September 15, 2003

Mr. R. T. Ridenoure
Division Manager - Nuclear Operations
Omaha Public Power District
Fort Calhoun Station, FC-2-4 Adm.
P.O. Box 550
Fort Calhoun, NE 68023-0550

SUBJECT: FORT CALHOUN STATION, UNIT NO. 1 – RELIEF REQUEST - THIRD 10-YEAR INTERVAL INSERVICE INSPECTION PROGRAM PLAN - REQUESTS FOR RELIEF RR-1, RR-2, RR-3, RR-4, AND RR-5 (TAC NO. MB6986)

Dear Mr. Ridenoure:

By letter dated December 20, 2002, Omaha Public Power District (OPPD) submitted Requests for Relief (RR) RR-1, RR-2, RR-3, RR-4, and RR-5 to the third 10-year inservice inspection interval at the Fort Calhoun Station, Unit No. 1. In its response dated May 16, 2003, to an NRC request for additional information dated April 14, 2003, OPPD withdrew RR-1 and RR-4 and provided additional information and clarification for RR-2 and RR-3. OPPD has cited 10 CFR 50.55a(a)(3)(i) as the basis for requesting relief for the use of an alternative ultrasonic examination.

The staff concludes that the proposed alternatives to the selected American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) requirements for RR-2, RR-3, and RR-5 will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the proposed alternatives are authorized for the Fort Calhoun Station, Unit No. 1 for the third 10-year inservice inspection interval. All other requirements of the ASME Code, Section XI for which relief has not been specifically requested and approved remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

The NRC staff's evaluation and conclusions are contained in the enclosed safety evaluation. Enclosure 2 is the NRC staff's consultant, Pacific Northwest National Laboratory, Technical Letter Report. All work under TAC NO. MB6986 is complete.

Sincerely,

/RA/

Stephen Dembek, Chief, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-285

Enclosures: 1. Safety Evaluation
2. Technical Letter Report

cc w/encls: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

THIRD 10-YEAR INSERVICE INSPECTION INTERVAL

REQUESTS FOR RELIEF RR-1, RR-2, RR-3, RR-4, AND RR-5

OMAHA PUBLIC POWER DISTRICT

FORT CALHOUN STATION, UNIT NO. 1

DOCKET NO. 50-285

1.0 INTRODUCTION

By letter dated December 20, 2002, Omaha Public Power District (OPPD) submitted to the NRC a request for relief from the 10 CFR 50.55a requirements as implemented through the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code). The staff, with technical assistance from its contractor, Pacific Northwest National Laboratory (PNNL), has reviewed the information concerning the inservice inspection (ISI) program Requests for Relief (RR) RR-1, RR-2, RR-3, RR-4, and RR-5 submitted by OPPD for Fort Calhoun Station's (FCS) third 10-year ISI interval. In OPPD's response dated May 16, 2003, to an NRC request for additional information (RAI), the licensee withdrew RR-1 and RR-4 and provided additional information and clarification for RR-2 and RR-3.

2.0 REGULATORY REQUIREMENTS

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 (ISI) of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first ten-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) twelve months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The applicable Code of record for the third 10-year inservice inspection for Fort Calhoun Station is the 1989 Edition of the ASME Boiler and Pressure Vessel Code, Section XI.

Inservice inspection of the ASME Code Class 1, 2, and 3 components is 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). Section 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if: (i) the proposed alternatives would provide an acceptable level of quality and safety or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

3.0 TECHNICAL EVALUATION

The NRC staff has adopted the evaluations and recommendations for authorizing the alternatives contained in PNNL's Technical Letter Report (TLR) (Enclosure 2). A summary of each relief request is provided below. The detailed review of each relief request is contained in the TLR.

For RR-2, OPPD proposed using ASME Section XI, Appendix VIII, Supplement 10 as administered under the Electric Power Research Institute (EPRI) - Performance Demonstration Initiative (PDI) implementation program. During the development process of the PDI program, selected aspects of Supplement 10 were determined to be ineffective, impractical, or unworkable. The PDI program developed alternatives for these selected aspects that challenged the effectiveness of the procedures, skill level of the personnel, and applicability of the equipment. These alternatives were presented in semi-annual meetings with the NRC staff and industry and were submitted to the ASME consensus building process as proposed code cases. The NRC staff conveyed its opinions at these meetings and did not take exceptions to the proposed code cases. The review of the alternatives is discussed in Enclosure 2. These alternatives are more conservative than, or as challenging as, the ASME Code requirements. The NRC staff has determined pursuant to 10 CFR 50.55a(a)(3)(i), that the proposed alternative for RR-2 will provide an acceptable level of quality and safety, and therefore, is acceptable.

For RR-3, OPPD proposed using ASME Section XI, Appendix VIII, Supplements 2 and 3 as administered under the PDI program "add-ons" to PDI Supplement 10 (RR-2) qualifications as an alternative for Code requirements. The PDI program developed the concept and performance challenging criteria for Supplement 2 and 3 qualification. The alternatives were presented in semi-annual public meetings with the NRC staff, and were submitted to the ASME consensus building process as a proposed code case. The NRC staff conveyed its opinions at these meetings and did not take exceptions to the proposed code case. The review of the alternative is discussed in Enclosure 2. The NRC staff has determined pursuant to 10 CFR 50.55a(a)(3)(i), that the proposed alternative for RR-3 will provide an acceptable level of quality and safety, and therefore, is acceptable.

For RR-5, OPPD proposed an alternative that would eliminate the use of ASME Section XI, Appendix VIII, Supplement 4, Subparagraph 3.2(c) qualification requirement. The requirement imposes statistical parameters for a linear regression process which is inappropriate for the data. The review of the alternative is discussed in Enclosure 2. The NRC staff has determined that pursuant to 10 CFR 50.55a(a)(3)(i), the proposed alternative for RR-5 will provide an acceptable level of quality and safety, and therefore, is acceptable.

4.0 CONCLUSION

The NRC staff adopts the evaluations and recommendations for authorizing alternatives contained in the PNNL TLR. The NRC staff concludes that the proposed alternatives to the selected Code requirements discussed in the TLR for RR-2, RR-3, and RR-5 will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the proposed alternatives are authorized for the Fort Calhoun Station, Unit No. 1 for the third 10-year inservice inspection interval. All other requirements of the ASME Code, Section XI for which relief has not been specifically requested and approved remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: D. Naujock

Date: September 15, 2003

TECHNICAL LETTER REPORT

ON THE THIRD 10-YEAR INTERVAL INSERVICE INSPECTION

REQUESTS FOR RELIEF

OMAHA PUBLIC POWER DISTRICT

FORT CALHOUN STATION

DOCKET NUMBER: 50-285

1.0 INTRODUCTION

By letter dated December 20, 2002, the licensee, Omaha Public Power District, submitted Requests for Relief Nos. RR-1 through RR-5, from requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*. In response to an NRC Request for Additional Information (RAI), the licensee provided further information in a letter dated May 16, 2003. These requests are for the third 10-year inservice inspection (ISI) interval at Fort Calhoun Station (FCS). The Pacific Northwest National Laboratory (PNNL) has evaluated the requests for relief in the following section.

2.0 REGULATORY REQUIREMENTS

Inservice inspection of the ASME Code Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME *Boiler and Pressure Vessel Code* (B&PV Code), and applicable addenda, as required by 10 CFR 50.55a(g), except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). The regulation at 10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the U.S. Nuclear Regulatory Commission (NRC), if the licensee 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, "Rules for Inservice Inspection (ISI) 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, which was 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 FCS third 10-year interval inservice inspection program, which began on September 26, 1993, is the 1989 Edition of Section XI of the ASME Boiler and Pressure Vessel Code, with no addenda.

3.0 EVALUATION

The information provided by Omaha Public Power District in support of the requests for relief from Code requirements has been evaluated and the bases for disposition are documented below.

3.1 Request for Relief No. RR-1, Examination Category B-D, Item B3.90, Reactor Pressure Vessel Nozzle-to-Vessel Welds

Note: In response to the NRC Request for Additional Information, the licensee has elected to withdraw RR-1 and has committed to perform the Code-required volumetric examination coverage.

3.2 Request for Relief No. RR-2, Pressure Retaining Welds in Piping Subject to Appendix VIII, Supplement 10, Qualification Requirements for Dissimilar Metal Piping Welds

Code Requirement: Performance demonstration requirements for qualifying procedures, personnel and equipment to inspect dissimilar metal piping welds are listed in the 1995 Edition/1996 Addenda of ASME Section XI, Appendix VIII, Supplement 10. Licensees may 1) elect to use the requirements of Supplement 10 as listed, 2) seek NRC approval for new ASME code cases currently being reviewed by Code Committees, or 3) propose an alternative to Code requirements. The licensee proposed to use the industry's Performance Demonstration Initiative (PDI) program as an alternative to the following paragraphs of Supplement 10:

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.

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

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.

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

Paragraph 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%.

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

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

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.

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.

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.

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

Licensee's Proposed Alternative to Code: Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee proposed using the PDI program in lieu of the requirements of ASME Section XI, 1995 Edition with 1996 Addenda, Appendix VIII, Supplement 10. The Electric Power Research Institute (EPRI) PDI program is described in the submittal as supplemented.

Licensee's Bases for Alternative (as stated):

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."

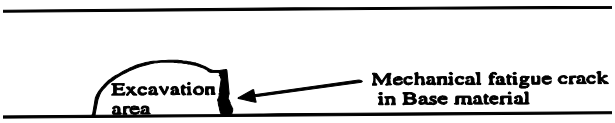
Technical Basis - The change in the minimum pipe diameter tolerance from 0.9 times the diameter to the nominal diameter minus 0.5 inch provides tolerances more in line with industry practice. Though the alternative is less stringent for small pipe diameters they typically have a thinner wall thickness 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 shall be used when available. Alternative flaws, if used, shall provide crack-like reflective characteristics and shall be limited to the case where implantation of cracks produces spurious reflectors that are uncharacteristic of actual flaws. Alternative flaw mechanisms shall have a tip width of less than or equal to 0.002 in. (.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 a maximum of 10% of the flaws shall be in ferritic base material. At least one and a maximum of 10% of the flaws shall be in austenitic base material."

Technical Basis - Under the current 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 Code.

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

"Detection sets shall be selected from Table VIII-S10-1. The number of unflawed grading units shall be at least one and a half 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 Minimum (% Wall Thickness)	Number of Flaws
(10 - 30)	20%
(31 - 60)	20%
(61 - 100)	20%

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 Code requires that the inside surface be concealed from the candidate. This makes qualifications conducted from the inside of the pipe (e.g., PWR nozzle to safe end welds) impractical. The proposed alternative differentiates between ID and OD scanning surfaces, requires that they be conducted separately, and requires that flaws be concealed from the candidate. This is consistent with the recent revision to Supplement 2.

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 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 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) state:

"... 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.

Technical Basis - The proposed alternative is identified as new Table S-10-1. It was modified to reflect the reduced number of unflawed grading units and allowable false calls. As a part of ongoing Code activities, PNNL has reviewed the statistical significance of these revisions and offered the revised Table S-10-1.

Response to Request for Additional Information (as stated):

In response to an NRC request for additional information, the licensee, in consultation with EPRI PDI, provided the following supplemental information in its letter dated May 16, 2003.

Response concerning re-qualification of procedures with new essential variables:

(1) Fort Calhoun Station wants to assure that the personnel being qualified are unable to predict the flaws in the test set.

(2) There are many essential variables with a broad range of applicability. For example, a typical piping procedure may address Supplement 2 austenitic welds and include intergranular stress corrosion cracking (IGSCC). In this particular case, a personnel test set would consist of a minimum of 10 austenitic flaws, accompanied by a minimum of 4 additional IGSCC flaws. If a new essential variable were applicable to IGSCC, a minimum of 4 additional IGSCC flaws would be included [in the new re-qualification test set]. It is intended that the qualification be successful (e.g., all flaws are detected/sized as appropriate), and that it include the number of flawed/unflawed grading units equal to one qualification set.

Evaluation: The licensee proposed to use the program developed by PDI that modifies selected aspects of the Code requirements. The differences between the Code and the PDI program are discussed below.

Paragraph 1.1(b)
The Code requirement of "0.9 to 1.5 times the nominal diameter are equivalent" was established for a single nominal diameter. When applying the Code-required tolerance to a range of diameters, the tolerance rapidly expands on the high side. Under the current 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 current 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. The difference between Code and the proposed alternative for diameters less than 5-inches is not significant because of shorter metal path and beam spread associated with smaller diameter piping. The proposed alternative is considered more conservative than current Code requirements. The proposed alternative paragraph provides an acceptable level of quality and safety.

Paragraph 1.1(d)
The 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, PDI developed a process for fabricating flaws that produce UT acoustic responses similar to the responses associated with real cracks. PDI presented its process for discussion at public meetings held June 12 through 14, 2001 and January 31 through February 2, 2002 at the EPRI NDE Center, Charlotte, NC. The staff attended these meetings and determined that the process parameters used for manufacturing fabricated flaws resulted in acceptable acoustic responses. PDI is selectively installing these fabricated flaws in specimen locations that are unsuitable for real cracks. The proposed alternative paragraph provides an acceptable level of quality and safety.

Paragraph 1.1(d)(1)
The code requires that at least 50% of the flaws be contained in austenitic material, 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 much more stringent ultrasonic scenario than that of a ferritic material or austenitic base material. Flaws made in austenitic base material that are free of spurious reflectors and telltale indicators are difficult to create. 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 proposed alternative paragraph provides an acceptable level of quality and safety.

Paragraph 1.2(b) and Paragraph 3.1
The 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 Code also requires the number of unflawed grading units to be two times the number of flawed grading units. The proposed alternative would follow the detection criteria of the table beginning with a minimum number of flaws in a test set being 10, and reducing the number of false calls to one and a half times the number of flawed grading units. The proposed alternative satisfies the pass/fail objective established for Appendix VIII performance demonstration acceptance criteria. The proposed alternative paragraphs provide an acceptable level of quality and safety.

Paragraph 1.2(c)(1), Paragraph 1.3(c)
For detection and length sizing, Code requires at least 1/3 of the flaws be located between 10 and 30% through the wall thickness and 1/3 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%. The remaining 40% would be located randomly throughout the pipe thickness. With the exception of the 10-30% increment, the proposed alternative is a subset of the current 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 proposed alternative paragraphs provide an acceptable level of quality and safety.

Paragraph 2.0
The 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 the Code requirements. The proposed alternative paragraph provides an acceptable level of quality and safety.

Paragraph 2.2(b) and 2.2(c)
The 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 alternative is more conservative than Code requirements. The proposed alternative paragraph provides an acceptable level of quality and safety.

Paragraph 2.3(a)
The Code requirement is that 80% of the flaws be sized in a specific location that is identified to the candidate. The proposed alternative 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 alternative is more conservative than the Code requirements. The proposed alternative paragraph provides an acceptable level of quality and safety.

Paragraph 2.3(b)
The Code 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 alternative is more conservative than the Code requirements. The proposed alternative paragraph provides an acceptable level of quality and safety.

Pursuant to 10 CFR 50.5a(a)(3)(i), and based on the evaluations above, it is recommended that Request for Relief RR-2 be authorized for the third interval inservice inspection at FCS.

3.3 Request for Relief No. RR-3, Pressure Retaining Welds in Piping Examined from the Inside Surface of Pressurized Water Reactors (PWR) Subject to Appendix VIII, Supplements 2, 3 and 10

Code Requirement: Performance demonstration requirements for qualifying procedures, personnel and equipment to inspect piping welds are listed in the 1995 Edition/1996 Addenda of ASME Section XI, Appendix VIII, Supplements 2, 3, and 10. Licensees may 1) elect to use the requirements of these supplements as listed, 2) seek NRC approval for new ASME code cases currently being reviewed by Code Committees, or 3) propose an alternative to Code requirements.

Licensee's Proposed Alternative to Code: Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee proposed to use the industry's Performance Demonstration Initiative (PDI) program as an alternative to the requirements listed in the 1995 Edition with 1996 Addenda of ASME Section XI, Appendix VIII, Table VIII-3110-1 for Supplement 2 Wrought Austenitic Piping Welds and Supplement 3 Ferritic Piping Welds, as coordinated with the proposed alternative (FCS RR-2) for the Supplement 10 Dissimilar Metal Piping Welds implementation program. The Electric Power Research Institute (EPRI) PDI program is described in the submittal as supplemented.

Licensee's Bases for Alternative (as stated):

Depending upon the particular design, the nozzle to main coolant piping may be fabricated using ferritic, austenitic, or cast stainless components and assembled using ferritic, austenitic, or dissimilar metal welds. Additionally, differing combinations of these

assemblies may be in close proximity, which typically means the same ultrasonic essential variables are used for each weld and the most challenging ultrasonic examination process is employed (e.g., the ultrasonic examination process associated with a dissimilar metal weld would be applied to a ferritic or austenitic weld.

Separate qualifications to Supplements 2, 3, and 10 are redundant when done in accordance with the PDI Program. For example, during a personnel qualification to the PDI Program, the candidate would be exposed to a minimum of 10 flawed grading units for each individual supplement. Personnel qualification to Supplements 2, 3, and 10 would therefore require a total of 30 flawed grading units. Test sets this large and tests of this duration are impractical. Additionally, a full procedure qualification (i.e. 3 personnel qualifications) to the PDI Program requirements would require 90 flawed grading units. This is particularly burdensome for a procedure that will use the same essential variables or the same criteria for selecting essential variables for all 3 supplements.

To resolve these issues, the PDI Program recognizes the Supplement 10 qualification as the most stringent and technically challenging ultrasonic application. The essential variables used for the examination of Supplements 2, 3, and 10 are equivalent and a coordinated implementation would be sufficiently stringent to qualify all three Supplements if the requirements used to qualify Supplement 10 are satisfied as a prerequisite. The basis for this conclusion is the fact that the majority of the flaws in Supplement 10 are located wholly in austenitic weld material, which is known to be challenging for ultrasonic techniques due to the variable dendritic structure of the weld material. Flaws in Supplements 2 and 3 are located in fine-grained base materials, which are known to be less challenging.

Additionally, the proposed alternative is more stringent than current Code requirements for a detection and length sizing qualification. For example, the current Code would allow a detection procedure, personnel, and equipment to be qualified to Supplement 10 with 5 flaws, Supplement 2 with 5 flaws, and Supplement 3 with 5 flaws, a total of only 15 flaws. The proposed alternative of qualifying Supplement 10 using 10 flaws and adding on Supplement 2 with 5 flaws and Supplement 3 with 3 flaws results in a total of 18 flaws which will be multiplied by a factor of 3 for the procedure qualification.

Based on the above, the use of a limited number of Supplement 2 or 3 flaws is sufficient to access the capabilities of procedures and personnel who have already satisfied Supplement 10 requirements. 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 proposed alternative is consistent with other coordinated qualifications currently contained in Appendix VIII.

The proposed alternate program is attached and is identified as Supplement 14. It has been submitted to the ASME Code for consideration as new Supplement 14 to Appendix VIII and as of September 2002 had been approved by the NDE Subcommittee.

Response to Request for Additional Information (as stated):

In response to an NRC request for additional information, the licensee, in consultation with EPRI PDI, provided the following supplemental information in its letter dated May 16, 2003.

Response concerning qualification of far-side weld examinations:

When applying Supplement 14, the following examination coverage criteria requirements and associated qualifications are appropriate and planned:

(1) Piping must be examined in two axial directions, and when examination in the circumferential direction is required, the circumferential examination must be performed in two directions, provided access is available. Dissimilar metal welds must be examined axially and circumferentially.

(2) Where examination from both sides is not possible, full coverage credit may be claimed from a single side for ferritic welds. Where examination from both sides is not possible on austenitic welds or dissimilar metal welds, full coverage credit from a single side may be claimed only after completing a successful single-sided demonstration using flaws on the opposite side (far-side) of the weld. Dissimilar metal weld qualifications must be demonstrated from the austenitic side of the weld and may be used to perform examinations from either side of the weld. To date, all qualifications performed from the inside surface have been demonstrated with dual side access with scanning from all 4 directions [axial and circumferential]. This is consistent with how the examinations will be performed in the field.

Evaluation: The licensee requests relief from the qualification requirements of ASME Section XI, Appendix VIII, Supplement 3 criteria. The Code currently requires separate qualifications for Supplements 2 for austenitic piping, 3 for ferritic piping, and 10 for austenitic-to-ferritic piping. Qualifications for each supplement would entail a minimum of 10 flaws each for a total of 30 flaws minimum. The minimum number of flaws per supplement established a statistical-based pass\fail objective. The process of a single qualification for each supplement would greatly expand the minimum number of ferritic and austenitic flaws required to be identified which would also raise the pass\fail acceptance criteria.

The Code recognized that flaws in austenitic material are more difficult to detect and size than flaws in ferritic material. The prevailing reasoning concluded that a Supplement 3 qualification following a Supplement 2 qualification had diminishing returns on measuring personnel skills and procedure effectiveness. Therefore, in lieu of separate Supplements 2 and 3 qualifications, the ASME Code developed Supplement 12 which provides for a Supplement 3 add-on to a Supplement 2 qualification. The add-on consists of a minimum of 3 flaws in ferritic material. A statistical evaluation of Supplement 12 acceptance criteria satisfied the pass\fail objective established for Appendix VIII performance demonstration acceptance criteria.

The proposed alternative builds upon the experiences of Supplement 12 by starting with the most challenging Supplement 10 qualifications, as implemented by the PDI program

(PDI Supplement 10), and adding a sufficient number of flaws to demonstrate the personnel skills and procedure effectiveness of the less challenging Supplements 2 and 3 qualifications. A PDI Supplement 10 performance demonstration has at least 1 flaw with a maximum of 10% of the total number of flaws being in the ferritic material. The rest of the flaws are in the more challenging austenitic material. When expanding the PDI Supplement 10 qualification to include Supplement 2 and 3, the proposed alternative would add a minimum of 5 flaws in austenitic material and 3 flaws in ferritic material to the performance demonstration. Therefore, combined Supplements 2, 3, and 10 require a minimum of 18 flaws in the performance demonstration test. The performance demonstration results added to the appropriate PDI Supplement 10 results must satisfy the acceptance criteria of the PDI Supplement 10. A statistical evaluation performed by the Pacific Northwest National Laboratories, an NRC contractor, showed that the proposed alternative acceptance criteria satisfied the pass\fail objective established for Appendix VIII for an acceptable performance demonstration.

It has been determined that use of a limited number of flaws to qualify Supplements 2 or 3 as coordinated with the PDI developed alternative to Supplement 10, will provide equivalent flaw detection performance to that of the Code-required qualification for piping welds. As such, the licensee's proposed alternative provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), it is recommended that the licensee's proposed alternative contained in RR-3 be authorized for the third interval at FCS.

3.4 Request for Relief No. RR-4, Examination Category B-F, Item B5.10, Pressure Retaining Dissimilar Metal Welds, Use of Code Case N-663

Note: In response to the NRC Request for Additional Information, the licensee has elected to withdraw RR-4, and must therefore meet the surface examination requirements listed in the Code, or propose an alternative in accordance with 10 CFR 50.55a(a)(3)(i) or (ii).

3.5 Request for Relief No. RR-5, Pressure Retaining Welds in the Reactor Pressure Vessel Subject to Appendix VIII, Supplement 4, Qualification Requirements for the Clad/Base Metal Interface of Reactor Vessel

Code Requirement: ASME Code, Section XI, 1995 Edition, 1996 Addenda, Appendix VIII, Supplement 4, subparagraphs 3.2 (b) requires 0.75 inch RMS length sizing and 3.2(c) requires performance demonstration results reported by the candidate when plotted on a two-dimensional plot (Figure VIII-S4-1) with the depth estimated by ultrasonics plotted along the ordinate and the true depth plotted along the abscissa, satisfy the following statistical parameters: (1) slope of the linear regression line is not less that 0.7; (2) the mean deviation of the flaw depth is less than 0.25 inch; (3) correlation coefficient is not less than 0.70.

Licensee's Proposed Alternative to Code (as stated):

Pursuant to 10 CFR 50.55a(a)(3)(i), relief is requested to use an alternative length sizing qualification criteria of 0.75 inch Root Mean Square Error (RMSE) in lieu of subparagraph 3.2(b) and to use the RMSE calculations of 3.2(a) and 3.2(b) in lieu of the

statistical parameters of 3.2(c). These examinations will be performed at Fort Calhoun Station during the 2003 Fall refueling outage.

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

On January 12, 2000, NRC staff, representatives from the Electric Power Research Institute (EPRI) Nondestructive Examination Center, and representatives from the Performance Demonstration Initiative (PDI) participated in a conference call. The discussion during the conference call included the difference between Supplement 4, "Qualification Requirements for the Clad/Basemetal Interface of Reactor Vessel," to Appendix VIII, "Performance Demonstration for Ultrasonic Examination Systems," Paragraph 10 CFR 50.55a(b)(2)(xv)(C)(1) in the rule (Federal Register, 64 FR 51370), and the implementation of Supplement 4 by the PDI Program. Supplement 4, Subparagraph 3.2(b) imposed a flaw sizing tolerance of -1/4 inch, +1.0 inch of the true length to the performance demonstration qualification criteria. The rule changed Subparagraph 3.2(a) to a depth sizing requirement of 0.15 inch RMS, and the PDI program uses a length sizing tolerance of 0.75 inch RMS for paragraph 3.2(b). The NRC staff acknowledged that Paragraph 10 CFR 50.55a(b)(2)(xv)(C)(1) in the rule was an error and should actually be a length sizing tolerance of 0.75 inch RMS, the same tolerance that was being implemented by the PDI program.

In a public meeting on October 11, 2000 at NRC offices in White Flint, MD, the PDI identified the discrepancy between the Subparagraph 3.2(c) and the PDI program. The NRC agreed that Paragraph 10 CFR 50.55a(b)(2)(xv)(C)(1) should have excluded Subparagraph 3.2(c) as a requirement.

The U.S. nuclear utilities created the PDI to implement demonstration requirements contained in Appendix VIII. PDI developed a performance demonstration program for qualifying UT techniques. In 1995, the NRC staff performed an assessment of the PDI program and reported that PDI was using a length sizing tolerance of 0.75 inch RMS for reactor pressure vessel performance demonstrations. This criterion was introduced to reduce testmanship (passing the test based on manipulation of results rather than skill). The staff noted in the assessment report dated, March 6, 1996, that the length sizing tolerance was not according to Appendix VIII but did not take exception to PDI's implementation of the 0.75 inch RMS length sizing tolerance. The staff requested that the length sizing difference between PDI and the Code be resolved.

The solution for resolving the differences between the PDI and the Code [was] for PDI to participate in development of a Code case that reflected PDI's program. The Code case was presented to ASME for discussion and consensus building. NRC representatives participated in this process. ASME approved the Code case and published it as Code Case N-622, "Ultrasonic Examination of RPV and Piping, Bolts and Studs, Section XI, Division 1."

Operating in parallel with the actions of PDI, the staff incorporated most of Code Case N-622 criteria in the rule published in the Federal Register, 64 FR 51370. Supplement 4 to Code Case N-622 contains the proposed alternative sizing criteria, which has been authorized by the staff. The staff agrees that the omission of the length sizing tolerance

0.75 inch RMS in the rule and the inclusion of statistical parameters of Paragraph 3.2(c) of Supplement 4 to Appendix VIII was an oversight.

In lieu of the length sizing requirements of the ASME Section XI, 1995 Edition, 1996 addenda, Appendix VIII, Supplement 4, Subparagraph 3.2(b), a length sizing qualification criteria of 0.75 inch RMSE will be used. The RMSE calculation will be used in lieu of Subparagraph 3.2(c).

Evaluation: The request for and alternative to Supplement 4, Subparagraph 3.2(b) is unnecessary because a correction was issued in the *Federal Register* 64 *FR* 16391 that changed 10 CFR 50.55a(b)(2)(xv)(C)(1)(b) to state that "... a length sizing requirement of 0.75 inch RMS shall be used in lieu of the requirement in Subparagraph 3.2(b)."

Supplement 4, Subparagraph 3.2(c) imposes three statistical parameters for depth sizing. The first parameter, 3.2(c)(1), pertains to the slope of a linear regression line. The linear regression line is a best fit line obtained by the least-square method using data points of UT measured flaw depth versus actual flaw depth. For Supplement 4 performance demonstrations, a best fit line acquired by the linear regression method would be calculated from data points that come from the inner 15% of the wall thickness. Plotting the data, UT measured flaw depth versus true flaw depth, produce closely grouped data points that resemble a shotgun pattern. The slope of a line calculated by linear regression from data points that are so close together would not produce meaningful results because the line would be extremely sensitive to small variations in depth measurements. The second parameter, 3.2(c)(2), pertains to the mean deviation of flaw depth. The Code currently requires a mean deviation flaw depth of less than 0.25-inch versus the licensee proposed 0.15 RMS value. The licensee's proposal to use the more restrictive criterion of 0.15 RMS of 10 CFR 50.55a(b)(2)(xv)(C)(1), which modifies Subparagraph 3.2(a), as the acceptance criterion is more conservative than Code and follows the PDI protocol. The third parameter, 3.2(c)(3), pertains to a correlation coefficient. The value of the correlation coefficient in Subparagraph 3.2(c)(3) is inappropriate for this application since it is based on the linear regression from Subparagraph 3.2(c)(1).

It has been determined that the proposed alternative to Supplement 4, as administered by the PDI program will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), it is recommended that RR-5 be authorized for the third interval at FCS.

4.0 CONCLUSION

Based on the above evaluations, it is concluded that the licensee's proposals, to use the EPRI PDI program alternative paragraphs and subparagraphs as described in the submittal as supplemented, in lieu of the paragraphs and subparagraphs to ASME Section XI, Appendix VIII, Supplements 2, 3, 4 and 10 qualification requirements, will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), it is recommended that Requests for Relief Nos. RR-2, RR-3 and RR-5 be authorized for the third 10-year interval at Fort Calhoun Station, which is scheduled to conclude on October 31, 2003. Requests for Relief RR-1 and RR-4 were withdrawn by the licensee as a result of the NRC Request for Additional Information.

FORT CALHOUN STATION
Third 10-Year ISI Interval

TABLE 1
SUMMARY OF RELIEF REQUESTS

Relief Request Number	PNNL TLR Sec.	System or Component	Exam. Category	Item No.	Volume or Area to be Examined	Required Method	Licensee Proposed Alternative	Relief Request Disposition
RR-1	3.1	Reactor Pressure Vessel	B-D	B3.90	100% of Class 1 nozzle-to-vessel welds	Volumetric	Decrease limits of examination volume to ½-inch on either side of weld	Withdrawn by licensee in letter dated May 29, 2003
RR-2	3.2	Vessel Nozzles	B-F	Multiple	100% of dissimilar metal nozzle welds in Class 1 vessels	Volumetric and Surface	Use PDI alternative to Appendix VIII, Supplement 10 for qualification of volumetric examinations	Authorized 10 CFR 50.55a(a)(3)(i)
RR-3	3.3	Piping	B-J	Multiple	Pressure retaining circumferential piping welds	Volumetric and Surface	Use PDI alternative to Appendix VIII, Supplements 2 and 3 for qualification of volumetric examinations	Authorized 10 CFR 50.55a(a)(3)(i)
RR-4	3.4	Vessel Nozzles	B-F	B5.10	100% of dissimilar metal nozzle welds in Class 1 vessels	Surface and Volumetric	Implement alternative requirements of ASME Code Case N-663 for elimination of surface examinations	Withdrawn by licensee in letter dated May 29, 2003
RR-5	3.5	Reactor Pressure Vessel	B-A B-D	Multiple	Clad-to-base Metal Interface at RPV welds	Volumetric	Use PDI alternative to Appendix VIII, Supplement 4 for sizing using RMSE	Authorized 10 CFR 50.55a(a)(3)(i)