



UNITED STATES  
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO THE FIRST 10-YEAR INTERVAL INSERVICE INSPECTION

REQUESTS FOR RELIEF

COMMONWEALTH EDISON COMPANY

BYRON STATION, UNIT 2

DOCKET NO. STN 50-455

1.0 INTRODUCTION

The inservice inspection (ISI) of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Class 1, 2 and 3 components shall be performed in accordance with Section XI of the ASME 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 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 10-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) twelve months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The applicable edition of the ASME Code, Section XI, for the Byron Station, Units 1 and 2, first 10-year ISI interval is the 1983 edition through summer 1983 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,

ENCLOSURE

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.

Additionally, pursuant to 10 CFR 50.55a(g)(6)(ii)(A)(5), licensees that make a determination that they are unable to completely satisfy the requirements for the augmented reactor vessel shell weld examination specified in 10 CFR 50.55a(g)(6)(ii)(A) shall submit information to the Commission to support the determination and shall propose an alternative to the examination requirements that would provide an acceptable level of quality and safety. The licensee may use the proposed alternative when authorized by the Director of the Office of Nuclear Reactor Regulation.

By letter dated December 9, 1998, Commonwealth Edison Company (ComEd, the licensee), submitted to the NRC its first 10-year interval ISI program relief requests NR-26, NR-27, and NR-28 for Byron, Unit 2. The licensee has proposed alternatives to limited volumetric examination of a valve-to-pipe weld in the reactor coolant system, the augmented examination of the reactor vessel lower head to shell weld and the ASME Section XI examination of the same weld due to obstructions. The staff has reviewed and evaluated the information provided by the licensee pertaining to the requests for relief for Byron, Unit 2.

## 2.0 DISCUSSION

### Relief Request NR-26

#### COMPONENT IDENTIFICATION:

Code Class:	1
Reference:	Table IWB-2500-1
Examination Category:	B-J
Item Number:	B9.11
Description:	Limited volumetric examination of reactor coolant system weld due to whip restraint obstruction

#### EXAMINATION REQUIREMENT:

Table IWB-2500-1, Examination Category B-J, Item Number B9.11 requires surface and volumetric examination of the regions described in Figure IWB-2500-8(c) for piping NPS 4 and greater. The examination includes essentially 100 percent of the weld length.

#### CODE REQUIREMENTS FROM WHICH RELIEF IS REQUESTED:

Relief is requested from the examination coverage requirements of Figure IWB-2500-8(c)

#### LICENSEE'S BASIS FOR RELIEF:

Pursuant to 10 CFR 50.55a(a)(3)(ii), relief is requested on the basis that conformance with the Code requirements would result in undue hardship or unusual difficulty without a compensating increase in the level of quality and safety.

In order to perform the Code-required examinations of this weld, modification of the whip restraint would be required. Weld 2RC29AC-10, J01 is adjacent to a permanent whip restraint making it only accessible for a partial volumetric examination. A restraint ring is located over the subject valve-to-pipe weld and is adjacent to the valve body. Therefore, the surface examination and the circumferential volumetric scan could not be performed. However, the weld was scanned in the axial direction by reaching under the restraint ring. The licensee states that they would incur significant engineering, material, and installation costs to replace the restraint and would not realize a compensating increase in the level of quality and safety to justify such modifications.

#### LICENSEE'S PROPOSED ALTERNATE PROVISIONS:

The Code-required volumetric and surface examinations will be completed to the maximum extent possible. Current methods allow only the axial volumetric scan.

#### EVALUATION AND CONCLUSION

The staff has evaluated the limitations to surface and volumetric examinations of the valve-to-pipe weld 2RC29AC-10, J01 due to interference of a permanent whip restraint located over the weld. The staff has determined that due to lack of clearance between the pipe and the whip restraint, the weld is not accessible for a surface examination and the circumferential scan for a volumetric examination. However, an axial volumetric scan was performed by positioning the transducer on the pipe side and reaching under the restraint ring. Upon clarification from the licensee of the axial volumetric scan, the licensee confirmed that the scan was capable of detecting reflectors oriented parallel to the weld seam where weld flaws are most likely to exist. The circumferential scan, however, was obstructed because of the valve-to-pipe weld transition which narrowed the space between the weld and the restraint ring preventing the transducer from scanning on the required surface. The staff agrees that the removal of the restraint to achieve the code-required coverage would involve cutting a welded bar stock in a high radiation area which would significantly affect the licensee's as low as reasonably achievable (ALARA) goals. The staff has determined that the extent of volumetric coverage of the subject weld should have detected presence of any significant service-related degradation mechanisms in the weld. Further, the licensee's review of the results of the preservice inspection of the subject weld did not identify any defect in the weld and also, the examination of an identical weld in another reactor coolant loop also did not reveal any service-related degradation. The staff, therefore, believes that there is reasonable assurance of pressure boundary integrity with the licensee's proposed alternate provisions and that compliance to Code requirement would result in hardship without a compensating increase in the level of quality and safety. Therefore, the staff concludes that pursuant to the provisions of 10 CFR 50.55a(a)(3)(ii), the alternative proposed in relief request NR-26 is authorized for the first 10-year inspection interval of Byron, Unit 2.

Relief Request NR-27

COMPONENT IDENTIFICATION:

Code Class: 1  
Reference: Table IWB-2500-1  
Examination Category: B-A  
Item Number: B1.11  
Description: Limited volumetric examination of reactor pressure vessel lower shell to dutchman weld (RPVC-WR29)

EXAMINATION REQUIREMENT:

10 CFR 50.55a(g)(6)(ii)(A)(2) states that all licensees shall augment their reactor vessel examinations by implementing the examination requirements for reactor pressure vessel (RPV) shell welds specified in Item B1.10 of Examination Category B-A, "Pressure Retaining Welds in Reactor Vessel," in Table IWB-2500-1 of Subsection IWB of the 1989 Edition of Section XI, Division I, of the ASME Code, subject to the conditions specified in 10 CFR 50.55a(g)(6)(ii)(A)(3) and (4). For the purpose of this augmented examination, essentially 100 percent as used in Table IWB-2500-1 means more than 90 percent of the examination volume for each weld. Additionally, 10 CFR 50.55a(g)(6)(ii)(A)(5) requires licensees that are unable to completely satisfy the augmented RPV shell weld examination requirement to submit information to the U.S. Nuclear Regulatory Commission to support the determination, and propose an alternative to the examination requirements that would provide an acceptable level of quality and safety.

LICENSEE'S BASIS FOR RELIEF:

The examination of Unit 2 lower shell course-to-dutchman weld, RPVC-WR29, is restricted by six (6) core barrel locating lugs welded to the inner surface of the vessel approximately 4 inches above the weld. These lugs obstruct the automated ultrasonic inspection tool from examining the Code-required volume of the weld below each lug. During the refueling outage B2R07 of the first ISI interval, the volumetric examination coverage obtained for the weld was 57 percent of the Code-required examination volume.

Pursuant to 10 CFR 50.55a(g)(6)(ii)(A)(5), relief is requested from the augmented examination requirement of examining essentially 100 percent which amounts to a coverage in excess of 90 percent for the subject weld on the basis that the licensee's proposed alternative would provide an acceptable level of quality and safety.

LICENSEE'S PROPOSED ALTERNATE EXAMINATION:

The ultrasonic examination of Byron, Unit 2, reactor vessel was performed to the maximum extent possible. No alternative volumetric examination is proposed to examine the areas not scanned due to obstructions or geometric constraints.

A VT-1 visual inspection was conducted on the weld and the heat affected zone (HAZ) from the inside clad surface utilizing a submersible robot during the Byron, Unit 2, refuel outage B2R07. Additionally, a VT-2 visual examination during system pressure testing per Category B-P is performed on the Reactor Vessel each refueling outage to verify leaktight integrity of the weld.

#### EVALUATION AND CONCLUSION:

The staff has evaluated the alternatives proposed by the licensee for the volumetric examination of the reactor vessel lower shell to dutchman weld with regard to the following factors:

- physical constraints at the weld that limits required examination coverage,
- maximum extent of volumetric coverage obtained with the existing constraints,
- supplementing inner diameter examination with examination from outside,
- results of augmented vessel examination,
- detect presence of degradation mechanism, if any, from the examination, and
- effect of neutron irradiation on the subject weld.

The licensee performed a best-effort examination of the above weld in the reactor vessel from the inside surface. The volumetric coverage obtained for the weld is 57 percent. The reduced examination coverage was attributed to interferences caused by the core barrel locating lugs and the instrument tubes.

The licensee has stated that in both Byron units there is insufficient clearance between the reactor vessel wall and concrete which prevents an examination from the outside surface of the vessel to supplement the examination coverage of the subject weld.

The staff notes that all recorded indications found during augmented examination are Code acceptable and has determined that the lower shell course to bottom head weld being located outside the vessel beltline region would not be exposed to critical neutron fluence to the extent of being adversely subjected to irradiation embrittlement. The staff further believes that an unacceptable flaw caused due to any degradation mechanism, if present, would have been detected with reasonable confidence during volumetric examination. As an alternative, the licensee has also performed a VT-1 visual examination from the inside surface of the vessel on the weld and the heat-affected zone using a submersible robot. The VT-1 examination would detect conditions such as cracks, wear, corrosion, erosion, or physical damage in the weld and the adjacent area. Hence, if a degradation mechanism existed in the weld which would have developed into an inside surface flaw, the VT-1 visual examination would have detected it. The licensee's alternative VT-1 visual examination did not reveal any such adverse condition in the weld and in the adjacent area.

Therefore, the licensee's proposed alternative would provide an acceptable level of quality and safety of the weld.

The staff has reviewed the licensee's submittal and concludes that the licensee has maximized examination coverage for the reactor vessel lower shell to dutchman weld and that service-induced degradation mechanism, if present, would have been detected. The licensee's proposed alternative to supplement its best-effort examination with a VT-1 visual examination along with the volumetric coverage obtained for this weld provides an acceptable level of quality and safety. Therefore, the licensee's proposed alternative is authorized pursuant to 10 CFR 50.55a(g)(6)(ii)(A)(5) for Byron, Unit 2, during the first 10-year interval.

Relief Request NR-28

COMPONENT IDENTIFICATION:

Code Class:	1
Reference:	Table IWB-2500-1
Examination Category:	B-A
Item Number:	B1.11
Description:	Limited volumetric examination of reactor pressure vessel lower shell to dutchman weld (RPVC-WR29)

CODE REQUIREMENT

ASME Code, Section XI, Table IWB-2500-1, Examination Category B-A, Item Number B1.11 require essentially 100 percent volumetric examination of the reactor vessel lower shell to dutchman weld as detailed in Figure IWB-2500-1.

CODE REQUIREMENT FROM WHICH RELIEF IS REQUESTED

Relief is requested from the examination coverage requirement of Figure IWB-2500-1.

LICENSEE'S BASIS FOR RELIEF:

The examination of Unit 2 lower shell course-to-dutchman weld, RPVC-WR29, is restricted by six (6) core barrel locating lugs welded to the inner surface of the vessel approximately 4 inches above the weld. These lugs obstruct the automated ultrasonic inspection tool from examining the Code-required volume of the weld below each lug. During the refueling outage B2R07 of the first ISI interval, the volumetric examination coverage obtained for the weld was 57 percent of the Code-required examination volume.

Pursuant to 10 CFR 50.55a(g)(5)(iii), relief is requested from the requirement of examining essentially 100 percent which amounts to a coverage in excess of 90 percent for the subject weld on the basis that conformance with the Code requirement is impractical.

## EVALUATION:

The ASME Code, Section XI, requires volumetric examination of essentially 100 percent of weld length of the lower shell course-to-dutchman weld in the reactor vessel. However, the volumetric examination of this weld is impractical to perform to the extent required by the Code due to interferences caused by the core barrel locating lugs and the instrument tubes. In order to fully comply with the Code requirements, design modifications of the reactor vessel is required. The attendant design changes would place a significant burden on the licensee.

The staff has evaluated the alternatives proposed by the licensee for the volumetric examination of the reactor vessel lower shell-to-dutchman weld in regard to the following factors:

- physical constraints at the weld that limits required examination coverage;
- maximum extent of volumetric coverage obtained with the existing constraints;
- supplementing inner diameter examination with examination from outside;
- results of augmented vessel examination;
- detect presence of degradation mechanism, if any, from the examination; and
- effect of neutron irradiation on the subject weld.

The licensee performed a best-effort examination of the above weld in the reactor vessel from the inside surface. The volumetric coverage obtained for the weld is 57 percent. The reduced examination coverage was attributed to interferences caused by the core barrel locating lugs and the instrument tubes.

The licensee has stated that in both Byron units there is insufficient clearance between the reactor vessel wall and concrete which prevents an examination from the outside surface of the vessel to supplement the examination coverage of the subject weld.

The staff notes that all recorded indications found during examination are Code acceptable and has determined that the lower shell course-to-dutchman weld being located outside the vessel beltline region, would not be exposed to critical neutron fluence level to the extent of being adversely subjected to irradiation embrittlement. The staff further believes that any degradation mechanism, if present, would have been detected with reasonable confidence during volumetric examination. As an alternative, the licensee has also performed a VT-1 visual examination from the inside surface of the vessel on the weld and the heat-affected zone using a submersible robot. The VT-1 examination would detect conditions such as cracks, wear, corrosion, erosion, or physical damage in the weld and the adjacent area. Hence, if one of these degradation mechanisms existed in the weld which would have developed into an inside surface flaw, the VT-1 visual examination would have detected it. The licensee's alternative VT-1 visual examination did not reveal any such adverse condition in the weld and in the adjacent area.

Therefore, the licensee's proposed alternative would provide a reasonable assurance of structural integrity for the subject weld.

## SUMMARY:

The staff has evaluated the licensee's submittal on the relief request and concludes that the examination requirement of the Code for the subject welds is impractical due to interference caused by various permanent attachments inside the reactor vessel and would cause significant burden on the licensee if the Code requirements were to be imposed. The limited volumetric examination, supplemented with a VT-1 visual examination of the welds would provide a reasonable assurance of pressure boundary integrity. Therefore, the licensee's proposed alternative is authorized pursuant to 10 CFR 50.55a(g)(6)(i) for Byron, Unit 2, during the first 10-year ISI interval. The relief granted 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.

## 3.0 CONCLUSION

The staff has evaluated the information submitted by the licensee and has reached the following conclusions. For relief request NR-26, the staff concludes that compliance with the Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety; therefore, the alternative may be authorized pursuant to 10 CFR 50.55a(a)(3)(ii). For relief request NR-27, the proposed alternative provides an acceptable level of quality and safety; therefore, the alternative may be authorized pursuant to 10 CFR 50.55a(g)(6)(ii)(A)(5). For relief request NR-28, the Code requirements are impractical and the licensee's proposed alternative provides reasonable assurance of pressure boundary integrity, therefore, the alternative may be authorized pursuant to 10 CFR 50.55a(g)(6)(i).

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