January 6, 2000

Mr. Oliver D. Kingsley, President
Nuclear Generation Group
Commonwealth Edison Company
Executive Towers West III
1400 Opus Place, Suite 500
Downers Grove, IL 60515

SUBJECT: EVALUATION OF THE SECOND 10-YEAR INTERVAL INSERVICE INSPECTION PROGRAM REQUESTS FOR RELIEF FOR BRAIDWOOD STATION, UNITS 1 AND 2 (TAC NOS. MA7304 AND MA7305)

Dear Mr. Kingsley:

By letter dated April 17, 1998, as supplemented by letters dated August 3 and September 2, 1998, Commonwealth Edison Company (ComEd) submitted the second 10-year interval inservice inspection (ISI) program plan and 31 requests for relief for Braidwood Station, Units 1 and 2. In NRC letters of August 31, October 2 and October 26, 1998, and October 10, 1999, and January 4, 2000, the results of the staff's review of some of the relief requests were provided.

The staff, with the assistance of the Idaho National Engineering and Environmental Laboratory (INEEL), has reviewed and evaluated the information provided by ComEd related to Relief Requests I2R-01, I2R-02, I2R-03, I2R-04, I2R-06, I2R-08, I2R-09, I2R-10, I2R-16, I2R-18, I2R-19, I2R-20, I2R-21, and I2R-22. The staff adopts the conclusions and recommendations presented in INEEL's Technical Letter Report (TLR) attached to the enclosed Safety Evaluation (SE).

The alternatives proposed in relief request I2R-01, I2R-03, I2R-04, I2R-08, I2R-09, I2R-10, I2R-18, I2R-20, and I2R-22 are granted pursuant to 10 CFR 50.55a(g)(6)(i) on the basis that the conduct of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) requirements are impractical. The alternatives proposed in relief requests I2R-02, I2R-16, I2R-19, and I2R-21 are authorized pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that it provides an acceptable level of quality and safety.

ComEd proposed the use of Code Case N-498-1 for Class 3 systems in its Relief Request I2R-06. Since the original request was submitted, the NRC staff, in Regulatory Guide 1.147, Revision 12, approved Code Case N-498-1 for general use. Therefore, no Code relief is required.

The bases for authorizing these reliefs are stated in the enclosed SE. This completes our review of the relief requests submitted in the aforementioned ComEd letters.

Sincerely,

/RA/

Anthony J. Mendiola, Chief, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. STN 50-456 and STN 50-457

Enclosure: Safety Evaluation w/attached TLR

cc w/encl: See next page

The bases for authorizing these reliefs are stated in the enclosed SE. This completes our review of the relief requests submitted in the aforementioned ComEd letters

Sincerely,

/RA/

Anthony J. Mendiola, Chief, Section 2
Project Directorate III
Division of Licensing Project Management
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Docket Nos. STN 50-456 and STN 50-457

Enclosure: Safety Evaluation w/attached TLR

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO THE SECOND 10-YEAR INTERVAL INSERVICE INSPECTION INTERVAL

REQUESTS FOR RELIEF

COMMONWEALTH EDISON COMPANY

BRAIDWOOD STATION, UNITS 1 AND 2

DOCKET NOS. STN 50-456 AND STN 50-457

1.0 INTRODUCTION

Inservice inspection 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(6)(g)(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 pre-service 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) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The Code of record for the Braidwod Station, Units 1 and 2, is the 1989 Edition.

2.0 EVALUATION

By letter dated April 17, 1998, Commonwealth Edison Company (ComEd, the licensee), submitted its second 10-year inservice inspection (ISI) program for Braidwood Station, Units 1 and 2. Included in the submittal were 31 requests for relief. The licensee submitted Revision 1 of the ISI program by letter dated August 3, 1998. Revision 1 included revisions to multiple

requests for relief and withdrawal of Relief Request I2R-27. In a letter dated September 2, 1998, the licensee submitted Revision 2 of the ISI program. Revision 2 included a second revision to Request for Relief I2R-15. The licensee requested expedited review of several specific relief requests, which have been evaluated by the NRC in its safety evaluations (SE) dated August 31, 1998, October 2, 1998, October 26, 1998, October 10, 1999, and January 4, 2000. The Idaho National Engineering and Environmental Laboratory (INEEL) staff has evaluated the additional requests for relief in the licensee's program.

Based on the results of the review, the staff adopts the contractor's conclusions and recommendations presented in the Technical Letter Report (TLR) attached.

The information provided by the licensee in support of its alternative to the Code requirements has been evaluated and the basis for disposition is documented below.

Request for Relief No. I2R-01:
Code Case N-408-2, Tables 1 and 2, Examination Categories C-F-1 and C-F-2, Items C5.41, C5.42, and C5.81 require a surface examination as defined by Figures IWC-2500-9 through 13 (of the Winter 1983 Addenda) for branch pipe connection welds and longitudinal weld seams greater than NPS 2.

> **Note:** The licensee is using Code Case N-408-2, *Alternative Rules for Examination of Class 2 Piping, Section XI, Division 1*, in lieu of the requirements of the Code for the examination of Class 2 piping welds. Code Case N-408-2 was approved for general use by reference in Regulatory Guide 1.147, *Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1*, Revision 11.

Pursuant to 10 CFR 50.55a(g)(5)(iii), relief is requested from performing the Code Case required surface examination of the main steam piping branch connections and residual heat removal piping-to-safety injection piping branch connections listed in Section A of the contractor's report.

The staff determined that access to the subject welds is completely obstructed by reinforcing saddle plates that are fillet welded over the pressure-retaining branch connection welds. The staff determined that the design of the subject components makes the Code examinations impractical for these branch connections. To gain access for examination, the saddle plates would have to be removed and the branch connections redesigned and modified. Imposition of this requirement would create a significant burden on the licensee.

The licensee proposed as an alternative that it will perform a surface examination of the fillet welds attaching the saddle plate to the main pipe and branch pipe. The staff concludes that the alternate surface examination, along with the Code-required pressure tests, provides reasonable assurance of structural integrity of the subject branch connections. Therefore, relief is granted pursuant to 10 CFR 50.55a(g)(6)(i).

Request for Relief No. 12R-02:
The licensee is using Code Case N-509, *Alternative Rules for the Selection and Examination of Class 1, 2, and 3 Integrally Welded Attachments*, in lieu of the requirements of the Code for the examination of Class 1, 2, and 3 integrally welded attachments. Code Case N-509, has been approved conditionally for general use in Regulatory Guide 1.147, Revision 12.

Code Case N-509, Examination Categories C-C, Item C3.30, requires a 100% surface examination as defined by Figure IWC-2500-8 for pump integrally welded attachments. A 10% sample of the welded attachments associated with the component supports are selected for examination.

The staff determined that portions of the welds are located between the pump and the concrete support, making them inaccessible for surface examination. In lieu of the Code required surface examination, the licensee will perform the surface examination on the accessible portions of the welds and a VT-1 visual examination on the portions inaccessible for surface examination.

Since the entire length of each weld will be examined either by a surface or a visual examination, the licensee's proposed alternative provides an acceptable level of quality and safety. Therefore, the licensee's proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(i).

Request for Relief No. I2R-03:
ASME Code, Section XI, Examination Category B-J, Item No. B9.11 requires surface and volumetric examination as defined by Figure IWC-2500-8 for circumferential welds in piping NPS 4 or larger.

Pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the Code required volumetric and surface examinations on valve-to-pipe weld 2SI-09-17.

The staff determined that interference from a permanent whip restraint limits access and precludes complete volumetric and surface examination of the subject weld. To meet the Code examination requirements design modifications would be necessary. Therefore, the Code volumetric and surface examination requirements are impractical and imposition of these requirements would be a significant burden on the licensee.

The licensee has access to 75% of the subject weld and will perform the surface and volumetric examination to the maximum extent possible. In addition, this weld is part of a larger sample of B-J welds to be examined. Therefore, the staff concludes that the licensee's proposed alternative provides reasonable assurance of structural integrity of the subject components. Relief is granted pursuant to 10 CFR 50.55a(g)(6)(i).

Request for Relief No. I2R-04:
ASME Code, Section XI, Examination Category C-F-2, Item C5.51 of Code Case N-408-2 requires 100% surface and volumetric examination of the circumferential piping welds $\geq$3/8" nominal wall thickness for piping >NPS 4 as defined by Figure IWB-2500-7.

Pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the Code required 100% volumetric examination coverage of the following welds: 1FW-01-01, 1FW-02-01, and 1MS-04-07.

The staff determined that due to branch connections, weld-o-lets, and valve and tee geometries, access to the subject welds is limited. To meet the Code examination requirements, design modifications would be necessary. Therefore, the staff concludes that the Code volumetric examination coverage requirements are impractical for these welds and imposition of the Code requirements would be a significant burden on the licensee.

The licensee can obtain 74-84% of the required volumetric examination coverage. In addition, these welds will receive 100% surface examination and are part of a larger sample of Examination Category C-F-2 welds to be examined. Therefore, the staff concludes that the licensee's proposed alternative provides reasonable assurance of structural integrity of the subject welds. Relief is granted pursuant to 10 CFR 50.55a(g)(6)(i).

Request for Relief No. I2R-06:
ASME Code, Section XI, Table IWD-2500-1, Examination Categories D-A, D-B, and D-C require hydrostatic testing of Class 3 pressure-retaining components in accordance with IWA-5000 and IWD-5223.

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee proposed the use of Code Case N-498-1 for Class 3 systems.

Since reviewing the licensee's submittal of April 17, 1998, the NRC staff has approved Code Case N-498-1 for general use in Regulatory Guide 1.147, Revision 12 (dated May 1999). Therefore, Code Case N-498-1 is acceptable for use at Braidwood, Units 1 and 2. The Code Case supercedes N-498 and should be used in its entirety for all Class 1, 2, and 3 components.

Request for Relief No. I2R-08:
ASME Code, Section XI, Examination Category B-D, Items B3.110 and B3.120, require 100% volumetric examination of nozzle-to-shell welds and inside radius sections, as defined in Figure IWB-2500-7(b).

Pursuant to 10 CFR 50.55a(g)(6)(i) [10 CFR 50.55a(g)(5)(iii)] the licensee requested relief from the Code-required volumetric examinations of the pressurizer nozzle-to-shell welds and inside radius sections.

The volumetric examination of the pressurizer surge nozzle-to-vessel welds is limited due to pressurizer heater penetrations and the radius of curvature in the transition area between the nozzle and the vessel shell. Therefore, the nozzles' geometric design configuration and proximity to heater penetrations make volumetric examination impractical to perform. In addition, to meet the Code requirements, insulation would have to be removed and the nozzles would have to be modified to facilitate access for ultrasonic search units. The licensee has estimated that the radiation exposure to plant personnel for insulation removal, surface preparation and inspection of the accessible portion would exceed 150 person-rem. Imposition of these requirements would create a significant burden on the licensee.

The staff determined that reasonable assurance of structural integrity is provided by the fabrication examinations that were completed on the subject components, the large flaw tolerance of these components, the volumetric examinations of other Class 1 nozzles, and periodic VT-2 examinations. Relief is granted pursuant to 10 CFR 50.55a(g)(6)(i).

Request for Relief No. I2R-09:
Code Case N-509 (adopted by the licensee), Examination Category B-K, Item B10.10 requires 100% surface or volumetric examination, as applicable, of the integrally welded attachments for Class 1 vessels as defined by Figures IWB-2500-13, -14, or -15.

The seismic lug welds are inaccessible due to seismic lug restraints and the configuration of the pressurizer coffin. In order for access to be obtained major modifications to the pressurizer coffin would be required. This would result in a significant burden on the licensee. The staff concludes that the surface examination is impractical to perform to the extent required by the Code.

The licensee will perform a visual examination (VT-1) of the upper surface of three accessible lugs (per unit) and a best effort surface examination will be performed on the accessible portion of the subject welds. Therefore, the staff concludes that the best effort of surface examinations and the VT-1 examinations provide reasonable assurance of structural integrity of the subject components. Relief is granted pursuant to 10 CFR 50.55a(g)(6)(i).

Request for Relief No. I2R-10:
ASME Code, Section XI, Examination Category C-C, Item 3.20 of Code Case N-509 (adopted by licensee) requires a 100% surface examination of the integrally welded attachments of Class 2 piping as defined by Figure IWC-2500-5.

Pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the surface examinations required in Code Case N-509 for the integrally welded attachments listed in Section G of the contractor's report.

Portions of these welds are located inside piping penetrations which restrict access to the welds and, therefore, the 100% surface examination coverage of these welds is impractical to achieve. To achieve the Code required examination coverage, redesign of the piping systems to facilitate access would be required. Imposition of the Code requirements would result in a significant burden on the licensee.

The licensee has proposed to examine the subject welds to the extent practical. The staff determined that approximately 50% of the cumulative Code required surface coverage can be achieved and the examinations that can be completed provide reasonable assurance of structural integrity of these subject integral attachment welds. Relief is granted pursuant to 10 CFR 50.55a(g)(6)(i).

Request for Relief No. I2R-16:
ASME Code, Section XI, Table IWB-2500-1, Examination Category B-D, Items B3.90 and B3.100 require that, for reactor pressure vessel (RPV) nozzle welds and inner radius sections, at least 25%, but not more than 50% (credited) of the nozzles be examined by the end of the

first inspection period and the remainder by the end of the inspection interval. Examination Category B-F, Item B5.10, Nozzle-to-Safe End Butt Weld examinations may be performed coincident with the vessel nozzle examinations required by Examination B-D.

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee proposed to perform the required examinations at or near the end of the inspection interval for the following welds:

Nozzle-to-Vessel Welds (Item No. B3.90)	Nozzle Inner Radius Sections (Item No. B3.100)	Nozzle-to-Safe End Welds (Item No. B5.10)
1RV-01-06, 07, 08, 09, 10, 11, 12, 13	1RV-01-14, 15, 16, 17, 18, 19, 20, 21	1RV-01, 22, 23, 24, 25, 26, 27, 28, 29
2RV-01-06, 07, 08, 09, 10, 11, 12, 13	2RV-01-14, 15, 16, 17, 18, 19, 20, 21	2RV-01, 22, 23, 24, 25, 26, 27, 28, 29

The staff concludes that the licensee's proposed alternative is essentially identical to Code Case N-521 which is approved for use in Regulatory Guide 1.147, Revision 12 and all conditions listed in the Code Case have been confirmed. The licensee's proposed alternative provides an acceptable level of quality and safety. Therefore, the licensee's proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(i).

Request for Relief No. I2R-18:
ASME Code, Section XI, Examination Category B-A, Item B1.11 requires 100% volumetric examination of RPV circumferential shell welds, as defined by Figure IWB-2500-1. Item B1.21 requires 100% volumetric examination of the accessible portion of all circumferential head welds, as defined by Figure IWB-2500-3.

Pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the Code required 100% volumetric examination coverage for the welds listed below:

WELD	ITEM	DESCRIPTION	COVERAGE	LIMITATION
1RV-02-001	B1.21	Lower Head Circumferential Weld	86%	Instrumentation Nozzle penetrations
1RV-02-002	B1.11	Circumferential Shell Weld	81%	Core barrel locating lugs
2RV-02-001	B1.21	Lower Head Circumferential Weld	86%	Instrumentation Nozzle penetrations
2RV-02-002	B1.11	Circumferential Shell Weld	81%	Core barrel locating lugs

Access restrictions caused by instrumentation nozzles and core barrel support lugs preclude complete ultrasonic scans of the full volume of these welds. The Code required 100% volumetric examination is impractical to achieve. To gain access for 100% coverage the component would have to be redesigned and modified. This would place a significant burden on the licensee.

The licensee is able to obtain a significant portion (81-86%) of the required volumetric coverage. In addition, other RPV shell welds will receive the full (100%) coverage as required by the Code. Therefore, the staff concludes that the examinations provide reasonable assurance of structural integrity of the subject weld. Relief is granted pursuant to 10 CFR 50.55a(g)(6)(i).

Request for Relief No. I2R-19:
ASME Code, Section XI, Examination B-G-1, Item B6.10 requires 100% surface examination of the reactor vessel closure head nuts.

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee proposed an alternative to performing 100% surface examination of the reactor vessel closure head nuts.

As an alternative, the licensee has proposed to perform a VT-1 visual examination of reactor pressure vessel (RPV) closure head nuts in lieu of the Code required surface examination. All items in Examination Category B-G-1 except the reactor pressure vessel closure head nuts and the closure studs (when removed) require VT-1 visual examinations and/or volumetric examination (as applicable).

Article IWB-3000, Acceptance Standards, IWB-3517.1, Visual Examination, VT-1, describes conditions that require corrective action prior to continued service for bolting and associated nuts. One of these requirements is to compare crack-like flaws to the flaw standards of IWB-3515 for acceptance. The VT-1 visual examination acceptance criteria include evaluation of crack-like indications and other conditions requiring corrective action, such as deformed or sheared threads, localized corrosion, deformation of part, and other degradation mechanisms. Therefore, the VT-1 visual examination provides a comprehensive assessment of the condition of the closure head nut. The staff concludes that a VT-1 visual examination provides an acceptable level of quality and safety and the licensee's proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(i).

Request for Relief No. I2R-20:
ASME Code, Section XI, Examination Category B-A, Item B1.40, requires volumetric and surface examination of essentially 100% of the weld length, as defined by Figure IWB-2500-5, of the RPV head-to-flange weld to be performed during each inspection interval.

Pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the Code-required volumetric examination coverage requirement for the RPV head-to-flange welds in Section K of the contractor's report.

Figures supplied by the licensee show that the surface geometry of the flange, in combination with access restrictions caused by the head lifting lugs, preclude complete ultrasonic scans of the full volume of this weld. Therefore, the Code-required 100% volumetric examination is impractical to achieve. To gain access for 100% coverage, the component would have to be redesigned and modified. This would place a significant burden on the licensee.

The licensee is able to obtain a significant portion (88%) of the required volumetric coverage. In addition, the licensee will complete the Code required 100% surface examination. These

examinations should detect any existing patterns of degradation and provide reasonable assurance of the continued structural integrity of the weld. Relief is granted pursuant to 10 CFR 50.55a(g)(6)(i).

Request for Relief No. I2R-21:
ASME Code, Section XI, Examination Category B-A, Item B1.30 requires a volumetric examination of at least 50% of the weld by the end of the first period.

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee proposed to perform the required examinations at or near the end of the inspection interval for welds 1RV-01-005 and 2RV-01-005.

The performance of the subject examinations during the first period of the interval results in potential personnel safety hazards and excessive radiation exposure. The licensee's proposed alternative to perform the subject examinations at or near the end of the interval in conjunction with the automated nozzle examinations allows for a significant reduction in personnel radiation exposure and eliminates many of the safety hazards associated with performance of a manual examination of the flange weld. Additionally, the licensee performed examinations on the subject welds during the third period of the first interval and found no indications or relevant conditions. The third period examinations performed ensure that no more than 10 (Code) years will lapse between the successive examinations.

Based on the examinations completed during the first and third period of the first interval, and the fact that no more than 10 (Code) years will lapse between successive examinations of the subject components, the staff concludes that the licensee's proposed alternative provides an acceptable level of quality and safety. The licensee's proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(i).

Request for Relief No. I2R-22:
ASME Code, Section XI, Examination Category B-D, Item B3.90 requires 100% volumetric examination of all nozzle-to-vessel welds in the reactor pressure vessel, as defined by Figure IWB-2500-7.

Pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the Code required volumetric examination for the welds listed in Section M of the contractor's report.

Complete examination from the inside diameter of all nozzle-to-vessel welds in the reactor pressure vessel, as defined by Figure IWB-2500-7, is restricted by physical obstructions (internal integral extension). In addition, access from the OD is restricted due to the proximity of the RPV shield wall that does not allow for removal of the RPV insulation, surface preparation and inspection. Therefore, the complete Code required volumetric coverage for these components is impractical. To perform the Code required examinations the RPV nozzles would require redesign and physical modifications. Imposition of this requirement would be a significant burden on the licensee.

The licensee is capable of examining a significant portion of the subject welds (81%). In addition, other Class 1 nozzle-to-vessel welds will be examined as required by the Code.

Therefore, the staff concludes that the licensee's proposed alternative provides reasonable assurance of structural integrity of the subject components. Relief is granted pursuant to 10 CFR 50.55a(g)(6)(i).

3.0 CONCLUSIONS

The staff concludes that for relief requests I2R-02, I2R-16, I2R-19 and I2R-21 the licensee's proposed alternatives to the Code requirements provide an acceptable level of quality and safety. Therefore, these proposed alternatives are authorized pursuant to 10 CFR 50.55a(a)(3)(i).

For relief requests I2R-01, I2R-03, I2R-04, I2R-08, I2R-09, I2R-10, I2R-18, I2R-20, and I2R-22, it is concluded that the Code requirements are impractical for the subject welds and their proposed alternatives provide reasonable structural integrity of the subject components. Relief is granted pursuant to 10 CFR 50.55a(g)(6)(i).

Relief request I2R-06 to use Code Case N-498-1 is acceptable for use at Braidwood, Units 1 and 2, as the Code Case has been approved for general use by incorporation in Regulatory Guide 1.147, Revision 12.

Attachment: Technical Letter Report

Principal Contributor: T. McLellan

Date: January 6, 2000

TECHNICAL LETTER REPORT
ON SECOND 10-YEAR INTERVAL INSERVICE INSPECTION PROGRAM
REQUESTS FOR RELIEF
FOR
COMMONWEALTH EDISON COMPANY
BRAIDWOOD NUCLEAR POWER STATION, UNITS 1 AND 2
DOCKET NUMBER: 50-456 AND 50-457

1. INTRODUCTION

By letter dated April 17, 1998, the licensee, Commonwealth Edison Company, submitted its second 10-year inservice inspection (ISI) program for Braidwood Nuclear Power Station, Units 1 and 2. The licensee submitted Revision 1 of the ISI program by letter dated August 3, 1998. Revision 1 included revisions to multiple requests for relief and withdrawal of Relief Request I2R-27. In a letter dated September 2, 1998, the licensee submitted Revision 2 of the ISI program. Revision 2 included a second revision to Request for Relief I2R-15. The licensee requested expedited review of several specific relief requests, which have been evaluated by the NRC in SERs dated August 31, 1998, October 2, 1998, and October 26, 1998. The Idaho National Engineering and Environmental Laboratory (INEEL) staff has evaluated the additional requests for relief in the licensee's program , with the exception of those previously expedited, in the section below.

2. EVALUATION

The information provided by Commonwealth Edison Company in support of the requests for relief from Code requirements has been evaluated and the bases for disposition are documented below. The Code of record for the Braidwood Nuclear Power Station, Units 1 and 2, second 10-year ISI interval, which began July 28, 1998 and October 17, 1998, respectively, is the 1989 Edition of Section XI of the ASME Boiler and Pressure Vessel Code.

A. Request for Relief No. I2R-01, Examination Categories C-F-1 and C-F-2, Items C5.41, C5.42, and C5.81, Class 2 Piping Welds

Note: The licensee is using Code Case N-408-2, *Alternative Rules for Examination of Class 2 Piping, Section XI, Division 1*, in lieu of the requirements of the Code for the examination of Class 2 piping welds. Code Case N-408-2 was approved for general use by reference in Regulatory Guide 1.147, *Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1*,Revision 11.

Code Requirement: Code Case N-408-2, Tables 1 and 2, Examination Categories C-F-1 and C-F-2, Items C5.41, C5.42, and C5.81 require a surface examination as defined by Figures IWC-2500-9 through 13 (of the Winter 1983 Addenda) for branch pipe connection welds and longitudinal weld seams greater than NPS 2.

Licensee's Code Relief Request: Pursuant to 10 CFR 50.55a(a)(5)(iii), relief is requested from performing the Code Case required surface examination of the main steam piping branch connections, and residual heat removal piping-to-safety injection piping branch connections listed in the table below.

ATTACHMENT

UNIT	SYSTEM	LINE	WELD NUMBERS
1	RH	1RH01CA-16"	1SI-24-23BA, 23ABA
1	RH	1RH01CB-16"	1SI-24-23BB, 23ABB
1	MS	1MS07AA-28"	1MS-04-25*, -26, -27, -28, -29
1	MS	1MS07AB-28"	1MS-06-43, -44, -45, -46, -47
1	MS	1MS07AC-28"	1MS-08-25, -26, -27, -28, -29
1	MS	1MS07AD-28"	1MS-02-37, -38, -39, -40, -41
2	RH	2RH01CA-16"	2SI-24-25, 26
2	RH	2RH01CB-16"	2SI-24-70, 71
2	MS	2MS07AA-28"	2MS-04-34*, -37, -40, -43, -46
2	MS	2MS07AB-28	2MS-06-34, -37, -40, -43, -46
2	MS	2MS07AC-28	2MS-08-31, -34, -37, -40, -43
2	MS	2MS07AD-28	2MS-02-36, -38, -42, -44, 47
(*) Denotes welds selected for Section XI inspection during the interval			

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

"Pursuant to 10 CFR 50.55a(g)(5)(iii), relief is requested on the basis that conformance with the Code requirements is impractical.

"The design of the branch pipe connection weld joints listed requires the use of reinforcement saddles. These saddles are fillet welded over the pressure retaining branch pipe connection weld (and long seams), completely encasing it as illustrated in Figures 1 and 2[1]. This design precludes performance of surface or volumetric examination of the pressure retaining branch connection weld (and long seams).

"In order to gain access to perform the Code required examination, the saddle plates would have to be removed, and the branch connections redesigned and modified. This course of action is deemed a considerable burden by Braidwood Station, thus making the Code required examination impractical to perform.

"Assurance of the continued integrity of these joints is afforded by the fact that the reinforcement saddle strengthens the joint and reduces the stresses on the obstructed branch to pipe weld. In addition, a VT-2 examination during system pressure testing per Category C-H is also performed on these welds each inspection period to verify leaktight integrity.

1Licensee's figures and attachments not included with this Technical Letter Report

"Based on the preceding information, Braidwood Station requests relief from the ASME Section XI requirements for Class 2 branch pipe connection welds (and long seams) that are designed with a reinforcement saddle."

Licensee's Proposed Alternative Examination (as stated):
"As an alternative, Braidwood Station will perform a surface examination of the saddle to main pipe weld and the saddle to branch pipe weld (and accessible long seam) on those inaccessible welds selected for examination."

Evaluation: The Code Case requires a 100% surface examination of each of the subject branch connection welds. However, access to these welds is completely obstructed by reinforcing saddle plates that are fillet welded over the pressure-retaining branch connection welds. Therefore, the design makes the Code examinations impractical for these branch connections. To gain access for examination, the saddle plates would have to be removed and the branch connections redesigned and modified. Imposition of this requirement would create a considerable burden on the licensee.

In lieu of the Code-required surface examination, the licensee will perform a surface examination of the fillet welds attaching the saddle plate to the main pipe and branch pipe. Examination of these welds will detect any gross structural deformation and confirm the overall integrity of the branch connection. In addition, the licensee will perform VT-2 visual examinations of these areas in conjunction with the Class 2 pressure tests. As depicted in the licensee's attached figure, each of the saddle plates includes a telltale hole. Any leakage that could occur from the inaccessible pressure-retaining weld would be detected during the Class 2 pressure tests. The INEEL staff concludes that the alternate surface examination, along with the Code-required pressure tests, will ensure the structural integrity of the subject branch connections. Therefore, considering the impracticality of the Code requirements for the subject welds and the assurances provided by the alternative surface examination and Code-required pressure tests, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

B. Request for Relief No. I2R-02, Examination Category C-C, Item C3.30, Integrally Welded Attachments to Pumps

Note: The licensee is using Code Case N-509, *Alternative Rules for the Selection and Examination of Class 1, 2, and 3 Integrally Welded Attachments*, in lieu of the requirements of the Code for the examination of Class 1, 2, and 3 Integrally welded attachments. Code Case N-509, has been approved conditionally for general use in Regulatory Guide 1.147, Revision 12.

Code Requirement: Code Case N-509, Examination Categories C-C, Item C3.30, requires a 100% surface examination as defined by Figure IWC-2500-8 for pump integrally welded attachments. A 10% sample of the welded attachments associated with the component supports are selected for examination.

Licensee's Proposed Alternative: In accordance with 10 CFR 50.55a(a)(3)(i), the licensee proposed an alternative to the Code-required surface examination of integrally welded

attachments to the centrifugal charging pumps, residual heat removal (RHR) pumps, and containment spray pumps; these attachments are:

PUMP	INTEGRAL ATTACHMENT WELDS
1(2)CV01PA	CVP-01*, CVP-02, CVP-03, CVP-04
1(2)CV01PB	CVP-01, CVP-02, CVP-03, CVP-04
1(2)RH01PA	RHP-01*, RHP-02, RHP-03
1(2)RH01PB	RHP-01, RHP-02, RHP-03
1(2)CS01PA	CSP-01**, CSP-02, CSP-03
1(2)CS01PB	CSP-04***, CSP-05, CSP-06
(*) Denotes welds selected for inspection during the interval (**) "A" Pump selected only for Unit 2 (***) "B" Pump selected only for Unit 1	

The licensee stated:

"When a pump has a lug scheduled for inspection, all the lugs on that pump will be inspected to the maximum extent possible per the below requirements:

(1) "The Code required surface examination will be performed for the subject pump on all the accessible portions of all pump lug welds.

(2) "A visual, VT-1 examination will be performed on the portions of the subject welds which are obstructed."

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

"Pursuant to 10 CFR 50.55a(a)(3)(i), relief is requested on the basis that the proposed alternative would provide an acceptable level of quality and safety.

"The design of the Centrifugal Charging Pump, Residual Heat Removal Pump and Containment Spray Pump support lugs obstruct portions of the associated integral attachment welds from the code required surface examination. The obstructed areas are shown in Figures 1, 2, and 3. As detailed in these Figures, the portion of the subject weld within the recess between the pumps and the support does not provide sufficient clearance to perform a surface examination. The approximate amount from field measurements and First Interval inspection data of accessible weld length per lug that can be surface examined is as follows: 77% for the CV pump, 76% for the RH pump, and 65% for the CS pump.

"Reasonable assurance of the continued inservice structural integrity of the subject weld(s) will be achieved without performing the complete Code examination based on the following. When a pump has a lug scheduled for inspection, all the lugs on that pump will be inspected to the maximum extent possible. The Code required surface examination will be performed for the subject pump on all the accessible portions of all pump lug welds. A visual VT-1 inspection will be performed on the portions of the subject welds which are obstructed. Performance of the alternative Visual, VT-1 examination of the obstructed weld length will provide an acceptable

level of quality and safety. These are not full penetration welds, but surface fillet welds. In addition, a VT-2 examination during system pressure testing per Category C-H is also performed on these pumps each inspection period to verify leaktight integrity."

Evaluation: Code Case N-509 requires 100% surface examination of the subject integral attachment welds. However, portions of the welds are located between the pump and the concrete support, making them inaccessible for surface examination. In lieu of the Code-required surface examination, the licensee will perform the surface examination on the accessible portions of the welds and a VT-1 visual examination on the portions inaccessible for surface examination.

The licensee's proposed alternative, to visually examine portions of the subject integral attachment welds that are inaccessible for surface examination, in combination with the Code-required surface examination of the accessible portions, will detect any significant patterns of degradation that could affect the structural integrity of the integral attachments. Since the entire length of each weld will be examined—either surface or visual examination—the licensee's alternative will provide an acceptable level of quality and safety. Therefore, it is recommended that the licensee's proposed alternative be authorized pursuant to 10 CFR 50.55a(a)(3)(i).

C. Request for Relief No. I2R-03, Examination Category B-J, Item No. B9.11, Pressure Retaining Welds in Piping

Code Requirement: Examination Category B-J, Item No. B9.11 requires surface and volumetric examination as defined by Figure IWC-2500-8 for circumferential welds in piping NPS 4 or larger.

Licensee's Code Relief Request: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the Code-required volumetric and surface examinations on valve-to-pipe Weld 2SI-09-17.

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

"Pursuant to 10 CFR 50.55a(g)(5)(iii), relief is requested on the basis that conformance with the Code requirements is impractical.

"In order to perform the Code required examinations of this weld, modification of the whip restraint would be required. Weld 2SI-09-17 is adjacent to a permanent whip restraint making it only accessible for partial surface and volumetric examination (See Figure 1). Braidwood would incur significant engineering, material, and installation costs to perform such a replacement and would not realize a compensating increase in the level of quality and safety to justify such modifications.

"During the First Interval inspection of weld 2SI-09-17, it was noted that approximately 8.4" of pipe surface was not accessible for volumetric and surface examination. This examination is essentially performed from the pipe side due to the pipe valve configuration. Clearance between the pipe and whip restraint allows for limited inspection where the transducer was capable of being maneuvered

between the pipe and whip restraint gap. The area of the whip restraint which contained the lugs caused the interferences with the examination. The obstructed surface area is conservatively calculated as follows:

"Pipe Circumference = (10.75)(3.141592654) = 33.77"
"Obstructed Area = 8.4"
"(%) Obstructed = 8.4"/33.77" =24.9%"

"Reasonable assurance of the continued inservice structural integrity of weld 2SI-09-17 will be achieved without completing the complete Code required volumetric and surface examinations based on the following. Past first interval inspections, preservice inspections, and construction inspections have not revealed any rejectable flaws in this weld. The required second interval surface and volumetric examinations will be performed to the maximum extent possible. In addition to the surface and volumetric exams, the Visual (VT-2) examination of the weld during the system leakage test performed each refueling outage and during the system hydrostatic test performed each interval (per Code Case N-498) will also continue to assure the inservice structural integrity of weld 2SI-09-17.

Licensee's Proposed Alternative Examination (as stated):

"The Code required volumetric and surface examination will completed to the maximum extent possible. Also, the VT-2 examination during system pressure testing will be performed on weld 2SI-09-17."

Evaluation: The Code requires 100% surface and volumetric examination of the subject Class 1 piping weld. Figures supplied by the licensee reveal that interference from a permanent whip restraint limits access and precludes complete volumetric and surface examination of the subject weld. To meet the Code examination requirements, design modifications would be necessary. Therefore, the Code volumetric and surface examination requirement is impractical. Imposition of this requirement would create a significant burden on the licensee.

The licensee has access to 75% of the subject weld and will perform the surface and volumetric examination to the maximum extent possible. In addition, this weld is part of a larger sample of B-J welds to be examined. Therefore, reasonable assurance of structural integrity is provided by the examinations that will be completed on this and other welds within the entire sample.

Based on the impracticality of meeting the Code's volumetric and surface examination requirements for the subject welds, and the reasonable assurance of structural integrity provided by the examinations that will be completed, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

D. Request for Relief No. I2R-04, Category C-F-2, Pressure-Retaining Welds in Carbon or Low Alloy Steel Piping

Code Requirement: Examination Category C-F-2, Item C5.51 of Code Case N-408-2 requires 100% surface and volumetric examination of the circumferential piping welds $\geq$3/8" nominal wall thickness for piping >NPS 4 as defined by Figure IWB-2500-7.

Licensee's Code Relief Request: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the Code-required 100% volumetric examination coverage of the welds listed below.

1FW-01-01 1FW-02-01 1MS-04-07

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

"The welds listed in Table 1 below have obstructions on each side which interferes with the volumetric examination. These interferences can cause poor coupling of the transducer, limited movement of the transducer, redirecting of the sound beam and, in some cases, complete restriction of a particular scan. The obstructions limit the percentage of code required volume examined as detailed in Table 1.

Table 1

Weld #	Line #	Weld Volume Not Examined	Reason For Limited Exam
1FW-01-01	1FW86AD-16"	16%	Branch connection, valve geometry
1FW-02-01	1FW86AA-16"	16%	Branch connection valve geometry
1MS-04-07	1MS01BA-30.25"	26%	Weldolets, tee geometry

The estimates of weld length not examined are extremely conservative and are actually a percent of weld length where complete coverage of the Code required weld volume was in question. The probability of a flaw occurring only in one of the areas not being examined is extremely small. Future indications of significant size are expected to be found by the examination of the accessible weld volume. In addition, these welds are located in the MSIV Valve rooms, which are part of a large population of high energy line welds which are required to be volumetrically examined once per 10 years. There are 314 welds in the Unit 1 population (Reference Note 5 of the ISI Program Plan). If flaw initiation and propagation is occurring in these systems, the inspection of the other weld locations should provide early signs of system degradation.

Reasonable assurance of the continued inservice structural integrity of the welds will be achieved without completing the complete Code required volumetric examination. The surface examination, along with the Visual (VT-2) examination of the weld during the system leakage test performed each period and during the system hydrostatic test performed each interval per Code Case N-498 will provide reasonable assurance of the continued inservice structural integrity of the welds.

Licensee's Proposed Alternative Examination (as stated):

"The Code required volumetric examination will be completed to the maximum extent practical using available ultrasonic examination techniques."

Evaluation: The Code Case requires 100% surface and volumetric examination of the subject Class 2 piping weld. Due to branch connections, weld-o-lets, and valve and tee geometries, access to the subject welds is limited. These conditions preclude complete

volumetric examination. To meet the Code examination requirements, design modifications would be necessary. Therefore, the Code volumetric examination coverage requirements are impractical for these welds. Imposition of these requirements would create a significant burden on the licensee.

The licensee can obtain 74-84% of the required volumetric examination coverage. In addition, these welds will receive 100% surface examination and are part of a larger sample of Examination Category C-F-2 welds to be examined. Therefore, reasonable assurance of structural integrity will be provided by the examinations that have been completed on the subject welds, and on other welds within the entire sample population.

Based on the impracticality of meeting the Code volumetric and surface examination coverage requirements for the subject welds, and the reasonable assurance of structural integrity that is provided by the examinations that can and will be completed, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

D. Request for Relief No. I2R-06, Use of Code Case N-498-1, *Alternative Rules for 10-Year System Hydrostatic Testing for Class 1, 2, and 3 Systems* for Class 3 Systems

Code Requirement: Section XI, Table IWD-2500-1, Examination Categories D-A, D-B, and D-C require hydrostatic testing of Class 3 pressure-retaining components in accordance with IWA-5000 and IWD-5223.

Licensee's Proposed Alternative: In accordance with 10 CFR 50.55a(a)(3)(i), the licensee proposed the use of Code Case N-498-1 for Class 3 Systems.
The licensee stated:

> "A system pressure test with a VT-2 visual examination will be performed with the Class 3 system pressurized to a test pressure equal to nominal operating pressure. The visual examination will be conducted after the system has been pressurized to test pressure for a minimum of 10 minutes for noninsulated components or 4 hours for insulated components prior to examination. The system will be maintained at test pressure for the duration of the VT-2 visual examination. Hydrostatic test instrumentation requirements of IWA-5260 are not applicable, as test parameter recording is performed by normal operating system instrumentation or equivalent.
>
> "The system pressure test will be conducted at or near the end of the inspection interval or during the same inspection period of each inspection interval.
>
> "The boundary subject to test pressurization and VT-2 visual examination during the system pressure test shall extend to all Class 3 components included in those portions of systems required to operate or support the safety system function up to and including the first normally closed valve (including safety or relief valve) or valve capable of automatic closure when the safety function is required."

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

> "Pursuant to 10 CFR 50.55a(a)(3)(i), relief is requested on the basis that the proposed alternatives provide an acceptable level of quality and safety.

"Elevated pressure hydrostatic tests are difficult to perform and often represent a true hardship without benefits gained. Some of the difficulties associated with 10 year system hydrostatic testing include:

- "Complicated or abnormal valve line-ups to provide system draining, filling, venting, and system isolation.

- "Relief valves with set points lower than the hydrostatic test pressure must be locked closed, removed and blank flanged. This process requires draining, refilling of the system prior to the test and draining, valve restoration, and refilling once more for system restoration. Improper blocking or gagging can result in damage to the relief valve.

- "Valves that are not normally used for isolation are often required to provide pressure isolation for a hydrostatic test. In order to provide proper isolation, time consuming valve maintenance would be required prior to a hydrostatic test.

"At hydrostatic test pressures required by ASME Section XI, 10% and 25% over the piping design pressure, a hydrostatic test does not induce significantly more stresses in the system than in a system operational test. Also, the system stresses associated with the hydrostatic test do not compare to the stress associated with thermal growth and dynamic loading during design basis events. Therefore, little benefit is gained from the hydrostatic test over the nominal operational pressure test.

"Industry experience, which ComEd Stations experience supports, indicates that most through wall leakage is detected during system operation as opposed to hydrostatic testing at elevated pressures.

"These arguments are also supported by ASME Code Case N-498-1, 'Alternate Rules for 10 Year Hydrostatic Pressure Testing for Class 1, 2 and 3 Systems, Section XI, Division 1' and ASME Code Case N-498, 'Alternate Rules for 10 Year Hydrostatic Pressure Testing for Class 1 and 2 Systems, Section XI, Division 1'. Code Case N-498-1 has been reviewed and approved by the Board of Nuclear Codes and Standards (BNCS). Code Case N-498 for Class 1 and 2 systems had previously been approved and accepted for industry use in Regulatory Guide 1.147, Revision 10.

"Based on the above, Braidwood Station requests relief from the ASME Section XI Class 3 Ten Year System Hydrostatic Pressure Testing requirements."

Evaluation: The Code requires a system hydrostatic test once per interval in accordance with the requirements of IWA-5000 for Class 3 pressure-retaining systems. In lieu of the Code-required hydrostatic testing, the licensee has requested authorization to use Code Case N-498-1, *Alternative Rules for 10-Year System Hydrostatic Testing for Class 1, 2, and 3 Systems*, dated May 11, 1994, for Class 3 components.

In paragraph 5.2.1 of the licensee's program submittal the licensee confirms the use of Code Case N-498. Code Case N-498, *Alternative Rules for 10-Year System Hydrostatic Testing for Class 1 and 2 Systems*, was previously approved for general use on Class 1 and 2 systems in Regulatory Guide 1.147, Revision 11. For Class 3 systems, N-498-1 specifies requirements identical to those for Class 2 components (for Class 1 and 2 systems, the alternative requirements in N-498-1 are unchanged from N-498). Since the licensee's submittal of April 17, 1998, the NRC staff has approved Code Case N-498-1 for general use in Regulatory Guide 1.147, Revision 12 (Dated May 1999). Therefore, Code Case N-498-1 is acceptable for use at Braidwood, Units 1 and 2. The Code Case supercedes N-498 and should be used in its entirety for all Class 1, 2, and 3 components.

E. Request for Relief No. I2R-08, Examination Category B-D, Pressurizer Full Penetration Nozzle-to-Vessel Welds and Inside Radius (IR) Sections

Code Requirement: Examination Category B-D, Items B3.110 and B3.120, require 100% volumetric examination of nozzle-to-shell welds and inside radius sections, as defined in Figure IWB-2500-7(b).

Licensee's Code Relief Request: The licensee requested relief from the Code-required volumetric examinations of the pressurizer nozzle-to-shell welds and inside radius sections.

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

> "Braidwood Units 1 and 2 pressurizer nozzles are welded to the vessel heads (Figure 1). Each pressurizer has a single surge nozzle in the lower head. In order to perform UT examinations on these areas, the outside surface of the lower vessel head, which is the optimal scanning surface, must be accessible. This optimal scanning surface is made accessible by removing the lower pressurizer head insulation. The impact of removing the lower head insulation is discussed below.
>
> "The lower head of the pressurizer is covered by 4 inches of multi-layered stainless steel mirror insulation. To remove the insulation, the 78 pressurizer heater cables would have to be disconnected (Figure 2). In addition, each of the 78 convection stops, which are riveted to the insulation, would have to be cut so that the insulation could be removed (Figure 3).
>
> "Previous attempts to acquire this data at another ComEd plant have proven unsuccessful. During previous outages, an attempt was made to modify the insulation on the lower head of the Byron Unit 2 pressurizer to allow inspection access without full insulation and heater cable removal. The insulation group worked for three shifts per day for five days to remove this insulation. The groups used small grinders to cut the insulation from the nozzle to the first ring of immersion heaters. After this work was completed, the bottom head insulation was lowered until stopped by the heater connections. These actions did not result in sufficient access to conduct the required examinations. Further actions to provide access were determined to be impractical. The insulation was replaced and the cut areas were covered.

"Examination of the nozzle to vessel weld and the nozzle inner radius would result in limited examination coverage. Even if the insulation were removed, full ultrasonic examination coverage of the surge nozzle-to-vessel weld can not be achieved. The pressurizer surge nozzle geometry limits transducer contact.

"Consequently, scanning on the nozzle side of the weld is impracticable. The Heater penetrations obstruct scanning from the shell side of the weld. The estimated coverage would only be approximately 60% of the weld volume. Regarding the nozzle inner radius, only limited ultrasonic examination of the nozzle inside radius sections would be achievable from the outside surface with the insulation removed. The complex geometry of the "blend region" is not conducive to typical UT examination techniques. A limited examination would be possible if ultrasonic scanning were conducted from the nozzle. However, due to the complex geometry of the nozzle, the resulting coverage would provide very limited data from which to assess the condition of the surge nozzle inside radius section. The limited data obtained from these examinations does not provide a compensatory increase in quality and safety to justify the hazards of personnel radiation exposure incurred to obtain the data.

"The radiation exposure to plant personnel for insulation removal, surface preparation, and inspection is estimated to be 154 person-rem. To provide a basis for the dose estimates, a survey was conducted during the Braidwood A2R05 outage on March 16, 1996. This survey shows a 500mR contact dose rate on the lower head insulation with a general area rate of over 200mR. The primary work of disconnecting the heater cables, removing insulation, surface preparation, and inspection would occur in an area approximately 1 foot from the surge nozzle. After the insulation is removed, the rates shown in the survey would increase. Lead shielding would not be practicable because the shielding would have to be placed on the surfaces that require work."

Estimated Dose for PZR Surge Nozzle and Nozzle Inner Radius Examination

Activity	Man Hour Estimates[1]	Dose Rate (R/hr)[2]	Accumulated Dose (R)
Scaffolding	98	0.150	14.7
Cable Disconnection/Replacement	412	0.250	103
Insulation Removal/Replacement	140	0.250	35
Surface Preparation	1	0.250	0.25
Examination	4	0.250	1
Total	655	-	153.95

[1]Time estimates established by W.A. Pope Company, the primary contractor, and Raytheon Engineers & Constructors, the inspection organization.

[2]Whole body dose rate estimates based on location of worker's trunk for specified work in required area at about 1 foot form surge line.

"Westinghouse Materials and Engineering Group has provided technical input to the basis for the exemption request for the nozzle to vessel weld and nozzle inner radius. This assessment discusses the structural integrity of the Braidwood Units 1 and 2 Pressurizer Surge Nozzle with respect to the nozzle to vessel weld and nozzle inner radius, and the need for the inservice inspection of these areas. The assessment includes three complimenting approaches which include inspection history, fracture assessment, and risk assessment. Each approach arrives at the same conclusion, which is that the inservice inspections of the nozzle areas do not significantly improve the confidence in the structural integrity of the pressurizer.

"The surge nozzle inner radius for each pressurizer was subjected to a surface examination both before and after the deposit of the stainless steel cladding. The inspection before cladding included 100% UT. The inspection after cladding was performed after the manufacturer hydrotest and included a radiographic examination for both the nozzle inner radii and nozzle to vessel weld for acceptance to ASME Section III.

"For preservice inspection, a UT was conducted on the nozzle to vessel welds with no indications in excess of allowables in ASME Section XI table IWB-3512-1. The nozzle inner radii did not have a preservice UT conducted due to the fact that no technique was available. Preservice relief request 1NR4 (Unit 1) and 2NR4 (Unit 2) were granted for the nozzle inner radius."

"For inservice inspection of the surge nozzles, access restrictions and the radiological concerns preclude contact examinations from the inside of the pressurizer. This leaves the only option to perform the examination from the nozzle outside surface blend region as described previously in the 'Basis for Relief'.

"A survey was conducted by the Westinghouse Owners Group, where it was discovered that roughly half of the plants surveyed have sought and received relief from volumetric examinations for the aforementioned reasons. Those that have been carrying out surge nozzle inspections have not reported any indications. Specifically, 21 inspections have been completed, 9 by using UT methods, with no reported indications. While this finding in itself is not sufficient to prove there is no need for further inspection in these areas, it is consistent with the other findings here, in that no concerns are evident with flaws in this region at the beginning of service, and there are no known mechanisms for cracks to initiate during service.

"Westinghouse conducted fracture evaluations of the Braidwood surge nozzle inner radius and nozzle to vessel weld regions to determine the sensitivity of this region to the presence of a flaw. The full set of design transients was considered, and the most limiting event was found to be the heatup and cooldown, which can involve insurges of cooler water into the bottom of the pressurizer. The cooler water has a higher density than the water in the pressurizer before the insurge, and therefore mixing cannot be guaranteed. The worst case where no mixing occurs was addressed, and the maximum temperature difference between the loop and pressurizer of 320°F was assumed. Because the pressurizer is hot when the insurges occur, the fracture toughness value from the ASME Code Section XI K_{1A} curve was found to be 200 ksi$\sqrt{}$in. The entire range of times during the insurge

events was considered along with all the other design transients, and the stress intensity factor never exceeded the toughness, regardless of the size of the postulated crack. These results are summarized in Figures 4 and 5. Therefore, the structural integrity of the pressurizer will not be affected by flaws in the surge nozzle inner radius or nozzle to vessel weld.

"Westinghouse examined the effects of inservice examinations on the risk of failure due to cracking in the surge nozzle. From the fracture assessment it was determined that there is a very large tolerance for the presence of flaws in both the nozzle inner radii and the nozzle to vessel weld. Since the applied stress intensity factor does not exceed the fracture toughness, it could be argued that leakage would occur from a through wall flaw at the nozzle before any integrity problems would occur.

"There are no mechanisms of damage other than fatigue for the surge nozzle. Therefore, the only scenarios of concern are for a flaw which was not found in the fabrication and preservice examinations to grow during service, or for a flaw to initiate during service and grow.

"The surge nozzle forgings for Braidwood Units 1 and 2 were examined by both UT and MT prior to the cladding being applied. After cladding, the surge nozzles were required to be liquid penetrant tested to ensure the integrity of the cladding. The nozzle to vessel welds received both penetrant and volumetric (RT) during fabrication and UT during preservice examinations. With these examinations, it is extremely unlikely that a flaw of any size would be missed. Fatigue crack growth from any such flaw would be very small, and the fatigue assessments carried out to certify the design acceptance ensure that the fatigue loads during service are unlikely to initiate a flaw. Therefore the risk of failure is very low, and is unchanged whether or not inservice UT inspections are conducted.

"The assessments discussed above have shown that there is no compensating increase in quality or safety from ultrasonic inservice inspection or the surge nozzle and nozzle to vessel weld. Inspections which have been performed have not identified any indications at all in the entire population of Westinghouse plants, and the fracture assessment showed that the nozzle and nozzle to vessel weld have a very large tolerance for flaws. There are no mechanisms for the development of flaws during service, so that the risk of failure is not decreased by inservice inspection. A VT-2 inspection at pressure, along with Reactor Coolant System Leakage Detection Systems ensure that through wall flaws would be identified prior to pressurizer structural integrity being compromised. The option of examining the pressurizer surge nozzle-to-head weld and nozzle inside radius section from the inside surface has been addressed and determined to be impractical. The inside surface of the pressurizer surge nozzle is accessible only from the manway. Removal and reinstallation of the manway would incure significant radiation exposure to plant personnel, which is estimated to be approximately 2 person-rem for Braidwood Unit 2. Braidwood Unit 1 would incur more dose to gain access to the pressurizer due to a diaphragm seal welded in the manway. Most importantly, baffle plates internal to the pressurizer would prohibit access to the debris screen

and the surrounding inside surfaces of the nozzle for a meaningful VT-1 examination.

Licensee's Proposed Alternative Examination (as stated):

"To ensure compliance with 10CFR50.55a(g)(3), continued periodic visual examination (VT-2) will be performed according to the requirements of ASME Section XI, Table IWB-2500-1, Examination Category B-P, including applicable Code Case(s).

"If insulation is removed volumetric examination of the nozzle-to-vessel and nozzle inner radius section will be performed to the maximum extent practical."

Evaluation: The Code requires 100% volumetric examination of the pressurizer nozzle-to-vessel welds. However, volumetric examination of the pressurizer surge nozzle-to-vessel welds is limited due to pressurizer heater penetrations and the radius of curvature in the transition area between the nozzle and the vessel shell. Therefore, the nozzles' geometric design configuration and proximity to heater penetrations make volumetric examination impractical to perform. In addition, to meet the Code requirements, insulation would have to be removed and the nozzles would have to be modified to facilitate access for ultrasonic search units. The licensee has estimated that the radiation exposure to plant personnel for insulation removal, surface preparation and inspection of the accessible portion would exceed 150 person-rem. Imposition of these requirements would create a considerable burden on the licensee.

Preservice UT examinations were performed on the nozzle to vessel welds and no indications in excess of the ASME acceptance criteria were identified. The surge nozzle inner radius sections of each pressurizer were subject to surface examinations before and after the cladding was deposited. Additionally, the subject nozzles are part of a larger population of Class 1 primary system nozzles that will be examined during the interval. Therefore, reasonable assurance of structural integrity will be provided by the examinations that have been completed on the subject components, the volumetric examinations of other Class 1 nozzles within the primary system, and the periodic visual examinations (VT-2).

Based on the impracticality of meeting the Code examination requirements for the subject nozzle-to-vessel welds, and the reasonable assurance provided by the examinations that will be completed, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

F. Request for Relief No. I2R-09, Examination Category B-K, Item B10.10, Integrally Welded Support Attachments for Class 1 Vessels, Piping, Pumps and Valves

Code Requirement: Code Case N-509 (adopted by the licensee), Examination Category B-K, Item B10.10 requires 100% surface or volumetric examination, as applicable, of the integrally welded attachments for Class 1 vessels as defined by Figures IWB-2500-13, -14, or -15.

Licensee's Code Relief Request: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from performing the surface examination to the extent required by the Code for the following pressurizer seismic lug welds.

1PZR-01-PSL-01	1PZR-01-PSL-02
1PZR-01-PSL-03	1PZR-01-PSL-04
2PZR-01-PSL-01	2PZR-01-PSL-02
2PZR-01-PSL-03	2PZR-01-PSL-04

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

"Braidwood Units 1 and 2 Pressurizer seismic lugs are welded to the Pressurizer shell (reference Figure 1). There are 4 seismic lugs per unit, located 90 degrees apart (reference Figure 5). In order to perform examinations on the seismic lug welds, the outside surface of the lower vessel shell to lug area must be accessible. The exam surface is not accessible since it is covered by the seismic lug restraint and lower Pressurizer shell insulation (reference Figures 3 and 4). Also, the configuration of the Pressurizer coffin limits access to the seismic lugs. The impact of removing the seismic lug restraint, altering the Pressurizer coffin and removing the lower shell insulation is presented below.

"The seismic lug restraint (Reference Figures 1 and 2), which surrounds the lug, prohibits access needed to perform a meaningful surface exam. There are 4 restraints located about the 428' elevation, one for each lug, which were not designed for removal. The top of the concrete floor at this location is a 428' 3" elevation. This floor, which is 2'6" thick, interferes with access to 3 of the 4 lugs (Reference Figures 2, 3, and 5). Also, the Pressurizer coffin itself severely limits access to the one remaining seismic restraint (Reference Figure 5). All of the restraints, which are embedded in the concrete, would require major modification to the existing Pressurizer coffin to allow for removal and access. This modification would require the redesign of the seismic restraint and Pressurizer coffin to allow for periodic removal and access to the seismic restraints. Implementation of this redesign would require significant engineering resources, construction resources and significant dose to plant personnel.

Only the upper insulation panels were designed with clips to provide for removal. Insulation on the lower shell of the Pressurizer prohibits access needed to perform a meaningful surface examination of the seismic lug weld areas. The removal of the insulation covering the lower Pressurizer shell to seismic lug area will result in high radiation exposure to plant personnel. The insulation on the pressurizer consists of panels which are fastened together. The lower panels are fastened together with screws. To provide access from below would require scaffolding from the 401' elevation grating to the 428' elevation of the seismic restraint. Also, to remove the Pressurizer shell insulation would require removal of the screw fasteners. Access to these screws is limited by the floor and Pressurizer coffin (reference Figures 3 and 5). As stated above, the insulation could be removed from the upper portions of the lugs. This can only be accomplished for 3 of the 4 seismic

lugs, because access is prohibited by the Pressurizer coffin configuration (Reference Figure 5). Also, the current configuration of the seismic restraint only allows limited access for visual examination. To provide suitable access for all 4 seismic lug restraints would require major modifications and significant resources.

"Even if the non-removable insulation is removed (Reference Figures 3, 4 & 5), full surface examination of the seismic lugs would not be achieved. The Pressurizer coffin, concrete floor and seismic restraint geometry would greatly limit access to all sides. The resulting coverage would only be a small percentage of the weld volume. The limited data obtained from these examinations does not provide a compensatory increase in quality and safety to justify the hazards of personnel radiation exposure to obtain the data. When the removable insulation panels were removed for the First Interval inspections, the following access was achieved. The Liquid Penetrant test was basically performed on the top side of the 3 accessible lugs. The Visual examinations (VT-1) were performed on the top side and upper portions of both sides of the 3 accessible lugs. Reference Table 1 for summary of accessible surfaces that were inspected during First Interval inspection.

"Only a best effort Liquid Penetrant (PT) exam can be performed on the accessible exposed surfaces. Access and clearance interferences will limit how well the surface of the examination volume can be prepped for the PT examination. Because the examination is being performed on slightly rusted carbon steel components, which will receive a best effort surface prep, that a white to pinkish background will be expected after developing. Even with a pinkish background, detection of relevant indications will still be possible. Also, bleed out from the lower edge of the non-removable insulation will interfere with some of the accessible exam volume. This volume of interference will depend upon the amount of bleed out and will mask any relevant indication.

Component	Length of Top Examined (PT and VT)	Length of Side 1 Examined (VT only)	Length of Side 2 Examined (VT only)	PT %	VT%
1PZR-01-PSL-01	4"	0.5"	0.5"	20%	25%
1PZR-01-PSL-02	4"	3.25"	3.25"	20%	52.5%
1PZR-01-PSL-03	4"	3.25"	3.25"	20%	52.5%
1PZR-01-PSL-04	Totally Obstructed			00%	00%
2PZR-01-PSL-01	4"	2.0"	1.25"	20%	36.25%
2PZR-01-PSL-02	4"	0"	2"	20%	30%
2PZR-01-PSL-03	Totally Obstructed			00%	00%
2PZR-01-PSL-04	4"	2"	3"	20%	45%

Licensee's Proposed Alternative Examination (as stated):

"A VT-1 of the upper surfaces of the 3 accessible lugs will be performed when the removable insulation panels are removed. Along with the VT-1 visual inspection, a best effort surface inspection (Liquid Penetrant) will be performed on those portions

of the lug that are inspectable when the removable insulation panels are removed. In conjunction with the above proposed alternative technique, the periodic VT-2 examinations in accordance with the requirements of ASME Section XI, Table IWB-2500-1, Examination Category B-P and applicable Reactor Coolant system monitoring requirements specified in the Technical Specification will provide reasonable assurance of continued structural integrity of the Pressurizer shell."

Note: Per a telephone discussion with the licensee on September 2, 1999, it was clarified that the VT-1 and best effort surface inspection (liquid penetrant) of the upper surfaces of the 3 accessible lugs will be scheduled and performed during the interval.

Evaluation: The Code requires that the subject Class 1 pressurizer seismic lug welds receive 100% surface examination each inspection interval. Review of the figures provided by the licensee show that the seismic lug welds are inaccessible due to seismic lug restraints and the configuration of the pressurizer coffin. In order for access to be obtained major modifications to the pressurizer coffin would be required. This would result in a significant burden on the licensee. The surface examination is therefore, impractical to perform to the extent required by the Code.

The licensee will perform a visual examination (VT-1) of the upper surface of 3 accessible lugs (per unit) and a best effort surface examination will be performed on the accessible portion of the subject welds. Therefore, based on the extent of surface coverage obtainable, and the visual examinations to be performed, it is reasonable to assume that existing patterns of degradation, if present, will be detected and reasonable assurance of inservice structural integrity is maintained. Therefore, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

G. Request for Relief No. I2R-10, Examination Category C-C, Item C3.20, Class 2, Integrally Welded Attachments

Code Requirement: Examination Category C-C, Item 3.20 of Code Case N-509 (adopted by licensee) requires a 100% surface examination of the integrally welded attachments of Class 2 piping as defined by Figure IWC-2500-5.

Licensee's Code Relief Request: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the surface examinations required in Code Case N-509 for the following integrally welded attachments.

Unit 1 Welds:

1RH-05-21B	1RH-05-22
1SD-01-19	1SD-01-20

Unit 2 Welds:

2FW-12-25	2FW-12-25A
2SX-04-02	2SX-04-03

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

> "Some penetrations at Braidwood were originally designed where one of the integral attachment welds is inside the penetration assembly, thus making the welds inaccessible for inservice inspection. Access from outside of the closed end of the penetration assembly for examiners is prohibited by the integral attachment. Access from the open end of the penetration is severely restrained due to geometry and clearance. See Figures 1, 2, 3, 4 and 5 for penetration details. The integral attachment weld is set back some distance inside the penetration assembly and the clearance between the pipe and penetration sleeve is small, see Table 1, Figure 6.
>
> "To satisfy the Code requirement to perform a surface examination of this weld, modification to the penetration assembly and/or piping to allow access would be required. Braidwood would incur significant engineering and installation costs to perform such a modification without a compensating increase in the level of quality and safety to justify such modifications."

Licensee's Proposed Alternative Examination (as stated):

> "When a weld is scheduled for inspection, a surface examination of the accessible weld on the exposed outside surface of the penetration will be performed. In conjunction with the above proposed alternative technique, the periodic VT-2 examinations in accordance with the requirements of ASME Section XI, Table IWC-2500-1, Examination Category C-H will provide reasonable assurance of continued structural integrity of the piping systems."

Evaluation: The Code requires 100% surface examination of the subject welded piping attachments. However, portions of these welds are located inside piping penetrations which restricts access to the welds. Therefore, the 100% surface examination coverage of these welds is impractical to achieve. To achieve the Code-required examination coverage, redesign of the piping systems to facilitate access would be required. Imposition of the Code requirements would result in a considerable burden on the licensee.

The licensee has proposed to examine the subject welds to the extent practical. Review of the figures supplied by the licensee show that approximately 50% of the cumulative Code-required surface coverage can be achieved. Therefore, any significant patterns of degradation will be detected by the examinations that can be completed and adequate assurance of the structural integrity of these integral attachment welds will be provided.

Based on the impracticality of meeting the Code coverage requirements for the subject welds, and the reasonable assurance provided by the examinations that can be completed, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

H. Request for Relief No. I2R-16, Examination Category B-D, Item Numbers B3.90 and B3.100, Full Penetration Welds of Nozzles in Vessels and Examination Category B-F, Item Number B5.10, Nozzle-to-Safe End Butt Welds

Code Requirement: Section XI, Table IWB-2500-1, Examination Category B-D, Items B3.90 and B3.100 require that, for reactor pressure vessel (RPV) nozzle welds and inner radius sections, at least 25% but not more than 50% (credited) of the nozzles be examined by the end of the first inspection period and the remainder by the end of the inspection interval. Examination Category B-F, Item B5.10, Nozzle-to-Safe End Butt Weld examinations may be performed coincident with the vessel nozzle examinations required by Examination B-D.

Licensee's Proposed Alternative: In accordance with 10 CFR 50.55a(a)(3)(i), the licensee proposed to perform the required examinations at or near the end of the inspection interval for the following welds.

Nozzle-to-Vessel Welds (Item No. B3.90)	Nozzle Inner Radius Sections (Item No. B3.100)	Nozzle-to-Safe End Welds (Item No. B5.10)
1RV-01-06, 07, 08, 09, 10, 11, 12, 13	1RV-01-14, 15, 16, 17, 18, 19, 20, 21	1RV-01, 22, 23, 24, 25, 26, 27, 28, 29
2RV-01-06, 07, 08, 09, 10, 11, 12, 13	2RV-01-14, 15, 16, 17, 18, 19, 20, 21	1RV-01, 22, 23, 24, 25, 26, 27, 28, 29

The licensee stated:

> "Braidwood shall complete the required nozzle-to-vessel weld examinations, the nozzle inside radius section examinations, and the nozzle-to-safe end weld examinations concurrent with the reactor vessel ten-year examinations at or near the end of the second ten-year inservice inspection interval. Scheduling will be such that no more than 10 years will accumulate between these examinations, except when the length of a 10-year interval is adjusted in accordance with IWA-2430."

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

> "Relief is requested to defer 100 percent of the reactor vessel nozzle-to-vessel weld examinations, the nozzle inside radius section examinations, and the nozzle-to-safe end weld examinations to the end of Braidwood's second ten-year inspection interval.
>
> "ComEd believes that performing 25 percent to 50 percent of the reactor vessel nozzle examinations in the first period of the second inspection interval is impractical for the following reasons:
>
> "1) The vendor cost alone (not including site training, plant support, or potential critical path time) to perform these examinations with automated tooling in the first inspection period is currently estimated at $250,000. The cost to perform these same examinations at the end of the second inspection interval concurrent with the reactor vessel ten-year examination is estimated at only $25,000. The major expense associated with the first inspection

period examinations is the added equipment and personnel mobilization costs and equipment assembly and disassembly costs.

"2) Approximately one man-rem exposure is currently expended for automated equipment assembly and disassembly in the reactor cavity area. In addition to exposure, there are approximately two to three cubic feet of solid radwaste generated during performance of automated examinations in the reactor vessel. Under current Code rules, this personnel exposure and radwaste generation would be incurred twice; once for the nozzle first inspection period examinations and again for the reactor vessel examinations at the end of the inspection interval. Performing the nozzle examinations concurrent with the reactor vessel ten-year examinations will save approximately one man-rem exposure and two to three cubic feet of solid radwaste.

"For reasons listed below, ComEd believes that deferral of 100 percent of the reactor vessel nozzle examinations to the end of the second inspection interval will provide an acceptable level of safety and quality.

"All four of Braidwood's Reactor Vessel hot leg nozzle-to-vessel welds, hot leg nozzle inside radius sections, and hot leg nozzle-to-safe end welds were examined during the first period of the first ten-year inspection interval. No indications or relevant conditions were discovered that required successive inspections in accordance with Paragraph IWB-2420(b). Furthermore, no inservice repairs or replacements by welding have ever been required on any of the nozzle-to-vessel welds, nozzle inside radius sections, or nozzle-to-safe end welds at Braidwood. Complete (100%) examination of all the previously mentioned components were completed in the third period of the current interval. No indications or relevant conditions were detected that required successive inspections per IWB-2420(b).

"From an industry perspective, there are two reasons why deferral of Braidwood's nozzle examinations to the end of the second inspection interval will not decrease the level of quality and safety. First, PWR reactor vessels similar to Braidwood's have been operating for over 20 years with no recorded inservice induced flaws or potential degradation mechanisms. Since each PWR reactor vessel in operation is representative of the operating conditions throughout the industry, continued inspection of these vessels ensures that any potential degradation mechanism will be detected.

"Second, considering the large population of PWR reactor vessels in operation, the examination of nozzles within the industry during any ten-year interval is evenly distributed. This distribution is essentially equivalent, regardless of whether or not a percentage of the nozzle examinations are performed in the first inspection period or performed concurrent with the reactor vessel ten-year examinations at the end of the inspection interval.

"The pressurizer and primary steam generator nozzle-to-vessel welds, inside radius sections, and nozzle-to-safe end welds are similar in configuration, material properties, weld process parameters, and operate in the same reactor coolant system environment as the reactor vessel nozzles. Due to this similarity,

distribution of the pressurizer and steam generator nozzle examinations in accordance with Examination Category B-D and Examination Category B-F will further substantiate the integrity of the reactor vessel nozzles until they are examined at or near the end of the second inservice inspection interval.

"Performing all the automated reactor vessel examinations during a single refueling outage improves consistency of the examinations by utilizing the same equipment, personnel, and procedures. Moreover, this improves the reliability and repeatability of the examinations."

Evaluation: The Code requires examination of at least 25%, but not more than 50% (credited) of RPV nozzles and associated inside radius (IR) sections and nozzle safe ends during the first inspection period. The licensee has proposed to defer the required examinations to the end of the 10-Year interval. This proposed alternative is similar to Code Case N-521, *Alternative Rules for Deferral of Inspections of Nozzle-to-Vessel Welds, Inside Radius Sections, and Nozzle-to-Safe End Welds of a Pressurized Water Reactor Vessel* which has been approved for use in Regulatory Guide 1.147, Revision 12.

Code Case N-521 states that examination of RPV nozzles, IR sections, and nozzle-to-safe end welds may be deferred provided (a) no inservice repairs or replacements by welding have ever been performed on any of the subject areas, (b) none of the subject areas contain identified flaws or relevant conditions that currently require successive inspections in accordance with IWB-2420(b), and (c) the unit is not in the first interval. The licensee has confirmed that all the above conditions have been met. Additionally, all of the subject areas will be scheduled for examination such that the new sequence of examinations will not exceed 10 (Code) years between examinations. Considering that the licensee's proposed alternative is essentially identical to Code Case N-521 which is approved for use in Regulatory Guide 1.147, Revision 12 and all conditions listed in the Code Case have been confirmed, the licensee's proposed alternative will provide an acceptable level of quality and safety. Therefore, it is recommended that the licensee's proposed alternative be authorized pursuant to 10 CFR 50.55a(a)(3)(i).

I. Request for Relief No. I2R-18, Examination Category B-A, Items B1.11, and B1.21, Pressure-Retaining Welds in Reactor Vessel

Code Requirement: Examination Category B-A, Item B1.11 requires 100% volumetric examination of RPV circumferential shell welds, as defined by Figure IWB-2500-1. Item B1.21 requires 100% volumetric examination of the accessible portion of all circumferential head welds, as defined by Figure IWB-2500-3.

Licensee's Code Relief Request: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the Code-required 100% volumetric examination coverage for the welds listed below.

WELD	ITEM	DESCRIPTION	COVERAGE	LIMITATION
1RV-02-001	B1.21	Lower Head Circumferential Weld	86%	Instrumentation Nozzle penetrations

1RV-02-002	B1.11	Circumferential Shell Weld	81%	Core barrel locating lugs
2RV-02-001	B1.21	Lower Head Circumferential Weld	86%	Instrumentation Nozzle penetrations
2RV-02-002	B1.11	Circumferential Shell Weld	81%	Core barrel locating lugs

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

"All RPV welds are examined using remotely operated underwater volumetric inspection techniques. Underwater volumetric inspection techniques are utilized to meet ALARA concerns due to the high radiation levels in these areas. Examination of the subject RPV shell and lower head welds were conducted on Braidwood Units 1 and 2 (during A1R06 and A2R06 refuel outage). During these examinations at Braidwood, physical obstructions and geometry prevented ultrasonic (UT) coverage in excess of 90% of the required volume.

"The examination of the Dutchman-to-Lower Center Disc welds, 1RV-02-001 and 2RV-02-001, is restricted by instrumentation nozzle penetrations (See Figure 1). These instrumentation nozzle penetrations obstruct the automated UT examination tool from examining the Code required volume of the weld and base material above the instrumentation nozzle penetrations in both the circumferential and perpendicular scan directions. All weld metal and base material can be examined between instrumentation nozzle penetrations. The instrumentation nozzle penetration interferences limit the examination aggregate volume coverage obtained for the weld and adjacent base metal to approximately 86% of the Code required volume.

"The examination of the Lower Shell Course-to-Dutchman welds, 1RV-02-002 and 2RV-02-002, is restricted by six (6) core barrel locating lugs welded to the inner surface of the vessel approximately 2.5 inches above the weld centerline (See Figure 2). These lugs obstruct the automated UT examination tool from examining the Code required volume of the weld and base material under and below each lug in both the circumferential and perpendicular scan directions (156° total for all 6 lugs, See Figures 3, 4 and 5). All weld metal and base material can be examined between the lugs (204° total between all 6 lugs). The 6 lug interferences limit the examination. aggregate volume coverage obtained for the weld and adjacent base metal to approximately 81% of the Code required volume.

"Compliance with the applicable Code requirements may be accomplished by redesigning and modifying the RPV and/or the building structure surrounding the vessel(s). Due to high radiation and ALARA concerns, RPV examinations are normally conducted from the I.D. of the vessel. Access for manual inspections from the OD of the RPV is limited because of the close proximity of the building structure to the RPV shell (See Figure 2).Strict ASME Section III quality controls were used when designing, fabricating, and installing these RPV welds. Preservice (PSI) examinations to the fullest extent practical were performed on these welds. PSI relief request 1NR-9 was submitted to the Staff and approved for these lug interferences. During the First Interval ISI inspection, ComEd performed ultrasonic examinations to the fullest extent practical, i.e. 86% for Lower Head Circumferential

Welds and 81% for the Circumferential Shell Welds (during the A1R06 and A2R06 refuel outages) using examination techniques that have been demonstrated and qualified to the Performance Demonstration Initiative (PDI) Program which meets the intent of the rules of Appendix VIII of the ASME Code, Section XI, 1992 Edition with 1993 Addenda. These enhanced First Interval inspections revealed that no unacceptable indications are present in the examined weld volume. The results of these examinations provide further assurance that unallowable inservice flaws have not developed in the subject weld. Thus, the modification of the RPV and/or the building structures to increase examination volume coverage from 86% for Lower Head Circumferential Weld and 81% for the Circumferential Shell Weld to essentially 100% would incur unnecessary radiological exposure and significant engineering expenses. Braidwood Station believes this course of action is a hardship without a compensating increase in the level of quality and safety."

Licensee's Proposed Alternative Examination (as stated):

"The ultrasonic examination of the Braidwood Unit 1 and 2 Lower Head Circumferential Welds (1RV-02-001, 2RV-02-001) and the Circumferential Shell Welds (1RV-02-M, 2RV-02-002) will be performed to the maximum extent practical using available underwater inspection techniques."

Evaluation: The Code requires 100% volumetric of the RPV lower head circumferential welds and circumferential shell welds during each inspection interval. Figures supplied by the licensee show that access restrictions caused by instrumentation nozzles and core barrel support lugs, preclude complete ultrasonic scans of the full volume of this weld. Therefore, the Code-required 100% volumetric examination is impractical to achieve. To gain access for 100% coverage, the component would have to be redesigned and modified. This would place a significant burden on the licensee.

The licensee is able to obtain a significant portion (81-86%) of the required volumetric coverage. In addition, other RPV shell welds will receive the full (100%) coverage as required by the Code. Consequently, it is concluded that the examinations will detect any existing patterns of degradation, and reasonable assurance of the continued structural integrity of the weld will be achieved. Therefore, based on the impracticality of the Code volumetric coverage requirements, and the extent of examinations that will be performed, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

J. Request for Relief No. I2R-19, Examination Category B-G-1, Item B6.10, Reactor Vessel Closure Head Nuts

Code Requirement: Examination B-G-1, Item B6.10 requires 100% surface examination of the reactor vessel closure head nuts.

Licensee's Proposed Alternative: In accordance with 10 CFR 50.55a(a)(3)(i), the licensee proposed an alternative to performing 100% surface examination of the reactor vessel closure head nuts.

The licensee stated:

"As an alternate examination, Braidwood Station will perform a VT-1 visual examination of the surface of all reactor closure head nuts, utilizing the acceptance criteria of IWB-3517, as delineated in the 1989 Edition of ASME Section XI."

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

"Table IWB-2500-1 of the 1989 Edition of ASME Section XI requires a surface examination to be performed on the reactor vessel closure head nuts. However, Table IWB-2500-1 does not provide the corresponding "Examination Requirements/Figure Number" and "Acceptance Standard". These provisions are still in the course of preparation.

"The 1989 Edition of ASME Section XI, Category B-G-1, employs a VT-1 visual examination for nuts associated with Heat Exchangers, Piping, Pumps, and Valves (Item Numbers B6.140, B6.170, B6.200, and B6.230, respectively). These Category B-G-1 requirements also provide an Acceptance Standard, IWB-3517, for the VT-1 examinations. Accordingly, these rules are deemed by Braidwood Station as an acceptable and complete set of rules to assure the integrity of reactor vessel closure nuts.

"Based on the above, Braidwood Station requests relief from the requirements specified in Table IWB-2500-1 of the 1989 Edition of ASME Section XI for reactor vessel closure head nuts."

Evaluation: The Code requires 100% surface examination for RPV closure head nuts. As an alternative, the licensee has proposed to perform a VT-1 visual examination of reactor pressure vessel (RPV) closure head nuts in lieu of the Code-required surface examination. All Items in Examination Category B-G-1 except the reactor pressure vessel closure head nuts and the closure studs (when removed) require VT-1 visual examinations and/or volumetric examination (as applicable).

Typical conditions that would require corrective action prior to putting closure head nuts back into service would include corrosion, deformed or sheared threads, deformation, and degradation (i.e., boric acid attack). Surface examination procedures are typically qualified for the detection of linear flaws (cracks) and have acceptance criteria specifying only rejectable linear flaw lengths. Acceptance criteria for surface examinations are not provided in the 1989 Edition of the Code, Item B6.10, as they were in the course of preparation when the Code was published. Without clearly defined acceptance criteria, conditions that require corrective measures may not be adequately addressed. The 1989 Addenda of Section XI addresses these problems by changing the requirement for the subject reactor pressure vessel closure head nuts from surface to VT-1 visual examination and providing appropriate acceptance criteria.

Article IWB-3000, Acceptance Standards, IWB-3517.1, Visual Examination, VT-1, describes conditions that require corrective action prior to continued service for bolting and associated nuts. One of these requirements is to compare crack-like flaws to the flaw standards of IWB-3515 for acceptance. The VT-1 visual examination acceptance criteria includes evaluation of crack-like indications and other conditions requiring corrective action, such as deformed or sheared threads, localized corrosion, deformation of part, and other degradation mechanisms. Therefore, the VT-1 visual examination

provides a comprehensive assessment of the condition of the closure head nut. As a result, the INEEL staff believes that VT-1 visual examination provides an acceptable level of quality and safety.

Based on the comprehensive assessment that the VT-1 visual examination provides, and considering that the 1989 Addenda and later editions of the Code require only a VT-1 visual examination on reactor pressure vessel closure head nuts, it is concluded that an acceptable level of quality and safety will be provided by the proposed alternative. Therefore, it is recommended that the proposed VT-1 visual examination be authorized pursuant to 10 CFR 50.55a(a)(3)(i).

K. Request for Relief No. I2R-20, Examination Category B-A, Item B1.40, Reactor Pressure Vessel Head-to-Flange Weld

Code Requirement: Examination Category B-A, Item B1.40, requires volumetric and surface examination of essentially 100% of the weld length, as defined by Figure IWB-2500-5, of the reactor pressure vessel (RPV) head-to-flange weld to be performed during each inspection interval.

Licensee's Code Relief Request: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the Code-required volumetric examination coverage requirement for the following RPV head-to-flange welds.

Comp. ID	Component Description	Aggregate Coverage	Limitation
1RV-03-001	RPV Head-to-Flange Weld	88%	The flange geometry and lifting lugs interfere with the scan paths.
2RV-03-001	RPV Head-to-Flange Weld	88%	The flange geometry and lifting lugs interfere with the scan paths.

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

> "During scans of the subject welds, the Reactor Vessel flange physically obstructs the ultrasonic transducer movement that is needed to examine the Code required volume from the flange side. In addition to the flange, part of the three larger lifting lugs also fall in the required scan area. Figures 1 and 2 show the position of the weld and flange. A detailed diagram of the transducer position for actual and required coverage is shown in Figure 3. Review of the first interval volumetric inspection data revealed that approximately 88% of the required Code volume could be examined. The code required surface exam will be performed on the accessible areas and can be completed on essentially 100% of the weld length.
>
> Completion of the remaining portions of the required examination is impractical and would result in undue hardship without a compensating increase in safety. The limited volumetric inspection, along with the surface inspection and the visual (VT-2) inspections performed every refuel outage will provide reasonable assurance of the continued structural integrity of the Reactor Vessel Head to Flange weld. Furthermore, past First Interval inspections, Preservice inspections, ASME Section III construction inspections and every refueling outage VT-2

inspections have revealed no recordable indications and provides reasonable assurance of the continued structural integrity of this weld."

Licensee's Proposed Alternative Examination (as stated):

"Braidwood Station will the perform the Code required volumetric examination of the Reactor Vessel Head-to-Flange weld to the maximum extent possible."

Evaluation: The Code requires 100% volumetric and surface examination of the RPV closure head-to-flange weld during each inspection interval. Figures supplied by the licensee show that the surface geometry of the flange, in combination with access restrictions caused by the head lifting lugs, preclude complete ultrasonic scans of the full volume of this weld. Therefore, the Code-required 100% volumetric examination is impractical to achieve. To gain access for 100% coverage, the component would have to be redesigned and modified. This would place a significant burden on the licensee.

The licensee is able to obtain a significant portion (88%) of the required volumetric coverage. In addition, the licensee will complete the Code-required 100% surface examination. These examinations should detect any existing patterns of degradation, and provide reasonable assurance of the continued structural integrity of the weld. Therefore, based on the impracticality of the Code volumetric coverage requirements, and the extent of examinations that will performed, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

L. Request for Relief No. I2R-21, Examination Category B-A, Item B1.30, Reactor Vessel Shell-to-Flange Weld

Code Requirement: Examination Category B-A, Item B1.30 requires a volumetric examination of at least 50% of the weld by the end of the first period.

Licensee's Proposed Alternative: In accordance with 10 CFR 50.55a(a)(3)(i), the licensee proposed to perform the required examinations at or near the end of the inspection interval for Welds 1RV-01-005 and 2RV-01-005.

The licensee stated:

"Braidwood Station will perform the complete Code required volumetric examination of the Reactor Vessel shell-to-flange welds concurrent with the reactor vessel ten-year examinations at or near the end of the second ten-year inservice inspection interval."

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

"Relief is requested to defer 100 percent of the reactor vessel shell-to-flange weld examination to the end of Braidwood's second ten-year inspection interval. Table IWB-2500-1, Examination Category B-A, Note 3 requires that examinations from the flange face be completed during the first and third inspection periods. Note 4 states that the shell-to-flange welds may be conducted during the first and third inspection periods in conjunction with the nozzle-to-vessel examinations of Category B-D, Program B. The purpose of Note 4 is to permit the licensee to combine examinations of the flange-to-shell from the flange surface and the nozzle bore exams, since both exams could use the automated RPV scanning equipment.

The equipment installation and use is a complex, time consuming, and expensive process. Since the publication of Code Case N-521, it is now permitted to defer the nozzle bore exams to the end of the interval. Braidwood has submitted Relief Request 12R-16 for use of Code Case N-521. Based on lack of any pervious indications in the flange-to-shell weld, requiring the inspection of only the flange-to-shell weld during the first period would constitute an economic and schedule hardship without a compensating increase in quality or safety.

“Braidwood's Unit I and 2 Reactor Vessel shell-to-flange welds were examined during the first period of the first ten-year inspection interval. No indications or relevant conditions were discovered that required successive inspections in accordance with Paragraph IWB-2420(b). Furthermore, no inservice repairs or replacements by welding have ever been performed on either of these welds. During the third period of the first ten-year inspection interval, both, Unit 1 and 2 shell-to-flange welds were completely (100%) examined, with no indications or relevant conditions discovered. At that time, ComEd performed ultrasonic examinations to the fullest extent practical, i.e. 100% for the Circumferential Shell-to-Flange welds (during the A1R06 and A2R06 refuel outages) using examination techniques that have been demonstrated and qualified to the Performance Demonstration Initiative (PDI) Program which meets the intent of the rules of Appendix VIII of the ASME Code, Section 3a, 1992 Edition with 1993 Addenda. These enhanced First Interval inspections revealed that no unacceptable indications are present in the examined weld volume. The results of these examinations provide further assurance that unallowable inservice flaws have not developed in the subject welds.

“Performing all the automated reactor vessel examinations during a single refueling outage improves consistency of the examinations by utilizing the same equipment, personnel, and procedures. Moreover, this improves the reliability and repeatability of the examinations.

“An alternative to the previous approach would be to perform the examination manually after removal of the RPV head, but before refueling pool flooding. Braidwood Station considers this alternative impractical for the following reasons:

1. Personnel Safety: Volumetric examination of these welds from the flange would typically be performed manually, requiring inspection personnel to position themselves under a suspended Reactor Vessel Head. The Reactor Head is used as shielding for ALARA purposes. This situation is a potential safety hazard which can be avoided by deferring the examination of 100% of this weld to the end of the interval.

   The examination of this weld at the end of the interval would be performed using automated UT equipment which allows technicians to gather inspection data remotely, minimizing safety risks.

2. Radiation Exposure: As mentioned above, this inspection is performed in a radiation area and significant shielding (the Reactor Head) is necessary for

ALARA purposes. Even with the Reactor Head as shielding, the dose rates ranged from approximately 0.5 to 1.0 REM.

By performing this inspection at or near the end of the Second 10-Year Interval using remote inspection equipment, unnecessary exposure from performing this examination manually can be avoided.

For reasons stated above, ComEd believes that deferral of 100 percent of the reactor vessel shell-to-flange weld examinations to the end of the second inspection interval will provide an acceptable level of safety and quality."

Evaluation: Examination Category B-A, Item B1.30 requires a volumetric examination of at least 50% of the weld by the end of the first period. Performance of the subject examinations during the first period of the interval results in potential personnel safety hazards and excessive radiation exposure. The licensee's proposed alternative to perform the subject examinations at or near the end of the interval in conjunction with the automated nozzle examinations allows for a significant reduction in personnel radiation exposure and eliminates many of the safety hazards associated with performance of a manual examination of the flange weld. Additionally, the licensee performed examinations on the subject welds during the third period of the first interval and found no indications or relevant conditions. The third period examinations performed ensure that no more than 10 (Code) years will lapse between the successive examinations.

Based on the examinations completed during the first and third period of the first interval, and the fact that no more than 10 (Code) years will lapse between successive examinations, the licensee's proposed alternative will provide an acceptable level of quality and safety. Therefore, it is recommended that the licensee's proposed alternative be authorized pursuant to 10 CFR 50.55a(a)(3)(i).

M. Request for Relief No. I2R-22, Examination Category B-D, Item B3.90, Full Penetration Welds of Nozzles in Vessels

Code Requirement: Examination Category B-D, Item B3.90 requires 100% volumetric examination of all nozzle-to-vessel welds in the reactor pressure vessel, as defined by Figure IWB-2500-7.

Licensee's Code Relief Request: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the Code-required volumetric examination for the welds listed below.

WELD	ITEM	DESCRIPTION	COVERAGE	LIMITATION
1RV-01-006	B3.90	Outlet Nozzle	81%	Integral Extension
1RV-01-009	B3.90	Outlet Nozzle	81%	Integral Extension
1RV-01-010	B3.90	Outlet Nozzle	81%	Integral Extension
1RV-01-013	B3.90	Outlet Nozzle	81%	Integral Extension
2RV-01-006	B3.90	Outlet Nozzle	81%	Integral Extension

2RV-01-009	B3.90	Outlet Nozzle	81%	Integral Extension
2RV-01-010	B3.90	Outlet Nozzle	81%	Integral Extension
2RV-01-013	B3.90	Outlet Nozzle	81%	Integral Extension

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

"ComEd's Braidwood Nuclear Power Station Units 1 and 2 conduct ISI activities in accordance with the 1989 Section XI Edition, No Addenda as required by Title 10, Code of Federal Regulations, Part 50, Section 55a, Paragraph (g), Subparagraph (4) [10 CFR 50.55a(g)(4)]. Pursuant to 10 CFR 50.55a(g)(5)(iii), relief is requested on the basis that the code requirement to examine essentially 100% of the welds' volume is impractical due to geometric interference.

"All RPV welds are examined using remotely operated underwater volumetric inspection techniques. Underwater volumetric inspection techniques are utilized to meet ALARA concerns due to the high radiation levels in these areas. The outlet (Hot Leg) nozzles are constructed with an integral extension on the I.D. surface which mates with the internal core barrel.

"The extension provides a flow path for reactor coolant from the core into the hot leg nozzles. The integral extensions partially obstruct the circumferential scan for reflectors transverse to the weld (Reference Figure 1). The integral extension, that confines the movement of the transducer package, along with the curvature of the RPV shell combine to limit full Code volume coverage when scanning in the direction parallel to the weld (Reference Figure 2). This configuration limits the examination aggregate volume coverage obtained for each weld and adjacent base metal. In review of the Interval 1 examination data, this obstruction limits the exam to approximately 81% instead of the Code required essentially 100% examination coverage.

"Compliance with the applicable Code requirements may be accomplished by redesigning and modifying the ID of the Hot Leg nozzles and/or the building structure surrounding the RPV at the nozzles' elevation. Braidwood Units 1 and 2 RPVs were designed with a RPV shield wall (Reference Figures 3 and 4). This wall impedes access to the OD of the RPV shell for insulation removal, surface preparation and ultrasonic inspection. Modifying the nozzle ID surface would incur extensive radiation exposure to station personnel and could be detrimental to the component. When designing, fabricating and installing these welds, strict ASME Section III quality controls and procedures were used to minimize the introduction of fabrication defects. Additionally, the periodic VT-2 examinations in accordance with the requirements of ASME Section XI, Table IWB-2500-1 Examination Category B-P and applicable Reactor Coolant system monitoring requirements stated in the Technical Specifications will provide reasonable assurance of continued structural integrity of the Reactor Vessel. ComEd has recently performed these volumetric examinations to the fullest extent practical, i.e. 81% during the First Interval ISI Program (A1R06 and A2R06 refuel outages) and no recordable indications (NRI) were detected. The NRI results of the examination provide further assurance that unacceptable inservice flaws have not developed in the subject

welds. Thus, the modification of the nozzles and/or the building structure to increase examination volume coverage from 81% to essentially 100% would incur unnecessary radiological exposure and significant engineering costs without a compensating increase in the level of quality and safety."

Licensee's Proposed Alternative Examination (as stated):

"The Reactor Vessel outlet (Hot Leg) nozzle welds will be examined to the fullest extent practical using the available underwater volumetric inspection techniques."

Evaluation: The Code requires 100% volumetric examination of the subject RPV nozzle-to-vessel welds. However, complete examination from the ID is restricted by physical obstructions (internal integral extension) that makes the 100% volumetric examination impractical for these areas. Access from the OD is restricted due to the proximity of the RPV shield wall. The near proximity of the RPV shield wall does not allow for removal of the RPV insulation, surface preparation and inspection. Therefore, the complete Code-required volumetric coverage for these components is impractical to achieve. To gain access for examination, the RPV nozzles would require re-design and physical modifications. Imposition of this requirement would create a significant burden on the licensee.

The licensee is capable of examining a significant portion of the subject welds (81%). In addition, other Class 1 nozzle-to-vessel welds will be examined as required by the Code. Therefore, any existing patterns of degradation should be detected by the examinations that are completed and reasonable assurance of the structural integrity will be provided.

Based on the impracticality of meeting the Code examination requirements for the subject nozzle-to-vessel welds, and the reasonable assurance provided by the examinations that will be completed on these and other Class 1 nozzles, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

N. Request for Relief No. I2R-30, IWA-5242(a), System Pressure Tests for Insulated Bolted Connections

Relief Request No. 12R-30 was evaluated and authorized for use by the NRC Staff in an SER dated October 2, 1998.

3. CONCLUSION

The INEEL staff has reviewed the licensee's submittals and concludes that for Requests for Relief I2R-02, -16, -19 and -21, the licensee's proposed alternatives to the Code requirements provide an acceptable level of quality and safety. Therefore, it is recommended that these proposed alternatives be authorized pursuant to 10 CFR 50.55a(a)(3)(i). For Request for Relief I2R-21, it is concluded that the Code requirements would result in a hardship without a compensating increase in the level of quality and safety. Therefore, it is recommended that these proposed alternative be

authorized pursuant to 10 CFR 50.55a(a)(3)(ii). For Requests for Relief I2R-01, -03, -04, -08, -09, -10, -18, -20, and -22 it is concluded that the Code requirements are impractical

for the subject welds. Therefore, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

Request for Relief I2R-30, was evaluated and authorized by the NRC staff in an SER dated October 2, 1998.

Request for Relief I2R-06 to use Code Case N-498-1 is acceptable for use at Braidwood, Units 1 and 2 as the Code Case has been approved for general use by incorporation in Regulatory Guide 1.147, Revision 12.