February 19, 2004

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: SAFETY EVALUATION FOR THE FOURTH 10-YEAR INTERVAL INSERVICE INSPECTION PROGRAM PLAN – FORT CALHOUN STATION (TAC NO. MB7241)

Dear Mr. Ridenoure:

By letter dated November 5, 2002, Omaha Public Power District (OPPD/the licensee) submitted its fourth 10-year inservice inspection (ISI) program plan. The Fort Calhoun Station, Unit 1 (FCS) ISI Program Plan incorporates the requirements of the ASME Section XI Code (1998 Edition, through 2000 Adenda) for non-destructive examinations (NDE) (ISI program) and repair/replacement and the O&M Manual (1998 Edition, through 2000 Adenda) for inservice pump and valve testing (IST program).

The November 5, 2002, letter proposed the fourth 10-year ISI program and Request for Relief (RR) Nos. RR-1, RR-2, RR-3, RR-4, RR-5, RR-6, RR-7, RR-8, and RR-9 for the FCS. The NRC staff, with technical assistance from its contractor Pacific Northwest National Laboratory (PNNL), has reviewed the information concerning ISI program RR-1, RR-2, RR-3, RR-4, RR-5, RR-6, RR-7, RR-8, and RR-9. In a letter dated March 3, 2003, the licensee withdrew RR-1. In your response dated June 27, 2003, to our request for additional information (RAI), OPPD provided additional information and withdrew RR-2, RR-3, and RR-5. RR-4 requested the use of Code Case N-508-1. Since the subject code case has been approved for general use in Regulatory Guide (RG) 1.147, Revision 13, "Inservice Inspection Code Case Acceptability – ASME Section XI, Division 1," relief is no longer required. RR-6 and RR-7 requested the use of Code Cases N-533-1 and N-566-1, respectively. Since the subject code cases have been approved for general use in RG 1.147, Revision 13, relief is no longer required.

The licensee's proposed alternatives for RR-8 and RR-9 are authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the fourth 10-year interval, since the proposed alternatives provide an acceptable level of quality and safety. The safety evaluation for these ISI relief requests is provided in Enclosure 1.

The November 5, 2002, letter also proposed the fourth 10-year IST program. OPPD submitted pump RR Nos. E1, E4, and valve RR Nos. E1, E2, E3, E4, and E6. During a telephone conversation on August 22, 2003, the NRC requested additional information to support OPPD's IST program relief requests. OPPD submitted the requested information by letter dated December 5, 2003. In addition, the December 5, 2003, letter withdrew valve RR E1, E2, E3, and E6 and submitted pump RR E5.

The licensee's proposed alternative for valve RR E4 is authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the fourth 10-year interval, since the proposed alternative provides an acceptable level of quality and safety.

The licensee's proposed alternative for pump RR E1 is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) for Cycle 22, an approximate period of 18 months, to allow evaluation of potential plant modifications to provide suction and/or differential pressure indications for the subject pumps, on the basis that compliance with the Code requirements would result in a hardship without a compensating increase in the level of quality and safety. The licensee's proposed alternative for pump RR E4 is authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the fourth 10-year interval, since the proposed alternative provides an acceptable level of quality and safety. For pump RR E5, the licensee's proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) for the fourth 10-year interval, on the basis that compliance with the Code requirements would result in a hardship without a compensating increase in the level of quality and safety. The safety evaluation for these IST relief requests is provided in Enclosure 2.

This completes work under TAC No. MB7241. If you have any questions, please contact Alan Wang, Project Manager, at (301) 415-1445.

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. ISI Safety Evaluation
2. IST Safety Evaluation

cc w/encls: See next page

The licensee's proposed alternative for valve RR E4 is authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the fourth 10-year interval, since the proposed alternative provides an acceptable level of quality and safety.

The licensee's proposed alternative for pump RR E1 is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) for Cycle 22, an approximate period of 18 months, to allow evaluation of potential plant modifications to provide suction and/or differential pressure indications for the subject pumps, on the basis that compliance with the Code requirements would result in a hardship without a compensating increase in the level of quality and safety. The licensee's proposed alternative for pump RR E4 is authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the fourth 10-year interval, since the proposed alternative provides an acceptable level of quality and safety. For pump RR E5, the licensee's proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) for the fourth 10-year interval, on the basis that compliance with the Code requirements would result in a hardship without a compensating increase in the level of quality and safety. The safety evaluation for these IST relief requests is provided in Enclosure 2.

This completes work under TAC No. MB7241. If you have any questions, please contact Alan Wang, Project Manager, at (301) 415-1445.

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. ISI Safety Evaluation
2. IST Safety Evaluation

cc w/encls: See next page

DISTRIBUTION:
PUBLIC
PDIV-2 Reading
RidsNrrDlpmPdiv (HBerkow)
RidsNrrPMAWang
RidsNrrLAEPeyton
RidsAcrsAcwMailCenter
RidsOgcRp
TMcLellan (NRR/DE/EMCB)
SCoffin (NRR/DE/EMCB)
WBateman (NRR/DE/EMCB)
RidRgn4MailCenter (CMarshall)
GHill (2)
KPoertner

ADAMS Accession No.: ML040570291 * Memo dated NRR-028

OFFICE	PDIV-2/PM	PDIV-2/LA	EMCB *	EMEB*	OGC(NLO)	PDIV-2/SC
NAME	AWang	EPeyton	SCoffin	DTerao	RHoefling	SDembek
DATE	2/12/04	2/12/04	12/29/03	12/24/03	2/12/04	2/17/04

OFFICIAL RECORD COPY

cc:

Winston & Strawn
ATTN: James R. Curtiss, Esq.
1400 L Street, N.W.
Washington, DC 20005-3502

Chairman
Washington County Board of Supervisors
P.O. Box 466
Blair, NE 68008

Mr. John Kramer, Resident Inspector
U.S. Nuclear Regulatory Commission
P.O. Box 310
Fort Calhoun, NE 68023

Regional Administrator, Region IV
U.S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-4005

Ms. Sue Semerera, Section Administrator
Nebraska Health and Human Services
Systems
Division of Public Health Assurance
Consumer Services Section
301 Cententiall Mall, South
P.O. Box 95007
Lincoln, NE 68509-5007

Mr. David J. Bannister, Manager
Fort Calhoun Station
Omaha Public Power District
Fort Calhoun Station FC-1-1 Plant
P.O. Box 550
Fort Calhoun, NE 68023-0550

Mr. John B. Herman
Manager - Nuclear Licensing
Omaha Public Power District
Fort Calhoun Station FC-2-4 Adm.
P.O. Box 550
Fort Calhoun, NE 68023-0550

Mr. Daniel K. McGhee
Bureau of Radiological Health
Iowa Department of Public Health
401 SW 7th Street, Suite D
Des Moines, IA 50309

Mr. Richard P. Clemens
Division Manager - Nuclear Assessments
Omaha Public Power District
Fort Calhoun Station
P.O. Box 550
Fort Calhoun, NE 68023-0550

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

FOR FOURTH 10-YEAR INTERVAL INSERVICE INSPECTION

REQUEST FOR RELIEF NOS. RR-1, RR-2, RR-3, RR-4, RR-5, RR-6, RR-7, RR-8, AND RR-9

OMAHA PUBLIC POWER DISTRICT

FORT CALHOUN STATION, UNIT 1

DOCKET NO. 50-285

1.0 INTRODUCTION

The NRC staff with technical assistance from its contractor Pacific Northwest National Laboratory (PNNL), has reviewed the information concerning inservice inspection (ISI) program Request for Relief (RR) Nos. RR-1, RR-2, RR-3, RR-4, RR-5, RR-6, RR-7, RR-8, and RR-9 submitted by letter dated November 5, 2002, for the fourth 10-year interval for Fort Calhoun Station, Unit 1 (FCS) by Omaha Public Power District (OPPD/the licensee). In response to an NRC request for additional information (RAI), the licensee provided additional information and withdrew RR-2, RR-3, and RR-5 in its letter dated June 27, 2003. In a letter dated March 3, 2003, the licensee withdrew RR-1. Request for Relief Nos. RR-1, RR-2, RR-3, and RR-5 are not in this safety evaluation (SE) since they have been withdrawn by the licensee.

2.0 REGULATORY REQUIREMENTS

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

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the 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 fourth 10-year inservice inspection for FCS is the 1998 Edition of the ASME Boiler and Pressure Vessel Code, Section XI with the 2000 Addenda.

3.0 TECHNICAL EVALUATION

The staff adopts the evaluations and recommendations for authorizing reliefs contained in the Technical Letter Report (TLR) prepared by PNNL (Attachment 1 to this SE). Attachment 2 to this SE lists each relief request and the status of approval.

In RR-4, the licensee requested to use Code Case N-508-1, "Rotation of Serviced Snubbers and Pressure Relief Valves for the Purpose of Testing, Division 1." The subject code case has been approved for general use without conditions in Regulatory Guide (RG) 1.147, "Inservice Inspection Code Case Acceptability ASME Section XI, Division 1," Revision 13, dated June 2003, subsequent to the licensee submitting its request for relief. Since the subject code case has been approved for general use in RG 1.147, Revision 13, relief is no longer required.

In RR-6 and RR-7, the licensee requested to use Code Cases N-533-1 and N-566-1, respectively. Both Code Cases N-533-1 (with conditions), "Alternative Requirements for VT-2 Visual Examination of Class 1, 2 and 3 Insulated Pressure Retaining Bolted Connections" and N-566-1, "Corrective Action for Leakage Identified at Bolted Connections," have been approved for general use in RG 1.147, Revision 13. For Code Case N-533-1 there is an imposed condition in that prior to conducting the VT-2 examination, the provisions of IWA-5213, "Test Condition Holding Times," 1989 Edition, are to be followed. Since the subject code cases have been approved for general use in RG 1.147, Revision 13, relief is no longer required.

In RR-8, the licensee proposed using Supplement 10, as administered by EPRI's Performance Demonstration Initiative (PDI) Program, in lieu of the selected requirements of ASME Section XI, 1995 Edition with 1996 Addenda, Appendix VIII, Supplement 10. The staff determined that the licensee's proposed alternative as administrated by EPRI-PDI will provide a comparatively challenging process for qualification in the detection and sizing of degradation in the subject components. Therefore, the licensee's proposed alternative will provide an acceptable level of quality and safety.

In RR-9, the licensee proposed using a Supplement 2 and 3 add-on to a Supplement 10 qualification, as administrated by the EPRI PDI program. The licensee's proposed alternative will be in lieu of the requirements listed in ASME 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 in RR-8 for the Supplement 10, "Dissimilar Metal Piping Welds" implementation program. The staff determined that the licensee's proposed alternative use of the EPRI-PDI administrated program in lieu of the selected requirements of ASME Section XI will provide a comparatively challenging process for qualification in the sizing and detection of degradation in the subject components. Therefore, the licensee's proposed alternative provides an acceptable level of quality and safety.

4.0 CONCLUSIONS

For RR-4, RR-6, and RR-7 for use of Code Cases N-508-1, N-533-1, and N-566-1, respectively, relief is not required. The subject code cases have been approved for general use in RG 1.147, Revision 13.

Based on the information provided in the licensee's submittal, the staff concludes that the alternatives proposed in RR-8 and RR-9 provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i) the licensee's proposed alternatives are authorized for the fourth 10-year inspection interval. 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.

Attachments: 1. Technical Evaluation Letter
2. Table

Principle Contributor: T. McLellan

Date: February 19, 2004

PACIFIC NORTHWEST NATIONAL LABORATORY
TECHNICAL LETTER REPORT

Attachment 1

TECHNICAL LETTER REPORT
ON THE FOURTH 10-YEAR INTERVAL INSERVICE INSPECTION
REQUESTS FOR RELIEF
FOR
OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION
DOCKET NUMBER: 50-285

1.0 INTRODUCTION

By letter dated November 5, 2002, the licensee, Omaha Public Power District, submitted the Fort Calhoun Station, Unit 1 (FCS) Inservice Inspection (ISI) Program Plan for the fourth operating interval. Included in the plan are Requests for Relief Nos. RR-1 through RR-9, 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 NRC Requests for Additional Information (RAI), the licensee withdrew certain requests, revised others and provided further information in letters dated March 3, 2003 and June 27, 2003. These requests are for the fourth 10-year inservice inspection interval at FCS. The Pacific Northwest National Laboratory (PNNL) has evaluated the remaining 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 fourth 10-year interval inservice inspection program, which begins on November 3, 2003, is the 1998 Edition of Section XI of the ASME Boiler and Pressure Vessel Code, with the 2000 Addenda. As allowed by the Code, the licensee extended the third interval to coincide with a refueling outage, thus the fourth interval will end on September 26, 2013.

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, Limited Examination of Class 1 and 2 Components

Note: In response to discussions with the NRC and a Request for Additional Information, the licensee elected to withdraw RR-1.

3.2 Request for Relief No. RR-2, Use of ASME Code Case N-498-1, *Alternative Rules for 10-Year System Hydrostatic Testing for Class 1, 2 and 3 Systems*, for Class 3 Systems Only

Note: In response to the NRC Request for Additional Information, the licensee elected to withdraw RR-2 and will invoke Code Case N-498-1 for Class 1, 2 and 3 systems. This Code Case has been approved for use by the Staff, thus relief is not required.

3.3 Request for Relief No. RR-3, Use of ASME Code Case N-648-1, *Alternative Requirements for Inner Radius Examinations of Class 1 Reactor Vessel Nozzles*

Note: In response to the NRC Request for Additional Information, the licensee elected to withdraw RR-3.

3.4 Request for Relief RR-4, Use of Code Case N-508-1, *Rotation of Serviced Snubbers and Pressure Relief Valves for the Purpose of Testing*

Code case N-508-1 was approved for general use without conditions in Regulatory Guide 1.147, *Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1*, Revision 13, dated June 2003 subsequent to the licensee submitting this request for relief. Therefore, relief is no longer required.

3.5 Request for Relief No. RR-5, Use of ASME Code Case N-568, *Alternative Examination Requirements for Welded Attachments*

Note: In response to the NRC Request for Additional Information, the licensee elected to withdraw RR-5.

3.6 Request for Relief No. RR-6, Use of Code Case N-533-1, *Alternative Requirements for VT-2 Visual Examination of Class 1, 2, and 3 Insulated Pressure-Retainng Bolted Connections*

Code Case N-533-1 was conditionally approved for use in Regulatory Guide 1.147, *Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1*, Revision 13, dated June 2003 subsequent to the licensee submitting this request for relief. The condition for use is that a 4 hour hold time for insulated systems and 10 min hold time noninsulated systems be implemented in accordance with IWA-5213 of the 1989 Edition of ASME Section XI. The licensee has committed to the above hold times in their submittal. Therefore, relief is no longer required.

3.7 Request for Relief No. RR-7, Use of Code Case N-566-1, *Corrective Action for Leakage Identified at Bolted Connections*

Code Case N-566-1 was approved for general use without conditions in Regulatory Guide 1.147, *Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1*, Revision 13, dated June 2003 subsequent to the licensee submitting this request for relief. Therefore, relief is no longer required.

3.8 Request for Relief No. RR-8, 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 1998 Edition/2000 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:

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.

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

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.

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

5. 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%.

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

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

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.

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.

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.

11. Table VIII-S2-I 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, 1998 Edition with 2000 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 - 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 (% Wall Thickness)	Minimum 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 June 27, 2003.

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

(1) FCS will require a minimum of one personnel qualification set composed of a number of specimens for inspector qualification with new essential variables. This will ensure that the personnel being qualified are unable to predict the flaws in the test set and are not biased by pre-conceived expectations of the type and number of flaws present in the test sample.

(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 both, then all the above flaws would be included. If it was only 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, and, therefore, 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 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 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 same pass/fail screening 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, while maintaining the same statistical design basis as the Code. The proposed alternative paragraphs satisfy the pass/fail objective established for Appendix VIII performance demonstration acceptance criteria, and, therefore, provide an acceptable level of quality and safety.

Paragraph 1.2(c)(1) and 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 40% 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 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 proposed alternative paragraph is more conservative than Code requirements and, therefore, 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 and, therefore, 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 and, therefore, 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-8 be authorized for the fourth interval inservice inspection at FCS.

3.9 Request for Relief No. RR-9, 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 1998 Edition/2000 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 1998 Edition/2000 Addenda of ASME XI, Appendix VIII, Table VIII-3110-1 for Supplement 2 "Wrought Austenitic Piping Welds" and Supplement 3 "Ferritic Piping Welds." The PDI Program implements selected aspects od Appendices 2 and 3, as coordinated with the proposed alternative (FCS RR-8) 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 l0 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 assess 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 June 27, 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, Supplements 2 and 3 criteria. The Code currently requires separate qualifications for Supplement 2 for austenitic piping, Supplement 3 for ferritic piping, and Supplement 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 is that the less challenging 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 Supplements 2 and 3, the proposed alternative would add a minimum of 3 flaws in ferritic material and 5 flaws in austenitic material to the performance demonstration. 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 Pacific Northwest National Laboratory, 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 personnel, procedures and equipment to 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 Request for Relief RR-9 be authorized for the fourth interval at FCS.

4.0 CONCLUSION

As a result of the NRC Request for Additional Information, Requests for Relief RR-1, RR-2, RR-3 and RR-5 were withdrawn by the licensee in their responses dated March 3, 2003 and June 27, 2003. Subsequent to the submission of Requests for Relief RR-4, RR-6, and RR-7 for use of ASME Code Cases N-508-1, N-533-1, and N-566-1, respectively, were approved for use in NRC Regulatory Guide 1.147, Revision 13. Therefore, relief is not required provided the conditions, if any, stated in RG 1.147, Revision 13 are applied.

Based on the information provided in the licensee's submittal, it has been concluded that the alternatives proposed in Requests for Relief RR-8 and RR-9 provide an acceptable level of quality and safety. Therefore, it is recommended that these requests be authorized, pursuant to 10 CFR 50.55a(a)(3)(i), for the fourth 10-year inspection interval at FCS, which will end on September 26, 2013. This authorization is limited to the components described in Sections 3.8 and 3.9 above.

Fourth 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	Class 1 and 2 Components	Multiple	Multiple	Dependent of item requirements	Volumetric, Surface, Visual	Use limited examinations in lieu of areas/volumes required by Code	Withdrawn by licensee in letter dated March 3, 2003
RR-2	3.2	Class 1, 2 and 3 Systems	Multiple	Multiple	100% of pressure-retaining boundary is required to be pressure tested	Visual VT-2	Use Code Case N-498-1	Withdrawn by licensee in letter dated June 27, 2003
RR-3	3.3	RPV Nozzles	B-D	B3.20	100% of inner radius of nozzle-to-vessel welds	Volumetric	Use Code Case N-648-1	Withdrawn by licensee in letter dated June 27, 2003
RR-4	3.4	Snubbers and relief valves	IWA-4000 (IWA-7000 for Editions and Addenda prior to 1991 Addenda)	N/A	N/A	N/A	Use Code Case N-508-1	Relief not required. Code Case N-508-1 is approved for general use in RG 1.147, Rev 13
RR-5	3.5	Class 1, 2 and 3 Components	B-K C-H D-A	Multiple	100% of integrally welded attachments	Surface	Use Code Case N-568	Withdrawn by licensee in letter dated June 27, 2003
RR-6	3.6	Insulated Bolted Connections	B-P C-H D-B	Multiple	Remove insulation and examine all bolted connections on borated systems	Visual VT-2	Use Code Case N-533-1	Relief not required. Code Case N-533-1 is conditionally approved in RG 1.147, Rev 13
RR-7	3.7	Bolted Connections	B-P C-H D-B	Multiple	Corrective actions for leakage detected at bolted connections	Removal of bolts for evaluation	Use Code Case N-566-1	Relief not required. Code Case N-566-1 is approved for general use in RG 1.147, Rev 13
RR-8	3.8	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 ultrasonic qualifications	Authorized 10 CFR 50.55a(a)(3)(i)
RR-9	3.9	Piping	B-J C-F-1	Multiple	Pressure retaining circumferential piping welds	Volumetric and Surface	Use PDI alternative to Appendix VIII, Supplements 2 and 3 for ultrasonic qualifications	Authorized 10 CFR 50.55a(a)(3)(i)

ATTACHMENT 2

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO THE INSERVICE TESTING PROGRAM, FOURTH 10-YEAR INTERVAL

OMAHA PUBLIC POWER DISTRICT

FORT CALHOUN STATION

DOCKET NO. 50-285

1.0 INTRODUCTION

By letter dated November 5, 2002, Omaha Public Power District (OPPD/the licensee), submitted its fourth 10-year inservice testing (IST) program plan for pumps and valves for its Fort Calhoun Station, Unit 1 (FCS). The licensee proposed several alternatives to the requirements of the ASME OM Code for its FCS fourth 10-year interval IST program. OPPD submitted pump Request for Relief (RR) Nos. E1, E4, and valve RR Nos. E1, E2, E3, E4, and E6. During a telephone conversation on August 22, 2003, the NRC requested additional information to support OPPD's IST program relief requests. OPPD submitted the requested information by letter dated December 5, 2003. In addition, the December 5, 2003, letter withdrew valve RR E1, E2, E3, and E6 and submitted pump RR E5.

2.0 REGULATORY EVALUATION

The *Code of Federal Regulations*, 10 CFR 50.55a, requires that inservice testing (IST) of certain American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 pumps and valves be performed at 120-month (10-year) IST program intervals in accordance with the ASME Code for Operation and Maintenance of Nuclear Power Plants (OM Code) and applicable addenda, except where alternatives have been authorized or relief has been requested by the licensee and granted by the Commission pursuant to paragraphs (a)(3)(i), (a)(3)(ii),or (f)(6)(i) of 10 CFR 50.55a. In accordance with 10 CFR 50.55a(f)(4)(ii), licensees are required to comply with the requirements of the latest edition and addenda of the ASME Code incorporated by reference in the regulations 12 months prior to the start of each 120-month IST program interval. In accordance with 10 CFR 50.55a(f)(4)(iv), IST of pumps and valves may meet the requirements set forth in subsequent editions and addenda that are incorporated by reference in 10 CFR 50.55a(b), subject to NRC approval. Portions of editions or addenda may be used provided that all related requirements of the respective editions and addenda are met. In proposing alternatives or requesting relief, the licensee must demonstrate that: (1) the proposed alternatives provide an acceptable level of quality and safety; (2) compliance would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety; or (3) conformance is impractical for the facility. Section 50.55a authorizes the Commission to approve alternatives and to grant relief from ASME Code requirements upon

ENCLOSURE 2

making necessary findings. NRC guidance contained in Generic Letter (GL) 89-04, "Guidance on Developing Acceptable Inservice Testing Programs," provides alternatives to Code requirements which are acceptable. Further guidance is given in GL 89-04, Supplement 1, and NUREG-1482, "Guidance for Inservice Testing at Nuclear Power Plants."

By letter dated November 5, 2002, OPPD proposed several alternatives to the requirements of the ASME OM Code for its FCS, fourth 10-year IST interval. The FCS fourth 10-year IST interval commences February 15, 2004. The program was developed in accordance with the 1998 Edition, through 2000 Addenda of the ASME OM Code.

The staff's findings with respect to authorizing alternatives and granting or denying the IST program relief requests are given below.

3.0 TECHNICAL EVALUATION OF PUMP RELIEF REQUEST

3.1 Pump Relief Request E1

3.1.1 Code Requirements

The licensee requested relief from ISTB 5100 and Table ISTB 3000-1 which requires that differential pressure be determined using a gauge or differential pressure transmitter that provides a direct measurement of the pressure difference between the pressure at a point in the inlet pipe and the pressure in the discharge pipe. Relief was requested for the following components:

Raw water pumps AC-10A, AC-10B, AC-10C, AC-10D
Low pressure safety injection pumps SI-1A, SI-1B
High pressure safety injection pumps SI-2A, SI-2B, SI-2C
Containment spray pumps SI-3A, SI-3B, SI-3C
Boric acid pumps CH-4A, CH-4B

3.1.2 Licensee's Basis for Requesting Relief

The system design does not include instrumentation for direct measurement of inlet and differential pressure.

The raw water pumps take suction directly from the river. Since (1) the river provides the required positive pressure at the suction of the pumps, (2) the river level does not change when a pump is started, and (3) at least one pump is usually in service, the calculated inlet pressure prior to starting a pump is the same as with a pump running.

The low pressure safety injection (LPSI), high pressure safety injection (HPSI), and containment spray (CS) pumps take their suction directly from the safety injection and refueling water tank and have inlet pressures due to the level of water in the tank above the pump inlets. Since the safety injection and refueling water tank provides the required pressure at the suction of the pumps and since the tank level does not significantly change when a pump is started, the calculated pump inlet pressure prior to starting a pump is the same as with a pump running. Flow losses through the suction piping of these pumps are negligible. Since the losses would be the same from test to test, not including them in the test would still enable pump degradation to be identified.

The boric acid pumps take their suction directly from the boric acid tanks and have an inlet pressure due to the level of acid in the tanks above the pump inlet. Pump inlet pressure can be calculated based on the level in the boric acid storage tank and the elevation difference between the tank level and the pump inlet.

This relief is necessary to allow the use of current measurement methods until potential plant modifications can be evaluated for feasibility to provide suction and/or differential pressure indications for the subject pumps. These potential modifications will be initiated and evaluated within one refueling cycle (18 months).

3.1.3 Licensee's Proposed Alternative Testing

The raw water pump inlet pressure will be calculated based on the river level and the elevation of the pump suction bells. The pump differential pressure will then be calculated based on the measured discharge pressure and the calculated inlet pressure.

The pump inlet pressure for the LPSI, HPSI, and CS pumps will be calculated based on the safety injection and refueling water tank level and the difference in elevation between the tank level and the pump inlets. Pump differential pressure will then be calculated by subtracting the calculated inlet pressure from the measured discharge pressure.

The pump inlet pressure for the boric acid pumps will be calculated based on the boric acid storage tank level and the elevation difference between the tank level and the pump inlet. Pump differential pressure will then be calculated by subtracting the calculated inlet pressure from the measured discharge pressure.

3.1.4 Evaluation

The OM Code requires that differential pressure be determined using a gauge or differential pressure transmitter that provides a direct measurement of the pressure difference between the pressure at a point in the inlet pipe and the pressure in the discharge pipe. The Code requires measurement of differential pressure to help assess pump hydraulic condition and detect degradation.

The Code has implemented a comprehensive pump test (CPT) requirement since the licensee last updated the IST program. The CPT provides a new, improved philosophy for testing safety-related pumps. The CPT establishes a more involved biennial test for all pumps, with narrow acceptance criteria for acceptable pump operation, which requires using highly accurate pressure instruments to determine differential pressure.

The differential pressure of these pumps cannot be directly measured because there are presently no installed direct reading differential pressure or inlet pressure instruments. The licensee has requested interim relief for one fuel cycle (18 months) to evaluate potential plant modifications to provide suction and/or differential pressure indications for the subject pumps. The licensee's proposal to determine inlet pressure by measuring the height of the fluid above the pump suction and to calculate differential pressure using this inlet pressure and the measured discharge pressure should allow assessment of the pump hydraulic condition and degradation until the licensee has evaluated the feasibility of providing suction and/or differential pressure indications. Requiring the licensee to implement the Code requirement to measure differential pressure prior to completion of the evaluation of potential plant modifications to provide suction and/or differential pressure indications for the subject pumps would result in hardship without a compensating increase in the level of quality and safety.

The staff finds that the proposed alternative provides reasonable assurance of adequate pump operation and readiness.

3.1.5 Conclusion

Based on the above evaluation, the staff concludes that pursuant to 10 CFR 50.55a(a)(3)(ii), the licensee's proposed alternative described in pump RR E1 is authorized for Cycle 22, an approximate period of 18 months, on the basis that compliance with the Code requirements would result in a hardship without a compensating increase in the level of quality and safety.

3.2 Pump Relief Request E4

3.2.1 Code Requirements

The licensee requested relief from ISTB 5000 which requires that system resistance be varied until either the measured differential pressure or flow rate equals the corresponding reference value. Relief was requested for the following components:

Component cooling water pumps AC-3A, AC-3B, AC-3C
Raw water pumps AC-10A, AC-10B, AC10C, AC-10D

3.2.2 Licensee's Basis for Requesting Relief

The raw water (RW) and component cooling water (CCW) systems are designed such that the total pump flow cannot be adjusted to one specific value for the purpose of testing without adversely affecting the system flow balance and technical specification operability requirements. Therefore, the RW and CCW pumps must be tested in a manner that the RW and CCW loops remain properly flow-balanced during and after the testing. In addition, certain supplied loads (e.g., cooling of control element drive mechanisms) must remain fully operable in accordance with the technical specifications to maintain the required level of plant safety during power operation.

The RW and CCW system loops are not designed with full flow test lines with single throttle valves. Therefore, the flow cannot be throttled to a fixed reference value every time a pump test is performed. Total pump flow rate can only be measured using the total flow indication as installed and read on the supply headers. There are no valves available in any of the loops, on either the supply or return lines for the purpose of throttling system flows. Only the flow of the served components are able to be individually throttled. The main loops of RW and CCW are piped in parallel with each other. Many loads are throttled to flow ranges specified in the design basis documents. All loads are aligned in parallel, and receive RW and CCW flow when the

RW and CCW pumps are running regardless of which served components are in service. During power operation, certain loops of RW/CCW are required to be operable in accordance with the technical specifications. Specific loops/components of RW/CCW cannot be taken out- of-service for testing without entering an action statement for a limiting condition for operation. Also, exceeding certain individual component flows/temperatures can require plant shutdown in two hours, depending on the load in question.

Certain RW/CCW loops are flow-balanced during each refueling outage (at a nominal 18-month frequency) to ensure that all loads are adequately supplied. Flow ranges are specified for those loads in order to balance flows against each other. Once properly flow-balanced, minimal flow adjustment can be made for any one particular load without adversely impacting the operability of the remaining loads (i.e., increasing flow to one load reduces flow to all of the others). Each time the system is flow-balanced, proper individual component flows are produced, but this in turn does not necessarily result in one specific value for total flow. Because certain loads have an acceptable flow range, overall system full flow (the sum of the individual component flows) also has a range. Consequently, the Code requirements to quarterly adjust RW/CCW loop flow to one specific value for the performance of inservice testing conflicts with system design and component operability requirements (i.e., flow balance) as required by the technical specifications.

The following elements are used in developing and implementing the reference pump curves:

> A reference pump curve (differential pressure vs. flow) has been established for each pump from data taken on these pumps when they were known to be operating acceptably. These pump curves represent pump performance close to the original manufacturer's pump test data. All subsequent test results are compared to these reference values.
>
> Pump curves are based on four or more test points whenever possible and have at least one point for each 20 percent of the maximum pump curve range. The range of the curves is adequate to bound the points of operation expected during subsequent testing. Rated capacities of these pumps are 6,000 - 7,000 gpm for the RW pumps and 4,500 - 5,500 gpm for the CCW pumps.
>
> The reference baseline pump curves are compared to the manufacturer's pump curves validated during plant preoperational testing.
>
> Review of the pump hydraulic data trend plots indicates close correlation with established pump reference curves, thus validating the adequacy of the pump curves to assess the pump's operational readiness.
>
> When a reference curve may have been affected by repair, replacement or servicing of a pump, a new reference curve shall be determined or the previous curve reconfirmed by an inservice test run before declaring the pump operable. Deviations between the previous and new reference curves shall be identified, and verification that the new curves represent acceptable operation shall be placed in the record of tests.

Only a small portion of the established reference curve is being used to accommodate flow rate variance due to flow balancing of various system loads.

Review of recent vibration data trend plots indicates that the change in vibration readings over the range of the pump curves being used is insignificant, therefore, only one fixed reference value has been assigned for each vibration measurement location.

If test results fall in the alert range, the frequency of testing is doubled until the cause of the deviation is determined and the condition corrected. If test results fall in the required action range, the pump shall be declared inoperable until the cause of the deviation has been determined and the cause corrected. Evaluations for deviations in the alert and required action ranges may be done graphically.

3.2.3 Licensee's Proposed Alternative Testing

Flow rate and differential pressure will be measured/calculated during inservice testing and compared to an established baseline reference curve.

3.2.4 Evaluation

The OM Code requires that system resistance be varied until either the measured differential pressure or flow rate equals the corresponding reference value. The RW and CCW systems are designed such that the total pump flow cannot be adjusted to one specific value for the purpose of testing without adversely affecting the system flow balance and technical specification operability requirements. Therefore, the RW and CCW pumps must be tested in a manner that the RW and CCW loops remain properly flow balanced during and after the testing.

Pump curves represent a set of infinite reference points of flow and differential pressure. Establishing a reference curve for a pump when it is known to be operating acceptably, and basing the acceptance criteria on this curve, can permit evaluation of pump condition and detection of degradation. There is, however, a higher degree of uncertainty associated with using a curve to assess operational readiness. Therefore, the development of the reference curve should be as accurate as possible. Code Case OMN-9, "Use of a Pump Curve for Testing," and NUREG-1482 allows the use of pump curves as an acceptable alternative to the Code requirements and provides guidance on establishing a reference curve.

The staff finds that the licensee's proposed alternative is consistent with the guidance in Code Case OMN-9 and NUREG-1482 and provides an acceptable means of assuring the operational readiness of the raw water and component cooling water pumps and that the licensee's proposed alternative provides an acceptable level of quality and safety.

3.2.5 Conclusion

Based on the above evaluation, the staff concludes that, pursuant to 10 CFR 50.55a(a)(3)(i), the licensee's proposed alternative described in pump RR E4 is authorized on the basis that the proposed alternative provides an acceptable level of quality and safety. This alternative is authorized for the fourth 10-year inservice test interval.

3.3 Pump Relief Request E5

3.3.1 Code Requirements

The licensee requested relief from ISTB 5221(e) which requires that vibration measurements be compared to both the relative and absolute criteria shown in the alert and required action ranges of Table ISTB-5200-1. Relief was requested for the following components:

Low pressure safety injection pumps SI-1A, SI-1B
Containment spray pumps SI-3A, SI-3B, SI-3C

3.3.2 Licensee's Basis for Requesting Relief

Analysis of previous quarterly pump tests while operating with minimum recirculation flow found that the LPSI pumps and the CS pumps consistently exceed the greater than 0.325 inches per second (ips) alert range limit when they are known to be operating acceptably. Based on the analysis of the pump design and discussions with the pump vendor, pump experts and another utility with identical pumps, OPPD has concluded that the installed pumps are not designed to meet this vibration criteria when operating with only minimum recirculation flow.

3.3.3 Licensee's Proposed Alternative Testing

During Group A quarterly testing, the greater than 0.325 ips alert range and greater than 0.70 ips required action limit of ISTB 5221(e) will be replaced with an alert range of greater than 0.80 ips and a required action limit of greater than 1.1 ips.

3.3.4 Evaluation

The Updated Safety Analysis Report (USAR) states that the LPSI pump design flow rate and head are 1500 gpm and 400 feet, respectively. At the maximum flow rate of 2400 gpm, the LPSI pumps have a head rise of 363 feet. The CS pumps are identical to the LPSI pumps in design and construction and both take a suction from the same source. The pumps have a minimum flow recirculation line which is orificed to allow approximately 150 to 200 gpm of flow to the safety injection and refueling water storage tank.

The minimum flow line was designed to only accommodate pump dead-head during pump startup. The pumps were not designed to operate on minimum flow for any extended period of time. In the licensee's response to NRC Bulletin 88-04, "Potential Safety-Related Pump Loss," dated February 10, 1989, the licensee stated that the LPSI and CS pumps had been run continuously for 45 minutes in testing conducted in November of 1988 to demonstrate the adequacy of the installed minimum flow lines to the safety injection and refueling water storage tank. The licensee compared the data taken from this testing with the original manufacturer's pump curve and found no evidence of degradation in pump performance that could be attributed to quarterly testing using the pump minimum flow lines.

The Code requires that these pumps be tested quarterly. Full flow testing can only be effectively performed while the pumps are being used for shutdown cooling when the unit is shutdown. Quarterly testing is performed using the minimum flow line for each pump. The licensee has previously stated that vibration levels during quarterly testing are significantly greater due in part to incipient cavitation caused by operating a high energy pump under low flow conditions.

The licensee's evaluation of the LPSI and CS pump vibration issue, coupled with the historical pump vibration data, show that the pumps normally run at high levels of vibration during quarterly testing using the minimum flow line. The licensee evaluation demonstrates that these pumps have not exhibited significant degradation since plant startup. Requiring the licensee to meet the Code requirements would result in a hardship without a compensating increase in quality and safety because the additional testing that would have to be performed on a pump that typically operates at elevated vibration levels represents a condition that could possibly damage the pump by increased running on minimum flow. The proposed testing provides reasonable assurance of operational readiness because the pumps will continue to be tested quarterly and the licensee will maintain the Code Alert and Required Action limits for pump full design flow testing during the Code required comprehensive pump test. In addition, the licensee conducts periodic spectral analysis of these pumps to closely monitor the condition of the pumps. The spectral data takes into account complex signals as opposed to assuming pure harmonic motions for peak values measured in displacement or velocity, thus providing more detailed and complete vibration data over a large frequency band. This analysis exceeds the vibration monitoring requirements of the Code.

3.3.5 Conclusion

Based on the above evaluation, the staff concludes that pursuant to 10 CFR 50.55a(a)(3)(ii), the licensee's proposed alternative described in pump RR E5 is authorized on the basis that compliance with the Code requirements would result in a hardship without a compensating increase in the level of quality and safety. This alternative is authorized for the fourth 10-year inservice test interval.

4.0 TECHNICAL EVALUATION OF VALVE RELIEF REQUEST

4.1 Valve Relief Request E4

4.1.1 Code Requirements

The licensee requested relief from ISTC 5221 which requires that a check valve be exercised by initiating flow and observing that the obturator has traveled to either the full open position or to the position required to perform its intended function(s) and verify closure or a sample disassembly examination program be used to verify valve obturator movement. This relief request applies to the following valves:

SI-207, SI-208, SI-211, SI-212, SI-215, SI-216, SI-219, SI-220

4.1.2 Licensee's Basis for Requesting Relief

These valves cannot be exercised during power operation because a flow path does not exist due to the higher reactor coolant system (RCS) pressure. The safety injection tank pressure is less than the RCS pressure during power operation. Also, these check valves cannot be exercised during cold shutdown because the RCS does not contain sufficient volume to accept the flow required and a low temperature overpressure condition of the RCS could result. This method of testing the check valves complies with the guidance provided in GL 89-04, Attachment 1, Position 1.

4.1.3 <u>Licensee's Proposed Alternative Testing</u>

The check valves will be full-stroke exercised in the open direction during refueling outages by dumping the safety injection tanks to the reactor vessel. Test parameters such as tank level decrease versus time, safety injection tank pressure, valve differential pressure, flow rate, etc., are used to determine a flow coefficient. The minimum flow coefficient was determined using the safety analysis data provided by the nuclear steam supply system vendor. Comparing the minimum flow coefficient as acceptance criteria to the flow coefficient determined by testing, assures that the valve is able to perform its safety function. This method of testing the check valves complies with the guidance provided in GL 89-04, Attachment 1, Position 1.

Closure verification will be performed in conjunction with the respective leakage test, performed each refueling.

Valves SI-208, SI-212, SI-216, and SI-220 will be partial-stroke exercised at a cold shutdown frequency in the open direction using shutdown cooling flow.

4.1.4 <u>Evaluation</u>

These valves have an open safety function to provide safety injection flow from the safety injection tanks to the RCS. These valves also have a closed safety function to act as pressure isolation valves between the low pressure safety injection tanks and the RCS.

The licensee proposes to use a combination of test and analysis to determine that the obturator has traveled to the full open position or to the position required to perform its intended function. The licensee will monitor test parameters such as tank level decrease versus time, SI tank pressure, valve differential pressure, flow rate, etc., while dumping the SI tanks to the reactor vessel and use the data to determine a flow coefficient. The calculated flow coefficient will be compared to the required flow coefficient that was determined using the safety analysis data provided by the NSSS vendor.

The licensee's methodology was evaluated during the previous 10-year IST interval by the staff with the assistance of its contractor, Oak Ridge National Laboratory (ORNL), and found to be acceptable. The staff also finds that the licensee's proposed alternative testing meets the guidance contained in GL 89-04, Position 1 and NUREG-1482, Section 4.1.2 which discuss the practice of exercising check valves with flow and non-intrusive techniques.

The staff finds that the licensee's proposed alternative provides an acceptable means of assuring the operational readiness of the safety injection tank header check valves and that the licensee's proposed alternative provides an acceptable level of quality and safety.

4.1.5 Conclusion

Based on the above evaluation, the staff concludes that, pursuant to 10 CFR 50.55a(a)(3)(i), the licensee's proposed alternative described in valve RR E4 is authorized on the basis that the proposed alternative provides an acceptable level of quality and safety. This alternative is authorized for the fourth 10-year inservice test interval.

5.0 REFERENCES

American Society of Mechanical Engineers, " SME Code for Operation and Maintenance of Nuclear Power Plants," 1998 Edition through 2000 Addenda, New York, NY.

U.S. Code of Federal Regulations, "Domestic Licensing of Production and Utilization Facilities," Part 50, Chapter I, Title 10, "Energy," Section 50.55a, Codes and standards.

U.S. Nuclear Regulatory Commission, "Guidance on Developing Acceptable Inservice Testing Programs," Generic Letter 89-04 through Supplement 1, April 4, 1995.

U.S. Nuclear Regulatory Commission, "Guidance for Inservice Testing at Nuclear Power Plants," NUREG-1482, April 1995.

Letter, R. T. Ridenoure, Omaha Public Power District to NRC, "Submittal of the Fort Calhoun Station (FCS) Inservice Inspection (ISI) Program Plan for the Fourth Ten-Year Interval," dated November 5, 2002.

Letter, R. T. Ridenhoure, Omaha Public Power District to NRC, "Re-submittal of the Fort Calhoun Station (FCS) Inservice Testing (IST) Program Plan for the Fourth 120 Month Interval," dated December 5, 2003.

Principle Contributor: Keith Poertner

Date: February 19, 2004