

Northeast
Utilities System

107 Selden Street, Berlin, CT 06037

Northeast Utilities Service Company
P.O. Box 270
Hartford, CT 06141-0270
(203) 665-5000

October 5, 1994

Docket No. 50-423
B14978

Re: 10CFR50.90

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Millstone Nuclear Power Station, Unit No. 3
Additional Information to Support
Request to Revise Technical Specifications
Main Steam Line Isolation Valve Closure Time

Purpose

The purpose of this submittal is to provide additional information to support the request made by Northeast Nuclear Energy Company (NNECO) on September 9, 1994,⁽¹⁾ to amend its Operating License, NPF-49, by modifying Surveillance Requirement 4.7.1.5.1 of the Millstone Unit No. 3 Technical Specifications. Additionally, NNECO is resubmitting the retyped technical specification page for the submittal dated September 9, 1994.

Summary

NNECO has restored the "C" main steam isolation valve (MSIV) to an operable status. This effort required that two separate and distinct issues be resolved. These issues were the slow stroke time for the "C" MSIV, and the inadvertent closure of the "C" MSIV during a partial stroke test. To resolve the first issue, both #2 solenoid valves for the "C" MSIV were replaced, and the "C" MSIV was full stroke tested per Surveillance Requirement 4.7.1.5.1. The "C" MSIV stroked within its required acceptance criterion; therefore, no further corrective measures on the "C" MSIV or its ancillaries are required to be performed. On October 4, 1994, each of the MSIVs was successfully partial stroke tested within its acceptance criterion. To resolve the second issue, the C2B solenoid valve has been replaced, and the broken pin has been sent to a laboratory for analysis. During the fifth refueling outage,

-
- (1) J. F. Opeka letter to the U.S. Nuclear Regulatory Commission, "Millstone Nuclear Power Station, Unit No. 3, Proposed Revision to Technical Specifications, Main Steam Line Isolation Closure Time," dated September 9, 1994.

ADD 1

the solenoid valves serving the MSIVs will be removed and inspected, and the pins will be replaced with pins having better durability, based on recommendations following the current evaluation.

Since NNECO has been able to restore the operability of the "C" MSIV, the proposed license amendment submitted on September 9, 1994, should be processed on a routine basis.

Background

The MSIVs serve to isolate the nonsafety-related portions of the main steam system under design basis accident conditions. The MSIVs also prevent the uncontrolled blowdown of more than one steam generator in the event of a main steam line break accident.

To ensure that the MSIVs are capable of fulfilling their safety functions, the Millstone Unit No. 3 Technical Specifications require that their operability be demonstrated. Specifically, Surveillance Requirement 4.7.1.5.1 of the Millstone Unit No. 3 Technical Specifications requires that each MSIV be determined operable on a quarterly basis by verifying full closure within five seconds during inservice testing. The MSIVs are equipped with provisions for inservice testing by partial valve stroking (see Figure 10.3-4 of the Millstone Unit No. 3 Final Safety Analysis Report). The partial stroking is accomplished by closing the #3 solenoid valves (vent valves for the lower piston chamber) and opening the #4 solenoid valves (supply valves for the lower piston chamber). These valve manipulations admit steam pressure into the lower piston chamber to preclude an inadvertent closure of the MSIV. After a time delay, the #1 solenoid valves close (vent valves for upper piston chamber) and the #2 solenoid valves open (supply valves for the upper piston chamber) and the MSIV begins to close. After 10 percent travel, both piston chambers are vented (the upper piston chamber is vented first (the #2 solenoid valves close and the #1 solenoid valves open) then the lower chamber is vented (the #4 solenoid valves close and the #3 solenoid valves open) and the MSIV opens to the back seat and remains open due to process steam pressure acting on the valve plug.

The five-second acceptance criterion is comprised of two stroke times. These are the stroke time of a #2 solenoid valve to fully open and the stroke time of an MSIV to fully close. For the partial stroke test, the stroke time of a #2 solenoid valve is measured. To meet the acceptance criterion, the #2 solenoid valve must stroke open in a time less than or equal to 1.10 seconds.

Discussion

On September 8, 1994, with the plant in Mode 1, the MSIVs were tested via partial stroke testing. NNECO determined that the "C" MSIV had a closure time slightly greater than that permitted by Surveillance Requirement 4.7.1.5.1 of the Millstone Unit No. 3 Technical Specifications. At that time, the "C" MSIV was determined to be inoperable and the Action Statements for Limiting Conditions for Operation (LCOs) 3.7.1.5 and 3.6.3 were entered. The Action Statement for LCO 3.7.1.5 permits power operation to continue provided the inoperable valve is restored to an operable status within four hours. If the MSIV cannot be restored to an operable condition, the plant must be in hot standby within the next six hours and in cold shutdown within the following 30 hours.

Historically, retesting the MSIV with a slow stroke time through the application of one or two additional test cycles has resulted in the stroke time of the MSIV meeting the acceptance criterion of Surveillance Requirement 4.7.1.5.1. NNECO believed that the "C" MSIV would react similarly. In an effort to restore the "C" MSIV to an operable condition within the limitation of the Action Statement for LCO 3.7.1.5, additional partial stroke tests of the "C" MSIV were conducted. Each of these tests indicated that the stroke time of the "C" MSIV would be slightly greater than five seconds, because solenoid valves C2A and C2B had stroke times slightly greater than 1.10 seconds.

While performing a partial stroke test of the "C" MSIV, the "C" MSIV unexpectedly went closed. When this occurred, the plant was manually tripped. This resulted in the plant going from Mode 1 to Mode 3. After this occurred, the plant entered the LCO 3.7.1.5 Action Statement for Modes 2, 3, and 4. This Action Statement permits the plant to continue to operate in Mode 2, 3, or 4 provided the isolation valve is maintained closed. Originally, NNECO had planned to maintain the plant in Mode 4 (Hot Shutdown) to repair the "C" MSIV. However, other unrelated conditions were discovered (independent of the issues involving the "C" MSIV) that required the plant to be placed in Mode 5 (cold shutdown).

NNECO has restored the "C" MSIV to an operable status. This effort required that two separate and distinct issues be resolved. These issues were the slow stroke time for the "C" MSIV, and the inadvertent closure of the "C" MSIV during the partial stroke testing.

Action Plan for Resolving Slow Stroke Time for the "C" MSIV

The #2 solenoid valve valves (C2A and C2B) for the "C" MSIV have been replaced. Prior to resuming plant operation, full stroke

testing of the "C" MSIV was performed, while in Mode 4, in accordance with Surveillance Requirement 4.7.1.5.2, and again in Mode 3, in accordance with Surveillance Requirement 4.7.1.5.1, to determine the stroke time of the "C" MSIV. The stroke time of the "C" MSIV was determined to be within its acceptance criterion, thus, no further maintenance on the "C" MSIV or its ancillaries was required. On October 4, 1994, each of the MSIVs was successfully partial stroke tested within its acceptance criterion on the first attempt.

Additional engineering investigations will be planned, utilizing the removed solenoids under simulated operation parameters to acquire additional information about the possible causes for sluggish valve operation. Follow-up discussions with the solenoid vendor are planned for the purpose of investigating improvements to the solenoids to enhance their reliability.

During the fifth refueling outage, each of the solenoid valves will be inspected in conjunction with the solenoid manifold block replacement project per NNECO's plans which were re-established prior to this event.

Action Plan to Resolve Inadvertent Closure of the "C" MSIV

The "C" MSIV inadvertently closed due to the failure of a pin on the C2B solenoid valve. To resolve this issue, the C2B solenoid valve has been replaced. Additionally, the pin has been sent to a laboratory for analysis. NNECO has determined that the pin failure did not contribute to the slow stroke times.

Currently, the pin failure experienced on the C2B solenoid valve is believed to have been of a random nature caused by inadequate pin material properties. NNECO's experience with these solenoid pins has not been up to our or the valve manufacturer's expectations. Metallurgical examinations of the failed pin, along with other pins removed from in-service solenoid valves and pins removed from warehouse stock has revealed that the pin materials may not have undergone adequate heat treatment which could optimize their properties. As a result, some pins may be subject to premature failures. Visual and other nondestructive examination techniques are not suitable to reveal these inadequacies.

Future stroke testing will monitor solenoid valve stroke travel. This will provide evidence of pin integrity. A single pin failure will not prevent the MSIV from performing its intended safety function. The consequence of a pin failure, in the worst case for a #2 solenoid valve, is the closure of the MSIV and subsequent reactor trip.

Pin failures, at this time, can not be predicted and are likely to occur at random. Low solenoid valve stroking cycles are not considered an absolute assurance of failure prevention, just as higher stroking cycles will not always lead to failures. The probability of a future pin failure has been evaluated by NNECO, and it is concluded that this event does not represent an abnormally high failure probability based on a comparison to the generic industry value.

During the recently completed shutdown, nine of the 32 solenoid valves were inspected, and each had their respective pins replaced. Many of the remaining solenoid valves had their pins replaced during the fourth refueling outage that was completed in November 1993. Many of these solenoid pins have seen limited stroking cycles. Based on experience of pin failure rate to date, NNECO has reasonable confidence that the solenoid valves will remain operable for the remainder of this operating cycle. In light of the experience gained from the September 8, 1994, event, NNECO will limit the number of stroking cycles per test. This decision is based on a NNECO evaluation, and the evidence that additional strokes beyond second or third attempts have not resulted in the operability of the subject solenoid valve being restored. Based on the anticipated test strokes to be performed through the remainder of this operating cycle, the degree of plant risk is not considered abnormally high as compared to industry experience.

NNECO intends to investigate the potential for replacement of these pins with pins manufactured from material having greater capability under shear loading. This will be investigated on a schedule which could support their installation during the fifth refueling outage.

Additional Information to Support Safety Assessment and Significant Hazards Consideration

During a telephone call with the NRC Staff on September 15, 1994, the NRC Staff raised questions concerning the re-analysis of a main steam line break (MSLB) with an increased MSIV stroke time as to 1) whether a new departure from nuclear boiling (DNB) value was determined, and 2) the amount of inventory remaining in the intact steam generators at the time of MSIV closure.

The MSLB with a 10 second MSIV stroke time was specifically re-analyzed for four loop and three loop operation to determine the impact on DNB. The minimum DNB was calculated and found to provide greater than 30% margin above the W-3 correlation limit including penalties. Note that the recently identified DNB penalty associated with rotated fuel grids does not apply to the W-3 correlation. The remaining inventory in the intact steam generators was not explicitly determined in the re-analysis.

However, an evaluation has been performed which estimates, based on mass/energy release data from the limiting containment temperature case that more than 50% of the pre-accident inventory will remain inside of the three intact steam generators.

Currently, the mass and energy analysis contained in Section 6.2 of the Millstone Unit No. 3 Final Safety Analysis Report (FSAR) assumes that the MSIV closure time is 10 seconds. However, the analyses for the MSLB and the feedwater line break contained in Chapter 15 of the Millstone Unit No. 3 FSAR assume that the MSIVs close in five seconds. The Chapter 15 analyses will be updated following the NRC Staff's approval and issuance of the subject license amendment. The schedule for the FSAR update will be consistent with the requirements of 10CFR50.71.

Resubmittal of Marked-Up and Retyped Technical Specification Page

NNECO has discovered that the retyped technical specification page submitted on September 9, 1994, contains a typographical error. Surveillance Requirement 4.7.1.5.1 is numbered 4.7.1.5 in the retyped technical specification page provided in the September 9, 1994, submittal. In addition, NNECO discovered an additional typographical error in our submittal dated September 17, 1994.⁽²⁾ Subsequently this submittal was approved by the NRC on September 29, 1994.⁽³⁾ The word 'second' in Surveillance Requirement 4.7.1.5.2 should be 'seconds.' Attachment 1 of this submittal provides the retyped page which corrects these typographical errors.

The retyped page reflects the currently issued version of the Millstone Unit No. 3 Technical Specifications up to Amendment No. 96.

Conclusion

NNECO has restored the "C" MSIV to an operable status. This effort required that two separate and distinct issues be resolved. These

-
- (2) J. F. Opeka letter to the U.S. Nuclear Regulatory Commission, "Millstone Nuclear Power Station, Unit No. 3, Proposed Revision to Technical Specifications, Auxiliary Feedwater System, Main Steam Line Isolation Valves and Engineered Safety Features Actuation System Instrumentation," dated September 17, 1994.
- (3) V. L. Rooney letter to J. F. Opeka, "Issuance of Amendment (TAC No. M90379)," dated September 29, 1994.

U.S. Nuclear Regulatory Commission
B14978/Page 7
October 5, 1994

issues were the slow stroke time for the "C" MSIV, and the inadvertent closure of the "C" MSIV during a partial stroke test.

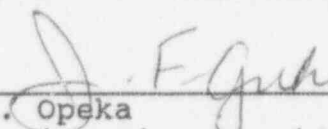
To resolve the first issue, both #2 solenoid valves for the "C" MSIV were replaced, and the "C" MSIV was full stroke tested in accordance with Surveillance Requirement 4.7.1.5.1. The "C" MSIV stroked within its required acceptance criterion, thus, no further corrective measures on the "C" MSIV or its ancillaries will be required prior to Millstone Unit No. 3 resuming power operations. Because the "C" MSIV has been determined to be operable, the NRC Staff should process the request for a license amendment submitted on September 9, 1994, on a routine basis.

To resolve the second issue, the C2B solenoid valve was replaced, and the failed pin and other new and used pins were sent to a laboratory for analysis. As a conservative measure, several of the pins in other solenoid valves that had been cycled a high number of times were replaced. Furthermore, a review of pin demand cycles reveals that solenoid valve performance has not been unacceptable over the unit operating history in comparison to the generic industry values. During the fifth refueling outage, the solenoid valves serving the MSIVs will be removed and inspected. NNECO is evaluating the replacement of the pins with pins constructed from an improved material which has greater capability under shear loading, thus, providing better durability.

If the NRC Staff should have any questions regarding this submittal, please contact Mr. R. G. Joshi at (203) 440-2080.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY



J. F. Opeka
Executive Vice President

U.S. Nuclear Regulatory Commission
B14978/Page 8
October 5, 1994

cc: T. T. Martin, Region I Administrator
V. L. Rooney, NRC Project Manager, Millstone Unit No. 3
P. D. Swetland, Senior Resident Inspector, Millstone Unit
Nos. 1, 2, and 3

Mr. Kevin T.A. McCarthy, Director
Monitoring and Radiation Division
Department of Environmental Protection
79 Elm Street
P.O. Box 5066
Hartford, CT 06102-5066

Subscribed and sworn to before me

this 5 day of OCTOBER, 1994

Carlene J. Tucker

Date Commission Expires: Nov. 30, 1999

Attachment 1

Millstone Nuclear Power Station, Unit No. 3

Additional Information to Support
Request to Revise Technical Specifications

Main Steam Line Isolation Valve Closure Time
Retyped Page