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

January 28, 2015

Mr. Adam C. Heflin
President, Chief Executive Officer,
and Chief Nuclear Officer
Wolf Creek Nuclear Operating Corporation
Post Office Box 411
Burlington, KS 66839

SUBJECT: WOLF CREEK GENERATING STATION – REQUEST FOR RELIEF NO. I3R-11 FOR THE THIRD 10-YEAR INSERVICE INSPECTION PROGRAM INTERVAL (TAC NO. MF4304)

Dear Mr. Heflin:

By letter dated June 26, 2014, as supplemented by letter dated August 21, 2014, Wolf Creek Nuclear Operating Corporation (WCNOC, the licensee) proposed an alternative to the inservice inspection (ISI) interval requirements of the American Society of Mechanical Engineers *Boiler and Pressure Vessel Code* (ASME Code), Section XI, ISI Program, for the Wolf Creek Generating Station (WCGS).

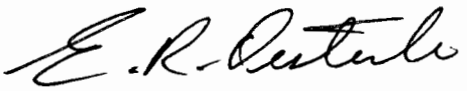
Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) paragraph 50.55a(a)(3)(ii) (retitled paragraph 50.55a(z)(2) by 79 FR 65776, dated November 5, 2014), relief request I3R-11 proposed an alternative to the pressure test requirements of ASME Code Section XI, paragraph IWC-5220 for the Class 2 piping and components in the reactor vessel flange leak-off lines connected to the reactor pressure vessel running to isolation valve BBHV8032.

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2) for I3R-11. Therefore, the NRC authorizes the use of relief request I3R-11 at WCGS for the remainder of the third 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.

The detailed results of the NRC staff review are provided in the enclosed safety evaluation. If you have any questions concerning this matter, please call Mr. F. Lyon of my staff at (301) 415-2296 or by electronic mail at fred.lyon@nrc.gov.

Sincerely,



Eric R. Oesterle, Acting Chief
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-482

Enclosure
Safety Evaluation

cc w/encl: Distribution via Listserv

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

THIRD 10-YEAR INSERVICE INSPECTION PROGRAM INTERVAL

REQUEST FOR RELIEF NO. I3R-11

WOLF CREEK NUCLEAR OPERATING CORPORATION

WOLF CREEK GENERATING STATION

DOCKET NO. 50-482

1.0 INTRODUCTION

By letter dated June 26, 2014, as supplemented by letter dated August 21, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML14182A091 and ML14239A495, respectively), Wolf Creek Nuclear Operating Corporation (WCNOC, the licensee) proposed an alternative to the inservice inspection (ISI) interval requirements of the American Society of Mechanical Engineers *Boiler and Pressure Vessel Code* (ASME Code), Section XI, ISI Program, for the Wolf Creek Generating Station (WCGS).

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) paragraph 50.55a(a)(3)(ii) (retitled paragraph 50.55a(z)(2) by 79 FR 65776, dated November 5, 2014), relief request I3R-11 proposed an alternative to the pressure test requirements of ASME Code, Section XI, paragraph IWC-5220 for the Class 2 piping and components in the reactor vessel flange leak-off lines connected to the reactor pressure vessel (RPV) running to isolation valve BBHV8032. The licensee proposed an alternative system leakage testing for the Class 2 RPV head flange seal leak-off line piping on the basis that complying with the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The relief request is for the remainder of the third 10-year ISI interval, which ends on September 2, 2015.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g)(4), the ASME Code Class 1, 2, and 3 components (including supports) must 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 of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components.

Pursuant to 10 CFR 50.55a(z), alternatives to the requirements of paragraph (g) of 10 CFR 50.55a may be used when authorized by the Director, Office of Nuclear Reactor

Enclosure

Regulation. A proposed alternative must be submitted and authorized prior to implementation. The licensee must demonstrate (1) the proposed alternative would provide an acceptable level of quality and safety; or (2) compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Based on the above, and subject to the following technical evaluation, the NRC staff finds that regulatory authority exists for the licensee to request and the NRC to authorize the alternative requested by the licensee.

3.0 TECHNICAL EVALUATION

3.1 Component Affected

The component affected is ASME Code Class 2. In accordance with IWC-2500 (Table IWC-2500-1), this component is classified as Examination Category C-H, Item Number C7.10.

The licensee requested relief for the Class 2 RPV flange seal leak-off lines piping. In the June 26, 2014, letter, the licensee stated that the material of construction of the leak-off piping is Type 304 stainless steel.

3.2 Applicable Code Edition and Addenda

The Code of record for the third 10-year ISI interval is the 1998 Edition through 2000 Addenda of the ASME Code, Section XI.

3.3 Duration of Relief Request

The licensee submitted RR I3R-11 for the remainder of the third 10-year ISI interval, which will end on September 2, 2015.

3.4 ASME Code Requirement

The ASME Code, Section XI, IWC-2500, Table IWC-2500-1, Examination Category C-H, requires the system leakage test be conducted according to IWC-5220 and the associated VT-2 visual examination according to IWA-5240 during each inspection period. As required by IWC-5221, the system leakage test shall be conducted at the system pressure obtained while the system, or portion of the system, is in service performing its normal operating function or at the system pressure developed during a test conducted to verify system operability (e.g., to demonstrate system safety function or satisfy technical specification surveillance requirements).

3.5 Proposed Alternative and Basis for Use

The licensee proposed an alternative to IWC-5221. To conduct the system leakage test of the RPV leak-off piping, the licensee proposed to subject the piping to the static pressure head, developed from the elevation of at least 23 feet of normal refueling water above the reactor vessel closure flange when the reactor cavity is flooded for refueling, for at least 4 hours. In the

August 21, 2014, letter, the licensee stated that as part of the system leakage test, it will perform the VT-2 visual examinations of the accessible insulated portion of the piping in accordance with IWA-5242 and the accessible non-insulated portion of the piping in accordance with IWA-5241(a). The licensee will also perform the VT-2 visual examinations of the inaccessible portion of the piping in accordance with IWA-5241(b). In addition, the licensee will perform a supplemental visual examination for boric acid residue indicative of leakage from the leak-off piping when the piping can be made accessible later in the refueling outage after drain down of the refueling cavity when access to the reactor vessel nozzle gallery is made available. This supplemental visual examination will include opening of the mirror insulation that covers a portion of the inaccessible leak-off piping in the nozzle gallery to allow direct performance of the visual examination.

The licensee stated that the leak-off piping is separated from the reactor coolant pressure boundary by metallic O-ring seal. The pressure openings for the leak-off piping are located on the RPV flange mating surface. Failure of the inner O-ring seal is the only condition under which the leak-off piping could be pressurized. Therefore, the leak-off piping is not expected to be pressurized during the system pressure test following a refueling outage or during normal operation. During operating cycle, if the inner O-ring seal should leak, it will be identified by an increase in temperature above ambient temperature. This piping has a temperature indication and a high temperature alarm in the Control Room which is monitored by the operator. This piping also collects leakage which is routed to the reactor coolant drain tank.

The licensee stated that the leak-off piping would only function as a Class 2 pressure boundary if the inner O-ring seal fails, thereby, pressurizing the line. If any significant pipe through-wall leakage were to occur in this piping during this time of pressurization, it would exhibit boric acid accumulation that would be identified by the boron trace residue during the VT-2 visual examination following the proposed leakage test. This piping is also subjected to the VT-2 visual examination during the reactor coolant system (RCS) pressure test at the end of each refueling outage for indications of leakage.

In the August 21, 2014, letter, the licensee stated that it has not detected any degradation of the RPV leak-off piping during performance of the VT-2 visual examinations at the end of each refueling outage, which includes accessible portions of the leak-off piping after pressurization from the static head of the flooded refueling cavity. There has not been any degradation or evidence of leakage in these leak-off piping identified in the spring of 2011 when the mirror insulation was removed from the leak-off piping inside the reactor vessel main loop nozzle gallery during walk down and work planning for reactor vessel nozzle mitigation. The licensee further stated that during plant heat up following a refueling outage in January 1988, it identified leakage from the inner O-ring seal, subsequently cooled down the plant, and replaced the O-rings. This was the only time the RPV leak-off piping at WCGS experienced elevated pressure since plant construction, and the licensee did not identify any evidence of degradation and leakage in this piping as a result of the inner O-ring leakage and subsequent pressurization of piping.

The licensee also stated that in an unlikely event, if a through-wall leak would occur in the leak-off piping concurrent with leak or failure of the RPV flange inner O-ring seal during normal operation, it would result in unidentified RCS leakage that is controlled by Technical Specification 3.4.13, "RCS Operational LEAKAGE." Leakage detection systems have been

designed to aid Control Room operators in differentiating between possible sources of detected leakage within the containment and identifying the physical location of the leak. The RCS leakage detection systems consist of the sump level and flow monitoring system, the containment air particulate monitoring system, the containment cooler condensate measuring system, and the containment humidity monitoring system. The sump level and flow monitoring system indicates leakage by monitoring increases in sump level. The containment cooler condensate measuring system and the containment humidity measuring system detect leakage from the release of steam or water to the containment atmosphere. The air particulate gas monitoring system detects leakage from the release of radioactive materials to the containment atmosphere.

3.6 Basis for Hardship

The licensee stated that the configuration of leak-off piping would pose personnel and equipment safety concerns if the pressure testing would be performed at the ASME Code required RCS operating pressure. With the reactor vessel head removed, plugs would need to be installed in the reactor vessel flange face to act as a pressure boundary for the system leakage test of the lines and removed after the test. The installation of the plugs and subsequent activities would cause personnel to incur additional radiological dose due to additional time for personnel at the reactor vessel flange. The handling of a very small diameter plug over the reactor vessel would present a foreign material exclusion issue if accidently dropped into the reactor pool. The use of an alternative test rig to test those isolated portions of piping at the full RCS operating pressure would have to include application of a compatible pressurized medium. This would result in exposing personnel stationed near pressurized vent or drain valves to unnecessary safety hazards in the event of a leak from the non-class test pressure rig connections. A break at any connection of the test rig under such conditions (temporary non-code connections under the RCS test pressure) would pose personnel safety hazards. The configuration also precludes pressurizing the line externally with the reactor vessel head installed. The closure head contains concentric grooves that hold the O-ring seal. The O-ring is held in place by a series of retainer clips that are housed in recessed cavities in the flange face. If a pressure test was to be performed with the reactor vessel head installed, the O-ring would be pressurized in a direction opposite to its design function. This test pressure would result in a net inward force on the O-ring that would tend to push it into the recessed cavity that houses the retainer clips. The thin O-ring material could be damaged by the inward force.

In the August 21, 2014, letter, the licensee stated that conducting the ASME Code required system leakage test before removing the RPV head in the beginning of a refueling outage would require the use of a hydro pump test skid and a non-class test pressure skid connection. This could expose personnel setting up and conducting the test, or stationed near the pressurized vent or drain valves, to unnecessary additional radiation dose and personnel safety hazards in the event of a leak or break of a non-class test pressure skid connections.

The licensee further stated that an accurate estimate of personnel radiation exposure for activities to facilitate the performance of the ASME Code required system leakage test of the leak-off piping (e.g., the installation of the plugs and/or non-class test pressure rig connections, subsequent testing, and removal after testing) cannot be made because these activities has never been performed in the past. However, based on past refueling outage radiation dose

rates survey, the estimated dose rates at the reactor vessel flange are 3 to 4 roentgen equivalent man per hour (rem/h).

3.7 NRC Staff Evaluation

The NRC staff has evaluated RR I3R-11 pursuant to 10 CFR 50.55a(z)(2). The NRC staff focuses on whether compliance with the specified requirements of 10 CFR 50.55a(g), or portions thereof, would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety.

Hardship

The NRC staff found that requiring the licensee to comply with IWC-5221 and conduct system leakage test of the RPV head flange seal leak-off lines piping at the RCS operating pressure would result in hardship. The basis for the hardship is as follows. To conduct the ASME Code required system leakage test of the leak-off piping when the reactor head is removed during refueling, the licensee would have to modify the existing RPV head flange taps to install plugs and/or non-class test pressure skid connections to facilitate for pressurizing the piping by use of a hydro pump test skid. The activities associated with installing the plugs and/or the test connections, pressurizing the piping to the RCS pressure and conducting the ASME Code required system leakage test, and removing the plugs after completion of test would cause personnel to incur additional radiation dose, and could introduce foreign materials into the reactor pool as well as the lines. Pressurizing the non-class test pressure skid connections to the RCS operating pressure would create personnel safety hazards in the event of a leak or break in any of the non-class test pressure rig connections. Pressurizing the lines to conduct the ASME Code required system leakage test when the RPV head is installed would not be possible due to design and configuration of the RPV head flange taps and the inner O-ring. The inner O-ring is designed to withstand pressure in one direction only, pressurizing in the opposite direction could damage the inner O-ring, and even result in unsuccessful test. Externally pressurizing the lines to conduct the ASME Code required system leakage test at the beginning of refueling outage when the RPV head is on would not be possible because the entire containment would have limited access due to high radiation level. Furthermore, pressurizing the inner O-ring in the opposite direction could damage the O-ring and result in unsuccessful test. Therefore, the NRC staff determined that concerns from the Foreign Material Exclusion program and an as low as is reasonably achievable criteria constitute a hardship.

Test Pressure

In evaluating the licensee's proposed alternative, the NRC staff assessed whether it appeared that the licensee used the highest achievable test pressure to conduct system leakage testing and the manner in which the licensee adequately preformed the testing and the associated VT-2 visual examinations of the piping for leakage. The NRC staff found that the licensee will use the highest pressure that is obtainable without major modifications to existing configuration of the lines to test the RPV leak-off piping for leakage. Specifically, the licensee's proposed system leakage test will subject the piping to the static pressure head developed from the elevation of 23 feet of refueling water above the vessel flange during the refueling cavity flood-up which eliminates a need for major design modifications to existing configurations of both the vessel flange and the leak-off lines. By performing the VT-2 visual examination of the insulated area of

the piping (according to IWA-5242) and the non-insulated area of the piping (according to IWA-4241), the licensee will be able to detect any leakage if it originated from an existing flaw in the piping and its welded connections after maintaining the static test pressure. As a supplement to IWA-5241 and IWA-5242, the licensee will visually examine the inaccessible area of the piping for boric acid residue when the piping can be made accessible later in the refueling outage after drain down of the refueling cavity when access to the reactor vessel nozzle gallery is made available. This supplemental examination will include opening of the mirror insulation that covers a portion of the inaccessible leak-off piping in the nozzle gallery to allow direct VT-2 visual examinations. Therefore, the NRC staff found that the licensee's alternative system leakage test subjects the piping under consideration to a test pressure that is as high as reasonably achievable.

Safety Significance of Alternative Test Pressure

In addition to the analysis described above, the NRC staff evaluated the safety significance of performance of the system leakage test at an alternative reduced pressure. The NRC staff notes that the leak-off piping is made of stainless steel. The degradation mechanism could be fatigue and stress-corrosion cracking. However, fatigue crack is known to have relatively slow growth and field experience has shown that stress-corrosion cracking under normal operating conditions is not expected to be a problem. Significant degradation would likely be detected by the system leakage test performed under proposed maximum obtainable static pressure head.

The NRC staff notes that if in an unlikely event, these piping developed a through wall flaw and a leak, the WCGS existing reactor coolant leakage detection systems will be able to identify the leakage during normal operation, and the licensee will take appropriate corrective actions in accordance with the plant technical specifications. Therefore, the NRC staff determined that based on the alternative system leakage testing that subject this piping to the maximum obtainable static pressure head and the performance of the ASME Code required VT-2 visual examinations, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have be detected either by the examinations that the licensee performed or the RCS leakage detection systems.

Therefore, the NRC staff concludes that the proposed system leakage testing using the proposed test pressure is adequate to provide a reasonable assurance of structural integrity and leak-tightness of the RPV flange seal leak-off lines piping.

4.0 CONCLUSION

As set forth above, the NRC staff determines that the proposed alternative provides reasonable assurance of structural integrity and leak-tightness of the RPV head flange seal leak-off lines piping. The NRC staff finds that complying with the specified ASME Code requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, the NRC staff authorizes the use of RR I3R-11 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.

Principal Contributor: A. Rezai, NRR/DE/EPNB

Date: January 28, 2015

The detailed results of the NRC staff review are provided in the enclosed safety evaluation. If you have any questions concerning this matter, please call Mr. F. Lyon of my staff at (301) 415-2296 or by electronic mail at fred.lyon@nrc.gov.

Sincerely,

/RA/

Eric R. Oesterle, Acting Chief
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-482

Enclosure
Safety Evaluation

cc w/encl: Distribution via Listserv

DISTRIBUTION:
PUBLIC
LPL4-1 r/f
RidsAcrsAcnw_MailCTR Resource
RidsNrrDeEpnb Resource
RidsNrrDorlLpl4-1 Resource
RidsNrrLAJBurkhardt Resource
RidsNrrPMWolfCreek Resource
RidsRgn4MailCenter Resource
ARezai, NRR/DE/EPNB
MWaters, EDO RIV

ADAMS Accession No.: ML15023A220 *email dated

OFFICE	NRR/DORL/LPL4-1/PM	NRR/DORL/LPL4-1/LA	NRR/DE/EPNB/BC	NRR/DORL/LPL4-1/BC(A)
NAME	FLyon	JBurkhardt	DAlley*	EOesterle
DATE	1/28/15	1/27/15	1/22/15	1/28/15

OFFICIAL RECORD COPY