



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

ALTERNATIVE TO AUGMENTED REACTOR

PRESSURE VESSEL EXAMINATION REQUIREMENTS

ENTERGY OPERATIONS, INC.

RIVER BEND STATION, UNIT 1

DOCKET NO. 50-458

1.0 INTRODUCTION

Inservice inspection 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 (ASME Code) and applicable addenda as required by Title 10 of the Code of Federal Regulations (10 CFR), Section 50.55a(g), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(6)(g)(i). Section 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 difficulty 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 the 10 CFR 50.55a(b) twelve months prior to the start of the 120-month interval, subject to limitations and modifications listed therein. The applicable edition of Section XI of the ASME Code for the River Bend Station (RBS) augmented reactor pressure vessel (RPV) welds is the 1980 Edition through Winter 1981 Addenda of Section XI of ASME Code.

By letter dated January 7, 1998, the licensee proposed an alternative to the Rule contained in the Request for Relief for RBS.

2.0 EVALUATION

The staff, with technical assistance from its contractor, the Idaho National Engineering and Environmental Laboratory (INEEL), has evaluated the information provided by the licensee in

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support of the licensee proposed alternative contained in its Request for Relief for RBS. Based on the results of the review, the staff generally adopts the contractor's conclusions and recommendations presented in the attached Technical Letter Report (TLR).

Request for Relief RR-1 (Rev 0): This request for relief involves the use of an Alternative to 10 CFR 50.55a(g)(6)(ii)(A), "Augmented Examination of Reactor Vessel."

In accordance with 10 CFR 50.55a(g)(6)(ii)(A), all licensee's must implement once, as part of the inservice inspection interval in effect on September 8, 1992, an augmented volumetric examination of the RPV welds specified in item B1.10 of Examination Category B-A of the 1989 Edition of the ASME Code, Section XI. Examination Category B-A, items B1.11 and B1.12 require volumetric examination of essentially 100 percent of the RPV circumferential and longitudinal shell welds, as defined by 10 CFR 50.55a(g)(6)(ii)(A)(2), is greater than 90 percent of the examination volume of each weld.

The first 10-year interval for the inservice examination of components and system pressure tests for RBS was conducted from June 16, 1986, through November 30, 1997. RBS utilized ASME Code, Section XI, 1980 Edition with Addenda through Winter 1981, as the code of record for this inspection interval. These requirements for the examination of RPV welds are identical to those contained in ASME Code, Section XI, 1989 Edition which is referenced in 10 CFR 50.55a(g)(6)(ii)(A)(2) for the augmented RPV examinations. River Bend Station was able to achieve 100 percent weld coverage, as defined in 10 CFR 50.55a(g)(6)(ii)(A)(2), for all RPV welds with one exception. Weld AA examination coverage was limited to 62 percent weld volume. This weld connects the first shell ring to the RPV bottom head. This weld is located at the edge of a transition in the vessel diameter. The weld location is such that it can only be inspected from the outside surface as physical interferences (i.e., shroud support shelf) prevent an exam originating from the RPV interior. The licensee reviewed the possibility of performing the examination of the subject weld from the outside surface of the RPV to obtain the required 100 percent coverage. RPV geometric limitations created by the change in vessel diameter at the transition to the bottom head prevented weld volume coverage in excess of 62 percent weld volume.

Under 10 CFR 50.55a(g)(6)(ii)(A)(5), the licensee proposed that the staff accept 62 percent coverage for weld AA as an alternative to the Rule required examination. However, the staff having evaluated the licensee's basis for the alternative does not agree with the licensee's interpretation of the alternative criteria pursuant to 10 CFR 50.55a(g)(6)(ii)(A)(5). Considering that no unacceptable flaws were found in the welds during the preservice inspection and all Item B1.10 welds were fully examined during the first inservice inspection interval with only one weld with essentially less than 100 percent coverage (i.e., 62 percent coverage for weld AA), the staff concludes that the RPV weld results obtained during preservice examination and examinations during the first inspection interval provide a reasonable assurance of structural integrity. The reduction in the required examination coverage will not endanger life or property or the common defense and security because the RPV is designed and constructed to have a low probability of gross rupture or significant leakage throughout its design life. Therefore, the staff concludes that the licensee's proposed alternative, in combination with future examinations required by the Code, provides an acceptable level of quality and safety.

3.0 CONCLUSION

The staff has evaluated the licensee's submittal pursuant to the provisions of 10 CFR 50.55a(g)(6)(ii)(A)(5) for RBS. This is a hardship without a compensating increase in safety

since the proposed alternative, the augmented RPV examination of accessible weld volume in combination with future reactor pressure vessel examinations required by the Code, provides an acceptable level of quality and safety. In addition, the licensee has maximized the examination coverage for the reactor vessel shell welds and that, any service-induced degradation, if present, would have been detected. The combination of no flaws found during preservice examination and essentially 100 percent of the welds in the first interval conforming to the augmented exam rule, the proposal will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii) and 10 CFR 50.55a(g)(6)(ii)(A)(5) the licensee's proposed alternative to examine weld AA with a weld volume coverage of 62 percent is authorized for the first 10-year inspection interval.

Attachment: Technical Letter Report

Principal Contributor: G. Hatchett

Date: March 26, 1999

TECHNICAL LETTER REPORT
ALTERNATIVE TO 10 CFR 50.55a(g)(6)(ii)(A)
AUGMENTED REACTOR PRESSURE VESSEL EXAMINATION
FOR
ENTERGY OPERATIONS, INC.
RIVER BEND STATION
DOCKET NUMBER: 50-458

1. INTRODUCTION

By letter dated January 7, 1998, the licensee, Entergy Operations, Inc. (EOI), proposed an alternative to the augmented examination requirements of the reactor pressure vessel (RPV) required by 10 CFR 50.55a(g)(6)(ii)(A) for the River Bend Station (RBS). The Idaho National Engineering and Environmental Laboratory (INEEL) staff's evaluation of the subject request for relief is in the following section.

2. EVALUATION

The licensee performed the augmented reactor pressure vessel weld examinations as part of its first 10-year ISI interval examination requirements. The Code of record for the River Bend Station, first 10-year ISI interval, which began June 16, 1986, is the 1980 Edition through Winter 1981 Addenda of Section XI of the ASME Boiler and Pressure Vessel Code. The information provided by Entergy Operations, Inc. in support of the proposed alternative has been evaluated and the basis for disposition is documented below.

Alternative to 10 CFR 50.55a(g)(6)(ii)(A), Augmented Reactor Pressure Vessel Examination

Regulatory Requirement: In accordance with 10 CFR 50.55a(g)(6)(ii)(A), all licensees must implement once, as part of the inservice inspection interval in effect on September 8, 1992, an augmented examination of the reactor pressure vessel (RPV) welds specified in Item B1.10 of Examination Category B-A of the 1989 Edition of the ASME Code Section XI. Examination Category B-A, Items B1.11 and B1.12 require volumetric examination of essentially 100% of the RPV circumferential and longitudinal shell welds, as defined by Figures IWB-2500-1 and -2, respectively. Essentially 100%,

as defined by 10 CFR 50.55a(g)(6)(ii)(A)(2), is greater than 90% of the examination volume of each weld.

Licensee's Proposed Alternative: Pursuant to 10 CFR 50.55a(g)(6)(ii)(A)(5), the licensee proposed that the coverages obtained for the subject welds be found acceptable. The licensee performed the examination to the maximum extent possible for each RPV shell weld, but was unable to achieve essentially 100% coverage of the examination volume for shell-to-lower head Weld AA. Weld AA was limited to 62% of the required examination volume. The licensee stated:

"EOI determined that one of the Item Number B1.10 welds could not be examined to the full ASME Code, Section XI, coverage required by 10 CFR 50.55a(g)(6)(ii)(A). Specifically, weld AA coverage was limited to 62% examination volume. The total weld volume coverage for all Item B1.10 welds exceeds 90%. However, the regulations specify that 'essentially 100%' applies to each weld. EOI considers that the examinations performed during the first inspection interval may be credited as the augmented examinations pursuant to 10 CFR 50.55a(g)(6)(ii)(A)(4). Additionally, pursuant to 10 CFR 50.55a(g)(6)(ii)(A)(5), EOI requests NRC approval of the examination of 62% of weld AA as an alternative to 'essentially 100%' based on the acceptable level of quality and safety afforded by the 62% coverage as discussed below."

Licensee's Basis for Proposed Alternative (as stated):

"RBS has a Mark III containment with approximately 3 feet of clearance between the biological shield wall and the RPV. Examination of the RPV shell welds were performed with manual and automated equipment from the external surface of the RPV in this limited space.

"Weld AA connects the first shell ring of the RPV to the bottom head. The inspection of weld AA was limited. The weld is located at the edge of a transition in vessel diameter. The geometry is such that it could only be examined from the outside diameter of the weld (the weld cannot be inspected from the vessel interior as it is located below the Shroud Support shelf and is not accessible). 'Weld volume' as discussed herein is defined as the area requiring examination per ASME Section XI, 1989 Edition, Figure IWB-2500-1.

RBS was in the first inspection interval when the augmented examinations became effective (September 8, 1992) and was scheduled to perform examinations on essentially 100% of the Item B1.10 welds volume per the requirements of Section XI 1980 Edition with Addenda through Winter 1981. The examination requirements for the inspection interval, based on the 1980 Edition with Addenda through Winter 1981, are the same as those required by the 1989 Edition, which is referenced in 10CFR50.55a for the augmented RPV examinations.

"Section 10CFR50.55a(g)(6)(ii)(A)(4) states the '[t]he requirement for augmented examination of the reactor vessel may be satisfied by an examination of essentially 100% of the reactor vessel shell welds specified in [Section] 10CFR50.55a(g)(6)(ii)(A)(2) that has been completed, or is scheduled for implementation with a written commitment, or is required by [Section] 50.55a(g)(4)(i), during the inservice inspection interval in effect on September 8, 1992.' In the accompanying Statement of Considerations for the rule change that added the augmented RPV weld examination requirements, the NRC said that a licensee that either completed or scheduled an inspection of essentially 100% of the length of all examination category B-A shell welds in the interval in effect when the rule became effective does not have to implement the 'augmented examination' of the reactor vessel shell welds, and 'the technical objective of the augmented examination will be accomplished under these conditions.' 57 Fed. Reg. 34,670 (Aug. 6, 1992).

"RBS considers the weld inspections in full compliance with the augmented RPV weld examination requirements for the first inservice inspection interval, with the exception of weld AA. Essentially 100% of all the RPV shell welds have been examined. The examination limitation for weld AA is due to geometry. As noted above, weld AA is located at the edge of a transition in vessel diameter (see Attachment 1)¹ and cannot be accessed from the interior of the RPV. Accordingly, additional examination coverage of weld AA is not feasible with available examination techniques.

"The NRC previously reviewed and approved Relief Request RR0012D, which identified the examination restrictions for weld AA, pursuant to Section 50.55a(g)(6)(i). Because the rule change for augmented RPV examination revoked all previously approved relief requests (see Paragraph (g)(6)(ii)(2)), the alternative requested herein is necessary for the RBS first interval Inservice Inspection Plan to document the limitations in accordance with the augmented RPV examination requirements.

"The reactor vessel shell weld examinations for the second interval will use the same techniques as the first interval inspection. That is, the examinations will be performed using a combination of automated and manual examination techniques from the external surface of the RPV. Even with these techniques, however, coverage of weld AA will be limited to approximately 62% of the weld volume.

"Augmented RPV examinations mandated by 10 CFR 50.55a(g)(6)(ii)(A) stemmed from NRC concerns with RPV degradation from embrittlement as indicated by irradiation surveillance material test results, stress corrosion cracking, and service induced cracking. Early Editions of Section XI of the ASME Code, including the Edition for RBS first inspection interval, required essentially 100% examination of the number of RPV shell welds for the first

1 Attachments included in the licensee's original submittal are not included in this report.

interval, but only a small percentage after the first inspection interval. Thus, the rule change for Section 50.55a(g)(6)(ii)(A) did not add examinations of shell welds to the inspection scope for the RBS first inspection interval. Section XI, 1980 Edition with Addenda through Winter 1981, required that RBS perform inspections on essentially 100% of the Item Number B1.10 RPV shell welds. These inspections were completed, with limited coverage on only one weld, as discussed above.

"Preservice ultrasonic inspection of the RBS RPV was performed prior to plant startup. No indications that exceeded ASME Section XI acceptance criteria were found during the first inservice inspection interval. All Item Number B1.10 welds were examined for inservice inspection, with only one weld (weld AA) examined with less than essentially 100% coverage (i.e., 62% coverage of weld AA). Inside diameter tooling cannot be used to increase the coverage of weld AA.

"RBS, still in its first inspection interval when the augmented requirements were issued, was required by Section XI of the ASME Code to perform examinations on essentially 100% of Category B-A, Item Number B1.10, shell welds. Therefore, pursuant to Section 50.55a, Paragraphs (g)(6)(ii)(A)(4) and (g)(6)(ii)(A)(5), based on essentially 100% coverage of the welds being examined, except for the limitations on weld AA, the examinations performed for the first inservice inspection interval provide an acceptable level of quality and safety for meeting the augmented examination requirements of Paragraph (g)(6)(ii)(A). Accordingly, NRC approval is requested."

Evaluation: To comply with the augmented RPV examination requirements of 10 CFR 50.55a(g)(6)(ii)(A), licensees must volumetrically examine essentially 100% of each of the Item B1.10 shell welds. Essentially 100% is defined as greater than 90% of the examination volume of each weld, where the reduction in coverage is due to interference by another component or to part geometry. As an alternative to the regulations, the licensee proposed that the examinations performed satisfy the augmented reactor vessel examination requirement.

At River Bend Station, the RPV examination was performed from the vessel outside diameter using a combination of automated and manual examination techniques. The licensee was able to obtain essentially 100% examination coverage for all RPV shell welds except for circumferential shell-to-lower head Weld AA. The licensee obtained approximately 62% coverage for Weld AA due to part geometry. Weld AA is located at the edge of a transition in the vessel diameter and can only be scanned from the outside diameter (the shroud support shelf completely restricts access from inside the vessel).

Consequently, the coverage requirements of the regulations cannot be met for Weld AA. To achieve complete coverage, the RPV would have to be redesigned and modified, causing a considerable burden on the licensee.

As a result of the augmented volumetric examination rule, licensees must make a reasonable effort to maximize examination coverage of their reactor vessel. The licensee has combined automated and manual techniques to maximize coverage from the exterior surface, and cannot increase coverage by performing examinations from the inside surface. The licensee has examined a significant portion of the subject weld (approx. 62%). In addition, the licensee has completed composite examination coverage of greater than 90% for the remaining RPV shell welds.

3. CONCLUSION

Based on the volumetric examination coverage attained, the INEEL staff concludes that the licensee has made a reasonable effort to maximize coverage of the RPV and that any significant patterns of degradation, if present, would have been detected. Further, it is concluded that the examinations performed provide an acceptable level of quality and safety for the RPV shell welds. Therefore, it is recommended that the licensee's proposed alternative be authorized pursuant to 10 CFR 50.55a(g)(6)(ii)(A)(5).