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NUCLEAR REGULATORY COMMISSION

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO THE INSERVICE TESTING PROGRAM

WOLF CREEK NUCLEAR OPERATING CORPORATION

WOLF CREEK GENERATING STATION

DOCKET NO. 50-482

1.0 INTRODUCTION

The Code of Federal Regulations, 10 CFR 50.55a, requires that inservice testing (IST) of certain ASME Code Class 1, 2, and 3 pumps and valves be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable addenda, except where relief has been requested and granted or proposed alternatives have been authorized by the Commission pursuant to 10 CFR 50.55a(f)(6)(i), (a)(3)(i), or (a)(3)(ii). In order to obtain authorization or relief, the licensee must demonstrate that: (1) conformance is impractical for its facility; (2) the proposed alternative provides an acceptable level of quality and safety; or (3) compliance would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety. Section 50.55a(f)(4)(iv) provides that inservice tests 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 the limitations and modifications listed, and subject to Commission approval. NRC guidance contained in Generic Letter (GL) 89-04, "Guidance on Developing Acceptable Inservice Testing Programs," provided alternatives to the Code requirements determined to be acceptable to the staff and authorized the use of the alternatives in Positions 1, 2, 6, 7, 9, and 10, provided the licensee follows the guidance delineated in the applicable position. When an alternative is proposed which is in accordance with GL 89-04 guidance and is documented in the IST program, no further evaluation is required; however, implementation of the alternative is subject to NRC inspection.

Pursuant to 10 CFR 50.55a, the Commission may grant relief from or authorize proposed alternatives to ASME Code requirements upon making the necessary findings. By letter dated January 28, 1997, the Wolf Creek Nuclear Operating Corporation (licensee) submitted Relief Requests 2VR-7 and 2VR-8 from ASME Section XI requirements for the IST Program at the Wolf Creek Generating Station. The NRC staff's findings with respect to the requested relief are contained in this safety evaluation (SE).

2.0 EVALUATION

Relief Request 2VR-7

The licensee proposes the use of an alternative to quarterly stroke-time testing of motor-operated valves (MOV) described in ASME Code Case OMN-1, "Alternative Rules for Preservice and Inservice Testing of Certain Electric Motor-Operated Valve Assemblies in Light-Water Reactor Power Plants, OM Code-1995, Subsection ISTC," with certain limitations. The NRC is evaluating ASME Code Case OMN-1 for possible endorsement through rulemaking or by a regulatory guide. However at this time, the NRC has not generically approved the use of this code case as an alternative to ASME Code IST requirements for quarterly stroke-time testing of MOVs.

Licensee's Basis for Requested Relief

The licensee provided the following basis for the relief request:

ASME OMA-1988, Part 10, Sections 4.1, "Valve Position Verification," and 4.2.1, "Valve Exercising Test," discusses position verification and exercising requirements for motor operated valves (MOV). The NRC staff has long recognized the limitations of stroke-time testing as a means of monitoring the operational readiness of MOVs. NUREG-1482, "Guidelines for Inservice Testing Programs at Nuclear Power Plants," Section 4.2.3 states that the staff has determined that a testing program established in accordance with the guidance of Generic Letter 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," can provide an acceptable level of quality and safety if the licensee has an established program of periodic testing. Generic Letter 96-05, ["Periodic Verification of Design-Basis Capability of Safety-Related Motor-Operated Valves,"] identifies ASME OM Code Case OMN-1, "Alternative Rules for Preservice and Inservice Testing of Certain Electric Motor-Operated Valve Assemblies in Light-Water Reactor Power Plants, OM Code-1995, Subsection ISTC," with limitations, as an appropriate means of implementing a periodic MOV design-basis verification testing program as described by Generic Letter 89-10.

Licensee's Proposed Alternative Testing

The licensee proposed the following alternative testing:

MOV testing will comply with the requirements of ASME OM Code Case OMN-1, "Alternative Rules for Preservice and Inservice Testing of Certain Electric Motor-Operated Valve Assemblies in Light-Water Reactor Power Plants, OM Code-1995, Subsection ISTC," with the following limitations:

- 1) The potential benefits (such as identification of decreased thrust output and increased thrust requirements) and potential adverse effects (such as accelerated aging or valve damage) will be considered when determining the appropriate testing for each MOV.

- 2) Where the selected test interval extends beyond 5 years, performance and test experience from previous tests shall be evaluated to justify the periodic verification interval.
- 3) The risk insights determined during Wolf Creek's participation in the Electric Power Research Institute (EPRI) Risk-Based Inservice Testing Pilot Project (ref. EPRI TR-105869) and on-going development of an updated risk-based categorization process based upon ASME Research guidance and Codes as applicable will be used in accordance with the requirements of the ASME OM Code Case OMN-1.

Discussion

The ASME Code specifies the performance of stroke-time testing of MOVs at quarterly intervals as part of the requirements for IST programs established under 10 CFR 50.55a. In Relief Request ZVR-7, the licensee indicates that the current test requirements for MOVs in the IST program at the Wolf Creek nuclear power plant are contained in ASME Code-1988 Part 10, Section 4.1, "Valve Position Verification," and Section 4.2.1, "Valve Exercising Test." Stroke-time testing provides valve exercising and some measure of on-demand reliability, and can help indicate degradation in dc-powered MOVs.

In GL 89-10, the NRC staff noted the benefits of stroke-time testing of MOVs but stated that such testing alone is not sufficient to provide assurance of MOV operability under design-basis conditions. As a result, the NRC staff requested in GL 89-10 that licensees verify the design-basis capability of their safety-related MOVs by reviewing MOV design bases, verifying MOV switch settings initially and periodically, testing MOVs under design-basis conditions where practicable, improving evaluations of MOV failures and necessary corrective action, and trending MOV problems. Since then, the NRC staff has issued GL 96-05 to request that licensees establish a program, or to ensure the effectiveness of their current program, to verify on a periodic basis that safety-related MOVs continue to be capable of performing their safety functions within the current licensing bases of the facility. GL 96-05 supersedes GL 89-10 with respect to periodic verification of MOV design-basis capability.

Following the issuance of GL 89-10, the ASME initiated an effort to develop guidance that would describe an acceptable alternative to the MOV stroke-time testing requirements of the ASME Code. In Code Case OMN-1, ASME establishes this guidance in an alternative program of exercising and diagnostic testing of MOVs on a frequency that provides continuing assurance of capability to perform their safety functions. OMN-1 specifies exercising of MOVs at least once every refueling cycle to verify electrical continuity and to provide internal lubrication. Further, OMN-1 specifies periodic diagnostic testing of MOVs (including a mix of static and dynamic tests) to obtain sufficient information to determine the rate of degradation of MOV performance in terms of the potential increase in required thrust and torque, and the potential decrease in actuator output. From this information, licensees can establish periodic test intervals that may extend up to 10 years if there is assurance

that the MOV will remain capable of performing its safety function throughout the interval. In sum, OMN-1 uses the significant information on MOV performance obtained from diagnostic testing to extend the periodic test intervals beyond those indicated in the ASME Code.

In GL 96-05, the NRC staff stated that, with certain limitations, the method described in OMN-1 is considered to meet the intent of the generic letter to verify the design-basis capability of safety-related MOVs on a periodic basis. The limitations listed in GL 96-05 on the use of OMN-1 were (1) a precaution regarding consideration of benefits and potential adverse effects when determining appropriate MOV testing, (2) a provision for the evaluation of applicable MOV test information before extending test intervals beyond 5 years or three refueling outages, and (3) a provision for licensees participating in the industry pilot effort for IST programs that would consider risk insights to address the relationship of OMN-1 to their pilot initiative. The Wolf Creek licensee incorporated the limitations on the benefits and adverse effects of MOV testing and the evaluation of test information in its submittal dated January 28, 1997. The limitation on risk-informed IST programs is not applicable to the Wolf Creek licensee in that it is not one of the two principal pilot licensees involved in that effort.

In response to questions from the NRC staff during a telephone discussion on June 3, 1997, the licensee provided additional information on Relief Request 2VR-7 in a letter dated September 2, 1997. In that letter, the licensee stated that, rather than implementing OMN-1 for all MOVs in its IST program, its engineering staff would evaluate each MOV group on the basis of safety importance and cost to determine the priority and scope for inclusion in an OMN-1 IST program at Wolf Creek. The licensee also stated that its review of the Joint Owners Group (JOG) Program on MOV Periodic Verification in response to GL 96-05 did not reveal any incompatibilities between OMN-1 and the JOG program. According to the licensee, the provisions of OMN-1 will be met for MOVs selected to be within the scope of the OMN-1 IST program at Wolf Creek, except where specific relief is provided by the NRC. The licensee committed to implement any OMN-1 provisions that are currently not included in the MOV Program at Wolf Creek using a controlled process in accordance with OMN-1 and evaluated under 10 CFR 50.59.

In its submittal dated September 2, 1997, the licensee provided a comparison of its existing MOV Program elements to the provisions of OMN-1. The NRC staff has the following comments on the licensee's specific program comparison:

- a. Although not mentioned in the licensee's submittal dated September 2, 1997, Section 3.3.1 of OMN-1 includes a 10-year maximum test interval.
- b. With respect to Section 3.7 of OMN-1, the licensee indicated that the results of the EPRI Risk-Based Inservice Testing Pilot Project, and other industry activities, may be used in applying risk-informed criteria when implementing OMN-1. The NRC staff is working with the nuclear industry and standard-writing organizations to develop generic guidance for the application of risk insights in IST programs. Until

such time as the NRC issues or endorses such generic guidance, the NRC staff will not accept the application of the risk insights described in Section 3.7 of OMN-1 without prior review and approval by the NRC staff of the specific risk-informed criteria to be applied by a licensee. For Relief Request 2VR-7, the licensee must submit its risk-informed criteria for NRC review and approval prior to using Section 3.7 of OMN-1 at Wolf Creek.

- c. With respect to Sections 6.4.3 and 6.4.4 of OMN-1, the licensee stated that the calculation of MOV functional margin and the determination of an allowable test interval will be performed using a controlled process, in accordance with OMN-1 and evaluated under 10 CFR 50.59. The licensee will also be expected to follow the provisions of OMN-1 in developing procedures to calculate MOV functional margin and to determine an allowable test interval. The NRC staff may review these procedures during an on-site inspection when they are available.
- d. The licensee referred to numerous plant-specific procedures that will be used in the implementation of OMN-1 at Wolf Creek. When the licensee is prepared to begin implementation of OMN-1 as part of its IST program, the NRC staff may review those procedures during an on-site inspection.

Conclusion

The NRC staff has determined that the licensee's proposed use of ASME Code Case OMN-1, together with the specified conditions, provides an acceptable level of quality and safety in assuring the operational readiness of MOVs. Therefore, the NRC staff concludes that the licensee's proposed alternative to use OMN-1 at Wolf Creek with the specified conditions is authorized pursuant to 50.55a(a)(3)(i).

The NRC staff requests that the licensee notify the NRC upon the development of procedures to calculate MOV functional margin and to determine an allowable test interval, and other procedures for implementing OMN-1, such that the NRC staff may review these procedures during an on-site inspection. Prior to the use of Section 3.7 of OMN-1 at Wolf Creek, the licensee must submit for NRC review and approval the risk-informed criteria to be used in applying risk insights in the OMN-1 program. This discussion of the application of risk insights does not affect the licensee's use of the deterministic provisions of OMN-1.

As discussed, the NRC is evaluating ASME Code Case OMN-1 for possible endorsement through rulemaking or by a regulatory guide. Relief Request 2VR-7 is approved until such time as the NRC staff's generic position on OMN-1 is issued through rulemaking or some other means. At that time, if the licensee intends to continue to implement this relief request, the licensee is to follow the provisions of OMN-1 with any limitations or conditions specified in the NRC staff endorsement of OMN-1.

Relief Request 2VR-8

The licensee proposes the use of ASME OMa-1996, Subsection ISTC 4.5, including the Mandatory Appendix II, "Check Valve Condition Monitoring Program," with certain limitations. In response to NRC staff questions during a telephone conference on June 3, 1997, the licensee submitted Revision 1 to Relief Request 2VR-8 in a letter dated September 2, 1997. The NRC is evaluating the ASME guidelines for condition monitoring programs for check valves for possible endorsement through rulemaking. However at this time, the NRC has not generically approved the use of a condition monitoring program as an alternative to ASME Code IST requirements for check valves.

Licensee's Basis for Requested Relief

The licensee provided the following basis for its proposed alternative:

ASME OMa 1998 Part 10 section 4.3.2, "Exercising Tests for Check Valves," discusses test requirements for check valves that are within the Scope statement of paragraph 1.1. The NRC and ASME have long recognized that the existing ASME Code check valve testing requirements will not typically detect degradation of performance or necessarily a check valve's ability to perform its intended function.

Certain check valves need more attention in order to determine their failure or maintenance patterns. Once these mechanisms have been analyzed, confirmed, and the valve or group of similar valves have had their performance improved, then the same level of attention is no longer needed.

Certain check valves need less attention as they have continuously exhibited acceptable operation every time they have been disassembled and examined or every time they have been non-intrusively tested. Once the reasons for their behavior have been analyzed, and confirmed, then the test, examination, and preventive maintenance activities necessary to maintain the continued acceptable performance can be optimized. Once optimized, the same level of attention is no longer needed.

The above examples demonstrate how the same types of tests and their associated intervals may need to be periodically adjusted based on their valve's performance. The ASME has developed a process that allows the Owner certain flexibility in establishing the types of test, examination, and preventive maintenance activities and their associated intervals.

ASME OMa-1996 Subsection ISTC 4.5 including the Mandatory Appendix II, "Check Valve Condition Monitoring Program," provides the equivalent or improved guidance with respect to the current check valve testing requirements set forth in ASME OMa 1988 Part 10 section 4.3.2, "Exercising Checks for Check Valves." Requirements are given for the implementation of a sample disassembly examination program. ASME OMa 1996 ISTC Mandatory Appendix II provides a methodology to optimize

testing, examination, and preventive maintenance activities. Wolf Creek Generating Station (WCGS) has an established Check Valve Reliability Improvement Program that has previously been inspected by the NRC (ref. NRC Inspection Report 50-482/94-14) and evaluated by an industry peer assessment team. The audits demonstrate the acceptability of the WCGS Check Valve Reliability Improvement Program. ASME OMa 1996 Subsection ISTC 4.5 with Mandatory Appendix II is an alternative to the current test requirements that provides an acceptable level of quality and safety.

A maximum test interval based upon current NRC and ASME guidance is specified. The maximum test interval allowed by ASME Code for relief valves is 10 years. The current maximum test interval specified for check valve disassembly is 8 years. The maximum test interval for ASME OMN-1, "Alternative Rules for Preservice and Inservice Testing of Certain Electric Motor-Operated Valve Assemblies in Light-Water Reactor Power Plants OM Code-1995, Subsection ISTC," referenced in Generic Letter 96-05, ["Periodic Verification of Design-Basis Capability of Safety-Related Motor-Operated Valves,"] is 10 years. The guidance of Generic Letter 96-05 for maximum test intervals will be used as specified below.

Licensee's Proposed Alternative Testing

The licensee proposed the following alternative testing:

Check valve testing will comply with the requirements of ASME OMa 1996 Subsection ISTC 4.5, including the Mandatory Appendix II with the following limitations:

- 1) Where the most frequently performed appropriate measure (test, examination, or preventive maintenance) interval extends beyond 60 months, performance, examination, maintenance history, and test experience from previous tests shall be evaluated to justify the periodic verification interval.
- 2) In no case shall a test or examination interval exceed 120 months.
- 3) The risk insights determined during Wolf Creek Nuclear Operating Corporation participation in the EPRI Risk-Based Inservice Testing Pilot Project (ref. EPRI TR-105869) and ongoing development of an updated risk-based categorization process based upon ASME Research guidance and Codes as applicable may be used to ensure that the testing, examination, or preventive measures taken are commensurate with each valve's safety significance.
- 4) Check valve obturator movement will be tested or examined in both the open and closed direction to ensure unambiguous detection of functionally degraded check valves. ASME OMa Code-1996 ISTC 4.5.4 will be used to determine valve obturator movement requirements.

- 5) Extensions of IST intervals will consider plant safety impact and be supported and justified by applicable methods of trending related to industry generic and plant specific experience to provide assurance that the valve is capable of performing its intended function over the entire interval.
- 6) Initial IST interval extensions of any valve must be limited to 2 fuel cycles or 3 years. Subsequent extended intervals must be limited to 1 fuel cycle per extension, up to 10 years.
- 7) If it is decided to discontinue the Condition Monitoring Program on a valve or group of valves, the testing and examination will revert back to the original ASME Code requirements.

Discussion

In Relief Request ZVR-8, the licensee indicates that the current test requirements for check valves in the IST program at Wolf Creek are contained in ASME OMa-1988 Part 10, Section 4.3.2, "Exercising Tests for Check Valves." Subsection ISTC 4.5.5, "Condition Monitoring," of ASME OMa-1996 describes the use of a condition monitoring program for check valves as an alternative to the testing or examination requirements of ISTC 4.5.1 through ISTC 4.5.4 of the Code. At this time, the NRC regulations in 10 CFR 50.55a reference the 1989 Edition of Section XI of the ASME Boiler and Pressure Vessel Code. Rulemaking to reference a later edition and addenda of the ASME Code is ongoing, but will not be completed for some time. Therefore, the licensee must justify relief from the requirements of the latest NRC-endorsed edition of the Code to implement its proposed program for check valves.

The licensee commits to the provisions of Appendix II, "Check Valve Condition Monitoring Program," of ASME OMa-1996 for implementing and maintaining its condition monitoring program. Appendix II specifies that an analysis be performed of the test and maintenance history of a valve or group of valves in order to establish the basis for specifying the inservice testing, examination, and preventive maintenance activities. The analysis includes identification of any common failure or maintenance patterns, and review of these patterns to determine their significance and to identify potential failure mechanisms. If sufficient information is not currently available to complete the required analysis, Appendix II specifies activities to be performed at sufficient intervals over an interim period of the next 5 years or two refueling outages (whichever is less) to determine the cause of the failure or the maintenance patterns. If sufficient information is available to assess the performance adequacy of the check valve or the group of check valves, Appendix II directs that the applicable preventive maintenance, examination, and test activities and appropriate interval be identified for each valve in the group. Appendix II specifies that the results of each activity be reviewed to determine if any changes to the program are required. If corrective maintenance is performed on a check valve, Appendix II specifies that the analysis used to formulate the basis for the program be reviewed to determine if any changes are required. Appendix II directs that the program be documented to include specific information.

In Revision 1 of Relief Request ZVR-8 (dated September 2, 1997), the licensee describes the limitations on its use of the provisions of Appendix II of ASME OMa-1996 in its IST program for check valves at Wolf Creek. These limitations are summarized as follows: (1) where the most frequently performed appropriate measure extends beyond 60 months, performance, examination, maintenance history, and test experience from previous tests shall be evaluated to justify the periodic verification interval; (2) the test or examination interval shall not exceed 120 months; (3) risk insights from other activities may be used to ensure that the testing, examination, or preventive measures taken are commensurate with each valve's safety significance; (4) check valve obturator movement will be tested or examined in both the open and closed direction to ensure unambiguous detection of functionality degraded check valves; (5) extensions of IST intervals will consider plant safety impact and be supported and justified by applicable methods of trending to provide assurance that the valve is capable of performing its intended function over the entire interval; (6) initial IST interval extensions of any valve must be limited to two fuel cycles or 3 years, and subsequent extended intervals must be limited to one fuel cycle per extension, up to 10 years; and (7) if the Condition Monitoring Program is discontinued, the testing and examination will revert back to the original ASME Code requirements.

With one clarification, the provisions of Appendix II of ASME OMa-1996 together with these specified limitations provide a reasonable basis to ensure that potential check valve degradation is adequately identified and addressed, and that the operational readiness of the check valves is assured. The clarification relates to the licensee's reference to the use of risk insights to ensure that the testing, examination, or preventive measures taken are commensurate with each valve's safety significance. The NRC staff is working with the nuclear industry and standard-writing organizations to develop generic guidance for the application of risk insights in IST programs. Until such time as the NRC issues or endorses such generic guidance, the NRC will not accept the use of risk-informed criteria without prior review and approval by the NRC staff. If the licensee intends to apply risk-informed criteria as part of Relief Request ZVR-8, the licensee must submit those criteria for NRC review and approval prior to their use in the check valve condition monitoring program at Wolf Creek.

In its relief request, the licensee refers to the provisions of ASME Code Case OMN-1 regarding maximum test intervals for MOVs. The guidance in OMN-1 was developed specifically with respect to the long-term MOV performance. Test programs for other components used in nuclear power plants, such as check valves, must be justified by licensees. In this instance, the NRC staff considers the licensee to have specifically justified its request to establish a condition monitoring program for check valves in the IST program at Wolf Creek. The NRC staff may review the plant procedures for implementing the condition monitoring program during an on-site inspection.

Conclusion

The NRC staff has determined that the licensee's proposed development of a condition monitoring program for check valves following the provisions of ASME OMa-1996 Subsection ISTC 4.5 and Appendix II, together with the specified conditions, provides an acceptable level of quality and safety in assuring the operational readiness of check valves within the scope of the IST program at Wolf Creek. Therefore, the NRC staff concludes that the licensee's proposed alternative to the requirements of ASME OMa-1988 Part 10 Section 4.3.2 is authorized pursuant to 50.55a(a)(3)(i).

The NRC staff requests that the licensee notify the NRC upon the development of plant procedures for implementing the condition monitoring program so that the NRC staff may review these procedures during an on-site inspection. Further, the licensee must submit any risk-informed criteria to be applied in its check valve condition monitoring program for NRC review and approval prior to their use at Wolf Creek. This discussion of the application of risk insights does not affect the licensee's use of the deterministic provisions of the ASME guidelines for a check valve condition monitoring program.

As discussed, the NRC staff is evaluating the ASME guidelines for a condition monitoring program for check valves for possible endorsement through rulemaking. Relief Request 2VR-8 is approved until such time as the NRC staff's generic position on the ASME guidelines for a check valve condition monitoring program is issued through rulemaking or some other means. At that time, if the licensee intends to continue to implement this relief request, the licensee is to follow the ASME guidelines for a check valve condition monitoring program with any limitations or conditions specified in the NRC staff endorsement of those guidelines.

3.0 CONCLUSION

The NRC staff concludes that Relief Requests 2VR-7 and 2VR-8 are authorized pursuant to 50.55a(a)(3)(i) based on the determination that the licensee's proposed alternatives, together with the conditions described herein, provide an acceptable level of quality and safety.

The NRC staff requests that the licensee notify the NRC upon the development of plant procedures to implement ASME Code Case OMN-1 and the check valve condition monitoring program. Following such notification, the NRC staff may review the procedures during an on-site inspection prior to implementation of these alternative MOV and check valve programs at Wolf Creek. With respect to any risk-informed criteria that the licensee intends to apply in implementing ASME Code Case OMN-1 or the check valve condition monitoring program, the licensee must submit those criteria for NRC review and approval prior to their use at Wolf Creek. Draft Regulatory Guide DG-1062 dated March 14, 1997, "An Approach for Plant Specific, Risk-Informed, Decision Making: Inservice Testing," provides staff guidance and risk-informed criteria that may be used

in implementing ASME Code Case OMN-1 or the check valve condition monitoring program. This discussion of the application of risk insights does not affect the licensee's use of the deterministic provisions of ASME Code Case OMN-1 or the ASME guidelines for a check valve condition monitoring program.

As discussed, the NRC is evaluating ASME Code Case OMN-1 and the ASME guidelines for a check valve condition monitoring program for possible endorsement through rulemaking or by a regulatory guide. Relief Requests 2VR-7 and 2VR-8 are approved until such time as the NRC staff's generic positions on OMN-1 and the ASME guidelines for a check valve condition monitoring program, respectively, are issued through rulemaking or some other means. At that time, if the licensee intends to continue to implement Relief Request 2VR-7 or 2VR-8, the licensee is to follow the provisions of OMN-1 or the ASME guidelines for a check valve condition monitoring program, respectively, with any limitations or conditions specified in the NRC staff endorsement of those ASME documents.

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