February 2, 2001

Mr. R. G. Lizotte
Master Process Owner - Assessment
c/o Mr. David A. Smith
Northeast Nuclear Energy Company
P. O. Box 128
Waterford, CT 06385-0128

SUBJECT: SAFETY EVALUATION FOR RELIEF REQUESTS ASSOCIATED WITH SECOND 10-YEAR PUMP AND VALVE INSERVICE TESTING PROGRAM, MILLSTONE NUCLEAR POWER STATION, UNIT NO. 3 (TAC NO. MA9336)

Dear Mr. Lizotte:

By letter dated May 26, 2000, and supplemented on August 25 and October 2, 2000, you submitted several requests for alternatives to requirements of Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(f) for performing the required testing for certain Class 2 and 3 components in accordance with the American Society of Mechanical Engineers (ASME) Code (the Code) Section XI. Pursuant to 10 CFR 50.55a(a)(3)(i) and 10 CFR 50.55a(f)(5)(iii), you requested that the proposed alternatives be authorized because they provide a commensurate level of quality and safety.

We have evaluated your proposed alternatives against the requirements of the 1988 Addenda for the ASME Code for Operation and Maintenance (OM) of Nuclear Power Plants (OMa-1988), Part 6 (OM-6) and Part 10 (OM-10), which are referenced in the 1989 Edition of ASME Section XI, Subsections IWP and IWV. The staff concludes the following:

1. For R-4, R-5, PR-3, PR-4, and PR-5, the proposed alternatives provide an acceptable level of quality and safety. Therefore, the proposed alternatives are authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the remainder of the second 10-year inservice testing program interval.

2. For R-3, compliance with the Code would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety, and the proposed alternative will provide reasonable assurance of pump and valve operability. Therefore, the proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) for the remainder of the second 10-year inservice testing program interval.

The U.S. Nuclear Regulatory Commission (NRC) staff's safety evaluation authorizing the requested alternatives is enclosed. Contact the NRC Project Manager, Victor Nerses at (301) 415-1484 if you have any questions. This completes the staff's effort on TAC No. MA9336

Sincerely,

/RA/

James W. Clifford, Chief, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-423

Enclosure: Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

ASSOCIATED WITH REQUESTS FOR RELIEF FOR THE SECOND 10-YEAR

PUMP AND VALVE INSERVICE TESTING PROGRAM INTERVAL

MILLSTONE NUCLEAR POWER STATION, UNIT NO. 3

NORTHEAST NUCLEAR ENERGY COMPANY, ET AL.

DOCKET NUMBER 50-423

1.0 INTRODUCTION

Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a, requires that inservice testing (IST) of certain American Society of Mechanical Engineers (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* (the 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 paragraphs (a)(3)(i), (a)(3)(ii), or (f)(6)(i) of 10 CFR 50.55a. 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 its facility. Section 50.55a authorizes the Commission to approve alternatives and to grant relief from ASME code requirements upon making the necessary findings. NRC guidance contained in Generic Letter (GL) 89-04, “Guidance on Developing Acceptable Inservice Testing Programs,” provides alternatives to the 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.”

By letter dated May 26, 2000, and supplemented August 25 and October 2, 2000, Northeast Nuclear Energy Company (the licensee) submitted several relief requests for their second 10-year interval IST program for pumps and valves. The second 10-year IST program interval began on April 15, 1998, and is scheduled to end on April 14, 2008.

The U.S. Nuclear Regulatory Commission (NRC) staff has evaluated the licensee’s proposed alternatives against the requirements of the 1988 Addenda for the ASME Code for Operation and Maintenance (OM) of Nuclear Power Plants (OMa-1988), Part 6 (OM-6) and Part 10 (OM-10), which are referenced in the 1989 Edition of ASME Section XI, Subsections IWP and IWV.

2.0 RELIEF REQUESTS

2.1 Relief Request R-3

The licensee has requested relief from the test frequency requirements of OM-10, Paragraph 4.2.1.1, for the service water (SW) valves listed below. The licensee has proposed to exercise these valves every 6 months with a 25-percent grace period to allow for scheduling flexibility. This testing will be performed in conjunction with the recirculation spray system (RSS) heat exchanger flush.

3SWP*MOV54A, MOV54B, MOV54C, and MOV54D.

2.1.1 Licensee's Basis for Requesting Relief

The licensee states:

> Testing these valves is a complex evolution. It requires an interlock to be defeated to allow opening the valves without a CDA [containment depressurization actuation] signal present. Entry into an LCO [limiting condition for operation] is required for the duration the jumper is installed to defeat the interlock. This makes one train of Recirculation Spray (RSS) and Service Water (SW) systems inoperable. When the valves are opened service water is introduced into the heat exchangers which is then required to be drained, the heat exchanger flushed with demineralized water and drained again. This process takes approximately 8-10 hours per heat exchanger (one valve). This results in accruing a significant amount of Maintenance Rule unavailability on the RSS system and additional time on the Service Water system.
>
> The valves (3SWP*MOV54A-D) are interlocked with the Service Water to Reactor Building Component Cooling (CCP) supply isolation valves (3SWP*MOV50A/B). The interlocks are in place to prevent valve misalignment during normal operation. Based on the above, testing would normally be deferred to cold shutdown, however, defeating the interlock to allow testing has been evaluated and determined acceptable from plant risk with the plant in Mode 1 to support performance of RSS heat exchanger service water side flushes.
>
> Millstone committed to perform these flushes (LER 95-011-00, Letter MP-95-186) at specific times during the year to minimize the vulnerability from plantigrade attachment. The flushes are scheduled to minimize the potential for large mussel colony infestation of upstream piping and subsequent heat exchanger fouling. Ideally, the flushes would be performed in late spring and early fall. This testing, however, is less frequent than the Code specified quarterly testing. The Code does not identify any other frequency during power operation, only deferrals to cold shutdown or refuel are allowed.

2.1.2 Alternative Testing

The licensee proposes:

> These valves will be exercised nominally every six months during RSS heat exchanger service water side flushes. The 25% grace allowed for other Technical Specification (TS) surveillances will be allowed for this frequency to facilitate scheduling of the surveillance due to plant conditions or other constraints.

2.1.3 Evaluation

Paragraph 4.2.1.1 of the OM-10 Code requires that Category A and B valves be exercised to their safety position once every 3 months. In addition, the code requires that power-operated valves be stroke-timed every 3 months unless this testing is impractical where it is then deferred to either plant shutdowns or refueling outages.

These valves (3SWP*MOV54A-D) are interlocked with the SW to CCP supply isolation valves (3SWP*MOV50A/B). The interlocks are in place to prevent valve misalignment during normal operation. Testing these valves requires an interlock to be defeated to allow opening the valves. Entry into a limiting condition for operation (LCO) is required for the duration the jumper is installed to defeat the interlock. This makes one train of RSS and SW systems inoperable, and furthermore, this process takes approximately 8-10 hours per valve. Therefore, testing these valves during power operation would result in hardship for the licensee, and the test would normally be deferred to shutdowns or refueling outages. While entry into an LCO alone does not justify deferral of testing to plant shutdowns or refueling outages, the licensee has provided an acceptable rationale for such a deferral.

The licensee previously committed to perform RSS heat exchanger service water side flushes at specific times during the year to minimize the vulnerability from plantigrade attachment. The flushes are scheduled to minimize the potential for large mussel colony infestation of upstream piping and subsequent heat exchanger fouling. The flushes would be normally performed twice a year in late spring and early fall. During RSS heat exchanger service water side flushes, the Code-required valve tests could be performed without additional cost to the licensee and impact to the plant operation. Therefore, in lieu of performing the Code required tests at cold shutdown, the licensee proposed to perform them approximately every 6 months in conjunction with the RRS heat exchanger flush. The staff finds that testing each valve twice a year is comparable to a cold shutdown frequency, and hence provides reasonable assurance of the valve operability. Imposing additional testing during plant shutdowns and refueling outages would result in hardship without a compensating increase in the level of quality and safety.

2.1.4 Conclusion

The proposed alternative to the valve exercise frequency requirements of OM-10, Paragraph 4.2.1.1, for the affected valves, is authorized for the remainder of the second 10-year interval pursuant to 10 CFR 50.55a(a)(3)(ii) on the basis that the proposed alternative provides reasonable assurance of valve operability and that imposing the Code requirements would result in hardship without a compensating increase in the level of quality and safety.

2.2 Relief Request R-4

The licensee has requested relief from the valve exercise frequency requirements of OM-10, Paragraph 4.2.1.1, for the manual valves listed below. The licensee has proposed to perform a manual exercise of each valve once every 18 months with a 25-percent grace period to allow for scheduling flexibility.

Valve		Function
3CCP*V965 3CCP*V981	3CCP*V966 3CCP*V986	closed to prevent diversion of flow (through failed radiation monitor piping or to charging pump cooling or safety injection pump cooling surge tanks) in the event of a fail closed air-operated valve fails open due to spurious actuation under adverse environmental conditions and during a seismic event
3CHS*V270 3CHS*V272	3CHS*V271 3CHS*V273	repositioned to provide seal flow in the event 3CHS*HCV182 fails to operate properly and provide a borated water flow path during a safety grade cold shutdown
3CHS*V291		opened to cross-tie boric acid tanks (BAT) to meet Technical Specification emergency boration requirements
3FWA*V2 3FWA*V30 3FWA*V998	3FWA*V16 3FWA*V997 3FWA*V999	closed to provide moderate energy line break (MELB) isolation of a pipe “break” (crack) in the auxiliary feedwater system piping downstream of deareated water storage tank suction line isolations in the engineered safety features building
3QSS*V1 3QSS*V5	3QSS*V2 3QSS*V6	closed to provide MELB isolation of a pipe “break” (crack) in the quench spray system (QSS) piping between suction line isolations and discharge line isolations

2.2.1 Licensee’s Basis For Requesting Relief

The licensee states:

> The Chemical and Volume Control (CHS), Reactor Building Component Cooling (CCP) and Auxiliary Feedwater (FWA) system valves are manual valves. Except for the charging system valves, these valves are normally open and are closed if necessary to prevent loss of system inventory. The charging valves are closed/opened as necessary to allow flow in the event power operated valve 3CHS*M0V182 fails. Valve 3CHS*V291 is opened to cross-tie BAT [Boric Acid Storage Tank] tanks to meet Technical Specification emergency boration requirements.
>
> The above valves are not normally operated during power operation except for surveillance testing, though some are used as maintenance isolations. The

predominant degradation and failure mechanisms (motor failures, electrical failures, switch settings, etc) associated with power operated valves (MOVs, AOVs) do not exist for these manual valves. Testing these valves on a quarterly frequency solely to meet the requirements of ASME/ANSI 1987, OMa 1988 Addenda, does not provide any added value. Quarterly testing is unnecessary for detecting degradation of manual valves and does not decrease the potential for a component failure. The valves have been successfully tested per the Code since startup in June of 1998. There have not been any failures in any components ability to perform its safety function. The proposed alternate testing will provide a comparable level of quality and safety as the current Code required testing.

The Quench Spray (QSS) system valves are also manual valves. These valves are normally open and are closed if necessary to prevent loss of system inventory. These valves are not operated during power operation except for surveillance testing and 3QSS*V2 and V6 are used as maintenance isolations. As stated above for the other valves, the predominant degradation and failure mechanisms associated with power operated valves do not exist for these manual valves and quarterly testing is unnecessary for detecting degradation. These valves have been tested per the Code since startup in June of 1998. The valves have been evaluated for adverse conditions. Valves 3QSS*V1 and V5 are outside and maintenance history has shown the environment to be harsh (winter conditions). Per the proposed alternate testing, these two valves will be tested once each refuel. A maintenance work history review did not identify any problems with valves 3QSS*V2 and V6. The proposed alternate testing will provide a comparable level of quality and safety as the current Code required testing.

2.2.2 <u>Alternative Testing</u>

The licensee proposes:

Manually full stroke exercise the valves at least once every 18 months. The 25 percent grace period allowed for other TS surveillances will be allowed for this frequency to facilitate scheduling of the surveillance due to plant conditions or other constraints.

2.2.3 <u>Evaluation</u>

The Code requires that Category A and B valves be exercised to their safety position once every 3 months. In addition, power-operated valves are required to be stroke timed every 3 months unless this testing is impractical where it is then deferred to either plant shutdowns or refueling outages. Active safety-related valves without power actuators, which require a plant operator to turn a hand wheel or other device to actuate the valve to its safety position, are referred to as manual valves. Manual valves are required to meet the Code exercise requirements. They are not required to meet the stroke-time testing requirements.

Many of the Code testing strategies for safety-related pumps and valves are in the process of, or have incorporated, significant revisions to their testing strategies. These revisions are either mandatory or optional, depending on the component. A common philosophy with these changes is to provide a more rigorous test or examination activity such as diagnostic testing of motor-operated valves or testing pumps within ±20% of their design flow. This enables a more comprehensive assessment of operational readiness and a better quantification of component degradation. Because of the enhanced testing, a longer interval between tests can be justified.

A manual valve, because it does not have an associated power actuator, is regarded as a relatively simple component with few possible degradation mechanisms. However, the valve body and internals of a manual valve are subject to the same degradation mechanisms as the valve body of a power-actuated valve such as corrosion and binding of the valve internals. The exercise of a manual valve is generally a relatively simple inservice test to perform. It should provide assurance that the obturator can be moved to its safety position by a plant operator and has not corroded or been otherwise impaired in performing its function since the previous test was conducted. Since rigorous testing, such as using diagnostic test equipment, is not used in the exercise test of a manual valve, the only comparison with previous valve performance is comments from the operators on the ability of the valve to open or close. While this information is useful, it is subjective and, therefore, not easily trendable.

To place the operation and testing of a manual valve in perspective, it can be contrasted with a swing check valve, which is arguably a component of simpler construction with fewer moving parts than a manual valve. In addition, a swing check valve is self actuating. The testing of check valves required by the Code generally involves the actuation of the obturator to its safety position by the use of flow at design conditions. Diagnostic test methods and non-intrusive test techniques are also used to verify obturator movement to the appropriate safety position. When these alternate methods are appropriately qualified, they can be compared against their baseline performance and trended over time. As stated above, manual valve exercising is not easily trendable because of the nature of the test.

The licensee's submittal of October 2, 2000, specifies that the manual valves in Relief Request R-4 would be exercised on an 18-month frequency with a 25-percent grace period to allow for scheduling flexibility. The proposed testing results in approximately an 80-percent reduction in the testing of the specified manual valves, and therefore a corresponding reduction in the burden of testing these valves, while performing an exercise test at a nominal interval of 18 months. This proposed test interval is consistent with the more simplistic Code testing requirements for valves (e.g., 2-year position indication verification). In addition, the test frequency is also consistent with allowed test frequency for testing of components which are impractical to perform at power and during cold shutdowns. The proposed alternative provides an acceptable level of quality and safety because of the reasons stated above.

The licensee's proposed alternative discusses more frequent testing of manual valves operating under adverse conditions. Examples of adverse conditions include harsh service environment, lubricant hardening, corrosive or sediment laden process fluid, or degraded valve components. Valves which operate under adverse conditions have been evaluated for inclusion in this relief request. It is the licensee's responsibility to assess if these valves require a more frequent exercise test than once every 18 months.

The NRC is currently considering rulemaking to 10 CFR 50.55a which will incorporate, by reference, the 1998 Edition of the ASME OM Code through the 2000 Addenda. OMa Code-1999, subsection ISTC 3540, includes new requirements for exercise testing of manual valves. When the final rule is issued, the licensee should consider the testing requirements specified for manual valves, including any limitations or modifications to the requirements in subsection ISTC 3540. Implementation of Code requirements of a later edition or addenda to the ASME OM Code require approval by the NRC in accordance with 10 CFR 50.55a(f)(4)(iv) and must incorporate any related requirements.

2.2.4 Conclusion

The proposed alternative to the valve exercise frequency requirements of OM-10, Paragraph 4.2.1.1, for the manual valves listed above, is authorized for the remainder of the second 10-year interval pursuant to 10 CFR 50.55a(a)(3)(i) based on the alternative, to exercise each manual valve on an 18-month frequency with a 25-percent grace period, providing an acceptable level of quality and safety.

2.3 Relief Request R-5

The licensee has requested relief from the class 2 and 3 pressure relief valve test frequency requirements of ASME OM 1987, Part 1 (OM-1), Paragraphs 1.3.4.1(a), 1.3.4.1(b), 1.3.4.1(c), 1.3.4.1(d), and 1.3.4.1(e), for the relief valves listed below. The licensee proposes to implement Code Case OMN-2, “Thermal Relief Valve Code Case, OM Code-1995, Appendix I” which allows either testing or replacement of certain relief valves every 10 years.

3CCE*RV40A	3CCP*RV59B	3SWP*RV92B
3CCE*RV40B	3CCP*RV64A	3SWP*RV93A
3CCE*RV43A	3CCP*RV64B	3SWP*RV93B
3CCE*RV43B	3SFC*RV52A	3SWP*RV94A
3CCE*RV43C	3SFC*RV52B	3SWP*RV94B
3CCI*RV31A	3SWP*RV89A	3SWP*RV94C
3CCI*RV31B	3SWP*RV89B	3SWP*RV94D
3CCI*RV36A	3SWP*RV90A	3SWP*RV96A
3CCI*RV36B	3SWP*RV90B	3SWP*RV96B
3CCP*RV239A	3SWP*RV91A	3SWP*RV132A
3CCP*RV239B	3SWP*RV91B	3SWP*RV132B
3CCP*RV59A	3SWP*RV92A	

2.3.1 Licensee’s Basis For Requesting Relief

The licensee states:

> Thermal relief valves are potentially challenged during train or component shutdowns when the component is isolated. Since these trains or components are not providing a safety function while they are isolated, the thermal relief valves have limited safety significance during this condition. While these components or trains are in service, the thermal relief safety is to remain closed as part of the system pressure boundary. This function is periodically verified during normal operation or system flow testing.

> A review of relief valves was performed as part of the design basis verification. Valves performing only a thermal relief function have been identified. Failure of these valves to relieve an overpressure condition has minimal safety significance.
>
> The proposed testing provides the same test frequency as the 1987 code which ensures that each of these valves will be adequately tested.

2.3.2 Alternative Testing

The licensee proposes:

> Implement the requirements of Code Case OMN-2 “Thermal Relief Valve Code Case, OM Code-1995, Appendix I.” Testing of pressure relief valves whose only function is to protect isolated components from fluid expansion caused by changes in fluid temperature shall be performed once every ten years on each device unless performance data indicates more frequent testing is needed to assure device function. In lieu of testing, Millstone 3 may replace these devices every ten years unless performance data indicates more frequent replacement is needed to assure device function.

2.3.3 Evaluation

OM-10, Paragraph 1.1, requires pressure relief devices which protect systems or portions of systems which perform a required function in shutting down a reactor to the cold shutdown condition, maintain the cold shutdown condition, or mitigate the consequences of an accident, to be included within the scope of IST. OM-10, Paragraph 4.3.1, requires that safety and relief valves tests shall be conducted in accordance with OM-1. The requirements for the test frequency of Class 2 and 3 pressure relief devices are included in Paragraph 1.3.4.1. The requirements include: (1) Paragraph 1.3.4.1(a) which include specific test frequency requirements for the initial 10-year period; (2) Paragraph 1.3.4.1(b) which specify that all valves of each type shall be tested in each subsequent 10-year period with a minimum of 20 percent of the valves tested within any 48-month period which have not been previously tested, if such valves exist; (3) Paragraph 1.3.4.1(c) which specifies requirements with pretested valves; (4) Paragraph 1.3.4.1(d) which specifies acceptance criteria for the tested valves; and (5) Paragraph 1.3.4.1(e) which specifies the required sample expansion if the tested valves do not meet the acceptance criteria.

The licensee has proposed to implement the requirements of Code Case OMN-2 “Thermal Relief Valve Code Case, OM Code-1995, Appendix I.” Thermal relief valves are defined in the code case as relief valves whose only overpressure protection function is to protect isolated components from fluid expansion caused by changes in fluid temperature. In lieu of the testing requirements of ASME OM Code-1995, Appendix I, Paragraphs 1.3.5(a), 1.3.5(b), and 1.3.5(c), relief valves which are considered to be thermal relief valves may be replaced once every 10 years unless performance data indicates more frequent replacement is needed to assure device function. Paragraph 1.3.5(a) requires that each Class 2 and 3 relief valve be tested every 10 years with a minimum of 20 percent of the valves tested within any 48-month period which have not been previously tested. Paragraph 1.3.5(b) specifies requirements for replacing valves with pretested valves. Paragraph 1.3.5(c) establishes requirements for test acceptance criteria and requirements for testing additional valves.

Code Case OMN-2 was intended to be used at facilities where their inservice testing program was developed in accordance with ASME OM Code-1995. It does not appear that it was intended to be used with the licensee's current code of record. The code case was published in the 1998 addenda of the Code which is currently included in rulemaking to 10 CFR 50.55a.

Two issues need to be addressed in order to authorize the alternative: (1) the acceptability of Code Case OMN-2 to the NRC; and (2) the applicability of the code case to be used with OM-1.

With regard to acceptability of the code case to the NRC, the staff reviewed activities of the Code Committee related to the development of this code case. In making their determination to reduce the testing requirements for thermal relief valves, the code committee performed a review of the Nuclear Plant Reliability Data System (NPRDS) database to assess the quantity and type of thermal relief valve failures. The code committee determined that the failure rates of thermal relief valves are limited. The code committee concluded that the low number of failure rates support the 10-year test or replacement frequency and the elimination of sample expansion if the failures were discovered during testing. In its evaluation of the code case for the current rulemaking effort, the NRC has concluded that there are no outstanding issues with the proposed testing for thermal relief valves.

With regard to the acceptability of applying this code case to OM-1 as opposed to OM Code-1995, Appendix I, the staff compared the requirements of both code editions. Thermal relief valves are not separately defined in either code edition. They currently fall within the requirements of Class 2 and 3 relief valves of both code editions as described above. In comparing the two Code editions, the OM Code-1995, Appendix I, requirements represent a relaxation of OM-1 requirements in the following areas: (1) elimination of the specific testing schedule for relief valves in the first 10-year interval; and (2) elimination of the requirement to repair or replace all valves which exceed their stamp set pressure by 3 percent or greater. The remaining requirements between the two codes are technically identical.

The NRC has completed an evaluation of Code Case OMN-2, which allows relaxation of testing requirements for relief valves identified as thermal reliefs. The evaluation did not identify any limitations or modifications necessary for the acceptability of this code case to be used in conjunction with the OM Code-1995, Appendix I. In addition, OM Code-1995, Appendix I, includes relaxations of certain requirements in the OM-1 Standard. Thermal relief valves are not defined in either Appendix I or OM-1. No related requirements have been identified in either OM Code-1995 or OM-1 that would be related to thermal relief valves. Therefore, there does not appear to be any conflict in applying code case OMN-2 to OM-1. On this basis, the staff finds that the licensee's alternative provides an acceptable level of quality and safety.

2.3.4 Conclusion

The proposed alternative to use Code Case OMN-2 in lieu of the requirements of OM-1, Paragraphs 1.3.4.1(a) through 1.3.4.1(e), for the Class 2 and 3 thermal relief valves listed above is authorized for the remainder of the second 10-year interval pursuant to 10 CFR 50.55a(a)(3)(i) based on the alternative providing an acceptable level of quality and safety.

2.4 Relief Request PR-3

The licensee has requested relief from the frequency response range requirements of OM-6, Paragraph 4.6.1.6, for vibration instrumentation used to test service water pumps 3SWP*P1A, 3SWP*P1B, 3SWP*P1C, and 3SWP*P1D. The licensee has proposed to use vibration instrumentation with a response range from 5.3 hertz to at least 1000 hertz.

2.4.1 Licensee's Basis For Requesting Relief

The licensee states:

> Millstone is transitioning from the TEC 1330 VLF SmartMeter to the ENTEK/IRD dataPAC 1500 vibration data collector due to Y2K issues with the TEC 1330 meter. The TEC 1330 meter is no longer being manufactured and technical support is being phased out. The vendor recommended the dataPAC 1500 as a suitable replacement for the TEC 1330 meter.
>
> Vibration personnel detected large errors in overall vibration measurement results when field validation testing the dataPAC 1500 data collectors. Investigation revealed that the dataPAC 1500 uses the entire meter's frequency response range (i.e., 0.36 Hz to 75.3 KHz) in calculating and displaying overall vibration results (called magnitude readings) whereas the TEC 1330 meter calculated overall vibration based on user specified upper and lower frequency limits. The TEC 1330 meter frequency response range was setup for approximately 4.0 Hz to 1000 Hz. Integration noise is created by processing the input signal from the accelerometer, which affects the lower response range. The integration noise is reduced in the dataPAC 1500 by filtering the vibration input signal through a 5.3 Hz high pass filter to obtain repeatable overall vibration data. This results in the lower bound of the Code-required frequency response range not being met. The TEC 1330 meter used a special algorithm in the data collector to subtract integration noise from the vibration measurement.
>
> The service water pumps are vertical line shaft turbine pumps with the same constant running speed of 885 rpm (equivalent to 14.7 Hz). Compliance with paragraph 4.6.1.6 would require using vibration instrumentation with a frequency response range of 4.9 Hz to at least 1000 Hz for these pumps.
>
> Vibration instrumentation with a frequency response range from 5.3 Hz to 1000 Hz for monitoring vibration of the service water pumps is acceptable because:
>
> - Overall vibration data would still contain vibration components from 0.36 Hz to 75.3 KHz but vibration amplitudes at frequencies below 5.3 Hz would be attenuated. The amount of attenuation for a particular frequency below 5.3 Hz is dependent on the high pass filter's characteristics. Inputting a known signal amplitude at 4.9 Hz into the dataPAC 1500 resulted in its amplitude being

reduced to only 85% of its original value. Spectral vibration data collected using the 5.3 Hz high pass filter would still provide observable and trendable vibration data that would indicate developing mechanical faults down to 4.9 Hz.

- Millstone has not identified any potential mechanical faults for the service water pumps below 6 Hz. The credible mechanical faults below pump running speed on these vertical line shaft pumps are structural resonance at the system's reed natural frequencies and pump shaft whirl. Millstone has identified the reed natural frequencies of these service water pumps to lie between 6 Hz and pump running speed. Non-IST required pump shaft measurements using a shaft stick or proximity probe are required to confirm pump shaft whirl. Millstone routinely collects and trends vertical pump line shaft vibration data primarily to trend line shaft bearing wear and has never identified sub-synchronous shaft vibration (shaft whirl) on their service water pumps.

- Overall vibration limits are only one indicator of component condition and may miss some mechanical faults entirely. Spectral vibration analysis is much more sensitive than overall vibration in detecting mechanical faults. Vibration analysts use spectral data to extract and trend vibration data from various frequency bands that were defined to detect particular machine faults for each specific machine type. Spectral analysis results in additional and earlier warning of degrading component conditions due to the capability to trend and alarm on multiple frequency bands and individual frequencies. Spectral vibration analysis techniques are used at Millstone on all IST components.

- The 1/3 running speed to 1000 Hz minimum frequency response range requirement does not apply well to slow speed machinery. Incorporating vibration frequency down to 1/3 running speed results in integration noise corrupting the overall vibration results on slow speed machinery. Overall vibration is excessively high unless the integration noise is reduced by high pass filtering the vibration input signal or by using special algorithms in data collectors to subtract integration noise from the vibration measurement.

  Many vibration standards segregate rotating equipment into various rotational speed categories (i.e., running speed above or below 600 RPM, speed range from 10 to 200 REV/S), machinery type classifications (i.e., turbines, pumps, compressors, fans, centrifugal, reciprocating, overhung rotor, etc.) and machinery support methods (i.e., hard or soft mounted) prior to specifying allowable vibration limits. This allows for more appropriate limits to be applied to the different types of equipment that optimize detection of credible mechanical faults.

2.4.2 <u>Alternative Testing</u>

The licensee proposes:

> The instrumentation used to measure pump vibration will have a frequency response range from 5.3 Hz to at least 1000 Hz.

2.4.3 Evaluation

The licensee is transitioning from the TEC 1330 VLF SmartMeter to the ENTEK/IRD dataPAC 1500 vibration data collector due to Y2K issues with the TEC 1330 meter. The TEC 1330 meter is no longer being manufactured and technical support is being phased out. The vendor recommended the dataPAC 1500 as a suitable replacement for the TEC 1330 meter. In order to obtain repeatable overall vibration data, the integration noise in the dataPAC 1500 is reduced by filtering the vibration input signal through a 5.3 Hz high pass filter. This results in the lower bound of the Code-required frequency response range to be 0.36 of minimum pump shaft rotational speed, which deviates slightly from the Code-required lower bound of 0.33 of the pump running speed. Compliance with the Code requirements would require acquiring a different vibration instrumentation with a frequency response range of 4.9 Hz to1000 Hz for these pumps.

The dataPAC 1500 would exclude a small portion of the data from 4.9 Hz to 5.3 Hz, but it should provide reasonable level of information for monitoring vibration of the affected service water pumps especially when used in conjunction with spectral vibration analysis techniques. Furthermore, the licensee indicates that: (1) spectral vibration data collected using the 5.3 Hz high pass filter would still provide observable and trendable vibration data that would indicate developing mechanical faults down to 4.9 Hz; (2) Millstone has not identified any potential mechanical faults for the service water pumps below 6 Hz; (3) Millstone routinely collects and trends vertical pump line shaft vibration data primarily to trend line shaft bearing wear and has never identified sub-synchronous shaft vibration (shaft whirl) on their service water pumps; and (4) spectral vibration analysis techniques are used at Millstone on all IST pumps, and spectral analysis results would provide early warning of degrading component conditions due to its capability to trend and alarm on multiple frequency bands and individual frequencies. Therefore, the staff finds that use of the instrumentation dataPAC 1500 in conjunction with spectral analysis techniques used at Millstone should provide reasonable assurance of the capability for monitoring vibration of the affected pumps.

2.4.4 Conclusion

The proposed alternative of using instrumentation dataPAC 1500 from 5.3 Hz to 1000 Hz for the affected pumps in conjunction with spectral vibration analysis techniques is authorized for the remainder of the second 10-year interval pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that the proposed alternative provides reasonable assurance of the pump operability and provides an acceptable level of quality and safety.

2.5 Relief Request PR-4

The licensee has requested relief from the digital instrument range requirements of OM-6, Paragraph 4.6.1.2(b), for unspecified instruments in the licensee's IST program. The licensee has proposed to use a digital instrument with a range of 90 percent of the reference value.

2.5.1 Licensee's Basis For Requesting Relief

The licensee states:

> The intent of the restrictions on the instrument calibration range is to ensure a specific accuracy is maintained for all acceptable test values, i.e. within 2% of indicated values. The basis for requiring reference values to be less than or equal to 70% of the calibrated range of the instrument is unclear. For a digital instrument, calibrated in accordance with ASME OM Code requirements, an instrument reading at 80% of the calibrated range would be equally valid for IST use as an instrument reading at 60% of the calibrated range. Both test readings would be within 2% accuracy of the indicated value.
>
> Since the ASME OM Code requirements allow pump test values within a maximum of ±10% of the reference value, to be considered acceptable, a limit of 90% of the reference value would ensure all possible pump test results are meeting the accuracy requirements of the Code.
>
> Additionally, the ASME OM Code Committee has approved Code Case OMN-6, "Alternate Rules for Digital Instruments," which identifies that digital instruments may be selected such that the reference value does not exceed 90% of the calibrated range of the instrument. This Code Case applies to ASME OM Code-1990 Edition through ASME OMb Code-1997 Addenda.

2.5.2 Alternative Testing

The licensee proposes:

> Select digital instruments for IST pumps such that the reference value does not exceed 90% of the calibrated range of the instrument.

2.5.3 Evaluation

Paragraph 4.6.1.2(b) of OM-6 requires that the reference value of digital instruments not exceed 70 percent of the calibrated range of the instrument. The ASME OM Code committees approved Code Case OMN-6, and was included in OMa-1999 Addenda. This Code Case allows owners to use digital instruments such that the reference value does not exceed 90 percent of the calibrated range of the instrument. This Code Case was written to allow Owners additional flexibility, since 70 percent was based on previous Section XI requirements for pressure testing equipment, and to ensure that if readings were in the required action range, they could be read. The licensee has proposed that digital instruments shall be selected such that the measured parameter does not exceed the calibrated range of the instrument.

Code Case OMN-6 was written to provide alternate requirements in lieu of Subsection ISTB, Paragraph 4.6.1(b)2 of the OM Code-1990 edition. The licensee's IST program is written to the requirements of OM-6 for pumps. The requirements for the range of digital instruments in both ISTB and OM-6 are identical. There are no related requirements. Therefore, Code Case OMN-6 may be applied to Paragraph 4.6.1.2(b) of OM-6.

Table 3b of OM-6 states that the maximum acceptable value of the measured parameter is 110 percent of the reference value. When selecting its digital instrument, it’s the licensee’s responsibility to ensure that 110 percent of the measured parameter’s reference value is within the instrument’s calibrated range. On this basis, the staff finds that the licensee’s alternative provides an acceptable level of quality and safety.

2.5.4 Conclusion

The proposed alternative to the Code digital instrument requirements for various Class 2 and 3 pumps is authorized for the remainder of the second 10-year interval pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that the alternative provides an acceptable level of quality and safety.

2.6 Relief Request PR-5

The licensee has requested relief from the corrective action requirements of OM-6, Paragraph 6.1, for all pumps in the licensee’s IST program. The licensee has proposed to use the requirements in OM Code-1995, ISTB 6.2.2, which allow an analysis of pumps in instances where their performance enters the required action range, in lieu of the corrective actions required by the Code.

2.6.1 Licensee’s Basis for Requesting Relief

The licensee states:

> By allowing an analysis of the pump's overall performance, premature maintenance of a pump that is subject to normal and gradual degradation over time or other test anomalies can be avoided provided the pump can be determined to be fully capable of reliably performing its intended safety function. The 1995 Edition of the ASME OM Code provides an alternative corrective action should a pump's performance enter the required action range. Paragraph 6.2.2 permits an analysis of the pump's performance and establishment of new reference values.
>
> By adopting the 1995 ASME Code requirements, for this specific instance, the frequency of pump maintenance, with concurrent equipment outage and applicable limiting condition of operation (LCO) time, can be reduced with little or no adverse affect on plant safety as determined by the acceptance of the 1996 addenda of the ASME Code.
>
> This proposed alternate test is consistent with the response to question 3.3.2 in the Summary of Public Workshops on Inspection Procedure 73756.

2.6.2 Alternative Testing

The licensee proposes:

> When a pump's test parameters fall within the required action range and the pump's overall performance has been determined to be acceptable by analysis, a new set of reference values may be established. The supporting analysis will include verification of the pump's operational readiness and the pumps continued performance in between testing intervals. The pump's analysis will address both component and system level evaluations of operational readiness, a description of the cause of the change in pump performance, an evaluation of all trends indicated by the data and an evaluation of applicable maintenance performed on the pump. This analysis will be documented in the record of tests.

2.6.3 Evaluation

OM-10, Paragraph 6.1, "Acceptance Criteria," specifies actions required to be taken if any of the measured pump parameters fall within the alert or required action ranges. For test results in the alert range, the test frequency shall be doubled until the cause of the deviation is determined and the condition is corrected. For test results in the required action range, the pump shall be declared inoperable until the cause of the deviation has been determined and the condition corrected.

ASME OM Code-1995 was endorsed on September 22, 1999, by the NRC in a rule change to 10 CFR 50.55a. Subsection ISTB, Paragraph 4.6, "New Reference Values," states that "[i]n cases where the pump's test parameters are either within the alert or required action ranges of ISTB 5.2.1.1, Table ISTB 5.2.1-2, Table ISTB 5.2.2-1, or Table ISTB 5.2.3-1, and the pump's continued use at the changed values is supported by an analysis, a new set of reference values may be established." Paragraph ISTB 4.6 also states that the analysis shall include both a pump level and a system level verification of pump operational readiness, the cause of the change in pump performance, and an evaluation of all trends indicated by available data.

Paragraph ISTB 6.2.2, which provides acceptance criteria for the required action range, allows an analysis to be performed and new reference values to be established in accordance with ISTB 4.6 in lieu of pump repair or replacement to satisfy the corrective action requirements. Paragraph ISTB 6.2.1, which provides requirements for alert range acceptance criteria, does not provide the option to use analysis as an alternative to doubling the test frequency.

The licensee has proposed to adopt the requirements of ISTB 6.2.2 in order to establish new reference values by analysis of the pump when its performance enters the required action range. The regulations, as specified in 10 CFR 50.55a(f)(4)(iv), allow the adoption of later editions of the Code provided that the related requirements are adopted. The allowances for use of analysis have been reintroduced into the Code in conjunction with modified pump testing strategies. These include reduced quarterly testing requirements for standby pumps and a more stringent requirements to test all safety-related pumps within ±20 percent of pump design flow every 2 years. Therefore, the requirements for testing pumps within ±20 percent of pump design flow are related to the Code analysis requirements because testing pumps at or near design flow conditions provides better data to analyze pump performance.

The NRC has previously issued guidance on performing an analysis where the result of an ASME Code test of a pump or valve concludes that the component is inoperable. In NRC Generic Letter 91-18, which concerns resolution of degraded and nonconforming conditions and operability, Section 6.11, "Technical Specification Operability vs. ASME Code, Section XI Operative Criteria," the NRC indicates that in cases where the required action range limit is more conservative than its corresponding technical specification limit, the corrective action may not be limited to replacement or repair. The corrective action may consist of an analysis to demonstrate that the specific pump performance degradation does not impair operability and that the pump or valve will still fulfill its function, such as delivering the required flow. A new required action range may be established after such an analysis which would then allow a new determination of operability. Hence, when licensees request to use the analysis alternative in OM Code-1995, Paragraph 6.2.2, for pumps in the required action range, the staff has authorized the alternative because it is consistent with the guidance in Generic Letter 91-18. Although the licensee has not adopted the related requirements of ISTB 6.2.2 (which are determined to be ISTB 4.3(e)(1), ISTB 4.6, and ISTB 5.2.3), the NRC has published guidance related to the performance of analysis when a pump is declared inoperable. Therefore, the proposed alternative to perform analysis when a safety-related pump is performing in the required action range provides reasonable assurance of operational readiness and an acceptable level of quality and safety.

The performance of analysis in the required action range should include, at a minimum, a comparison of the current measurements for the particular parameter, i.e., flow rate, vibration, discharge pressure, or differential pressure to the baseline measurements, an evaluation of the trend of available data for the parameter, and a determination of the cause and the need for corrective action. Alternate diagnostic methods, such as vibration spectral analysis, are expected to be used to support the analysis. The analysis is subject to NRC inspection. This analysis must provide reasonable assurance that the condition of the pump will not further degrade such that, before the next pump test or before repairs can be performed, the pump would fail. Additionally, it should be noted that changes to the vibration reference values would affect only the vibration relative alert and required action limits, and not the absolute limits specified by the Code. If the absolute limits are exceeded (i.e., 0.7 inches per second for the required action range), the licensee would be required to declare the pump inoperable in accordance with the Code.

The use of this analysis is expected to be a rare occurrence. This analysis should be used cautiously, as it is not intended to be used regularly to evaluate the operability of all pumps that fall into the required action range in order to declare the pump operable and define new reference values where significant degradation has occurred. Repeated application of analysis could lead to stair stepping the Code limits downward to the safety limits of the pump. The licensee should have an understanding of the margin of each pump above its design-basis requirements.

2.6.4 <u>Conclusion</u>

The proposed alternative to use OM Code-1995, ISTB 6.2.2, for safety-related pumps in the required action range is authorized for the remainder of the second 10-year interval pursuant to 10 CFR 50.55a(a)(3)(i) based on the alternative providing an acceptable level of quality and safety.

3.0 CONCLUSION

For Relief Request R-3, the proposed alternative to the valve exercise frequency requirements of OM-10, Paragraph 4.2.1.1, for the SW valves listed in Section 2.1 of this relief request, is authorized for the remainder of the second 10-year interval pursuant to 10 CFR 50.55a(a)(3)(ii) on the basis that the proposed alternative provides reasonable assurance of the valve operability and that imposing the Code requirements would result in hardship without a compensating increase in the level of quality and safety.

For Relief Request R-4, the proposed alternative to the valve exercise frequency requirements of OM-10, Paragraph 4.2.1.1, for the manual valves listed in Section 2.2 of this relief request, is authorized for the remainder of the second 10-year interval pursuant to 10 CFR 50.55a(a)(3)(i) based on the alternative providing an acceptable level of quality and safety.

For Relief Request R-5, the proposed alternative to use Code Case OMN-2 in lieu of the requirements of ASME OM 1987, Part 1, Paragraphs 1.3.4.1(a), 1.3.4.1(b), 1.3.4.1(c), 1.3.4.1(d), and 1.3.4.1(e), for Class 2 and 3 thermal relief valves listed in Section 2.3 of this relief request, is authorized for the remainder of the second 10-year interval pursuant to 10 CFR 50.55a(a)(3)(i) based on the alternative providing an acceptable level of quality and safety.

For Relief Request PR-3, the proposed alternative to the frequency response range requirements of OM-6, Paragraph 4.6.1.6, for the service water pumps listed in Section 2.4 of this relief request is authorized for the remainder of the second 10-year interval pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that the proposed alternative provides reasonable assurance of pump operability and provides an acceptable level of quality and safety.

In Relief Request PR-4, the proposed alternative to the Code digital instrument requirements of OM-6, Paragraph 4.6.1.2(b), for various Class 2 and 3 pumps is authorized for the remainder of the second 10-year interval pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that the alternative provides an acceptable level of quality and safety.

For Relief Request PR-5, the proposed alternative to use OM Code-1995, ISTB 6.2.2, for safety-related pumps in the required action range is authorized for the remainder of the second 10-year interval pursuant to 10 CFR 50.55a(a)(3)(i) based on the alternative providing an acceptable level of quality and safety.

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