



UNITED STATES  
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D. C. 20555-0001

ENCLOSURE

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
OF THE FIRST TEN-YEAR INTERVAL INSERVICE INSPECTION

REQUESTS FOR RELIEF

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT 2

DOCKET NO. 50-368

1.0 INTRODUCTION

The Technical Specifications for Arkansas Nuclear One, Unit 2 (ANO-2), state that the inservice inspection and testing of the American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 components shall be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable Addenda as required by 10 CFR 50.55a(g), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). 10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) 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 difficulties without a compensating increase in the level of quality and safety.

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 preservice 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 ten-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) on the date twelve months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The applicable edition of Section XI of the ASME Code for the ANO-2, first 10-year inservice inspection (ISI) Interval is the 1974 Edition, through Summer 1975 Addenda. The components (including supports) may meet the requirements set forth in subsequent editions and addenda of the ASME Code incorporated by reference in 10 CFR 50.55a(b) subject to the limitations and modifications listed therein and subject to Commission approval.

Pursuant to 10 CFR 50.55a(g)(5), if the licensee determines that conformance with an examination requirement of Section XI of the ASME Code is not practical for its facility, information shall be submitted to the Commission in support of that determination and a request made for relief from the ASME Code requirement. After evaluation of the determination, pursuant to 10 CFR 50.55a(g)(6)(i), the Commission may grant relief and may impose alternative requirements that are determined to be authorized by law, will not endanger life, property, or the common defense and security, and are otherwise in the public interest, giving due consideration to the burden upon the licensee that could result if the requirements were imposed.

In a letter dated November 3, 1993, the licensee, Entergy Operations, Inc., submitted additional information regarding three previously evaluated relief requests for the first 10-year inservice inspection (ISI) interval. These three (and other) relief requests, from the requirements of American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, were originally submitted by a letter dated August 31, 1989. The August 31, 1989, submittal, and additional information submitted by the licensee on April 30 and August 20, 1992, was evaluated in an NRC Safety Evaluation (SE) dated December 30, 1992. This SE stated that the licensee was required to perform the appropriate inspections (where relief was denied - these three were denied) at the next scheduled outage of sufficient duration, or resubmit the relief requests with additional information.

## 2.0 EVALUATION AND CONCLUSION

The staff, with assistance of its contractor, the Idaho National Engineering Laboratory (INEL), has evaluated the additional information provided by the licensee in support of first 10-year interval Relief Requests B-B/B3.1, B-J/B4.5, and C-E-1/C2.5. Based on the information submitted, the staff adopts the contractor's recommendations and conclusions presented in the attached Technical Evaluation Summary. For Relief Request B-B/B3.1, performance of the Code-required examinations for the first 10-year interval would result in a hardship without a compensating increase in quality and safety. Therefore, the licensee's proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(ii), provided that at least one steam generator stay cylinder weld be added to the ISI program and examined each 10-year ISI interval (in addition to other Code requirements).

The Code-required examinations that the licensee proposed to perform on Weld 25-017 and on integral attachment Weld 59-049W are acceptable resolutions for Relief Requests B-J/B4.5 and C-E-1/C2.5, respectively.

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Date: March 25, 1994

Attachment:  
Technical Evaluation  
Summary

## ATTACHMENT

TECHNICAL EVALUATION SUMMARY  
OF THE FIRST TEN-YEAR INTERVAL INSERVICE INSPECTION  
REQUESTS FOR RELIEF  
FOR  
ARKANSAS POWER AND LIGHT  
ARKANSAS NUCLEAR ONE, UNIT 2  
DOCKET NUMBER: 50-368

### 1.0 INTRODUCTION

By letter dated November 3, 1993, the licensee, Arkansas Power and Light, submitted additional information regarding three previously evaluated requests for relief for the first 10-year inservice inspection (ISI) interval. These requests for relief from the requirements of American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, were originally submitted by a letter dated August 31, 1989. This submittal, and additional information submitted by the licensee on April 30, 1992 and August 20, 1992, was evaluated in an NRC Safety Evaluation Report (SER) dated December 30, 1992. This SER stated that the licensee was required to perform the appropriate inspections (where relief was denied) at the next scheduled outage of sufficient duration, or resubmit the relief requests with additional information. The Idaho National Engineering Laboratory (INEL) staff has evaluated the additional information provided by the licensee in support of first 10-year interval Requests for Relief Nos. B-B/B3.1, B-J/B4.5, and C-E-1/C2.5 in the following section.

### 2.0 EVALUATION

The information provided by the licensee in support of the requests for relief has been reviewed and is documented below. The first 10-year ISI interval for Arkansas Nuclear One, Unit 2 (ANO-2) ended March 25, 1990. As a matter of record, the applicable edition of Section XI of the ASME Code for the first 10-year ISI interval was the 1974 Edition through Summer 1975 Addenda (74S75). The applicable edition of the ASME Code for the Arkansas Nuclear One, Unit 2, second 10-year ISI interval, which began March 26, 1990, is the 1986 Edition.

A. Request for Relief No. B-B/B3.1, Examination Category B-B, Item B3.1, Steam Generator (SG) Shell Welds

Code Requirement: Tables IWB-2500 and IWB-2600, Examination Category B-B, Item B3.1 requires volumetric examination of 10% of the length of each longitudinal shell weld and meridional head weld and 5% of the length of each circumferential shell and head weld.

Licensee's Code Relief Request: In the August 31, 1989 submittal, the licensee requested relief from volumetric examination to the extent required by the Code for SG stay cylinder base-to-lower head Weld 03-002, and SG peel segment Welds 03-003, 03-004, and 03-005. By letter dated November 3, 1993, the licensee provided additional information in response to the December 30, 1992 SER, and reiterated its request for relief for these welds. The additional information provided by the licensee is stated in the basis below.

Licensee's Basis for Requesting Relief (as stated):

"In section 2.0(C) [of the December 30, 1992 SER], relief was denied for the Code Category B-B/Item No. B3.1, steam generator 2E-24A circumferential Weld 03-002 and meridional Welds 03-003, 03-004, and 03-005, on the basis that insufficient technical justification was provided for failing to attain the Code required coverage (i.e., 5% circumferential and 10% meridional). The SE stated that review of Drawing ISI-203 indicated that the minimum Code-required volume can be examined and also that the examination should have been extended to include other accessible portions of the same weld, even if only a one-sided exam could be performed.

"As previously stated in Entergy Operations' submittal of August 20, 1992, the examination of circumferential Weld 03-002 was limited to scanning with a 1/2V calibration from the lower head side of the weld only, due to the blend radius of the stay cylinder base. The examination of this weld was performed for 12 inches of weld length starting at meridional Weld 03-003 and extending towards meridional Weld 03-004. The 1974 Edition of the ASME Section XI Code through Summer 1975 Addenda (hereafter referred to as the 74S75 Code) requires that 5% of the length of this circumferential weld be volumetrically examined. Article 4 of the ASME Section V Code states that the required examination volume shall be scanned in two directions. Two directional coverage of this examination volume cannot be achieved because: 1) scanning can only be

performed from the lower head side of the weld and 2) scanning is limited to a 1/2V calibration which prohibits attainment of the second opposing direction coverage by reflecting the sound off the inner diameter surface. The premise of two directional coverage is that a flaw oriented in such a plane that it cannot be observed in one direction should be detectable by a scan from the second opposing direction. Entergy Operations believes the intent of the 74S75 Code is two directional coverage of 5% of the examination volume and that this requirement cannot be met by scanning more of the weld length from only one direction (since a hypothetical flaw oriented in a plane parallel to the beam path introduced from the lower head side surface may go undetected).

"A second inspection interval examination was performed during the ANO-2 2R9 refueling outage on lower head-to-lower extension ring circumferential Weld 03-008. This circumferential weld is the same Code Category and Item Number as the circumferential weld in question, and is also located on the lower head of Steam Generator 2E-24A. Calculation of the 'effective coverage' (i.e., an algebraic combination of one and two directional angle-beam scanning coverage expressed in terms of equivalent Code-required, two-directional coverage) achieved for the entire length of circumferential Weld 03-008 reveals that 97% and 100% coverage was attained for reflectors oriented parallel and transverse to the weld, respectively. The overall percentage of scanning coverage achieved on the entire length of this weld, per 1986 ASME Section XI Code requirements, represents a considerable quantity of examination volume in comparison with the 74S75 Code requirement of 5% for the weld in question, and provides substantial demonstration of the integrity of the steam generator lower head circumferential welds.

"For meridional Welds 03-003, 03-004, and 03-005, examination was limited to scanning with a 1/2V calibration from one side of the peel segment weld only, due to a nozzle (hot or cold leg) obstruction on the other side of the weld. The examination of these welds was performed for 10 inches of weld length starting at 30 inches and extending to 40 inches above Weld 03-002. If this scan limitation existed for the entire length of these welds, then the same concept as above would apply. However, as a result of a second inspection interval examination performed during the ANO-2 2R9 refueling outage on peel segment Weld 03-005, it is now known for this weld, and suspected for Welds 03-003 and 03-004, that sufficient weld length exists both above and below the hot and cold leg nozzle obstructions to enable the performance of a second direction scan from the other side of the peel segment. For example, peel segment Weld 03-005 has a total weld length of 78 inches. The hot leg nozzle prohibits or limits scanning for 56 of these inches from one side of the peel segment, while the remaining 22 inches of weld length (11" above and 11" below the nozzle obstruction), uninhibited scanning can be performed from both sides of the weld. Calculation of the 'effective coverage' achieved for the entire length of meridional Weld 03-005 reveals that 81% and 83% coverage was attained for reflectors oriented parallel and transverse to the weld, respectively. The overall percentage of scanning coverage achieved on the entire length of this weld, per 1986 ASME

Section XI Code requirements, represents a considerable quantity of examination volume in comparison with the 74S75 Code requirement of 10% for each of the three meridional welds in question, and provides substantial demonstration of the integrity of the steam generator lower head meridional welds.

"In summary, additional scanning of Weld 03-002 will not accomplish the 74S75 Code-required, two-directional coverage of 5% of the examination volume for the reasons stated above. For meridional Welds 03-003, 03-004, and 03-005, it is now known for one of these welds, and believed for the other two, that the 74S75 Code requirement of 10% could have been fulfilled during the first inspection interval. However, based on the total effective coverage achieved approaching 100% for circumferential Weld 03-008 and a total effective coverage achieved in excess of 80% for meridional Weld 03-005, ample evidence exists to validate the integrity of the steam generator lower head circumferential and meridional welds. The 1986 ASME Section XI Code examination coverage achieved for circumferential Weld 03-008 is approximately 20 times more than that required for circumferential Weld 03-002 per 74S75 Code requirements, and the 1986 ASME Section XI Code examination coverage achieved for meridional Weld 03-005 more than doubles the collective examination coverage requirement for all three meridional welds per 74S75 Code requirements.

"The examination coverage of these welds is at issue because of the 74S75 Code requirement to only examine partial weld lengths (i.e., 5% circumferential and 10% meridional). The questions of how to adequately fulfill these requirements, when a scanning limitation exists, has historically been a subject of debate. The Winter '75 Addenda eliminated the partial weld lengths requirement. The ASME Section XI Code now requires examination coverage of the entire length of these welds; therefore this particular issue should not appear again. Entergy Operations recognizes that ASME Section XI Code examinations are not intended to serve a dual purpose (i.e., double crediting examinations performed during 2R9 to satisfy first and second inspection interval examination requirements). However, by virtue of having performed second inspection interval examinations during ANO-2's last refueling outage (and prior to resolution of the first interval relief request), the structural integrity of the steam generator has been verified. Entergy Operations believes this addresses the most important aspect of the NRC's concern and requests that the NRC consider all of the above as a basis for relief from the first 10-year requirements and to preclude the expense of further examinations. The estimated dose and plant cost to perform these examinations, including required support, are four rem and \$30,000, respectively. However, to bring this issue to closure, tentative plans have been made to perform examinations of Welds 03-002, 03-003, and 03-005 during 2R10. The examinations will be performed unless relief is approved."

Licensee's Proposed Alternative Examination: The licensee proposed to use the examinations performed in the 2R9 refueling outage of the second 10-year inspection interval to satisfy the examination requirements for the first 10-year interval.

Evaluation: The 74S75 Code required volumetric examination of 10% of the length of each of the meridional head welds and 5% of the length of each of the circumferential head welds. However, the licensee did not perform the examinations on the subject welds to the extent required by the Code and requested relief from these requirements for the first 10-year ISI interval in the August 31, 1989 submittal. Request for Relief B-B/3.1 was subsequently denied in an SER dated December 30, 1992 due to lack of technical justification. The licensee was asked to either perform the required examinations in the next outage of sufficient duration, or provide additional information supporting the original request.

By letter November 3, 1993, the licensee provided additional information regarding steam generator circumferential head Weld 03-002 and meridional head Welds 03-003, 03-004, and 03-005. In this submittal, the licensee stated that approximately 100% of another circumferential weld (#03-008) on the same SG head was examined during the 2R9 refueling outage of the second 10-year interval. In addition, the licensee examined meridional Weld 03-005 during the 2R9 refueling outage and found that a significant portion (>80%) of that weld could be examined, and speculates that a similar percentage could be examined on the other two meridional welds in question. The licensee has proposed to use these second 10-year interval examinations to satisfy the first interval examination requirements.

To satisfy the requirements of the 74S75 Code, the licensee would have to remove the insulation from SG 2E-24A to gain access and examine a small percentage of the subject welds. Imposition of this requirement on the licensee would cause a significant amount of radiation exposure (4 rem)

and would result in a hardship without a compensating increase in quality and safety. The examinations performed during the second 10-year interval to the 1986 Edition Code requirements far exceed the small percentage of each weld that was required to be examined for the first 10-year interval by the 74S74 Code. For the meridional head welds, the examination of 80% of the length of Weld 03-005 during the second 10-year interval is substantially more than the combined volume of all three meridional welds required by the 74S75 Code. In lieu of examining 5% of the length of circumferential Weld 03-002, the licensee has examined nearly 100% of the length of circumferential head Weld 03-008, which is on the same SG head, and is substantially longer than Weld 03-002. These alternative examinations provide reasonable assurance of the operational readiness of the subject welds.

Based on the above evaluation, it is recommended that the licensee's proposed alternative be authorized pursuant to 10 CFR 50.55a(a)(3)(ii) for the first 10-year interval. However, because of the unique design of the steam generators at ANO-2, it is also recommended that the steam generator stay cylinder base-to-lower head welds be examined to the extent practical each interval, in addition to the examination of the other circumferential head weld.

The 1986 Edition of the Code requires volumetric examination of all steam generator head welds during the first 10-year ISI interval, but only requires the examination of one meridional and one circumferential weld during successive intervals. Consequently, examination of the lower head-to-stay cylinder weld (#03-002) is not specifically required in successive intervals (if the other circumferential weld is selected for examination). Considering the unique design and function of this weld, it appears that the Code has overlooked this type of weld. Although this weld has been classified as a circumferential head weld, by design it is more similar to a full penetration nozzle-to-vessel weld (Examination Category B-D), as depicted in Figure IWB-2500-7(a). In terms of



function, these welds act both as the primary pressure-retaining boundary and as a component support. Based on the design and function of this weld, examination is recommended. Similarly, there are three other welds within the stay cylinder that are subjected to conditions similar to Weld 03-002. These are Welds 03-024, 03-025, and 03-026. It is recommended that at least one stay cylinder weld, preferably the lower head-to-stay cylinder weld, is incorporated into the ISI program plan at ANO-2, and examined each interval.

B. Request for Relief No. B-J/B4.5, Examination Category B-J, Item B4.5, Volumetric Examination of Circumferential Weld 25-017

This relief request was originally evaluated in the NRC SER dated December 30, 1992. Relief was granted for two welds, but denied for Weld 25-017. In the November 3, 1993 submittal, the licensee stated, in part:

"Entergy Operations agrees with the NRC assessment that an axial scan could have been performed and will perform an axial scan of this piping weld during 2R10 [refueling outage]. An attempt will first be made to perform the required examination from the tee side of the weld with a sufficiently long metal path to enable the accomplishment of two direction axial coverage from the tee side. If the examination is prohibited or limited by the configuration of the tee, the pipe clamp will be removed to enable the performance of the required axial scan from the pipe side of the weld."

The licensee has committed to perform the Code-required examination in the next outage. This should be considered an acceptable resolution of Request for Relief C-E-1/C2.5 and the examination of Weld 25-017 for the first 10-year ISI interval.

C. Request for Relief No. C-E-1/C2.5, Examination Category C-E-1, Item C2.5, Shutdown Cooling Integrally Welded Supports

Request for Relief C-E-1/C2.5 was evaluated and denied in the NRC SER dated December 30, 1992. The licensee failed to meet its own proposed

alternative to remove a pipe clamp that inhibited access for the Code-required surface examination. In the November 3, 1993 submittal, the licensee stated:

"In Section 2.0(0) [of the December 30, 1992 SER], relief was denied for Code Category C-E-1/Item No. C2.5, shutdown cooling integrally welded attachment 59-049W, on the basis that in the original relief request submittal of August 31, 1989, it was stated that the interfering pipe clamp obstruction would be removed to allow for the complete surface examination of this attachment. As stated in the Entergy Operations submittal of August 20, 1992, no evidence can be found that the pipe clamp was ever removed.

"Entergy Operations will remove this pipe clamp during the next refueling outage and enable the complete surface examination of this integrally welded attachment."

The licensee has agreed to perform the required examinations in the next outage. This should be considered an acceptable resolution for Request for Relief C-E-1/C2.5 and the examination of integral attachment Weld 59-049W for the first 10-year ISI interval.

### 3.0 CONCLUSION

The INEL staff has reviewed the licensee's submittal and concludes that for Request for Relief B-B/B3.1, performance of the Code-required examinations for the first 10-year interval would result in a hardship without a compensating increase in quality and safety. Therefore, it is recommended that the licensee's proposed alternative be authorized pursuant to 10 CFR 50.55a(a)(3)(ii). However, it is also recommended that at least one SG stay cylinder weld be added to the ISI program and examined each 10-year ISI interval (in addition to other Code requirements). These welds are unique in design and function and are not currently addressed by the Code. Therefore, examination of these welds would be prudent.

In the SER dated December 30, 1992, the licensee was informed that for cases where relief was denied, the appropriate examinations had to be performed in the next outage of sufficient duration. Since the first interval ended in

March of 1990, the performance of these examinations had to be carried over into the subsequent interval. The INEL staff acknowledges that the Code-required examinations will be performed on Weld 25-017 for Request for Relief B-J/B4.5, and on integral attachment Weld 59-049W for Request for Relief C-E-1/C2.5. The performance of these examinations during the second interval should be considered an acceptable resolution for these requests, which were previously denied for the first 10-year ISI interval.