February 2, 2005

Mr. Lew W. Myers
Chief Operating Officer
FirstEnergy Nuclear Operating Company
Perry Nuclear Power Plant
P.O. Box 97, A290
10 Center Road
Perry, OH 44081

SUBJECT: PERRY NUCLEAR POWER PLANT, UNIT 1 - INSERVICE INSPECTION RELIEF REQUESTS IR-050, IR-051, AND IR-052 (TAC NOS. MC3169, MC3170, MC3171)

Dear Mr. Myers:

By letter to the U.S. Nuclear Regulatory Commission (NRC) dated May 14, 2004, as supplemented by letter dated December 7, 2004, FirstEnergy Nuclear Operating Company, the licensee for Perry Nuclear Power Plant, Unit 1 (PNPP), submitted requests for relief from certain Inservice Inspection (ISI) requirements associated with the implementation of Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," of the American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code* (Code).

The NRC staff has completed its review of the subject ISI Relief Requests IR-050, IR-051, and IR-052. As documented in the enclosed Safety Evaluation, the NRC staff has authorized the licensee-proposed examination alternatives to ASME Code requirements in accordance with Title 10 of the *Code of Federal Regulations,* Section 50.55a(a)(3)(i), on the basis that the alternative examinations provide an acceptable level of quality and safety.

The licensee's proposed alternatives are authorized for the remainder of PNPP's Second 10-year ISI interval which began November 18, 1998, and ends November 17, 2008, or until Code Case N-663 (for IR-051) or Code Case N-613-1 (for IR-052) is published in a future version of Regulatory Guide (RG) 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1." At that time, if the licensee intends to continue implementing these Code Cases, the licensee must follow all provisions of Code Case N-663 or Code Case N-613-1, as applicable, with the limitations or conditions specified in RG 1.147, if any.

All other requirements of the ASME Code, Section XI, for which relief has not been specifically requested remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Sincerely,

/RA/

Gene Suh, Chief, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-440

Enclosure: As stated

cc w/encl: See next page

All other requirements of the ASME Code, Section XI, for which relief has not been specifically requested remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Sincerely,

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Enclosure: As stated

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO INSERVICE INSPECTION RELIEF REQUESTS

IR-050, IR-051, AND IR-052

FIRSTENERGY NUCLEAR OPERATING COMPANY

PERRY NUCLEAR POWER PLANT, UNIT 1

DOCKET NO. 50-440

1.0 INTRODUCTION

By letter to the U.S. Nuclear Regulatory Commission (NRC, Commission) dated May 14, 2004 (ML041450325), as supplemented by letter dated December 7, 2004 (ML043550225), FirstEnergy Nuclear Operating Company, the licensee for Perry Nuclear Power Plant, Unit 1 (PNPP), submitted requests for relief from certain Inservice Inspection (ISI) requirements associated with the implementation of Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," of the American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code* (Code). These relief requests will be utilized through the remainder of PNPP's second 10-year ISI interval which began November 18, 1998, and ends November 17, 2008.

Relief Request IR-050 documents the request for relief from ASME Code Section XI, Appendix VIII, Supplement 10, requirements for Class 1 dissimilar metal welds. In lieu of the ASME Code requirements, the licensee proposes to use the dissimilar metal weld criteria of the Electric Power Research Institute (EPRI) Performance Demonstration Initiative (PDI) Program.

Relief Request IR-051 documents the request for relief from performing the ASME Code required surface examinations for Class 2 welds pursuant to Section XI, Table IWC-2500-1, requirements for Class 2, Category C-F-2, carbon steel piping welds. In lieu of the ASME Code requirements, the licensee proposes to use the requirements of Code Case N-663, "Alternative Requirements for Class 1 and 2 Surface Examinations."

Relief Request IR-052 documents the request for relief from performing the ASME Code required volumetric examinations of Class 1 reactor pressure vessel (RPV) nozzel-to-vessel welds pursuant to Section XI, Appendix VIII, "Performance Demonstration for Ultrasonic Examination Systems," Figure IWB-2500-7(b). In lieu of ASME Code requirements, the licensee proposes to use the requirements of Code Case N-613-1, "Ultrasonic Examination of Full Penetration Nozzles in Vessels, Examination Category B-D, Item No’s. B3.10 and B3.90, Reactor Vessel-To-Nozzle Welds, Fig. IWB-2500-7(a), (b), and (c), Section XI, Division 1."

2.0 REGULATORY EVALUATION

Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(g), requires the ISI of ASME Code Class 1, 2, and 3 components is to be performed in accordance with Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," and applicable editions and addenda, except when specific relief has been granted by the NRC pursuant to 10 CFR 50.55a(g)(6)(i). Section 50.55a(a)(3) states in part that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the applicant demonstrates that: (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, 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 editions and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) twelve months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein.

3.0 TECHNICAL EVALUATION

3.1 RELIEF REQUEST IR-050; ALTERNATIVE TO CERTAIN QUALIFICATION REQUIREMENTS IN THE 1995 EDITION, 1996 ADDENDA OF THE ASME CODE, SECTION XI, APPENDIX VIII, SUPPLEMENT 10

3.1.1 System/Component(s) for which Relief is Requested

This relief request applies to dissimilar metal, Classes 1, 2, and 3, piping welds subject to ultrasonic examination using procedures, personnel, and equipment qualified through Appendix VIII, Supplement 10, "Qualification Requirements for Dissimilar Metal Piping Welds," in the 1995 Edition, 1996 Addenda of the ASME Code, Section XI.

3.1.2 ASME Code Requirements for which Relief is Requested

Appendix VIII, Supplement 10, to the 1995 Edition, 1996 Addenda, of the ASME Code, Section XI, specifies the performance demonstration requirements for equipment, procedures, and personnel used to detect and size flaws on dissimilar metal piping welds. The licensee requested relief from the following Supplement 10 requirements:

Item 1 - Paragraph 1.1(b) states in part: Pipe diameters within a range of 0.9 to 1.5 times a nominal diameter shall be considered equivalent.

Item 2 - Paragraph 1.1(d) states: All flaws in the specimen set shall be cracks.

Item 3 - Paragraph 1.1(d)(1) states: At least 50% of the cracks shall be in austenitic material. At least 50% of the cracks in austenitic material shall be contained wholly in weld or buttering material. At least 10% of the cracks shall be in ferritic material. The remainder of the cracks may be in either austenitic or ferritic material.

Item 4 - Paragraph 1.2(b) states in part: The number of unflawed grading units shall be twice the number of flawed grading units.

Item 5 - Paragraphs 1.2(c)(1) and 1.3(c) state in part: At least 1/3 of the flaws, rounded to the next higher whole number, shall have depths between 10% and 30% of the nominal pipe wall thickness. Paragraph 1.4(b) distribution table requires 20% of the flaws to have depths between 10% and 30%.

Item 6 - Paragraph 2.0 first sentence states: The specimen inside surface and identification shall be concealed from the candidate.

Item 7 - Paragraph 2.2(b) states in part: The regions containing a flaw to be sized shall be identified to the candidate.

Item 8 - Paragraph 2.2(c) states in part: For a separate length sizing test, the regions of each specimen containing a flaw to be sized shall be identified to the candidate.

Item 9 - Paragraph 2.3(a) states: For the depth sizing test, 80% of the flaws shall be sized at a specific location on the surface of the specimen identified to the candidate.

Item 10 - Paragraph 2.3(b) states: For the remaining flaws, the regions of each specimen containing a flaw to be sized shall be identified to the candidate. The candidate shall determine the maximum depth of the flaw in each region.

Item 11 - Table VIII-S2-1 provides the false call criteria when the number of unflawed grading units is at least twice the number of flawed grading units.

3.1.3 Proposed Alternative to the ASME Code and Technical Basis (as stated by the licensee)

In lieu of the ASME Code requirements listed above, the licensee proposed to use the dissimilar metal weld criteria of the EPRI PDI Program. The proposed alternative and technical basis is discussed below:

Item 1 - The proposed alternative to Paragraph 1.1(b) states:

> The specimen set shall include the minimum and maximum pipe diameters and thicknesses for which the examination procedure is applicable. Pipe diameters within a range of ½ in. (13 mm) of the nominal diameter shall be considered equivalent. Pipe diameters larger than 24 in. (610 mm) shall be considered to be flat. When a range of thicknesses is to be examined, a thickness tolerance of ± 25% is acceptable.

Technical Basis - The change in the minimum pipe diameter tolerance from 0.9 times the diameter to the nominal diameter minus 0.5 inch provides tolerances more in line with industry practice. Though the alternative is less stringent for small pipe diameters, they typically have a thinner wall thickness than larger diameter piping. A thinner wall thickness results in shorter sound path distances that reduce the detrimental effects of the curvature. This change maintains consistency between Supplement 10 and the recent revision to Supplement 2.

Item 2 - The proposed alternative to Paragraph 1.1(d) states:

> At least 60% of the flaws shall be cracks, the remainder shall be alternative flaws. Specimens with IGSCC [Intergranular Stress Corrosion Cracking] shall be used when available. Alternative flaws, if used, shall meet the following requirements:
>
> (1) Alternative flaw[s], if used, shall provide crack-like reflective characteristics and shall only be used when implantation of cracks would produce spurious reflectors that are uncharacteristic of actual flaws.
>
> (2) Alternative flaw mechanisms shall have a tip width of less than or equal to 0.002 in. (0.05 mm).

Note: To avoid confusion, the proposed alternative modifies instances of the term "cracks" or "cracking" to the term "flaws" because of the use of "alternative flaw mechanisms."

Technical Basis - As illustrated below, implanting a crack requires excavation of the base material on at least one side of the flaw. While this may be satisfactory for ferritic materials, it does not produce a useable axial flaw in austenitic materials because the sound beam, which normally passes only through base material, must now travel through weld material on at least one side, producing an unrealistic flaw response. In addition, it is important to preserve the dendritic structure present in field welds that would otherwise be destroyed by the implantation process. To resolve these issues, the proposed alternative allows the use of up to 40% fabricated flaws as an alternative flaw mechanism under controlled conditions. The fabricated flaws are isostatically compressed which produces ultrasonic reflective characteristics similar to tight cracks.

Item 3 - The proposed alternative to Paragraph 1.1(d)(1) states:

> At least 80% of the flaws shall be contained wholly in weld or buttering material. At least one and no more than 10% of the flaws shall be in ferritic base material. At least one and no more than 10% of the flaws shall be in austenitic base material.

Technical Basis - Under the current ASME Code, as few as 25% of the flaws are contained in austenitic weld or buttering material. Recent experience has indicated that flaws contained within the weld are the likely scenarios. The metallurgical structure of austenitic weld material is ultrasonically more challenging than either ferritic or austenitic base material. The proposed alternative is therefore more challenging than the current ASME Code.

Item 4 - The proposed alternative to Paragraph 1.2(b) states:

> Personnel performance demonstration detection test sets shall be selected from Table VIII-S10-1. The number of unflawed grading units shall be at least 1-1/2 times the number of flawed grading units.

Technical Basis - Table [VIII-]S10-1 provides a statistically based ratio between the number of unflawed grading units and the number of flawed grading units. The proposed alternative reduces the ratio to 1.5 times to reduce the number of test samples to a more reasonable number from the human factors perspective.

However, the statistical basis used for screening personnel and procedures is still maintained at the same level with competent personnel being successful and less skilled personnel being unsuccessful. The acceptance criteria for the statistical basis are in Table VIII-S10-1.

Item 5 - The proposed alternative to the flaw distribution requirements of Paragraph 1.2(c)(1) (detection) and 1.3(c)(length) is to use the Paragraph 1.4(b)(depth) distribution table (see below) for all qualifications.

Flaw Depth (% Wall Thickness)	Minimum Number of Flaws
10-30%	20%
31-60%	20%
61-100%	20%

At least 75% of the flaws shall be in the range of 10% to 60% of wall thickness.

Technical Basis - The proposed alternative uses the depth sizing distribution for both detection and depth sizing because it provides for a better distribution of flaw sizes within the test set. This distribution allows candidates to perform detection, length, and depth sizing demonstrations simultaneously utilizing the same test set. The requirement that at least 75% of the flaws shall be in the range of 10% to 60% of wall thickness provides an overall distribution tolerance yet the distribution uncertainty decreases the possibilities for testmanship that would be inherent to a uniform distribution. It must be noted that it is possible to achieve the same distribution utilizing the present requirements, but it is preferable to make the criteria consistent.

Item 6 - The proposed alternative to Paragraph 2.0 first sentence states:

> For qualifications from the outside surface, the specimen inside surface and identification shall be concealed from the candidate. When qualifications are performed from the inside surface, the flaw location and specimen identification shall be obscured to maintain a "blind test."

Technical Basis - The current ASME Code requires that the inside surface be concealed from the candidate. This makes qualifications conducted from the inside of the pipe (e.g., PWR [pressurized water reactor] nozzle to safe end welds) impractical. The proposed alternative differentiates between ID [inside diameter] and OD [outside diameter] scanning surfaces, requires that they be conducted separately, and requires that flaws be concealed from the candidate.

Items 7 and 8 - The proposed alternatives to Paragraph 2.2(b) and 2.2(c) state:

> ...containing a flaw to be sized may be identified to the candidate.

Technical Basis - The current ASME Code requires that the regions of each specimen containing a flaw to be length sized shall be identified to the candidate. The candidate shall determine the length of the flaw in each region. (Note that the length and depth sizing use the term "regions" while detection uses the term "grading units" the two terms define different concepts and are not intended to be equal or interchangeable.) To ensure security of the samples, the proposed alternative modifies the first "shall" to a "may" to allow the test administrator the option of not identifying specifically where a flaw is located. This is consistent with the recent revision to Supplement 2.

Items 9 and 10 - The proposed alternative to Paragraph 2.3(a) and 2.3(b) states:

> ...regions of each specimen containing a flaw to be sized may be identified to the candidate.

Technical Basis - The current Code requires that a large number of flaws be sized at a specific location. The proposed alternative changes the "shall" to a "may" which modifies this from a specific area to a more generalized region to ensure security of samples. This is consistent with the recent revision to Supplement 2. It also incorporates terminology from length sizing for additional clarity.

Item 11 - The proposed alternative modifies the acceptance criteria of Table VIII-S2-1 as follows:

TABLE VIII-S~~2~~10-1[1]
PERFORMANCE DEMONSTRATION DETECTION TEST
ACCEPTANCE CRITERIA

Detection Test Acceptance Criteria		**False Call Test Acceptance Criteria**	
No. of Flawed Grading Units	**Minimum Detection Criteria**	**No. of Unflawed Grading Units**	**Maximum Number of False Calls**
~~5~~	~~5~~	~~10~~	~~0~~
~~6~~	~~6~~	~~12~~	~~1~~
~~7~~	~~6~~	~~14~~	~~1~~
~~8~~	~~7~~	~~16~~	~~2~~
~~9~~	~~7~~	~~18~~	~~2~~
10	8	~~20~~ 15	~~3~~ 2
11	9	~~22~~ 17	~~3~~ 3
12	9	~~24~~ 18	~~3~~ 3
13	10	~~26~~ 20	~~4~~ 3
14	10	~~28~~ 21	~~5~~ 3
15	11	~~30~~ 23	~~5~~ 3
16	12	~~32~~ 24	~~6~~ 4
17	12	~~34~~ 26	~~6~~ 4
18	13	~~36~~ 27	~~7~~ 4
19	13	~~38~~ 29	~~7~~ 4
20	14	~~40~~ 30	~~8~~ 5

[1]Table VIII-S10-1 obtained from FirstEnergy letter to the NRC (PY-CEI/NRR-2800L) and reproduced on this page.

Technical Basis - The proposed alternative adds the new Table VIII-S10-1 above. It is a modified version of Table VIII-S2-1 to reflect the reduced number of unflawed grading units and allowable false calls. As provided by the [EPRI] PDI as a part of the ongoing [ASME] Code activities, Pacific Northwest National Laboratories has reviewed the statistical significance of these revisions and offered the revised Table VIII-S10-1.

Note that a Code Case and changes to the ASME Code were processed through ASME Subcommittee XI to incorporate the dissimilar metal qualification process as implemented by the EPRI PDI Program. Code Case N-695, "Qualification Requirements for Dissimilar Metal Welds, Section XI, Division 1," and the accompanying ASME Code change were approved on May 1, 2003. The Code Case was published in Supplement 10 to the 2001 Code Cases and the ASME Code change will be published in the 2004 Addenda to Section XI.

3.1.4 Implementation Schedule

The licensee will use the proposed alternative during the remainder of the second 10-year ISI interval, which started on November 18, 1998, and will end on November 17, 2008.

3.1.5 Evaluation

Since 2001, EPRI has been developing a PDI program to implement Supplement 10 to Appendix VIII of Section XI of the ASME Code. During the development process, certain aspects of Supplement 10 were identified as difficult or impossible to implement. To overcome the implementation difficulties, EPRI researched, tested, and demonstrated the effectiveness of an alternative to selected paragraphs of the ASME Code. EPRI representatives presented the PDI alternative before the appropriate ASME committees which formalized the alternative in Code Case N-695 which was approved on May 21, 2003. The NRC staff representatives on these committees participated in the consensus process and joined with the industry in approving Code Case N-695. The differences between the ASME Code and the EPRI PDI program are discussed below.

Paragraph 1.1(b)

The ASME Code requirement of "0.9 to 1.5 times the nominal diameter are equivalent" was established for a single nominal diameter. When applying the ASME Code-required tolerance to a range of diameters, the tolerance rapidly expands on the high side. Under the current ASME Code requirements, a 5-inch OD pipe would be equivalent to a range of 4.5-inch to [7.5-inch diameter pipe. Under the proposed PDI guidelines, the equivalent range would be reduced to 4.5-inch to 5.5-inch diameter pipe. With the current ASME Code requirements, a 16-inch nominal diameter pipe would be equivalent to a range of 14.4-inch to 24-inch diameter pipe. The proposed alternative would significantly reduce the equivalent range to between 15.5-inch and 16.5-inch diameter pipe. The difference between the ASME Code and the proposed PDI program for diameters less than 5 inches is not significant because of shorter metal path and beam spread associated with smaller diameter piping. The NRC staff considers the proposed alternative to be more conservative overall than current ASME Code requirements. The NRC staff finds that the proposed alternative will provide an acceptable level of quality and safety and, therefore, is acceptable.

Paragraph 1.1(d)

The ASME Code requires all flaws to be cracks. Manufacturing test specimens containing cracks free of spurious reflections and telltale indicators is extremely difficult in austenitic material. To overcome these difficulties, EPRI developed a process for fabricating flaws that produce ultrasonic testing (UT) acoustic responses similar to the responses associated with real cracks. EPRI presented its process for discussion at public meetings held June 12-14, 2001, and January 31 through February 2, 2002, at the EPRI NDE (Non-Destructive Examination) Center in Charlotte, NC. The NRC staff attended these meetings and determined that the process parameters used for manufacturing fabricated flaws resulted in acceptable acoustic responses. EPRI is selectively installing these fabricated flaws in specimen locations that are unsuitable for real cracks. The NRC staff finds that the proposed alternative will provide an acceptable level of quality and safety and, therefore, is acceptable.

Paragraph 1.1(d)(1)

The ASME Code requires that at least 50% of the flaws be contained in austenitic material and 50% of the flaws in the austenitic material shall be contained fully in weld or buttering material. This means that at least 25% of the total flaws must be located in the weld or buttering material. Field experience shows that flaws identified during ISI of dissimilar metal welds are more likely to be located in the weld or buttering material. The grain structure of austenitic weld and buttering material represents a more stringent ultrasonic examination than that of a ferritic or austenitic base material. Flaws made in austenitic base material are difficult to create free of spurious reflectors and telltale indicators. The proposed alternative of 80% of the flaws in the weld metal or buttering material provides a challenging testing scenario reflective of field experience and minimizes testmanship associated with telltale reflectors common to placing flaws in austenitic base material. The NRC staff considers the proposed alternative to be more conservative overall than current ASME Code requirements. The NRC staff finds that the proposed alternative will provide an acceptable level of quality and safety and, therefore, is acceptable.

Paragraph 1.2(b) and Table VIII-S10-1

The ASME Code requires that detection sets meet the requirements of Table VIII-S2-1, which specifies the minimum number of flaws in a test set to be 5 with 100% detection. The current ASME Code also requires the number of unflawed grading units to be two times the number of flawed grading units. The proposed alternative, as shown in the licensee's submittal as Table VIII-S10-1, would follow the detection criteria of the table beginning with a minimum number of flaws in a test set starting at 10, and reducing the number of unflawed grading units to one and a half times the number of flawed grading units, while maintaining the same statistical design basis as the ASME Code. The proposed alternative paragraphs satisfy the Pass/Fail objective established for the Appendix VIII performance demonstration acceptance criteria. The NRC staff finds that the proposed alternative will provide an acceptable level of quality and safety and, therefore, is acceptable.

Paragraphs 1.2(c)(1) and 1.3(c)

For detection and length sizing, the ASME Code requires at least one third of the flaws to be located between 10% and 30% through the wall thickness and one third located greater than 30% through the wall thickness. The remaining flaws would be located randomly throughout the wall thickness. The proposed alternative sets the distribution criteria for detection and length sizing to be the same as the depth sizing distribution, which stipulates that at least 20% of the flaws be located in each of the increments of 10-30%, 31-60% and 61-100%. At least 75% of the flaws shall be in the range of 10 to 60% of the wall thickness with the remaining flaws located randomly throughout the pipe thickness. With the exception of the 10-30% increment, the proposed alternative is a subset of the current ASME Code requirements. The 10-30% increment would be in the subset if it contained at least 30% of the flaws. The change simplifies assembling test sets for detection and sizing qualifications and is more indicative of conditions in the field. The NRC staff finds that the proposed alternative will provide an acceptable level of quality and safety and, therefore, is acceptable.

Paragraph 2.0

The ASME Code requires the specimen inside surface be concealed from the candidate. This requirement is applicable for test specimens used for qualification performed from the outside surface. With the expansion of Supplement 10 to include qualifications performed from the inside surface, the inside surface must be accessible while maintaining the specimen integrity. The proposed alternative requires that flaws and specimen identifications be obscured from candidates, thus maintaining blind test conditions. The NRC staff considers this to be consistent with the intent of ASME Code requirements. The NRC staff finds that the proposed alternative will provide an acceptable level of quality and safety and, therefore, is acceptable.

Paragraphs 2.2(b) and 2.2(c)

The ASME Code requires that the location of flaws added to the test set for length sizing shall be identified to the candidate. The proposed alternative is to make identifying the location of additional flaws an option. This option provides an additional element of difficulty to the testing process because the candidate would be expected to demonstrate the skill of detecting and sizing flaws over an area larger than a specific location. The NRC staff considers the proposed alternative to be more conservative than current ASME Code requirements. The NRC staff finds that the proposed alternative will provide an acceptable level of quality and safety and, therefore, is acceptable.

Paragraphs 2.3(a) and 2.3(b)

In paragraph 2.3(a), the ASME Code requires that 80% of the flaws be sized in a specific location that is identified to the candidate. The proposed alternative allows identification of the specific location to be an option. This permits detection and depth sizing to be conducted separately or concurrently. In order to maintain a blind test, the location of flaws cannot be shared with the candidate. For depth sizing that is conducted separately, allowing the test administrator the option of not identifying flaw locations makes the testing process more challenging. The NRC staff considers the proposed alternative to be more conservative than current ASME Code requirements. The NRC staff finds that the proposed alternative will provide an acceptable level of quality and safety and, therefore, is acceptable.

In paragraph 2.3(b), the ASME Code also requires that the location of flaws added to the test set for depth sizing shall be identified to the candidate. The proposed alternative is to make identifying the location of additional flaws an option. This option provides an additional element of difficulty to the testing process because the candidate would be expected to demonstrate the skill of finding and sizing flaws in an area larger than a specific location. The NRC staff considers the proposed alternative to be more conservative than current ASME Code requirements.

The NRC staff finds that the proposed alternative will provide an acceptable level of quality and safety and, therefore, is acceptable.

3.1.6 Conclusion

Based upon review of the information provided by the licensee in support of its Relief Request IR-050, the NRC staff concludes that the licensee's proposed alternative to use Supplement 10, as administered by the EPRI PDI program, provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff NRC authorizes the use of the proposed examination alternative at PNPP during the second 10-year ISI interval. All other ASME Code, Section XI, requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

3.2 RELIEF REQUEST IR-051; USE OF CODE CASE N-663 FOR SURFACE EXAMINATION OF CLASS 2 COMPONENTS

3.2.1 Identification of components

This relief request applies to ASME Code Section XI, Table IWC-2500-1, Class 2, Examination Category C-F-2, Item Nos. C5.51, C5.52, and C5.81 welds greater than nominal pipe size (NPS) 4.

3.2.2 ASME Code Requirements for which Relief is Requested

The 1989 Edition, No Addenda of the ASME Code, Section XI, Table IWC-2500-1, Class 2, Examination Category C-F-2, pressure-retaining welds in carbon or low allow steel piping, requires a sampling of piping welds using volumetric examination, surface examination, or both of at least 7.5%, but not less than 28 welds, of all the welds subject to examination. Specifically, Examination Category C-F-2, Item Nos. C5.51, C5.52, and C5.81 (the only Category C-F-2 item numbers applicable at PNPP) require a surface examination.

3.2.3 Proposed Alternative to the ASME Code

In lieu of the surface examination requirements for Table IWC-2500-1, Class 2, Examination Category C-F-2, Item Nos. C5.51, C5.52, and C5.81 (NPS 4 and larger), the licensee proposed to use the examination requirements of Code Case N-663.

3.2.4 Basis for Relief (as stated by the licensee)

ASME Section XI Task Group on ISI Optimization Report No. 92-01-01, "Evaluation of Inservice Inspection Requirements for Class 1, Category B-J Pressure Retaining Welds in Piping," dated July 1995, concluded (with 50 units responding with a total of 9333 welds inspected) only 2 welds (0.02%) were found to have flaws detected by Section XI surface examinations. These flaws were determined to be fabrication-induced.

In parallel with the above, several risk-informed Code Cases have been developed for use on piping welds (e.g., Code Cases N-560, N-577, and N-578). One of the methods for risk-informing piping examinations is via use of EPRI report TR-112657, Revision B-A, "Revised Risk-Informed Inservice Inspection Evaluation Procedure;" the NRC staff's safety evaluation for this report is dated October 28, 1999. Table 4-1, "Summary of Degradation-Specific Inspection

Requirements and Examination Methods," of the EPRI report lists the required degradation mechanisms to be evaluated in Class 1, 2, and 3 piping. It also identifies the risk-informed examination method required for each of these degradation mechanisms. The only degradation mechanism that requires a surface examination is OD chloride cracking. These two initiatives led ASME to investigate the value of surface examinations.

3.2.5 Implementation Schedule

The licensee will use the proposed alternative during the remainder of the second 10-year ISI interval, which started on November 18, 1998, and will end on November 17, 2008.

3.2.6 Evaluation

The proposed use of Code Case N-663 by the licensee to replace the existing Section XI surface examination requirements for Examination Category C-F-2, carbon steel piping welds greater than nominal pipe size (NPS) 4, is consistent with the approved underlying EPRI and Westinghouse methodologies on risk-informed ISI contained in TR-112657, Revision B-A, and WCAP-14572, Revision 1-NP-A, "Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report." Although the two topical reports use different approaches, both have reached their objectives of identifying the risk-important areas of the piping systems and defining the appropriate examination methods, examination volumes, procedures, and evaluation standards necessary to address the degradation mechanisms of concern and the ones most likely to occur at each location to be inspected. Risk-informed ISI analyzes specific pipe segments for probability of failure and operational safety significance.

In regard to the current issue of surface examinations for piping welds of Examination Category C-F-2, all plants that performed risk-informed ISI of their Class 2 piping systems in accordance with the topical reports referenced above resulted in the conclusion that the only degradation mechanism that required surface examination is OD chloride cracking. Consequently, within these plants, surface examination would be considered only when OD chloride cracking is identified to be the degradation mechanism affecting the structural integrity of the subject piping welds.

Code Case N-663 states, in part, that: "...in lieu of the surface examination requirements for piping welds of Examination Category B-F (NPS 4 and larger), B-J (NPS 4 and larger), C-F-1, and C-F-2, surface examinations may be limited to areas identified by the Owner as susceptible to outside cracking." The susceptibility criteria are listed in Table 1 of Code Case N-663 for two types of degradation mechanisms: 1) external (OD) chloride stress corrosion cracking; and, 2) other outside surface initiated mechanisms. These other outside surface initiated mechanisms include thermal fatigue, boric acid corrosion, and any other owner identified mechanisms. The staff determined that the surface inspection requirements of Code Case N-663 are acceptable because the inspection requirements defined in the Code Case are comparable to the corresponding inspection requirements approved by the NRC staff and adopted by using risk-informed ISI programs. Further, the Code Case requires that licensees conduct a plant-specific service history review to identify other mechanisms which can result in outside surface attack, and to include plant-specific processes and programs that minimize chlorides and other contaminants. Hence, the alternative provides reasonable assurance that the proposed inspections will not lead to degraded piping performance when compared to the existing performance levels. The NRC staff finds that the proposed alternative will provide an acceptable level of quality and safety and, therefore, is acceptable.

3.2.7 Conclusion

Based upon review of the information provided by the licensee in support of its Relief Request IR-051, the NRC staff concludes that the use of Code Case N-663 for Class 2 surface examinations, in lieu of the Table IWC-2500-1, Class 2, Examination Category C-F-2 requirements, provides an acceptable level of quality and safety. This conclusion is based on the fact that inspection requirements defined in Code Case N-663 are comparable to the inspection requirements adopted by plants employing risk-informed ISI programs, and because the licensee will be required to conduct a plant-specific service history review to identify other possible mechanisms besides chloride-induced mechanisms that will cause outside surface attack upon subject plant components. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the use of Code Case N-663 at PNPP during the second 10-year ISI interval or until Code Case N-663 is published in a future version of Regulatory Guide (RG) 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1." At that time, if the licensee intends to continue implementing this Code Case, the licensee must follow all provisions of Code Case N-663 with the limitations or conditions specified in RG 1.147, if any. All other ASME Code, Section XI, requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

3.3 RELIEF REQUEST IR-052; USE OF CODE CASE N-613-1 FOR EXAMINATION OF RPV NOZZEL-TO-VESSEL WELDS

3.3.1 Components for which Relief is Requested

This relief request applies to the following ASME Code, Section XI, Class 1, RPV nozzle-to-vessel welds:

1B13-N1A-KB Recirculation Outlet Nozzle N1A to Vessel Weld
1B13-N1B-KB Recirculation Outlet Nozzle N1B to Vessel Weld
1B13-N2A-KB Recirculation Inlet Nozzle N2A to Vessel Weld
1B13-N2B-KB Recirculation Inlet Nozzle N2B to Vessel Weld
1B13-N2C-KB Recirculation Inlet Nozzle N2C to Vessel Weld
1B13-N2D-KB Recirculation Inlet Nozzle N2D to Vessel Weld
1B13-N2E-KB Recirculation Inlet Nozzle N2E to Vessel Weld
1B13-N2F-KB Recirculation Inlet Nozzle N2F to Vessel Weld
1B13-N2G-KB Recirculation Inlet Nozzle N2G to Vessel Weld
1B13-N2H-KB Recirculation Inlet Nozzle N2H to Vessel Weld
1B13-N2J-KB Recirculation Inlet Nozzle N2J to Vessel Weld
1B13-N2K-KB Recirculation Inlet Nozzle N2K to Vessel Weld
1B13-N3A-KB Main Steam Nozzle N3A to Vessel Weld
1B13-N3B-KB Main Steam Nozzle N3B to Vessel Weld
1B13-N3C-KB Main Steam Nozzle N3C to Vessel Weld
1B13-N3D-KB Main Steam Nozzle N3D to Vessel Weld
1B13-N7-KB Top Head Spare Nozzle N7 to Vessel Weld
1B13-N9A-KB Jet Pump Instrumentation Nozzle N9A to Vessel Weld
1B13-N9B-KB Jet Pump Instrumentation Nozzle N9B to Vessel Weld
1B13-N16-KB Vibration Monitoring Nozzle N16 to Vessel Weld

3.3.2 Applicable ASME Code Requirements from which Relief is Requested

ASME Code, Section XI, 1989 Edition with No Addenda, Subsection IWB, Table IWB-2500-1, Class 1, Examination Category B-D Full Penetration Welds of Nozzles in Vessels, Item No. B3.90, Figure IWB-2500-7(b) defines the examination volume of the RPV nozzle-to-shell welds.

The specific ASME Code requirement from which relief is requested is the requirement to perform the volumetric examination of the indicated nozzle-to-vessel welds in accordance with the examination volume requirements of Figure IWB-2500-7(b). Pursuant to 10 CFR 50.55a(a)(3)(i), relief is requested to perform the ASME Code examination on a reduced volume in accordance with Code Case N-613-1. However, to ensure that the examination encompasses potential in-process weld repair areas, PNPP will extend the Code Case N-613-1 examination volume out from ½ inch on either side of the weld to 1 inch on either side of the weld. When performing the examinations of nozzle-to-vessel welds, PNPP will still comply with the special requirements imposed in 10 CFR 50.55a(b)(2)(xv)(K)(3) and, where access is achievable, 10 CFR 50.55a(b)(2)(xv)(G). Note that all of PNPP's nozzle-to-shell weld examinations are conducted from outside of the vessel. These requirements dictate that the examination scanning processes must also be performed in such a manner to detect flaws oriented axially with the nozzle. PNPP will continue to perform the required UT examinations in accordance with 10 CFR 50.55a, except that the examination volume will be reduced.

3.3.3 Proposed Alternative to the ASME Code (as stated by the licensee)

In lieu of the volumetric examination requirements of Figure IWB-2500-7(b), the licensee proposed to perform the examinations of the RPV nozzle-to-vessel welds as follows:

1. Ultrasonic examinations of the RPV nozzle-to-vessel welds in accordance with the qualification requirements of ASME Section XI Appendix VIII and the examination volumes as defined in Code Case N-613-1 [except that the examination volume is increased from ½ inch on either side of the weld to 1 inch on either side of the weld.]

2. In accordance with the requirements shown in ASME Section XI Appendix VIII of the 1995 Edition with the 1996 Addenda, as amended by the Final Rule and as required in paragraphs 10 CFR 50.55a(b)(2)(xiv), (xv), and (xvi); and in 10 CFR 50.55a(g)(6)(ii)(C) through the use of the EPRI PDI program document, "PDI Program Description," Revision 1, Change 1, as allowed in the discussion on the Final Rule published in the *Federal Register*.

3. Continued periodic system pressure tests of the RPV per ASME Section XI requirements of Table IWB-2500-1, for Category B-P items.

3.3.4 Basis for Relief (as stated by the licensee)

The examination volume required by IWB-2500-7(b) for the reactor vessel pressure retaining nozzle-to-vessel welds extends far beyond the weld and the heat affected zones into the base metal, and is unnecessarily large. This extends examination time significantly, increases the radiation exposure of exam support personnel, and results in no net increase in safety; as the additional area being examined is a base-metal region of the reactor vessel shell or nozzle wall areas where industry experience has shown service-induced cracks are not prone to occur.

In addition, these regions have been extensively examined during the fabrication and installation periods before the vessels were put in service and during the inservice examinations already performed.

The reduction of UT examination volumes adjacent to the widest part of the weld from one-half of the vessel wall thickness to one-half inch beyond the weld boundary eliminates base metal material volume to be examined. These areas are not located in the weld or the immediate heat affected zone. The weld and the immediate heat affected zone are the areas where inservice flaws are most likely to initiate and they are adequately addressed and contained in the examination volume defined by the area one half inch beyond the weld boundary. Since fabrication, there have been no repairs to any of the PNPP's nozzle-to-vessel welds. Detailed records of the in-process repairs that were made to the nozzle-to-vessel welds during fabrication are not available.

To ensure that the examination encompasses potential in process weld repair areas, PNPP will extend the Code Case N-613-1 examination volume out from ½ inch on either side of the weld to 1 inch on either side of the weld.

All of the subject nozzle-to-vessel welds were made using the Submerged Arc Welding method with the root of the weld being on the outside of the vessel and the face of the weld being on the inside of the vessel. As such, the widest section of the weld is not visible to the examination personnel. Complete coverage is determined by calculating the weld width from the drawings and scanning the appropriate distance on either side of the weld centerline, which was marked with punch marks by Chicago Bridge and Iron - Nuclear (CBIN) when the vessel was fabricated. Residual stresses in the weld and heat affected zones of the nozzle-to-shell welds are minimal as all these welds, including in-process weld repairs if any, were subjected to post-weld heat treatment during vessel fabrication.

In addition, use of the proposed examination boundaries will be conducted in conjunction with PNPP's programmatic implementation of the mandated use of ASME Code Section XI, Appendix VIII. PNPP will implement these requirements in accordance with the requirements shown in ASME Code Section XI, Appendix VIII, of the 1995 Edition with the 1996 Addenda, as amended by 10 CFR 50.55a and as required in paragraphs 10 CFR 50.55a(b)(2)(xiv), (xv), and (xvi); and in 10 CFR 50.55a(g)(6)(ii)(C). PNPP will comply with these requirements through the use of the EPRI PDI program. These procedures will ensure that the performance-based UT methodologies used and the techniques will be qualified and examination personnel will be certified by a performance demonstration.

The use of the reduced examination volumes in lieu of the identified ASME Code Section XI referenced requirements will reduce on-vessel examination time by as much as 12 hours an outage, with approximately 4 hours of that involving manually performed exams. For the manually performed nozzle exams, on average there will be a dose savings of approximately 500 mRem per outage. During certain outages, inservice examination of Reactor Vessel nozzles are on critical path. As such, over the course of a 10-year inspection interval, it is conservatively estimated that at least 24 hours of critical path time will be saved by the reduced examination times. This reduction in the outage duration translates to a replacement power cost savings of approximately $850,000. The personnel radiation exposure is dependent upon the choice of RPV examination equipment (i.e. automated versus manual) and by the degree of plant RPV contamination and/or decontamination conducted prior to the exam.

In conclusion, use of the reduced examination volume requirements in conjunction with the application of the Appendix VIII implementing the EPRI PDI program will provide sufficient assurance that RPV nozzle-to-vessel welds have remained free of service induced flaws or identify such flaws prior to failure. The application of the PDI techniques will enhance quality of the UT examinations and ensure plant safety and pressure boundary reliability.

Therefore, the proposed alternative provides for an acceptable level of quality and safety and, pursuant to 10 CFR 50.55a(a)(3)(i), relief to use the reduced examination volumes may be granted.

3.3.5 Implementation Schedule

The licensee will use the proposed alternative during the remainder of the second 10-year ISI interval, which started on November 18, 1998, and will end on November 17, 2008.

3.3.6 Evaluation

The licensee has requested relief from the UT examination volume requirements specified in Table IWB-2500-1, Examination Category B-D, Code Item B3.90, Figures IWB-2500-7 (a) through (d) pertaining to UT examination of full penetration nozzles in vessels. The licensee proposes to use a reduced examination volume, extending to 1 inch from each side of the widest part of the nozzle-to-vessel weld in lieu of an examination volume extending to a distance equal to one-half the through-wall thickness from each side of the widest part of the nozzle-to-vessel weld, as required by Figures IWB-2500-7 (a) through (d). The initial relief requested was to perform the ASME Code examination on a reduced volume in accordance with Code Case N-613-1. However, detailed records of the in-process repairs that were made to the nozzle-to-vessel welds during fabrication are not available. To ensure that the examination encompasses potential in-process weld repair areas, the licensee modified their initial request to extend the Code Case N-613-1 examination volume out from ½ inch on either side of the weld to 1 inch on either side of the weld.

In response to the NRC staff's request for additional information (RAI), the licensee provided a supplemental sketch showing the configuration of the nozzle-to-vessel weld and the revised examination volume. The revised examination volume depicted in this sketch extends to 1 inch from each side of the widest part of the nozzle-to-vessel weld and is therefore consistent with licensee's request for the reduced UT examination volume. All other aspects of the UT examination volumes for RPV nozzle-to-vessel welds remain unchanged in the licensee's request. Their response to NRC staff's RAI also contains a listing of all nozzle-to-vessel welds included within the scope of this relief request.

The acceptability of the reduced UT examination volume is based on prior full volumetric examinations of the welds and base metal, as well as the internal stress distribution near the weld. Prior full volumetric examinations of the nozzle-to-vessel welds included within the scope of these relief requests cover the full volume of base metal, extending to a distance equal to one-half the through-wall thickness from each side of the widest part of the nozzle-to-vessel weld, as required by the ASME Code. This base metal region included in the original ASME Code volume was extensively examined during construction, preservice inspection, and prior inservice inspections. These examinations all show the ASME Code volume to be free of unacceptable flaws. The creation of flaws during plant service in the volume excluded from the proposed reduced examination volume is unlikely because of the low stress in the base metal away from the weld. The stresses caused by welding are concentrated at or near the weld.

Cracks, should they initiate, occur in the highly-stressed area of the weld. The highly-stressed areas are within the volume included in the reduced examination volume proposed by the licensee. The prior full volume examinations of the base metal in addition to the examinations of the highly-stressed areas of the weld provide an acceptable level of quality and safety.

The proposed alternative examination will be conducted in conjunction with PNPP's programmatic implementation of the mandated use of ASME Code Section XI, Appendix VIII. PNPP will implement these requirements in accordance with the requirements shown in ASME Code Section XI, Appendix VIII of the 1995 Edition with the 1996 Addenda, as amended by 10 CFR 50.55a and as required in paragraphs 10 CFR 50.55a(b)(2)(xiv), (xv), and (xvi); and in 10 CFR 50.55a(g)(6)(ii)(C). PNPP will comply with these requirements through the use of the EPRI PDI program. These procedures will ensure that the performance-based UT methodologies used and the techniques will be qualified and examination personnel will be certified by a performance demonstration. All of PNPP's nozzle-to-shell weld exams are conducted from outside of the vessel. These requirements dictate that the examination scanning processes must be performed in such a manner to detect flaws oriented axially with the nozzle. PNPP will continue to perform the required UT examinations in accordance with the 10 CFR 50.55a, except that the examination volume will be reduced.

In response to a RAI question from the NRC staff regarding how the width of the weld can be determined if repairs were made to that weld, the licensee stated:

> Since fabrication, there have been no repairs to any of the PNPP's nozzle-to-vessel welds. Detailed records of the in-process repairs that were made to the nozzle-to-vessel welds during fabrication are not available. Until such time that the Nuclear Regulatory Commission (NRC) staff formally approves Code Case N-613-1, to ensure that the in-process repairs encompass the weld repair areas, the PNPP staff will extend the Code Case N-613-1 examination volume out from ½ inch on either side of the weld to 1 inch on either side of the weld.
>
> All of the subject nozzle-to-vessel welds were made using the Submerged Arc Welding method with the root of the weld being on the outside of the vessel and the face of the weld being on the inside of the vessel. As such, the widest section of the weld is not visible to the examination personnel. Complete coverage is determined by calculating the weld width from the drawings and scanning the appropriate distance on either side of the weld centerline, which was marked with punch marks by CBIN when the vessel was fabricated.

The sketches included in the RAI response reflect this additional conservatism. Therefore, since there have been no repairs in the area to be examined since fabrication which could extend past the original weld boundaries and since the examination volume will be extended out from ½ inch on either side of the weld to 1 inch on either side of the weld, this additional conservatism to the examination will ensure examination of the entire weld. The NRC staff finds that the proposed alternative will provide an acceptable level of quality and safety and, therefore, is acceptable.

In their submittal, the licensee referred to EPRI Technical Report 1003557, "BWRVIP-108: BWR Vessel and Internals Project Technical Basis for the Reduction of Inspection Requirements for Boiling Water Reactor Nozzel-to-Vessel Shell Welds and Nozzel Blend Radii" (BWRVIP-108). It should be noted that BWRVIP-108 is currently under NRC review and has not yet been accepted.

Therefore, BWRVIP-108 was not used by the NRC staff in its evaluation of the acceptance of this Relief Request IR-052.

3.3.7 Conclusion

Based upon review of the information provided by the licensee in support of its Relief Request IR-052, the NRC staff finds that the proposed alternative to reduce the UT examination volume to 1 inch from the widest part of the nozzle-to-vessel weld on each side of the weld crown in lieu of one-half the through-wall thickness from the widest part of the nozzle-to-vessel weld on each side of the weld crown will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the use of the proposed examination alternative at PNPP during the second 10-year ISI interval or until Code Case N-613-1 is published in a future version of RG 1.147. At that time, if the licensee intends to continue implementing this Code Case, the licensee must follow all provisions of Code Case N-613-1 with the limitations or conditions specified in RG 1.147, if any. All other ASME Code, Section XI, requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

4.0 CONCLUSION

Based on the above evaluation, the NRC staff authorizes the licensee-proposed examination alternatives for PNPP in accordance with 10 CFR 50.55a(a)(3)(i), on the basis that the alternative examinations provide an acceptable level of quality and safety. The licensee's proposed alternatives are authorized for the remainder of PNPP's Second 10-year ISI interval which began November 19, 1998, and ends November 18, 2008, or until Code Case N-663 (for IR-051) or Code Case N-613-1 (for IR-052) is published in a future version of RG 1.147. At that time, if the licensee intends to continue implementing these Code Cases, the licensee must follow all provisions of Code Case N-663 or N-613-1, as applicable, with the limitations or conditions specified in RG 1.147, if any. All other requirements of the ASME Code, Section XI, for which relief has not been specifically requested remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

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