November 20, 2006

Mr. Rick A. Muench
President and Chief Executive Officer
Wolf Creek Nuclear Operating Corporation
Post Office Box 411
Burlington, KS 66839

SUBJECT: WOLF CREEK GENERATING STATION - RELIEF REQUEST I2R-34 FOR THE SECOND 10-YEAR INTERVAL INSERVICE INSPECTION (TAC NO. MD0288)

Dear Mr. Muench:

By letter dated March 2, 2006 (ET 06-0011), supplemented by letter dated July 12, 2006 (ET 06-0027), Wolf Creek Nuclear Operating Corporation (the licensee) submitted Relief Request (RR) I2R-34 for its second 10-year inservice inspection (ISI) program interval at Wolf Creek Generating Station (WCGS). Included with the submittal were the following five RRs: I2R-34, I2R-35, I2R-36, I2R-37, and I2R-38. This letter only addresses RR I2R-34.

In the enclosed safety evaluation (SE), the Nuclear Regulatory Commission (NRC) staff has evaluated the information provided by the licensee for the proposed second 10-year ISI interval RR I2R-34 for WCGS. Based on the SE, the staff concludes that it is impractical for the licensee to meet the applicable American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code requirements. Therefore, granting relief pursuant to 10 CFR 50.55a (g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. The NRC staff grants relief and imposes alternative requirements in accordance with paragraph 50.55a(g)(6)(i) of Title 10 of the *Code of Federal Regulations* for the second 10-year ISI interval for WCGS. All other requirements of the ASME Code, Sections III and XI, for which relief has not been specifically requested, remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Sincerely,

***/RA/***

David Terao, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-482

Enclosure: Safety Evaluation

cc w/encl: See next page

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**OFFICIAL AGENCY RECORD**

Wolf Creek Generating Station

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO RELIEF REQUEST I2R-34

FOR THE SECOND 10-YEAR INTERVAL INSERVICE INSPECTION

WOLF CREEK NUCLEAR OPERATING CORPORATION

WOLF CREEK GENERATING STATION

DOCKET NO. 50-482

## 1.0 INTRODUCTION

By letter dated March 2, 2006 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML060720056), supplemented by letter dated July 12, 2006 (ADAMS Accession No. ML062000312), Wolf Creek Nuclear Operating Corporation (the licensee) submitted Relief Request (RR) I2R-34 for its second 10-year inservice inspection (ISI) program interval at Wolf Creek Generating Station (WCGS). Included with the submittal were the following five RRs: I2R-34, I2R-35, I2R-36, I2R-37, and I2R-38. This safety evaluation (SE) only addresses RR I2R-34.

## 2.0 REGULATORY EVALUATION

ISI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Class 1, 2, and 3 components is performed in accordance with applicable editions and addenda of Section XI of the ASME Code, "Rules for Inservice Inspection of Nuclear Power Plant Components," as required by Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g), except where specific relief has been granted by the Nuclear Regulatory Commission (NRC) pursuant to 10 CFR 50.55a(g)(6)(i) where code requirements are impractical.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2 and 3 components (including supports) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The ASME Code of record for the WCGS second 10-year ISI interval is the 1989 Edition, with no addenda.

3.0 TECHNICAL EVALUATION

3.1 ASME Code Requirement

ASME Code, 1989 Edition, with no addenda, Figure IWB-2500-7(b), Section XI, Examination Category B-D, Full Penetration Nozzles-to-Pressurizer welds, Code Item Number B3.110, requires that ultrasonic testing (UT) must be conducted on nozzle-to-pressurizer welds for a minimum volume of base material on each side of the weld equal to a distance of one-half of the pressurizer shell thickness from each side of the weld crown. Figure IWB-2500-7(b) of the ASME Code, Section XI, Code Item Number B3.120, requires UT examination of a volume one-half-inch thick on the inner radius of the nozzle extending from a point that is the beginning of the radius of the nozzle on the head side to a point equal to the thickness of the shell up the nozzle towards the piping connection for the nozzle inner radius section.

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

The licensee requested relief for the following ASME Code, Section XI, Category B-D, full penetration pressurizer nozzle welds and nozzle inner radii:

Code Item Number B3.110 - Pressurizer Surge Nozzle to Bottom Head Weld

Code Item Number B3.110 - Pressurizer Spray Nozzle to Top Head Weld

Code Item Number B3.120 - Pressurizer Spray Nozzle Inside Radius Section

3.3 Licensee's Proposed Alternative and Basis for Requesting Relief (as stated in the licensee's letter dated March 2, 2006):

**3. Applicable Code Requirement**

ASME Section XI, Figure IWB-2500-7 (b) 1989 Edition with no addenda requires volumetric examination of a minimum volume of base material on each side of the weld equal to a distance of $t_s/2$ (one half of the Pressurizer shell thickness adjacent to the weld) for the nozzle to shell welds (Code Item B3.110). The same figure requires volumetric examination of a volume ½" thick on the inner radius of the nozzle, extending from a point that is the beginning of the radius of the nozzle on the head side to a point equal to the thickness of the shell up the nozzle towards the piping connection for the nozzle inner radius section (Code Item B3.120).

The Wolf Creek Nuclear Operating Corporation (WCNOC) second ten-year interval inservice inspection program plan also implements Code Case N-460, ["Alternative Examination Coverage for Class 1 and Class 2 Welds,"] which is endorsed by the NRC in Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability ASME Section XI, Division 1." Code Case N-460 states in part, "when the entire examination volume or area cannot be examined due to interference by another component or part geometry, a reduction in examination

coverage on any Class 1 or Class 2 weld may be accepted provided the reduction in coverage for that weld is less than 10 percent."

NRC Information Notice (IN) 98-42, "Implementation of 10 CFR 50.55a(g) Inservice Inspection Requirements," termed a reduction in coverage of less than 10 percent to be "essentially 100 percent." IN 98-42 states in part, 'The NRC has adopted and further refined the definition of "essentially 100 percent" to mean "greater than 90 percent"... has been applied to all examinations of welds or other areas required by ASME Section XI.'

**4. Impracticality of Compliance**

The examination of the Code Item B3.110 components is limited by the geometry of the nozzle design. As shown on the attached Figures 1 and 2 [in the licensee's March 2, 2006, submittal], the configuration of the nozzle to vessel welds limits the scans from the vessel head. The proximity of the pressurizer heaters to the weld also limits the scan of the surge nozzle to bottom head weld. The examination of the Code Item B3.120 components is also limited by the geometry of the nozzle design. As shown on the attached Figure 3 [in the licensee's March 2, 2006, submittal], the configuration of the nozzle limits the scan from the vessel head. See Table 1 [shown below - of the March 2, 2006, submittal] for a breakdown of the beam angle coverages for these components.

**Table 1**

**Beam Angle Breakdown for Pressurizer Nozzle-to-Vessel Welds and Nozzle Inside Radius Section**

| Component ID | $0^0$ | $45^0$ [Note 1] | $45^0$ [Note 2] | $60^0$ [Note 1] | $60^0$ [Note 2] | Composite |
|---|---|---|---|---|---|---|
| TBB03-10A-W | 77.9 | 96.3 | 77.9 | 79.7 | 77.9 | 81.9% |
| TBB03-10C-W | 70.7 | 93.1 | 70.7 | 96.2 | 70.7 | 80.3% |
| TBB03-10C-1R | NA | NA | NA | NA | 52.5% | 52.5% |

[Note 1----Perpendicular Scan]

[Note 2----Parallel Scan]

TBB03-10A-W perpendicular scans are limited by the nozzle configuration for the inner portion (getting into the radius of the nozzle) and by the heater sleeves on the outer portion (not allowing the transducer to be backed up far enough). The 0 degree and parallel scans are limited only by the nozzle configuration for

the inner portion (getting into the radius of the nozzle). See Figure 1 [in the licensee's March 2, 2006, submittal].

TBB03-10C-W scans are limited by the nozzle configuration for the inner portion (getting into the radius of the nozzle). See Figure 2 [in the licensee's March 2, 2006, submittal].

TBB03-I0C-1R scan is limited by the nozzle configuration (getting into the radius of the nozzle). Conducting further examination from the nozzle boss and OD [outside diameter] blend is not practical, due to the complex beam angles that must be calculated and then maintained during manual scanning in order to achieve an effective examination. See Figure 3 [in the licensee's March 2, 2006, submittal].

**5. Burden Caused by Compliance**

The design configuration restrictions of the subject nozzles at Wolf Creek Generation Station (WCGS) make the Code required examination coverage requirements impractical. Plant modifications or the replacement of components designed to allow for complete coverage would be needed to meet the Code requirements. This would impose a considerable burden to WCNOC.

**6. Proposed Alternative and Basis for Use**

Proposed Alternative

The following alternatives are proposed in lieu of the required examination coverage of essentially 100 percent:

1. Ultrasonic Testing (UT) of the subject components was performed to the maximum extent practical, as listed in Table 1 [shown above], due to design configuration restrictions during the second ten-year interval.

2. Pressure test VT-2 visual examinations were performed as required by Code Category B-P during the second ten-year interval. No evidence of leakage was identified for these components.

Basis for Use

The basis for use of these alternatives is that they provide the maximum examination coverage possible within the limitations of the current design configuration.

**7. Duration of Proposed Alternative**

The second ten year ISI interval which began September 3, 1995, and ended September 2, 2005.

**8. Precedents**

Duke Energy Letter dated May 10, 2000, McGuire Nuclear Station Unit 1 Docket No. 50-369, "Relief Request 99-003", and the associated NRC Safety Evaluation Report dated March 28, 2001 (TAC No. MA9034).

## 4.0 NRC STAFF EVALUATION

The 1989 Edition, with no addenda of the ASME Code, Section XI, Figure IWB-2500-7(b), requires that the examination volume of the nozzle-to-pressurizer bottom-head or top-head welds shall extend one-half the through-wall thickness from each side of the weld crown. This requirement applies from the pressurizer surge nozzle to the bottom-head welds and from the pressurizer spray nozzle to the top-head welds. Figure IWB-2500-7(b) of the ASME Code, Section XI, Code Item Number B3.120, requires UT examination of a volume one-half-inch thick on the inner radius of the pressurizer spray nozzle extending from a point that is the beginning of the radius of the nozzle on the pressurizer head side to a point equal to the thickness of the shell up the nozzle towards the piping connection for the nozzle inner-radius section.

As stated in its application for relief and discussed above in the section on the licensee's basis for requesting relief from the ASME Code, the licensee explained that: (1) the examination of the Code Items B3.110 and B3.120 components is limited by the geometry of the nozzle design; (2) the configuration of the nozzle-to-vessel welds limits the scans from the vessel head; and (3) the proximity of the pressurizer heaters to the weld limits the scan of the surge nozzle-to-bottom head weld. Therefore, the licensee concluded that it was impractical to meet the applicable ASME Code requirement. Based on its review of the relief requested, the NRC staff agrees with the licensee that it is impractical for the licensee to meet the applicable ASME Code requirements.

To effectively evaluate the licensee's proposed alternative, the staff, in an electronic mail dated May 9, 2006, requested that the licensee provide additional information regarding the following issues associated with the RR:.

(1) Coverage of previous UT examinations and the results.

(2) Previous industry experience associated with aging degradation of the subject welds.

(3) Type of weld metal that was used for the subject welds.

(4) State of stress that is present in the uninspected portion of the welds.

The licensee, in its letter dated July 12, 2006, provided responses to the staff's request for additional information (RAI). The following section provides information regarding the responses from the licensee and the corresponding staff evaluation.

4.1 Coverage of Previous UT Examinations and the Results

In its response to the staff's RAI, the licensee, in a letter dated July 12, 2006, stated that the preservice inspection and the first 10-year ISI interval UT examinations identified no flaws which required evaluation per the ASME Code. Complete coverage of the subject welds was not achieved during these UT examinations.

4.2 Previous Industry Experience Associated with Aging Degradation of the Subject Welds

In its response to the staff's RAI, the licensee, in a letter dated July 12, 2006, stated that so far there have been no reported service-induced failures or degradation of the subject welds, and with the exception of fatigue loading, these welds are not subjected to any known degradation mechanism.

4.3 Type of Weld Metal that was Used for the Subject Welds

In its response to the staff's RAI, the licensee, in a letter dated July 12, 2006, stated that carbon/low-alloy steel weld metal was used for all the subject welds.

4.4 State of Stress that is Present in the Uninspected Portion of the Welds

In its response to the staff's RAI, the licensee, in a letter dated July 12, 2006, stated that the uninspected portion of the weld is a low-stressed region. The volume of the subject welds where degradation would be first expected to occur was examined to the ASME Code, Section XI, requirements. The licensee also reiterated that in addition to the UT examinations, pressure visual testing (VT-2) was performed during every outage per the ASME Code, Section XI, Category B-P criteria. The licensee determined that any significant cracking would have been detected by these examinations, and the pressure test VT-2 examinations would detect any through-wall leakage in the subject welds.

The staff reviewed the licensee's responses to the RAIs and finds that the licensee's technical basis for the reduction in the examination volume is acceptable for the following reasons:

(1) The base metal was extensively examined during construction, preservice inspection, and prior inservice inspections. These examinations indicated no flaws which required evaluation per the ASME Code.

(2) The low-alloy steel nozzle-to-pressurizer welds are classified as ferritic welds. Unlike stainless steel welds or nickel-alloy welds, these ferritic welds are less likely to experience aging degradation due to intergranular stress-corrosion cracking near the heat-affected zone region of the weld area.

(3) Even though the subject welds are subject to fatigue loading, in the absence of any service-induced flaws, it can be surmised that the subject welds are not prone to any aging degradation due to fatigue loading.

(4) The uninspected portion of the weld is a low-stress region and, therefore, service-induced flaws are less likely to occur in the volume near the weld that

was excluded from the UT examinations. The licensee conducted UT examinations on the volume of the subject welds where service-induced cracking is more likely to occur. Since UT examinations thus far did not identify any cracking in the inspected region, the staff concludes that there is no reason to expect service-induced degradation in the uninspected regions of the subject welds. Furthermore, the licensee's pressure test VT-2 examinations during every refueling outage did not identify any through-wall leakage in these welds.

Based on the above evaluation, the NRC staff concludes that the prior UT examinations and VT-2 and pressure tests of the subject welds did not identify any unacceptable flaws (per the ASME Code, Section XI criteria), the location of the uninspected region of the welds is a low-stress region and this region is less prone to any service-induced cracking. Based on these conclusions, the NRC staff finds that the licensee's proposed alternative will identify degradation in these welds in a timely manner so that corrective actions can be taken by the licensee to maintain the structural integrity of the subject welds. Based on this and the impracticality of meeting the applicable ASME Code requirements, the NRC staff concludes that the requested relief may be granted to the licensee for the second 10-year interval in accordance with 10 CFR 50.55a(g)(6)(i).

## 5.0 CONCLUSION

Based on the above discussion, the staff concludes that it is impractical for the licensee to meet the applicable code requirements. Therefore, granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. The proposed RR I2R-34 is granted for the second 10-year ISI interval for WCGS. All other requirements of the ASME Code, Sections III and XI, for which relief has not been specifically requested remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: Ganesh S. Cheruvenki

Date: November 20, 2006