UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 23, 2009

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 I3R-06, ALTERNATIVE TO THE EXAMINATION REQUIREMENTS OF ASME CODE, SECTION XI FOR CLASS 1 PIPING WELDS EXAMINED FROM THE INSIDE OF THE REACTOR VESSEL (TAC NO. MD9658)

Dear Mr. Muench:

By letter dated September 16, 2008, as supplemented by letter dated April 23, 2009, Wolf Creek Nuclear Operating Corporation (the licensee) requested relief (I3R-06) from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI requirements. The licensee proposed an alternative to the depth sizing error requirements in ASME Code Cases N-695, "Qualification Requirements for Dissimilar Metal Piping Welds," and N-696, "Qualification Requirements for Appendix VIII Piping Examinations Conducted From the Inside Surface," for the third 10-year inservice inspection (ISI) interval for the Wolf Creek Generating Station (WCGS).

The U.S. Nuclear Regulatory Commission (NRC) staff has completed its review of the subject relief request. Based on the enclosed safety evaluation, the NRC staff concludes that compliance with the ASME Code-required volumetric examination for the depth sizing error requirements and coverage in the presence of rough surfaces is impractical. The NRC staff also concludes that the use of the proposed Alternatives A and B provide reasonable assurance of structural integrity of the subject welds. Therefore, pursuant to paragraph 50.55a(g)(6)(i) of Title 10 of the *Code of Federal Regulations*, relief is granted to implement Alternatives A and B for the remainder of the third 10-year ISI interval, which ends on September 2, 2015.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

If you have any questions regarding the safety evaluation, please contact Balwant K. Singal at (301) 415-3016.

Sincerely,

Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-482

Enclosure
As stated

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST IR3-06

WOLF CREEK GENERATING STATION

WOLF CREEK NUCLEAR OPERATING CORPORATION

DOCKET NO. 50-482

1.0 INTRODUCTION

By letter dated September 16, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML082670891), as supplemented on April 23, 2009 (ADAMS Accession No. ML091210226), Wolf Creek Nuclear Operating Corporation (the licensee) requested relief (I3R-06) from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI requirements. The licensee proposed an alternative to the depth sizing error requirements in ASME Code Cases N-695, "Qualification Requirements for Dissimilar Metal Piping Welds," and N-696, "Qualification Requirements for Appendix VIII Piping Examinations Conducted From the Inside Surface," for the third 10-year inservice inspection (ISI) interval for Wolf Creek Generating Station (WCGS).

2.0 REGULATORY EVALUATION

The ISI of Code Class 1, 2, and 3 components is to be performed in accordance with ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," and the applicable edition and addenda as required by paragraph 50.55a(g) of Title 10 of the *Code of Federal Regulations* (10 CFR), except where specific written relief has been granted by the U.S. Nuclear Regulatory Commission (NRC) pursuant to 10 CFR 50.55a(g)(6)(i). In addition, 10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the 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) will 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

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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 ISI Code of record for WCGS is the 1998 Edition with 2000 Addenda of the ASME Code.

3.0 TECHNICAL EVALUATION

3.1 Licensee Evaluation

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

As stated in its September 16, 2008, letter, the licensee's request for relief is for the Class 1 risk-informed inservice inspection (RI-ISI) pressure retaining piping welds as follows:

SAFE-END DISSIMILAR METAL WELDS CODE CATEGORY R-A (Formerly CODE CATEGORY B-F)

Code Item (Note 1)	Description	Weld No.
R1.20	Safe-end to Loop A RPV Outlet Nozzle	RV-301-121-A
R1.20	Safe-end to Loop A RPV Inlet Nozzle	RV-302-121-A, Note 3
R1.20	Safe-end to Loop B RPV Outlet Nozzle	RV-301-121-B
R1.20	Safe-end to Loop B RPV Inlet Nozzle	RV-302-121-B, Note 3
R1.20	Safe-end to Loop C RPV Outlet Nozzle	RV-301-121-C
R1.20	Safe-end to Loop C RPV Inlet Nozzle	RV-302-121-C, Note 3
R1.20	Safe-end to Loop D RPV Outlet Nozzle	RV-301-121-D
R1.20	Safe-end to Loop D RPV Inlet Nozzle	RV-302-121-D, Note 3

SAFE-END PIPING WELD CODE CATEGORY R-A (Formerly CODE CATEGORY B-J)

Code Item (Note 2)	Description	Weld No.
R1.20	Elbow to Loop A RPV Inlet Safe-End Weld	BB-01-F102
R1.20	Pipe to Loop A RPV Outlet Safe-End Weld	BB-01-F103
R1.20	Elbow to Loop B RPV Inlet Safe-End Weld	BB-01-F202
R1.20	Pipe to Loop B RPV Outlet Safe-End Weld	BB-01-F203
R1.20	Elbow to Loop C RPV Inlet Safe-End Weld	BB-01-F302
R1.20	Pipe to Loop C RPV Outlet Safe-End Weld	BB-01-F303
R1.20	Elbow to Loop D RPV Inlet Safe-End Weld	BB-01-F402
R1.20	Pipe to Loop D RPV Outlet Safe-End Weld	BB-01-F403

Note 1: These welds were formerly Item B5.10
Note 2: These welds were formerly Item B9.11
Note 3: During the Second Ten-Year Interval of Wolf Creek Nuclear Operating Corporation's (WCNOC) ISI Program, these locations had surface conditions that limited the detection of axial flaws by Ultrasonic Testing (UT)

3.1.2 Applicable Code Requirement (as stated)

Examination Category R-A, items R1.20 (formerly Code Categories B-F, B5.10 and B-J, B9.11 in the 1998 Edition through 2000 Addenda) specifies volumetric examination. This volumetric examination is conducted in accordance with Appendix VIII, Supplements 10 and 2, with the alternative requirements of approved Code Cases N-695 and N-696.

3.1.3 Licensee's Code Relief Request

In its submittal, the licensee has requested two alternatives:

Requested Alternative A (as stated)

Alternative A to the 0.125 inch root mean square error (RMSE) depth sizing requirement of Appendix VIII, Supplements 10 and 2, with the alternative requirements of Code Cases N-695 and N-696.

To date, although examination vendors have qualified for detection and length sizing on [the involved] welds, the examination vendors have not met the established RMSE of 0.125 inch for depth sizing.

[The licensee] proposes to use a contracted examination vendor that has demonstrated the ability to meet a depth sizing qualification requirement with an RMSE of 0.189 inch instead of the 0.125 inch required for Supplement 10 and Code Case N-695, and an RMSE of 0.245 inch instead of the 0.125 inch for Supplements 10 and 2 combined, as per Code Case N-696.

Requested Alternative B (as stated)

Alternative to supplement the ultrasonic test (UT) method with eddy current examinations when performing examinations of the Code specified pipe weld volumes from the inside diameter (ID) surface due to existing ID configurations.

The examination vendor for the [WCGS] reactor vessel nozzle examinations has been qualified for detection of circumferential flaws in accordance with Appendix VIII, Supplements 10 and 2 with the alternative requirements of Code Cases N-696 and N-696, as demonstrated through the Electric Power Research Institute (EPRI) Performance Demonstration Initiative (PDI) Program, for nozzle-to-safe end and safe end-to-pipe welds examined from the ID surface. The vendor is similarly qualified for the detection of axial flaws provided the surface is machined or ground smooth with no exposed root reinforcement or counter-bore. Surface roughness is present that will call into question the ultrasonic qualifications demonstrated for detection of axial flaws.

The examination vendor has developed an eddy current technique to augment the ultrasonic examination method and provide increased sensitivity at the ID

surface. The eddy current technique was first used in the VC summer reactor vessel primary nozzle examinations of 2000. [This procedure has been successfully used at VC Summer in 2002 and 2003 examinations.]

Since that time, the technique has been successfully blind tested... [and] used to supplement examination of portions of the relevant near-surface volumes during the last 15 domestic pressurized water reactor nozzle-to-pipe examinations conducted by the vendor.

3.1.4 Licensee's Proposed Alternative and Basis for Requesting Relief

Requested Alternative A (as stated)

WCNOC proposes to use approved Code Cases N-695 and N-696 with a combined RMSE of 0.245 inch instead of the 0.125 inch specified for depth sizing in the Code Cases. In the event an indicate is detected that requires depth sizing, the 0.120 inch difference between the required RMSE and the demonstrated RMSE (0.245 inch – 0.125 inch = 0.120 inch) will be added to the measured through-wall extent for comparison with applicable flaw acceptance criteria. If the examination vendor demonstrates an improved depth sizing RMSE prior to the examination, the excess of that improved RMSE over the 0.125 inch RMSE requirement, if any, will be added to the measured value for comparison with applicable flaw acceptance criteria.

The proposed alternative assures that the nozzle-to-safe end welds and the subject reactor coolant piping circumferential welds will be fully examined by procedures, personnel and equipment qualified by demonstration in all aspects except depth sizing. For depth sizing, the proposed addition of the difference between the qualified and demonstrated sizing tolerance to any flaw required to be sized compensates for the potential variation and provides an acceptable level of quality and safety in accordance with 10 CFR 50.55a(a)(3)(i).

Requested Alternative B

Proposed Alternative B was previously approved by the NRC after discovering (in refueling outage RF14 of ISI Interval 2) that 12 of the 16 components identified in this request had inside surface conditions that did not allow coverage to be claimed for detection of axial flaws. This alternative was approved in a letter dated December 27, 2006. The licensee proposes to continue the use of this alternative in the third 10-year ISI interval.

In its September 16, 2008, letter, the licensee states that,

WCNOC proposes using surface geometry profiling software (profilometry) in conjunction with a focused immersion ultrasonic transducer positioned to permit accurate profile data across the examination volume to help the examiner confirm locations where the raw data indicates lack of transducer contact due to problematic surface geometry. Eddy current examination will be used to supplement ultrasonic examination for all nozzle-to-safe end and safe end-to-

pipe welds. Profilometry will be used to determine the surface areas, and confirm those previously identified, where roughness may limit the ability of ultrasonic methods to be used effectively as qualified through performance demonstration.

The eddy current method will be used to assure any axial flaws at the ID surface volume that could be missed by ultrasonic examination due to potential surface roughness are detected. As a [complement] to ultrasonic examinations for rough surface detection coverage, the following eddy current techniques will be utilized:

- Up to two plus point probes applied circumferentially on the pipe inside surface in scan increments of 0.080 inch circumferentially (for axial flaws) and 0.25 inch axially.

- Automated systems for data collection and analysis.

The target flaw size for the eddy current procedure is 0.28 inch long, well within the ASME Code linear flaw acceptance standards of 0.45 inches for austenitic material, and 0.625 inch for ferritic material [ ]. All eight nozzle-to-safe end welds and all eight safe end-to-pipe welds will be examined.

The ultrasonic examinations supplemented by eddy current examinations and profilometry will be conducted to the maximum extent practical and are subject to third party review by the Authorized Nuclear Inservice Inspector.

Use of ultrasonic profilometry and eddy current examination with procedures and personnel qualified through the SQC [Swedish Qualification Center] blind tests to supplement Appendix VIII qualified ultrasonic procedures and personnel for the nozzle-to-safe end and safe end-to-pipe welds provides additional assurance that surface-breaking flaws that may be present would be detected in the presence of potential surface roughness...

3.2 NRC Staff Evaluation

Requested Alternative A

Supplement 10 of ASME Code, Section XI, Appendix VIII requires that examination procedures, equipment, and personnel meet specific criteria for flaw depth sizing accuracy. The ASME Code specifies that the maximum error of flaw depth measurements, as compared to the true flaw depths, must be less than or equal to 0.125-inch RMSE. The nuclear power industry has been trying to qualify personnel and procedures for ID pipe examinations; however, they have been unsuccessful at qualifying personnel to achieve the 0.125-inch RMSE depth sizing criterion. Therefore, at this time, achieving the 0.125-inch RMSE is impractical.

The licensee proposes to use a contracted examination vendor that has demonstrated the ability to meet a depth sizing qualification requirement with an RMSE of 0.189 inch for Supplement 10 and Code Case N-695, and an RMSE of 0.245 inch for a qualified Supplement 10 in conjunction with selected aspects of Supplement 2, as per Code Case N-696.

Although the 0.189-inch and 0.245-inch RMSE can result in under-sizing a flaw by an amount greater than the Code-required error, the probability of a flaw occurring precisely when surface roughness is affecting UT is considered small.

In its April 23, 2009, response to the NRC staff's request for additional information question 3, the licensee states that the roughness criterion of the 1/32-inch gap beneath the transducer for UT examinations was applicable to outside diameter (OD) examinations only and is not applicable to ID examinations such as those addressed by Relief Request I3R-06. NRC staff believes that there should be no difference in UT problems caused by the gap between the transducer and pipe for OD and ID examinations. These examinations are expected to be the same unless technical data is provided otherwise.

The U.S. nuclear power industry is using the EPRI PDI Program to implement the performance demonstration required by Code Cases N-695 and N-696. The difficulties in meeting the RMSE requirement are associated with surface roughness and pipe misalignment that are common to field welds, and are replicated in mockups used in the EPRI PDI Program. The EPRI PDI mockups contain the bounding dissimilar metal welds and austenitic-to-austenitic weld surface conditions found in nuclear power plants. There is the possibility that performance demonstrations performed on mockups with less severe surface conditions could meet the RMSE requirement; however, such mockups are not available in the EPRI PDI Program.

In the event that vendors are able to qualify their UT techniques on mockups with less severe surface conditions than those used in the current EPRI PDI mockups, the less severe surface conditions would be necessary for depth sizing flaws at nuclear power plants. The NRC and EPRI PDI have been discussing the RMSE issue and test specimen availability at semiannual public meetings with industry representatives. Based on the above, NRC staff concludes that the proposed alternative provides reasonable assurance of structural integrity of the subject welds and is, therefore, acceptable.

Requested Alternative B

The licensee's contracted vendor did not fully meet the qualification requirements of ASME Code, Section XI, Appendix VIII, Supplements 2 and 10, because the vendor was unable to detect the axial flaws in the presence of rough surfaces. The NRC staff concludes that compliance with the Code Case N-695 paragraph 3.3(c) and Code Case N-696 paragraph 3.3(d) required 0.125-inch RMSE would require that the surfaces be machined or ground with no exposed root reinforcement or counter bore. To rework the ID of the weld surface to create a smooth surface to support the required UT examinations, is a significant burden on the licensee due to the location access, contamination and dose issues, and potential rework that would be required and is, therefore, impractical.

However, the examination vendor has developed an eddy current technique to augment the UT method and provide increased sensitivity at the ID surface. The NRC staff concludes this alternative is acceptable based on the following:

- The eddy current transducer has a smaller surface area than an ultrasonic transducer, which allows eddy current to more easily transverse rougher surfaces, and

- Surface conditions away from the weld do not affect eddy current to the extent that they would affect ultrasonic testing, adjacent welds should have no effect on surface areas examined by eddy current because of the distance separating the roots.

The licensee's contractor vendor has significant experience in performing examinations using a combined ultrasonic and eddy current examinations. Therefore, the NRC staff has concluded that the licensee's proposed alternative of performing UT examinations supplemented with eddy current and Category B-P VT-2 (visual) examinations, as required by ASME Code, Section XI, will provide reasonable assurance that the axial flaws in the presence of rough surface will be detected and, thus, provide reasonable assurance of structural integrity. The proposed alternative is, therefore, acceptable.

4.0 CONCLUSION

Based on the above evaluation, NRC staff concludes that compliance with Code Cases N-695 paragraph 3.3(c) and N-696 paragraph 3.3(d) required 0.125-inch RMSE is impractical and that the proposed alternative to use a 0.189-inch RMSE for Supplement 10 and Code Case N-695, and a 0.245-inch RMSE for Supplement 10 in conjunction with selected aspects of Supplement 2, as per Code Case N-696, provides reasonable assurance of structural integrity of the subject welds. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), relief is granted to WCGS to implement Alternative A for the remainder of the third 10-year ISI interval, which ends on September 2, 2015, or until such time as UT techniques are capable of satisfying the 0.125-inch RMSE requirement of Code Cases N-695 and N-696, whichever occurs first.

The NRC staff finds that, due to the burden in machining weld surfaces to a level of quality to support qualified volumetric inspection, compliance with the current examination requirement is impractical. The NRC staff also concludes that the proposed alternative of using eddy current and VT-2 examinations to supplement the UT is acceptable because eddy current is capable of detecting axial flaws in the presence of rough ID surfaces. Therefore, the licensee's proposed Alternative B to use eddy current and visual examination to supplement a best-effort ultrasonic examination provides reasonable assurance of structural integrity of the subject welds. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), relief is granted to implement Alternative B for the remainder of the third 10-year ISI interval, which ends on September 2, 2015.

The granting of relief is authorized by law and will not endanger life or property, or the common defense and security and is otherwise in the public interest. All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: M. Audrain

Date: July 23, 2009

If you have any questions regarding the safety evaluation, please contact Balwant K. Singal at (301) 415-3016.

Sincerely,

/RA/

Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-482

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