July 17, 2003

Mr. David L. Wilson
Site Vice President
Monticello Nuclear Generating Plant
Nuclear Management Company, LLC
2807 West County Road 75
Monticello, MN 55362-9637

SUBJECT: MONTICELLO NUCLEAR GENERATING PLANT — EVALUATION OF RELIEF REQUEST NOS. PR-01, PR-02, PR-03, PR-04, PR-05, AND VR-02 RELATED TO THE FOURTH 10-YEAR INTERVAL INSERVICE TESTING PROGRAM (TAC NO. MB6807)

Dear Mr. Wilson:

The Nuclear Management Company, LLC's (NMC's), letter of November 22, 2002, as supplemented May 15 and 30, 2003, submitted pump Relief Request Nos. PR-01, PR-02, PR-03, PR-04, and PR-05, and valve Relief Request Nos. VR-01 and VR-02 requesting relief from certain requirements of the American Society of Mechanical Engineers *Code for Operation and Maintenance of Nuclear Power Plants* (ASME OM Code). These requests apply to the fourth 10-year interval of the inservice testing plan for the Monticello Nuclear Generating Plant.

The NRC staff evaluated NMC's requests and concludes that the proposed alternatives specified in Relief Requests PR-01, PR-03, and PR-05 provide reasonable assurance of operational readiness of the pumps. The NRC staff authorizes the proposed alternatives pursuant to 10 CFR 50.55a(a)(3)(ii) on the basis that compliance with the ASME OM Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The NRC staff also authorizes the alternatives proposed in Relief Requests PR-02 and PR-04 pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that they provide an acceptable level of quality and safety. The NRC staff further grants the relief requested in Relief Request VR-02 pursuant to 10 CFR 50.55a(f)(6)(i) based on the impractically of performing testing in accordance with the ASME OM Code requirements.

The reliefs are authorized for the fourth 10-year interval of the inservice testing plan.

The NRC staff is evaluating Relief Request VR-01 separately.

Enclosed is our safety evaluation.

Sincerely,

/RA/

L. Raghavan, Chief, Section 1
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-263

Enclosure: Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST NOS. PR-01, PR-02, PR-03, PR-04, PR-05, AND VR-02

RELATED TO THE FOURTH 10-YEAR INSERVICE TESTING PROGRAM

NUCLEAR MANAGEMENT COMPANY, LLC

MONTICELLO NUCLEAR GENERATING PLANT

DOCKET NO. 50-263

1.0 INTRODUCTION

The Nuclear Management Company, LLC's (NMC's), letter of November 22, 2002, submitted pump Relief Request Nos. PR-01, PR-02, PR-03, PR-04, and PR-05, and valve Relief Request Nos. VR-01 and VR-02 requesting relief from certain requirements of the American Society of Mechanical Engineers *Code for Operation and Maintenance of Nuclear Power Plants* (ASME OM Code), 1995 edition including 1996 addenda. The request applied to the fourth 10-year interval of the inservice testing (IST) plan for the Monticello Nuclear Generating Plant. NMC's letters of May 15, and May 30, 2003, provided additional information for Relief Request Nos. PR-03 and PR-04, respectively, in response to NRC requests for additional information.

In a phone call between NRC and NMC staff on May 20, 2003, NMC said it would revise Relief Request VR-01 to include an alternative to testing check valve function in both the open and closed directions and resubmit the request to the NRC. Accordingly, the NRC is not evaluating Relief Request VR-01 in this safety evaluation. Descriptions of the evaluated relief requests follow.

Relief Request PR-01

NMC proposed measuring changes in the level of liquid in a test tank over time to determine the flow rate of standby liquid control (SBLC) system pumps P-203A and P-203B. This is in lieu of installing a rate or quantity meter in the pump test circuits as paragraph ISTB 4.7.5 of the ASME OM Code requires, and measuring certain quantities as paragraph ISTB 5.6.3 of the ASME OM Code requires.

Relief Request PR-02

NMC proposed using existing instrumentation to measure test parameters for pumps in the residual heat removal (RHR) and RHR service water (RHRSW) systems. This is in lieu of meeting flow instrumentation range requirements as paragraph ISTB 4.7.1(b)(1) of the ASME OM Code requires.

Enclosure

Relief Request PR-03

NMC proposed using a vibration alert limit of 0.50 inches/second (in/sec) for horizontal vibration data points of high pressure coolant injection (HPCI) pump P-209 in lieu of meeting the requirements in Table ISTB 5.2.1-1 and paragraph ISTB 6.2.1 of the ASME OM Code.

Relief Request PR-04, Revision 1

NMC proposed using existing instrumentation, along with temporary instruments, to determine differential pressure for HPCI pump P-209 and reactor core isolation cooling (RCIC) pump P-207. This is in lieu of meeting the pressure instrumentation range requirements specified in paragraph ISTB 4.7.1(b)(1) of the ASME OM Code.

Relief Request PR-05

NMC proposed using a frequency response range of 4 to 1000 Hz (Hertz) for vibration measurement on SBLC pumps P-203A and P-203B in lieu of the requirements in paragraph ISTB 4.7.1(f) of the ASME OM Code.

Relief Request VR-02

NMC proposed using an alternative method as specified in paragraph ISTC 4.2.3 to demonstrate disk movement during inservice testing of RHRSW valves CV-1728 and CV-1729. This is in lieu of meeting the requirements in paragraphs ISTC 4.2.4, 4.2.8, and 4.2.9 of the ASME OM Code.

2.0 REGULATORY EVALUATION

Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a, requires that IST of certain ASME Code Class 1, 2, and 3 pumps and valves be performed in accordance with the ASME OM Code and applicable addenda, except where alternatives have been authorized or relief has been requested by the licensee and granted by the Commission pursuant to 10 CFR 50.55a(a)(3)(i), 10 CFR 50.55a(a)(3)(ii), and 10 CFR 50.55a(f)(6)(i). In proposing alternatives or requesting relief, the licensee must demonstrate that: (1) the proposed alternatives provide an acceptable level of quality and safety; (2) compliance would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety; or (3) conformance is impractical for the facility. The regulation at 10 CFR 50.55a authorizes the Commission to approve alternatives and to grant relief from ASME Code requirements upon making necessary findings. NRC guidance contained in Generic Letter (GL) 89-04, "Guidance on Developing Acceptable Inservice Testing Programs," provides alternatives to ASME Code requirements which are acceptable. Further guidance is given in GL 89-04, Supplement 1, and NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants."

NMC is required to meet the requirements of the 1995 edition including the 1996 addenda of the ASME OM Code for pump and valve IST for its fourth 10-year IST interval program. Subsection ISTB, "Inservice Testing of Pumps in Light-Water Reactor Power Plants," of the ASME OM Code provides the requirements for IST of pumps. Subsection ISTC, "Inservice Testing of Valves in Light-Water Reactor Power Plants," of the ASME OM Code provides the requirements for IST of valves. The ASME OM Code replaces specific requirements in previous editions of the ASME *Boiler and Pressure Vessel Code,* Section XI, Subsections IWP and IWV for pumps and valves, respectively. Monticello's fourth 10-year IST interval began June 1, 2003, and ends May 31, 2012.

3.0 TECHNICAL EVALUATION

3.1 Relief Request PR-01

3.1.1 ASME OM Code Requirements

Paragraph ISTB 4.7.5 of the ASME OM Code specifies that a rate or quantity meter shall be installed in the pump circuit when measuring flow rate. Paragraph ISTB 5.6.3 requires that each pump shall be run at least 2 minutes as the system permits after pump conditions are stable. At least one measurement, or a determination of each of the quantities required by Table ISTB 4.1-1, shall be made and recorded at the end of this time.

3.1.2 Specific Relief Requested

NMC requested relief from having to install a rate or quantity meter in the pump test circuits as paragraph ISTB 4.7.5 of the ASME OM Code requires, and measuring certain quantities as paragraph ISTB 5.6.3 of the ASME OM Code requires.

3.1.3 Basis for Relief

Positive displacement SBLC pumps P-203A and P-203B are designed to pump a constant flow rate regardless of system resistance. In its November 22, 2002, letter, NMC states that the SBLC system was not designed with a flow meter in the flow loop. Rather, the system was designed to be tested using a test tank where the change in level can be measured over time. This test methodology also limits the pump run time based on the size of the test tank.

NMC considers the ASME OM Code requirements to use flow rate instrumentation and a 2-minute test duration to be a burden that would result in a hardship without a corresponding increase in the level of quality or safety. Accordingly, NMC requested relief in accordance with 10 CFR 50.55a(a)(3)(ii). On July 6, 1993, the NRC staff authorized NMC's proposed alternative for a similar relief request for its previous 10-year interval IST program.

3.1.4 Alternative Examinations

As an alternative to the ASME OM Code requirements of paragraphs ISTB 4.7.5 and ISTB 5.6.3, NMC proposed measuring changes in the level of liquid in a test tank over time to determine the flow rate of SBLC system pumps P-203A and P-203B. NMC will start the pumps taking suction from the condensate storage system and discharging to the test tank. The test tank level is approximately the same at the beginning of each test to ensure repeatability. After approximately 2 minutes of operation, NMC will stop the pump and use the following formula convert the change in level over the measured time to flow rate:

$Q\ (GPM) = \Psi \Delta L\ (inches) / \Delta t\ (seconds)$

Where Ψ is a constant which reflects tank dimensions and unit conversions, and ΔL is the measured change in liquid level in the tank.

The vibration testing will be performed while recirculating an adequately filled test tank. Therefore, the duration of ASME OM Code test requirements for vibration testing will be met.

3.1.5 NRC Staff Evaluation of Relief Request No. PR-01

The ASME OM Code requires measuring pump flow rate in order to determine the extent of any pump degradation. A 2-minute run time is required by the ASME OM Code to achieve stable pump performance parameters before data are recorded during the test. There is currently no installed flow instrumentation to record the pump flow rate. Also, the size of the test tank does not guarantee that the pump will run a minimum of 2 minutes before data are taken even if flow instrumentation was available. Requiring NMC to install a larger test tank to facilitate pump testing would be a burden because of the design, fabrication, and installation changes that would have to be made.

NMC proposed determining flow rate by measuring the change in tank level over time, and calculating an average flow rate into the test tank. The change in flow resistance due to the rising test tank level will be small in comparison with the pump discharge pressure. Thus, this will have no significant effect on the test results. Repeatable results can be achieved, provided the tank level at the beginning of each test is about the same. In addition, the suction source (from the condensate storage system) is from a large source at a constant pressure. This allows pump performance parameters to stabilize quickly. NMC will maintain the record for the test method used as required by paragraph ISTB 4.7.5 of the ASME Code. This method gives reasonable assurance of pump operational readiness when the test tank test level is measured in accordance with the accuracy requirements of Table ISTB 4.7.1-1 of the ASME Code, and the record includes the method used. Implementing procedures must include the calculation method and any test conditions required to achieve this accuracy. Therefore, the proposed alternative provides reasonable assurance of pump operational readiness.

3.1.6 Conclusion

As previously mentioned, NMC's proposed alternative provides reasonable assurance of operational readiness of SBLC system pumps P-203A and P-203B. Based on the above, and pursuant to 10 CFR 50.55a(a)(3)(ii), the NRC staff authorizes the proposed alternative to the requirements of the ASME OM Code, paragraphs ISTB 4.7.5 and ISTB 5.6.3, for flow rate measurement during testing of SBLC system pumps P-203A and P-203B using a tank level calculation method. The basis for this is that complying with the specified ASME OM Code requirements results in a hardship without a compensating increase in the level of quality and safety.

3.2 Relief Request No. PR-02

3.2.1 ASME OM Code Requirements

Paragraph ISTB 4.7.1(b)(1) of the ASME OM Code specifies that the instrument range of analog flow instrumentation shall not exceed three times the reference value.

3.2.2 Specific Relief Requested

NMC proposed using existing instrumentation to measure test parameters for RHR pumps P-202A/B/C/D and RHR service water pumps P-109A/B/C/D.

3.2.3 Licensee's Basis for Relief (as stated)

Flow transmitters FT-10-111A, FT-10-111B, FT-10-97A, and FT-10-97B are each designed to indicate flow while two parallel pumps are operating (RHR or RHRSW). During In-Service testing, only one pump operates at a time. The resulting reference value of flow for one pump is less than one-third of the instrument's range. The installed flow transmitters have typically had as-found accuracy of about 0.25% of full-scale. In addition, the system is verified to have an as-found accuracy that is within 2% of the [ASME OM] Code allowed reference value for analog instruments.

The current relevant data for the instruments is as follows:

Instruments	Pumps	Instrument Span (Range)	Equivalent Reference Value	Range to Reference Value Ratio
FT-10-111A	P-202A P-202C	4-20 mA [milliamp]	6.4 mA	(16/2.4) = 6.67
FT-10-111B	P-202B P-202D			
FT-10-97A	P-109A P-109C	10-50 mA	18.37 mA	(40/8.37) = 4.78
FT-10-97B	P-109B P-109D		18.57 mA	(40/8.57) = 4.67

NOTE 1: The transmitters FT-10-111A, FT-10-111B, and FT-10-97A output signal is read on a mV display with the pump test procedures specifying a reference target range that correspond one to one mV [millivolt] to mA. The transmitter FT-10-97B output signal is converted from a 10-50 mA range to a 4-20 mA range via FY-4105, RHR SERVICE WATER FLOW ISOL[ATION], and read on a mV display with the pump test procedures specifying a reference target range that corresponds one to one mV to mA of the converted signal range. The equivalent reference value is the center of this reference flow signal range and is in mA. Dividing the transmitter range by the

equivalent reference mA value shows the instrument range to exceed the reference value by more than a factor of 3.

NOTE 2: FY-4105 output equivalent reference value is 7.43 mA. Thus the range to reference value ratio is also (16/3.43) = 4.67 when taken at the FY-4105 output which is equivalent to the (40/8.57) = 4.67 at FT-10-97B output.

3.2.4 Alternative Examinations

NMC's letter of November 22, 2002, states that it proposes to use existing station instruments to measure pump inservice test parameters. NMC proposes to perform a loop check on the flow instrumentation for these systems that varies the as-found accuracy to within the 2-percent accuracy requirement in Table ISTB 4.7.1-1 of the ASME OM Code, and within the range required of three times the reference value of any RHR or RHRSW pump. NMC will complete this as part of a routine calibration task.

3.2.5 Evaluation of Relief Request No. PR-02

NMC states that the alternative testing provides an acceptable level of quality and safety because the variance of flow instrumentation is within the maximum variance allowed in Table ISTB 4.7.1-1, and will ensure the intent of the ASME OM Code is met. Accordingly, NMC requested NRC staff to authorize NMC's proposed alternative pursuant to 10 CFR 50.55a(a)(3)(i). The NRC staff authorized a similar relief request for Monticello on July 6, 1993, for its previous 10-year interval IST program.

NMC's letter of November 22, 2002, states that the installed flow transmitters typically have an as-found accuracy of 0.25 percent of full scale. In addition, NMC stated that the system is verified to have an as-found accuracy that is within 2 percent of the ASME OM Code-allowed reference value for analog instruments. ASME OM Code paragraph ISTB 4.7.1(b)(1) requires that the full-range of each instrument be no greater than three times the reference value. Therefore, combining these two requirements results in an effective accuracy of ± 6 percent (3 x 2 percent) of the reference values.

The following table shows the ranges, reference values, range to reference value ratio, and calculated effective accuracies for instruments FT-10-111A/B and FT-10-97A/B. The calculated effective instrument accuracies are much less than the required effective accuracy of ± 6 percent. Therefore, these instruments yield readings at least equivalent to the reading achieved from instruments that meet ASME OM Code requirements (i.e., up to ± 6 percent) and, thus, provide an acceptable level of quality and safety.

Instruments	Pumps	Instrument Range	Reference Value	Range to Reference Value Ratio	Effective Accuracies with ± 0.25 percent Instrument Accuracy
FT-10-111A	P-202A P-202C	16 mA	(6.4 - 4) = 2.4 mA	(16/2.4) = 6.67	(6.67 x 0.25%) = ± 1.67%
FT-10-111B	P-202B P-202D		(6.4 - 4) = 2.4 mA	(16/2.4) = 6.67	(6.67 x 0.25%) = ± 1.67%
FT-10-97A	P-109A P-109C	40 mA	(18.37- 10) = 8.37 mA	(40/8.37) = 4.78	(4.78 x 0.25%) = ± 1.2%
FT-10-97B	P-109B P-109D		(18.57 -10) = 8.57 mA	(40/8.57) = 4.67	(4.78 x 0.25%) = ± 1.2%

3.2.6 Conclusion

Based on the above, the NRC staff authorizes NMC's proposed alternative to the ASME OM Code requirements pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that the alternative provides an acceptable level of quality and safety. This authorization does not apply to digital instrumentation.

3.3 Relief Request PR-03

3.3.1 ASME OM Code Requirements

Table ISTB 5.2.1-1 of the ASME OM Code requires a comprehensive pump test vibration alert limit of 0.325 in/sec. Paragraph ISTB 6.2.1 specifies that if the measured values fall within the alert range of Table ISTB 5.2.1-1, as applicable, the frequency of testing specified in paragraph ISTB 5.1 shall be doubled until the cause of the deviation is determined and the condition is corrected.

3.3.2 Specific Relief Requested

NMC requested relief from performing the ASME OM Code requirements of ISTB Table 5.2.1-1 and paragraph ISTB 6.2.1 for HPCI pump P-209.

3.3.3 Licensee's Basis for Relief (as stated)

> The HPCI pump consists of a centrifugal main pump, a separate centrifugal booster pump, a speed reducing gear for the booster pump, and a Terry turbine steam driver. All these components are mounted horizontally along the same drive train. Therefore, there are four independently balanced and aligned rotating assemblies that are coupled together. As a result, the normal (baseline) vibration readings in the horizontal direction on the main pump is approximately 0.415 in/Sec. Application of a 0.325 in/Sec alert limit would require MNGP [Monticello Nuclear Generating Plant] to enter accelerated test frequency each time the pump was tested because one or more of these points measured would exceed this limit.

Prior to its third ten-year interval, the alert limit of 0.325 in/Sec was not a [ASME OM C]ode requirement at Monticello. MNGP has many years of In-Service test data showing that baseline vibrations at 0.415 in/Sec represent acceptable pump operation and that vibration levels have not trended up. MNGP had these vibration levels were analyzed by an Engineering Consultant that specializes in vibration analysis. The analysis showed that this pump can operate at vibration levels up to 0.700 in/Sec.

EPIX [Equipment Performance and Information Exchange] and NPRDS [Nuclear Plant Reliability Data System] (Jan 1, 1991 to present) component history was reviewed for this type of pump. No failure attributed to extended hours of pump operation at vibration levels exceeding 0.325 in/Sec were found. Implementing the alert limit of 0.325 in/Sec would require MNGP to constantly have the HPCI pump on accelerated test frequency. This would result in [performing] an annual comprehensive pump In-Service test [annually] instead of biennial[ly as required by the ASME OM Code]. The intent of increased test frequency is to closely monitor a pump that is deteriorating from its baseline values. In this case, the pump would be operating at its normal vibration range and no change [expected degradation] would be seen. The additional annual test would require a significant amount of time and resources and only create additional maintenance due to normal wear of the system. Modifications to try and reduce the vibration levels, such as installing new shafts and impellers, are extremely expensive and may not reduce the vibration levels. Therefore, requiring an alert limit of 0.325 in/Sec on the HPCI pump is an extreme hardship without a compensating increase in public safety [the level of quality and safety]. An appropriate alert limit for these vibration data points is 0.500 in/Sec. This is based on previous test history, a review of industry data and the vibration analysis performed.

3.3.4 Alternative Examinations

NMC proposes, as an alternative to the ASME OM Code requirements of Table ISTB 5.2.1-1, a vibration alert limit of 0.500 in/sec for pump horizontal vibration data points. NMC is not proposing to change the vibration requirement in Table ISTB 5.2.1-1 for the required action limit of 0.700 in/sec.

3.3.5 NRC Staff Evaluation of Relief Request No. PR-03

NMC requested relief from the specified ASME OM Code requirements pursuant to 10 CFR 50.55a(a)(3)(ii) on the basis that complying with these requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The NRC staff authorized a similar relief for Monticello on September 9, 1994, for its previous 10-year IST interval.

HPCI pump P-209 at Monticello consists of a main pump and booster pump with a speed-reducing gear driven by a common steam turbine. Because of this configuration, both pumps must be tested simultaneously. NMC's letter of November 22, 2002, states that because of this combination, high vibration levels are recorded at the main and booster pump bearings of both pumps. NMC characterized this high bearing vibration level as the normal vibration level of the HPCI pump bearings. Therefore, NMC stated that complying with the ASME OM Code requirements for HPCI pump P-209 would be a hardship without a compensating increase in level of quality and safety.

ASME OM Code paragraph ISTB 6.2 specifies that if pump vibration velocity levels exceed the alert range of 0.325 in/sec of Table ISTB 5.2.1-1, the testing frequency shall be doubled until the problem with the pump is determined and corrective action taken. The ASME OM Code also uses vibration reference values to determine vibration limits, or institutes absolute alert and required action range limits for centrifugal pumps regardless of the magnitude of the vibration reference value.

NMC proposed raising the alert-range horizontal vibration limit for the HPCI pump P-209 bearings to 0.500 in/sec. The alert range for the axial and vertical vibration components would remain at 0.325 in/sec. NMC stated that the vibration levels of HPCI pump bearings have historically run at velocity vibration levels above 0.325 in/sec. NMC submitted bearing vibration data in its supplemental letter of May 15, 2003. This data, plotted in Figures 1 through 4 (attached to this safety evaluation), provides recorded test data for all four HPCI main and booster pump bearings from the period from June 1994 through December 2002, and similar results were found.

The test data shows that horizontal components of vibration for all four HPCI pump bearings are near or above the ASME OM Code alert range. In several instances, the vibration levels have exceeded the ASME OM Code limit of 0.325 in/sec, whereas most of the time vibration level stayed below NMC's proposed alert limit of 0.5 in/sec. In two instances (see Figure 1 data on October 24 and October 26, 1994), the horizontal vibration levels at point 3-H were recorded above the required action range.

After finding the vibration level above the alert range, NMC declared the HPCI pump inoperable, initiated a condition report, and evaluated the data to determine the cause of the high vibration. The results indicated that the conditions were attributed to a turbine-speed oscillation and an inaccurately measured reading. NMC corrected the problem with the speed control and associated instruments, and re-performed the pump vibration measurement on October 27, 1994. The vibration data obtained was within ASME OM Code requirements and proposed limits of 0.50 in/sec.

NMC searched the EPIX and NPRDS databases and found no recorded pump failures attributed to extended hours of pump operation at extended bearing vibration above 0.325 in/sec. The pump manufacturer reviewed NMC's proposed alternative range and concluded that vibration levels which fall in the range of 0.325 in/sec to 0.500 in/sec do not require corrective action. In addition, NMC's vibration consultant reviewed the vibration data for these HPCI pumps and concluded that the HPCI pumps could operate at vibration levels up to 0.700 in/sec.

NMC's evaluation of the HPCI pump vibration issue, coupled with the historical pump vibration data, show that HPCI pump P-209 normally runs at high levels of vibration and has not experienced any failure to date. Requiring NMC to meet the ASME OM Code requirements by increasing the frequency of the HPCI pump testing would result in hardship without a compensating increase in the level of quality and safety. This is because of the additional testing that would need to be performed on a pump that adequately operates at elevated vibration levels. The proposed testing provides reasonable assurance of operational readiness because NMC will continue to test HPCI pump P-209 quarterly, and will maintain the ASME OM Code alert ranges for axial and vertical components of vibration. Also, NMC will adhere to the required action range as stated in the ASME OM Code.

3.3.6 Conclusion

As previously mentioned, NMC’s proposed alternative provides reasonable assurance of operational readiness of HPCI pump P-209. Based on the above, the NRC staff authorizes NMC’s proposed alternative pursuant to 10 CFR 50.55a(a)(3)(ii) on the basis that complying with the specified requirements results in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

3.4 Relief Request PR-04, Revision 1

3.4.1 Code Requirements

Paragraph ISTB 4.7.1(b)(1) of the ASME OM Code specifies that analog instrument range shall not exceed three times the reference value.

3.4.2 Specific Relief Requested

In Relief Request PR-04, Revision 1, dated May 30, 2003, NMC requested relief from performing the ASME OM Code requirements of paragraph ISTB 4.7.1(b)(1) for instruments PI-23-116, PT-23-100, and PI-13-66 which are used to determine differential pressure for HPCI pump P-209 and RCIC pump P-207.

3.4.3 Licensee’s Basis for Relief (as stated)

> The differential pressure for the HPCI and RCIC pumps is determined by subtracting the indicated suction pressure from the indicated discharge pressure. The HPCI pump suction pressure is read in the Control Room from instrument PI-23-116, which is sent a 10 to 50 mAmp [milliamp] signal from local transmitter PT-23-100. The RCIC pump suction pressure is read locally from instrument PI-13-66. The current instrument ranges exceed three times the current reference values. The relevant data for the instruments is as follows.

Instrument	Pump	[Instrument] Range	Reference [Value]	[Range to Reference Value] Ratio
PI-23-116 (See NOTE 1)	P-209	30“ Hg — 100 PSI (pound per square inch)	33.7 PSI	114.7/33.7 = 3.4
PT-23-100 (See NOTE 2)	P-209	10 — 50 mAmps	11.8 mAmps	40/11.8 = 3.4
PI-13-66 (See NOTE 1)	P-207	30“ Hg — 100 PSI	33.7 PSI	114.7/33.7 = 3.4

> NOTE 1: The vacuum range for the pressure indicators was converted to PSI for determining the ratio. 30" HG Vacuum = 14.7 PSI; thus the range = 100 + 14.7 PSI. The same principle was applied to the reference value. With a reference value of 19 PSI indicated on the instrument, the reference value used for the ratio determination is 19 + 14.7 = 33.7 PSI.

NOTE 2: The pressure transmitter has a 10 to 50 mAmp range, or a span of 40 mAmps. The ratio for this instrument must be determined by reducing the reference value to its value on the 40 mAmp span.

Group A and B Tests: In accordance with ISTB 4.7.1(b)(1), NMC proposes to apply three times the reference value for determination of the [ASME OM] [C]ode equivalent range for the instruments(s). The ± 2 % [ASME OM C]ode allowable instrument accuracy (see ISTB 4.7.1(a)) for Group A and B Tests is then determined from this [ASME OM] [C]ode equivalent range as described below:

Instrument	Reference Value [RV]	Code Equivalent Range [3 x RV]	± 2 % of Code Equivalent Range
PI-23-116	33.7 psi	3 x 33.7 = 101 psi	[101 x 0 .02] = ± 2 psi
PT-23-100*	21.8 mAmps	3 x 11.8 = 35.4 mAmps	[35.4 x 0.02] = ± 0.7 mAmps
PI-13-66	33.7 psi	3 x 33.7 = 101 psi	[101 x 0.02] = ± 2 psi

* 21.8 mAmps equates to 11.8 mAmps on the 40 mAmp span [range of transmitter].

The as-found data in the calibration history for these instruments shows that they have been consistently well within these current [ASME OM] [C]ode [equivalent tolerances].

Comprehensive Tests: The full-scale range of pressure transmitter PT-23-100 is approximately 3.4 times the reference value, which is greater than the ISTB 4.7.1(b)(1) requirements of 3 times the reference value.

Therefore, NMC proposes that the instrument accuracy requirements (see ISTB 1.3) of ISTB 4.7.1(a) be demonstrated by determining the loop accuracy using both temporary and in-plant installed instrumentation (PT-23-100).

The as-found data in the calibration history for these instruments shows that [they have] consistently been well within the current ASME OM Code[-equivalent tolerances].

3.4.4 Alternative Examinations

NMC's proposed alternatives to the ASME OM Code requirements of paragraph ISTB 4.7.1(b)(1) as described below.

Group A and B Tests: NMC will calibrate instruments PI-23-116, PT-23-100, and PI-13-66 to ± 2 percent of the ASME OM Code-equivalent range for Group A and B tests. The Code-equivalent range will be calculated by multiplying the current test parameter reference value by three.

Comprehensive Tests: NMC will demonstrate the instrument accuracy requirements of paragraph ISTB 4.7.1(a) by determining the loop accuracy using both temporary and in-plant installed instrumentation (PT-23-100).

3.4.5 NRC Staff Evaluation of Relief Request No. PR-04

NMC's letter of November 22, 2002, requested relief pursuant to 10 CFR 50.55a(a)(3)(i) on the basis of the proposed alternative providing an acceptable level of quality and safety. The NRC staff previously authorized a similar relief to Monticello on December 8, 1994.

The ASME OM Code requirements for full-scale range of analog instruments, coupled with the accuracy requirements, are intended to ensure that the readings themselves do not mask degrading conditions of the tested pump. Table ISTB 4.7.1-1 of the ASME OM Code specifies required instrument accuracy. The required accuracy of pressure instruments for Group A and B tests is ± 2 percent, whereas, for the Comprehensive Pump Test it is ± ½ percent. NMC's letter of May 30, 2003, indicated it would determine instrument accuracy requirements as explained below.

Group A and B Tests: Combining the full-scale range and accuracy requirements results in an accuracy of the value read ± 6 percent (3 x RV ± 2 percent). The two pressure indicators and the one pressure transmitter in the HPSI and RCIC systems exceed the full-scale range requirements of the ASME OM Code paragraph ISTB 4.7.1(b)(1). The two pressure indicators are calibrated to an accuracy of ± 2 psi. The pressure transmitter is calibrated to ± 0.7 mA. The ± 2 percent ASME OM Code instrument accuracy requirement equates to ± 2 psi for the pressure indicator and ± 0.7 mA for the pressure transmitter. The reading given by currently installed instrumentation results in the actual variance having a value essentially equal to the maximum variance in the reading allowed by the ASME OM Code. Therefore, the installed instrumentation has sufficient accuracy because the variance in test results is essentially equal to the variance allowed if the ASME OM Code requirements are met. Therefore, these instruments yield readings at least equivalent to the readings achieved from instruments that meet ASME OM Code requirements (i.e., up to ± 6 percent) and, thus, provide an acceptable level of quality and safety.

Comprehensive Pump Test: The combination of the full-scale range and accuracy requirements results in an accuracy of the value read ± 1.5 percent (3 x RV ± ½ percent). The two pressure indicators and the one pressure transmitter in the HPSI and RCIC systems exceed the full-scale range requirements of ASME OM Code paragraph ISTB 4.7.1(b)(1). NMC states that instrument accuracy requirements of the ASME OM Code will be demonstrated by determining the loop accuracy using both temporary and in-plant installed instrumentation. Therefore, these instruments yield readings at least equivalent to the reading achieved from instruments that meet ASME OM Code requirements (i.e., up to ± 1.5 percent) and, thus, provide an acceptable level of quality and safety.

3.4.6 Conclusion

The NRC staff authorizes NMC's proposed alternatives to the ASME OM Code pursuant to 10 CFR 50.55a(a)(3)(i) based on the alternatives providing an acceptable level of quality and safety. This authorization does not apply if the instruments are digital.

3.5 Relief Request No. PR-05

3.5.1 ASME OM Code Requirements

Paragraph ISTB 4.7.1(f) of the ASME OM Code requires that the frequency response range of the vibration measuring transducers and their readout system shall be from one-third minimum pump shaft rotational speed to at least 1000 Hz.

3.5.2 Specific Relief Requested

NMC requested relief from the ASME OM Code requirements of paragraph ISTB 4.7.1(f) for SBLC pumps P-203A and P-203B.

3.5.3 Licensee's Basis for Relief (as stated)

> The nominal shaft rotational speed of these pumps is 280 RPM, which is equivalent to approximately 4.7 Hz. Based on this frequency and ISTB 4.7.1(f), the required frequency response range of instruments used for measuring pump vibration are to be 1.56 to 1000 Hz. Procurement and calibration of instruments to cover this range to the lower extreme (1.56 Hz) is difficult due to limited number of vendors supplying such equipment (and replacement parts), the level of equipment sophistication, and the equipment cost.
>
> These pumps are of a simplified reciprocating (piston) positive-displacement design with rolling element bearings, Model Number TD-60, manufactured by Union Pump Corporation. Union Pump Corporation has performed an evaluation of the pump design and has determined that there are no probable sub-synchronous failure modes associated with these pumps under normal operating conditions. Further, there are no known failure mechanisms that would be revealed by vibration at frequencies below those related to shaft speed (4.7 Hz). Based upon the absence of a credible failure mode, no useful information is obtained by testing below the 4 Hz frequency nor will any indication of pump degradation be masked by instrumentation unable to collect data below this frequency.
>
> The requirement to measure vibration with instruments with response to 1/3 shaft speed stems from the need to detect oil whip or oil whirl associated with journal bearings. In the case of these pumps, there are no journal bearings to create these phenomena, thus satisfying the [ASME OM] Code requirements of ISTB 4.7.1(f) would serve no significant purpose. The significant modes of vibration, with respect to equipment monitoring, are as follows:
>
> - 1-Times Crankshaft Speed — An increase in vibration at this frequency may be an indication of rubbing between a single crankshaft cheek and rod end, cavitations at a single valve or coupling misalignment.
>
> - 2-Times Crankshaft Speed — An increase in vibration at this frequency may be an indication of looseness at a single rod bearing or crosshead pin, a loose valve seat in the fluid cylinder, a loose plunger/crosshead stub connection or coupling misalignment.

- Other Multiple of Shaft Speed — An increase in vibration at this frequencies may be an indication of cavitation at several valves, looseness at multiple locations or bearing degradation.

Based on the foregoing discussion, it is clear that monitoring the pump vibration within the frequency range of 4 to 1000 Hz will provide adequate information for evaluating pump condition and ensuring continued reliability with respect to the pumps' function.

3.5.4 Alternative Examination

NMC stated in its letter of November 22, 2002, that it will measure the vibration levels of SBLC pumps in accordance with the applicable portions of Subsection ISTB of the ASME OM Code, except for the lower frequency response limit for the instrumentation listed in paragraph 4.7.1(f). NMC indicated that the frequency response range for measuring vibration of the SBLC pumps shall be 4 to 1000 Hz. NMC proposes to use its existing instrumentation which meets the ASME OM Code accuracy requirements over a range of 4 Hz to 1,000 Hz.

3.5.5 NRC Staff Evaluation of Pump Relief Request No. PR-05

NMC requested relief from the specified ASME OM Code requirements pursuant to 10 CFR 50.55a(a)(3)(ii) on the basis that complying with these requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

SBLC pumps P-203A and P-203B are positive-displacement pumps with rolling-element bearings. The pump manufacturer told NMC that this type of pump has no sub-synchronous failure modes. Furthermore, there are no known failure mechanisms that would be revealed by vibration at frequencies below those related to shaft speed (4.7 Hz). NMC states that based upon the absence of a credible failure mode, no useful information will be obtained by testing below the 4 Hz frequency, nor will any indication of pump degradation be masked by instrumentation unable to collect data below frequency.

NMC identified the frequencies where high vibration would provide an indication of pump degradation as "one times pump running speed," "two times pump running speed," and "multiples of pump running speed." The types of problems that could be encountered at these frequencies were also identified. The frequency spectrum of the signals generated is characteristic of each pump and constitutes a unique pattern. Analysis of the pattern allows identification of vibration sources, and monitoring of change over time permits evaluation of the mechanical condition of the pump.

NMC states that there are a limited number of vendors capable of supplying vibration instrumentation and replacement parts to cover the range to lower extreme (1.56 Hz), which results in hardship in trying to procure a replacement. Strict compliance with ASME OM Code requirements would not provide a compensating increase in the level of quality and safety because the current instrumentation adequately assessment of the pump operational readiness for this type of the pump.

3.5.6 Conclusion

As previously mentioned, NMC's proposed alternative provides reasonable assurance of operational readiness of standby liquid control pumps P-203A and P-203B. Based on the above, the NRC staff authorizes NMC's proposed alternative pursuant to 10 CFR 50.55a(a)(3)(ii) on the basis that compliance with the ASME OM Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

3.6 Relief Request No. VR-02

3.6.1 ASME OM Code Requirements

Paragraph ISTC 4.2.4 of the ASME OM Code requires a limiting value(s) of full stroke time be established for a power-operated valve and that the stroke time to be measured whenever such a valve is full-stroke tested.

Paragraph ISTC 4.2.8 specifies that test results shall be compared to the initial reference values or reference values established in accordance with paragraphs ISTC 3.4 and ISTC 3.5.

Paragraph ISTC 4.2.9 indicates that corrective actions shall be taken as specified in this paragraph when the valve fails to exhibit its required function or meet its test requirements.

3.6.2 Specific Relief Requested

NMC requested relief from the ASME OM Code requirements of paragraphs ISTC 4.2.4, ISTC 4.2.8, and ISTC 4.2.9 for control valves CV-1728 and CV-1729 in the RHRSW system.

3.6.3 Licensee's Basis for Relief (as stated)

> ISTC 4.2.4 requires that a limiting value of full stroke time be established for a power[-]operated valve and that the stroke time be measured whenever such a valve is full[-]stroke tested. Performing full stroke time testing of these valves is impractical based on the control scheme design of the valves, adverse plant impact, and the functional requirements of the valves.
>
> ISTC 1.3 defines the *full-stroke time* as the time interval from initiation of the actuating signal to the indication of the end of the operating stroke. The control scheme design of these valves does not receive an actuation signal (neither by manual hand switch nor by automatic logic) to stroke to the position required to fulfill their safety function. RHRSW valves CV-1728 and CV-1729 are air operated control valves on the outlet line of the RHRSW side of the "A" and "B" RHR heat exchangers, respectively. These control valves maintain a differential pressure between the RHRSW process stream and the RHR process stream during RHRSW system operation. The valves are controlled by a positioner, controlled by a differential pressure-indicating controller (DPIC). The DPIC senses pressure on the RHRSW discharge line and the RHR inlet line to the RHR heat exchanger. The desired differential pressure control point, and thus the desired valve position for system flow, is manually set by the operator by manual adjustment of the DPIC setpoint. The valve positioner positions the valve and modulates the valve

position as necessary to maintain this control point. Stroke time testing of these valves on quarterly basis is not consistent with the design of the valve's control scheme and is not in the interest of plant safety.

These valves are interlocked to receive a closed signal when the RHRSW pumps are de-energized. This interlock is provided to ensure that system water inventory is not lost during system shutdown. Stroke time testing of valves CV-1728 and CV-1729 when the RHRSW pumps are de-energized would result in the loss of liquid fill for a significant portion of the RHRSW system as well as require the bypassing of an interlock designed to minimize the potential for water hammer. Such testing increases the possibility of an adverse water hammer during startup of the RHRSW system as well as requires filling and venting of the system following the stroke time testing. In addition to the adverse impact on the plant operation, such testing results in an undesirable burden on plant resources via the expenditure of person-hours and person-REM to perform system fillings and venting.

Stroke time testing of the valves during RHRSW pump operation negates the loss of system fill concern; however, this testing would also have an adverse impact on plant safety and equipment integrity. Stroke time testing during pump operation would require the valve be initially in the closed position during pump operation. Establishing the initial test conditions of a closed valve during pump operation would result in an undesirable deadheading of the pump. Subsequent opening of the valve to perform stroke time testing will result in pump runout if a single RHRSW pump is in operation, an undesirable condition which adversely impacts pump integrity and performance. The pump runout concern can be addressed by stroke timing the valve open during operation of both RHRSW pumps, however, this exacerbates the pump deadheading concerns and would result in undesirable transients on the system.

Proper stroke time testing would require the plant to modify the control logic of the valves. This hardship is not offset by an increase in public safety. The proposed alternative testing is an effective means to ensure the valves perform their safety function and is consistent with other valve category test requirements, such as check valve exercising. By extension, if stroke[-]time testing is not performed, the requirement of ISTC 4.2.8 for establishing stroke[-]time acceptance criteria is impractical. Similarly, if there are no stroke time limits applicable, then the requirement of ISTC 4.2.9 for corrective action when stroke time limits are exceeded is not applicable.

3.6.4 Alternative Examination

NMC proposed using paragraph ISTC 4.2.3 to demonstrate the necessary valve disk movement by observing indirect evidence (such as changes in system pressure, flow rate, level, or temperature) to reflect stem or disk position. The most representative test of the capability of valves CV-1728 and CV-1729 to perform their intended function is performed during IST of the RHRSW pumps. Quarterly testing of the RHRSW pumps verifies the capability of the valves to operate properly to pass the maximum required accident flow, and the valve position necessary to achieve required flow conditions. Testing the valves in this manner demonstrates valve performance capability and provides a means to monitor valve degradation.

3.6.5 NRC Staff Evaluation of Relief Request No. VR-02

NMC requested relief from the ASME OM Code stroke-timing requirements pursuant to 10 CFR 50.55a(f)(6)(i) based on the impractically of performing the testing and considering the burden on NMC that could result if the ASME OM Code requirements were imposed on the facility. The staff previously granted a similar relief request to Monticello by letter dated August 25, 1995, during the previous 10-year IST interval.

NMC states that the valves are not required to stroke-full open in order to perform their required function. According to Monticello's Updated Final Safety Analysis Report (UFSAR), Section 10.4.2.3, the differential pressure control valve is interlocked with the RHRSW pumps such that the valve actuator instrument air solenoid is energized only when a pump is in service. The valves are closed and the solenoid is de-energized during normal plant operation when the RHR system is not in service.

The primary safety function of valves CV-1728 and CV-1729 is to remove decay heat from the RHR system when it is in shutdown cooling or containment spray/cooling mode. In the case of an emergency core cooling system (ECCS) initiation signal, the RHRSW pumps will automatically trip, thereby de-energizing the differential pressure control valve solenoid. Once the ECCS condition has cleared and reactor water level is being maintained, the RHRSW system must be manually started and flow established by the operator using the differential pressure-indicating controller located in the control room. There is no fixed-time requirement for this system to be placed into operation following a design-basis loss-of-coolant accident (LOCA) condition since at least 8 hours are available before the containment design pressure is reached. Therefore, stroke-time testing of these valves does not indicate their ability to perform the safety function described in the UFSAR.

NMC requests relief from the requirements of paragraphs ISTC 4.2.4, ISTC 4.2.8, and ISTC 4.2.9 of the ASME Code, because of impractical test conditions during power operation. Further, stroke-time testing of these control valves on a quarterly basis is not consistent with the design of the valves control scheme. Paragraph ISTC 4.2.4 requires that all power-operated valves be full-stroke-time tested with a frequency as described in paragraph ISTC 4.2. Paragraph ISTC 4.2.8 requires that test results be compared to the initial reference values or reference values established in accordance with paragraphs ISTC 3.4 and ISTC 3.5. Stroke-time testing valves provides a means for monitoring degrading conditions. Paragraph ISTC 4.2.9 provides corrective action statements for those valves which exceed the stroke-time acceptance criteria.

The water inventory in the RHRSW piping system remains full when the system is not in operation. This maintains a readily-available coolant source and minimizes the potential for water hammer during RHRSW pump startup. Stroke-time testing these control valves according to ISTC 4.2.4 would require NMC to fill and vent the system following the test. Filling and venting the RHRSW system requires the expenditure of person-hours and, more importantly, person-REM without a significant increase in NMC's ability to monitor for valve degradation. Reasonably, the filling and venting would not be necessary if valves were stroke-time tested during pump operation. However, testing the valves from the fully-closed to fully-opened position while a pump is running can create one of two following adverse conditions:

- If the valve is fully closed when pump is running, it is likely the pump head will reach its shutoff value. At shutoff head, the maintainable flow rate is reduced to zero and resistance to flow is greater than the power that a centrifugal pump can impart to the fluid. Deadheading the pump in this manner can severely degrade the performance of the pump.

- Pump run-out occurs when system back-pressure is very low and the fluid flows through the pump without absorbing much energy. Under these conditions, the pumping process is inefficient and the pump undergoes extreme mechanical stress. Stroking the control valve to its full-open position when only one RHRSW pump is running will result in pump run-out, which is an undesirable condition.

Pump run-out is avoided by running both of the RHRSW pumps when testing the valves, but the shutoff head conditions are worsened by this condition.

NMC states that the control scheme of the valves is not consistent with the requirements of paragraph ISTC 4.2.4. The valve position is dialed into the DPIC in the control room, and the valve positioner modulates accordingly to the set point. Stroke-time testing these control valves does not indicate their ability to perform the function outlined in UFSAR Section 10.4.2.3.

Paragraph ISTC 4.2.2 states that for valves which are impractical to full-stroke exercise during plant operations, they shall be partial-stroke exercised during power operation and full-stroked exercised during cold shutdown. NMC proposes to partial-stroke the RHRSW control valves on a quarterly basis concurrent with the RHRSW pump tests, and verify the capability of the valves to pass the required accident flow. In addition, the valve disk position will be determined as that which is necessary to achieve the required flow conditions.

In NUREG-1482, Section 4.2.9, the NRC staff recommended finding an alternative method (when the ASME OM Code requirements for stroke timing valves are impractical) to monitor valve degradation. Preferably, the alternative would include stroke timing with acoustic monitors or other nonintrusive methods. The NUREG-1482 guidance does, however, allow for alternative testing for which NMC must obtain relief, if stroke-time testing is impractical. In this case, stroke timing is an impractical test due to the obvious adverse effects on the other components in the system. NMC's proposed alternative (which relies on existing ASME OM Code requirements) provides a measure of the valves' capability to perform their safety function, even though degradation is monitored on a broader basis than if stroke times were measured. Accordingly, the NRC staff concludes that the proposed testing provides reasonable assurance that control valves CV-1728 and CV-1729 are operationally ready.

3.6.6 Conclusion

As previously mentioned, the NRC staff concludes that the proposed testing provides reasonable assurance that control valves CV-1728 and CV-1729 are operationally ready. Based on the above, the NRC staff further concludes that granting relief pursuant to 10 CFR 50.55a(f)(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. Accordingly, the NRC staff grants relief from the stroke-timing requirement pursuant to 10 CFR 50.55a(f)(6)(i) based on the impractically of performing testing in accordance with

ASME OM Code requirements and considering the burden on NMC that could result if the ASME OM Code requirements were imposed on the facility.

4.0 CONCLUSION

The NRC staff concludes that the proposed alternatives specified in Relief Requests PR-01, PR-03, and PR-05 provide reasonable assurance of operational readiness of the subject pumps. The NRC staff authorizes the proposed alternatives pursuant to 10 CFR 50.55a(a)(3)(ii) on the basis that compliance with the ASME OM Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The NRC staff also authorizes the alternatives proposed in Relief Requests PR-02 and PR-04 pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that they provide an acceptable level of quality and safety.

The NRC staff finds that the alternative proposed in Relief Request VR-02 provides reasonable assurance that the valves are operationally ready, and grants relief pursuant to 10 CFR 50.55a(f)(6)(i) based on the impractically of performing testing in accordance with the ASME OM Code requirements. The NRC staff further concludes that granting relief pursuant to 10 CFR 50.55a(f)(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 reliefs are authorized for the fourth 10-year interval of the inservice testing plan.

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