004, dated April 24, 2013, proposed the addition of Weld Number 02-001 to the previously approved alternative pursuant to Section 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations* (10 CFR). The previous extension of the ISI interval was applicable to examinations of the ANO-2 RPV welds (Category B-A), as well as the nozzle-to-vessel welds and inner radius sections (Category B-D). Weld Number 02-001 is a Category B-D weld that was not specifically addressed by the authorization dated September 21, 2010.

Enclosure

2.0 REGULATORY EVALUATION

2.1 Regulations and Guidance

In accordance with 10 CFR 50.55a(g)(4), the licensee is required to perform ISI of ASME Code Class 1, 2, and 3 components and system pressure tests during the first 10-year interval and subsequent 10-year intervals that 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), subject to the limitations and modifications listed therein.

For the third 10-year ISI interval at ANO-2, the Code of record for the inspection of ASME Code Class 1, 2, and 3 components is the 1992 Edition of the ASME Code, Section XI. The 1995 Edition with the 1996 Addenda of the ASME Code, Section XI is applicable for ultrasonic testing. The regulation in 10 CFR 50.55a(a)(3) states, in part, that the Director of the Office of Nuclear Reactor Regulation may authorize an alternative to the requirements of 10 CFR 50.55a(g). For an alternative to be authorized per 10 CFR 50.55a(a)(3)(i), the licensee must demonstrate that the proposed alternative would provide an acceptable level of quality and safety.

Regulatory Guide (RG) 1.99, Revision (Rev.) 2, "Radiation Embrittlement of Reactor Vessel Materials," May 1988 (ADAMS Accession No. ML003740284), describes general procedures acceptable to the NRC staff for calculating the effects of neutron radiation embrittlement of the low-alloy steels currently used for light-water-cooled RPVs.

RG 1.174, Rev. 1, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," November 2002 (ADAMS Accession No. ML023240437), describes a risk-informed approach acceptable to the NRC staff for assessing the nature and impact of proposed licensing basis changes by considering engineering issues and applying risk insights.

2.2 Background

The ISI of Categories B-A and B-D components consists of surface and volumetric examinations intended to discover whether flaws have initiated, whether pre-existing flaws have extended, and whether pre-existing flaws may have been missed in prior examinations. These examinations are required to be performed at regular intervals, as defined in Section XI of the ASME Code.

2.3 Summary of the Revised NRC Safety Evaluation for WCAP-16168-NP-A, Rev. 2

As described in Section 3.3 of the safety evaluation (SE) attached to the NRC's letter dated September 21, 2010, the prior authorized alternative for ANO-2 was based on WCAP-16168-NP-A, Rev. 2, "Risk-Informed Extension of the Reactor Vessel In-Service Inspection Interval," June 2008 (ADAMS Accession No. ML082820046). The original WCAP-16168-NP-A, Rev. 2 SE dated May 8, 2008 (ADAMS Accession No. ML081060045), was published in 2008. That SE was superseded by a revised SE dated July 26, 2011 (ADAMS Accession No. ML111600303), to address the Pressurized Water Reactor Owners Group's (PWROG's) request for clarification of the information needed in applications utilizing

WCAP-16168-NP-A, Rev. 2. The NRC staff's conclusion in this latter SE indicated that the methodology presented in WCAP-16168-NP-A, Rev. 2 is consistent with RG 1.174, Rev. 1 and is acceptable for referencing in requests to implement alternatives to ASME Code inspection requirements for pressurized-water reactor (PWR) plants in accordance with the limitations and conditions in the SE. In addition to showing that the subject plant parameters and inspection history are bounded by the critical parameters identified in Appendix A in WCAP-16168-NP-A, Rev. 2, the licensee's application must provide the following plant-specific information:

- (1) Licensees must demonstrate that the embrittlement of their RPV is within the envelope used in the supporting analyses. Licensees must provide the 95th percentile total through-wall cracking frequency ($TWCF_{TOTAL}$) and its supporting material properties at the end of the period in which the relief is requested to extend the ISI from 10 to 20 years. The 95th percentile $TWCF_{TOTAL}$ must be calculated using the methodology in NUREG-1874. The RT_{MAX-X} and the shift in the Charpy transition temperature produced by irradiation defined at the 30 ft-lb energy level, ΔT_{30} , must be calculated using the methodology documented in the latest revision of RG 1.99 or other NRC-approved methodology.
- (2) Licensees must report whether the frequency of the limiting design basis transients during prior plant operation are less than the frequency of the design basis transients identified in the PWROG fatigue analysis that are considered to significantly contribute to fatigue crack growth.
- (3) Licensees must report the results of prior ISI of RPV welds and the proposed schedule for the next 20-year ISI interval. The 20-year inspection interval is a maximum interval. In its request for an alternative, each licensee shall identify the years in which future inspections will be performed. The dates provided must be within plus or minus one refueling cycle of the dates identified in the implementation plan provided to the NRC in PWROG letter OG-10-238 dated July 12, 2010 (ADAMS Accession No. ML11153A033).
- (4) Licensees with Babcock and Wilcox (B&W) plants must (a) verify that the fatigue crack growth of 12 heat-up/cool-down transients per year that was used in the PWROG fatigue analysis bound the fatigue crack growth for all of its design basis transients and (b) identify the design bases transients that contribute to significant fatigue crack growth.
- (5) Licensees with RPVs having forgings that are susceptible to underclad cracking and with RT_{MAX-FO} values exceeding 240 degrees Fahrenheit (°F) must submit a plant-specific evaluation to extend the inspection interval for ASME Code, Section XI, Category B-A and B-D RPV welds from 10 to a maximum of 20 years because the analyses performed in WCAP-16168-NP-A are not applicable.
- (6) Licensees seeking second or additional interval extensions shall provide the information and analyses requested in Section (e) of 10 CFR 50.61a.

Eventually, WCAP-16168-NP-A, Rev. 3, which contains this latter SE for WCAP-16168-NP-A, Rev. 2, was issued in October 2011 (ADAMS Accession No. ML11306A084).

WCAP-16168-NP-A, Rev. 3 is used as the basis of evaluation for amended alternative request ANO2-ISI-004, and is referred to as WCAP-16168 in the rest of this SE.

3.0 TECHNICAL EVALUATION

3.1 Description of Proposed Alternative

In ANO2-ISI-004, the licensee proposed to defer the ASME Code required inspections of Categories B-A and B-D welds until 2018. As identified in Section 3.1 of the SE attached to the NRC's letter dated September 21, 2010, this schedule is consistent with the information in PWROG letter OG-06-356 dated October 31, 2006 (ADAMS Accession No. ML082210245). This date is also consistent with Item (3) in Section 2.3 above. In the amended request, the licensee proposes to add an additional weld to the previously authorized ANO2-ISI-004.

3.2 Components for Which Relief is Requested

The affected components for ANO2-ISI-004 are the ANO-2 RPV and the interior attachments and core support structures. The following examination categories and item numbers from IWB-2500 and Table IWB-2500-1 of the ASME Code, Section XI, are addressed in this request:

<u>Exam Category</u>	<u>Item Number</u>	<u>Description</u>
B-A	B1.40	Head-to-Flange Weld (Weld Number 02-001)

3.3 Basis for Proposed Alternative

The licensee's basis for the proposed alternative was provided in Section 5 of the attachment to the original proposed alternative dated October 29, 2009. As documented in Section 3.3 of the NRC's SE dated September 21, 2010, all of the critical parameters listed in Tables 1, 2, and 3 of the attachment to the licensee's request of October 29, 2009, are bounded by the WCAP-16168 pilot plant. By letter dated November 11, 2013, in response to a request for additional information (RAI) from the NRC staff dated October 9, 2013 (RAI Number 3; ADAMS Accession No. ML13282A360), the licensee confirmed that these requirements are still met with the inclusion of Weld Number 02-001.

3.4 Duration of Proposed Alternative

The licensee's letter dated April 24, 2013, amended the previously approved alternative to the third ISI interval to include Weld Number 02-001 for ANO-2. The extension of the third ISI interval for this weld to 20 years corresponds to an end date of March 25, 2020, with the next ASME Category B-A and B-D RPV weld inspections for ANO-2 scheduled to occur in 2018.

3.5 NRC Staff Evaluation

The NRC staff reviewed the licensee's submittal dated April 24, 2013. In Table 1 of the licensee's original alternative request dated October 29, 2009, the "Frequency and Severity of Design Transients" at ANO-2 were found to be bounded by WCAP-16168. Therefore, the NRC staff determined that the licensee had addressed plant-specific information item (2) satisfactorily and confirmed that, regarding design transients, the WCAP-16168 methodology is applicable to ANO-2. Also, the ANO-2 RPV has single-layer cladding on the inside consistent with the assumption used in the WCAP-16168 analysis. Considering these critical plant-specific parameters, the licensee performed TWCF calculations using the WCAP-16168 methodology in its address of plant-specific information item (1).

These TWCF calculations used inputs from Table 3 of the licensee's original alternative request dated October 29, 2009, and used RG 1.99, Rev. 2, Positions 1.1 and 2.1 when credible surveillance data were available to calculate ΔT_{30} for all RPV beltline materials for ANO-2. As stated in Section 3.4 of the NRC SE dated September 21, 2010, the licensee's TWCF calculations were verified independently via NRC staff calculations and the difference between the licensee's and staff's calculations were found to be insignificant. The NRC staff determined that the licensee addressed plant-specific information item (1) satisfactorily and confirmed that the embrittlement of the ANO-2 RPV is within the envelope used in the Westinghouse pilot plant analysis.

Table 2 of the licensee's original alternative request dated October 29, 2009, contains additional information pertaining to previous RPV inspections and the schedule for future ones. Table 2 was provided to address plant-specific information item (3). In addition, the licensee's amended alternative request dated April 24, 2013, stated that Weld Number 02-001 was last examined, one-third per outage, during the fall of 1992, spring of 1994 and spring of 1997 outages, and that no unsatisfactory indications were identified during those inspections. Further, by letter dated November 11, 2013, the licensee reported that there were no recordable service-induced indications observed on the subject weld from any of the previous exams in their response to RAI Number 1. The licensee's response to RAI Number 2 stated that examinations were not performed during the third 10-year ISI interval on Weld Number 02-001 and thus there were no further examination results to report.

The next RPV inspection for ANO-2 is scheduled in 2018. The NRC staff has reviewed the revised PWROG plan and finds that the proposed alternative matches the inspection plan for the PWR fleet.

In its letter dated November 11, 2013, the licensee further confirmed in its response to RAI Number 3 that the WCAP-16168 requirements are still met with the inclusion of Weld Number 02-001.

Based on the above evaluation, the NRC staff concludes that the licensee has addressed plant-specific information item (3) satisfactorily because the licensee demonstrated that the plant-specific flaw information for ANO-2 in ANO2-ISI-004 is bounded by WCAP-16168, supporting the plant-specific applicability of the WCAP-16168 to ANO-2. These determinations apply to the evaluation of Weld Number 02-001, the subject of this amended request.

Plant-specific information items (4), (5), and (6) have not been addressed by the licensee because they do not apply to ANO-2. Specifically, item (4) applies only to B&W plants whereas ANO-2 is a Combustion Engineering-designed plant. Item (5) applies to plants with forgings in the beltline region of the RPV, whereas the ANO-2 RPV beltline region is made from plates. Item (6) applies to second or additional extensions, whereas this is the first requested extension for ANO-2.

In summary, the NRC staff has reviewed the licensee's submittal dated April 24, 2013, as supplemented. Combined with the NRC staff's previous evaluation for alternative request ANO2-ISI-004, as documented in the NRC staff's authorization dated September 21, 2010, the NRC staff concludes that the revised proposed alternative will provide an acceptable level of quality and safety and meet the guidance provided by RG 1.174, Rev. 1 for risk-informed decisions.

4.0 CONCLUSION

The NRC staff has completed its review of amended alternative, ANO2-ISI-004, for ANO-2. The NRC staff concludes that including Weld Number 02-001 into the ISI interval that was increased from 10 to 20 years will result in no appreciable increase in risk. This conclusion is based on the fact that the plant-specific information provided by the licensee is bounded by the data in the WCAP-16168 and the request meets all the conditions and limitations described in the WCAP-16168. Therefore, amended alternative request ANO2-ISI-004 provides an acceptable level of quality and safety, and the alternative, including Weld Number 02-001, is authorized pursuant to 10 CFR 50.55a(a)(3)(i), until March 25, 2020, which corresponds to the end of the third ISI interval for the subject welds at ANO-2. The examination for Weld Number 02-001 is scheduled to occur in 2018, and thus the NRC staff also concludes that the planned examination date for Weld Number 02-001 is acceptable.

All other requirements of the ASME Code, Section XI 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.

Principal Contributor: G. Stevens

Date: June 6, 2014

has demonstrated an acceptable level of quality and safety with the proposed alternative. The NRC staff further concludes that the amended alternative request, ANO2-ISI-004, meets all of the regulatory requirements in 10 CFR 50.55a(a)(3)(i) and authorizes the extension of the examination interval for Weld Number 02-001, until the end of the third ISI interval at ANO-2, which is March 25, 2020, for the welds covered by ANO2-ISI-004. The NRC staff notes that the examination of Weld Number 02-001 is scheduled to occur in 2018.

All other requirements of the ASME Code, Section XI 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 and addresses Weld Number 002-01 only. The NRC staff's letter and safety evaluation dated September 21, 2010, which authorized the original alternative ANO2-ISI-004, remains in effect regarding the originally requested welds.

If you have any questions, please contact Peter Bamford at (301) 415-2833 or via e-mail at Peter.Bamford@nrc.gov.

Sincerely,

/RA by FLyon for/

Michael T. Markley, Chief
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-368

Enclosure:
Safety Evaluation

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