Northeast
Utilities System

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January 28, 1997

Docket No. 50-423
B16105

Re.: 10CFR50.109
10CFR50.54(f)

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Millstone Nuclear Power Station Unit No. 3
Response to Requested Action 1 of Generic Letter 96-06
Assurance of Equipment Operability and Containment Integrity During
Design-Basis Accident Conditions

In a letter dated September 30, 1996, the NRC transmitted Generic Letter (GL) 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions." The NRC requested that licensees submit a letter within 30 days of the date of the subject GL indicating whether or not the Requested Actions will be completed and whether or not Requested Information will be submitted within 120 days of the date of the GL. Specifically, the GL requests licensees to determine:

(1) If containment air cooler cooling water systems are susceptible to either waterhammer or two-phase flow conditions during postulated accident conditions; and

(2) If piping systems that penetrate containment are susceptible to thermal expansion of fluid so that overpressurization of piping could occur.

The GL requests that Actions 1 and 2 above be reviewed based on the plant's postulated accident conditions, as well as with respect to the scenarios referenced in the GL. Operability of affected systems should be assessed and corrective actions

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taken as appropriate in accordance with 10CFR50, Appendix B and the plant operating license.

Accordingly, in a letter dated October 30, 1996, Northeast Nuclear Energy Company (NNECO) reported that Millstone Unit No. 3 would complete Requested Action 1 and submit the written summary report for the action within 120 days of the date of the GL (i.e., January 28, 1997). The response for the written summary report for completion of the action is as follows.

Actions Taken in Response to the Requested Actions

NNECO performed an Engineering Evaluation that reviewed cooling water systems serving the containment air recirculation (CAR) coolers for two-phase flow and waterhammer susceptibility during design basis accident conditions. (A summary of the evaluation is provided in Attachment 2 of this submittal.) Plant conditions considered in the evaluation include:

- Containment Depressurization Actuation (CDA) signal, concurrent with a Loss of Offsite Power (LOP) signal,
- Small or Intermediate break Loss of Coolant Accident (LOCA), with no CDA signal, concurrent with a LOP signal,
- Events with a CDA signal and offsite power available,
- Events with a Safety Injection System (SIS) signal and offsite power available, and
- LOP event.

In addition, the susceptibility to two-phase flow and waterhammer was evaluated for other containment heat removal systems.

Conclusions that were Reached Relative to Susceptibility for Waterhammer and Two-Phase Flow in the Containment Air Cooler Cooling Water System and Overpressurization of Piping that Penetrates Containment

- Failure scenarios (two-phase flow or waterhammer) postulated in the GL and involving the CAR System are not expected to occur at Millstone Unit No. 3.
- Our October 30, 1996 letter reported that the engineering review, to determine if any piping sections of isolated water-filled piping systems that penetrate

containment are susceptible to thermally induced overpressurization during Design Basis Accidents (Requested Action 2), is scheduled to be completed in conjunction with a review of Stress Data Packages (SDPs) for Category I piping systems. The review of the SDPs is scheduled to be completed prior to unit startup as part of the ongoing unit recovery plan. Completion of Requested Action 2 for Millstone Unit No. 3 and submittal of a written summary report will be completed prior to startup, as previously reported in the October 30, 1996 letter.

In addition, a review of system configuration shows that the Recirculation Spray System (RSS) heat exchangers and associated piping at Millstone Unit Nc. 3 could experience water column separation if the RSS pumps are restarted after being stopped during post LOCA conditions. Water column rejoining after the RSS pumps are restarted has the potential for creating unacceptable waterhammer loads upon the RSS piping.

Basis for Continued Operability of Affected Systems and Components, As Applicable

If a Design Basis Accident (DBA) occurred coincident with or without a LOP signal, the CAR fan cooling system would not be susceptible to two-phase flow, steam formation or waterhammer.

For events where a CDA or Containment Isolation Phase B (CIB) signal is not initiated (with or without a LOP signal), the evaluation demonstrates that the CAR cooling system would not be susceptible to two-phase flow, steam formation or waterhammer, and therefore remain operable.

The containment heat removal function during a DBA is provided by the Quench Spray System (QSS) and the RSS. The evaluation identified a condition in which a water column separation and subsequent waterhammer could be experienced in the RSS system during a design basis accident. This condition was reported in accordance with the provisions of 10CFR50.72. Based on this condition, the RSS System is determined to be inoperable. Issues discovered as a result of the review will be further investigated in accordance with the Corrective Action Program and will be reported in accordance with the provisions of 10CFR50.73.

Corrective Actions Implemented or Are Planned to be Implemented

The identified condition, in which an RSS water column separation and subsequent waterhammer could be experienced during a DBA will be investigated in accordance with the Corrective Action Program and will be reported in accordance with the provisions of 10CFR50.73.

If Systems were Found to be Susceptible to the Conditions that are Discussed in this Generic Letter, Identify the Systems Affected and Describe the Specific Circumstances Involved

Water column separation may occur in the RSS piping between the pump and heat exchanger due to system design and hydraulics, if the RSS pump is tripped after the system is filled with water. This water vapor space could collapse due to system pressures after the RSS pump is restarted and create a waterhammer that could damage the RSS pressure boundary. These containment isolation valves may also be adversely affected by the waterhammer effects creating a potential radiation release pathway. In addition, if the containment sump water temperature is high, RSS pressure boundary damage could create a harsh environment in the Emergency Safety Features Building (ESFB), which is beyond the plant design basis. ESFB flooding beyond that currently postulated may also be possible. With respect to containment and core heat removal functions, increased containment sump water flow due to the failed train could adversely affect the redundant RSS train due to the common RSS sump design.

Commitments

Attachment 1 provides the regulatory commitments in this submittal.

NNECO is continuing to review the licensing and design bases of Millstone Unit No. 3 pursuant to the requirements set forth in the Staff's 50.54(f) letter of April 4, 1996. If any discrepancies are discovered during this review, that affect the conclusions of this letter, a supplement will be provided.

Should you have any questions regarding this submittal, please contact Mr. James M. Peschel at (860) 437-5840.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

John Paul Cowan
Millstone Unit No. 3, Recovery Officer

Subscribed and sworn to before me

this 28 day of JANUARY, 1997

Loretta F. Goodson

Date Commission Expires: Nov 30, 2001

LORETTA F. GOODSON
NOTARY PUBLIC
Commission Expires November 30, 2001

cc: H. J. Miller, Region I Administrator
J. W. Andersen, NRC Project Manager, Millstone Unit No. 3
A. C. Cerne, Senior Resident Inspector, Millstone Unit No. 3
W. D. Travers, Dr., Director, Special Projects

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Attachment 1
Millstone Nuclear Power Station Unit No. 3
List of Regulatory Commitments

January 1997

Enclosure
List of Regulatory Commitments

The following table identifies those actions committed to by NNECO in this document. Any other actions discussed in the submittal represent intended or planned actions by NNECO. They are described to the NRC for the NRC's information and are not regulatory commitments. Please notify the Manager - Nuclear Licensing at the Millstone Nuclear Power Station Unit No. 3 of any questions regarding this document or any associated regulatory commitments.

Commitment	Committed Date or Outage
B16105-1: Investigate RSS issues discovered as a result of the review for completion of Requested Action 1 of GL 96-06 and report in accordance with the provisions of 10CFR50.73.	February 12, 1997
B15962-4: Complete Requested Action 2 of GL 96-06 and submit the requested information per the recommendation of the GL.	Prior to Unit Startup

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Attachment 2
Millstone Nuclear Power Station Unit No. 3
Response to Generic Letter 96-06
Completion of Requested Action 1

January 1997

Requested Action 1

Determine if containment air cooler cooling water systems are susceptible to either waterhammer or two phase flow conditions during postulated accident conditions.

Response

1.0 Purpose

NNECO performed an Engineering Evaluation to address the issue of containment air cooler cooling water systems susceptibility to waterhammer and two-phase flow during design basis accidents addressed by Requested Action 1 of NRC Generic Letter 96-06. Completion of the evaluation identifies potential system vulnerabilities in the RSS system.

2.0 Background

On September 30, 1996, the Nuclear Regulatory Commission issued Generic Letter (GL) 96-06 to address issues related to equipment operability and containment integrity during design basis accident conditions. Other industry documentation issued prior to the generic letter includes NRC Information Notice 96-45 and Westinghouse's NSAL 96-003 based on events identified by the Pacific Gas & Electric Company (Diablo Canyon) and the Connecticut Yankee Atomic Power Company (Haddam Neck).

According to NNECO's preliminary response to the NRC, dated October 30, 1996, which contains the schedule to address the above issues for Northeast Utilities (NU) plants, NNECO committed to provide the NRC with a written summary report to address Requested Action 1 of the GL for Millstone Unit No. 3 within 120 days of the date of the Generic Letter (i.e., January 28, 1997). For Requested Action 2 of the GL for Millstone Unit No. 3, NNECO committed to provide a summary report prior to Unit startup as part of the Unit Recovery Plan.

3. Discussion

The evaluation reviewed the following plant conditions:

- CDA signal, concurrent with a LOP,
- Small or Intermediate break LOCA, with no CDA signal, concurrent with a LOP,

- Events with CDA signal and offsite power available,
- Events with Safety Injection System (SIS) signal and offsite power available,
- LOP event.

In addition, the susceptibility to two-phase flow and waterhammer was evaluated for other containment heat removal systems.

3.1 CDA Concurrent With A LOP

For Millstone Unit No. 3, the CAR fan coolers cool the containment during normal plant operations. However, these fan coolers are not credited in the Final Safety Analysis Report (FSAR) Chapter 6 or Chapter 15 accident analyses for removing containment heat nor maintaining containment integrity during (or after) a design basis accident (DBA). During a large break LOCA or main steam line break event, a CDA signal is initiated. Waterhammer is not a concern for this system during a DBA because the Reactor Plant Component Cooling Water (CCP) pumps are automatically stopped by the CDA signal and stay off throughout the event. The CCP pumps are manually restarted by operator action later in the event (at containment pressure below 17.5 psia), when containment heat loads are not capable of causing steam formation in the CCP piping.

Additional system features are available to avoid two-phase flow or steam void formation during design basis accident conditions. These include containment isolation of the CCP piping loops into the CAR fan coolers on a Containment Isolation Phase B (CIB) signal. This signal is initiated simultaneously with the CDA signal at approximately 10 psig containment pressure. Also, relief valves are installed to provide piping protection due to fluid thermal expansion. In addition, sufficient elevation head is available from the Chilled Water System (CDS) and CCP surge tanks to the CCP piping loop to avoid steam formation during the DBA.

3.2 Small Break LOCA With Concurrent LOP (no CDA)

For intermediate and small break LOCAs concurrent with a LOP signal, the CDA signal may not initiate. However, a Safety Injection System (SIS) signal is initiated at some point during the event. The CAR fans are in operation for this event. Since containment pressure does not reach the CDA signal setpoint during this event, there is not enough energy in the containment atmosphere to produce saturated conditions in the CAR fan cooling coils during the DBA. In addition, sufficient elevation head is available from the CDS and CCP surge tanks to the CCP piping loop to avoid steam formation.

3.3 Events With CDA Signal And Offsite Power Available

For a CDA signal with offsite power available, flow from the CCP system to the CAR fan coolers is not established since the containment isolation valves close on a CIB signal. Also, the CCP pumps are automatically stopped by the CDA signal and stay off throughout the event. Therefore, waterhammer conditions are not a concern. In addition, steam formation or two-phase flow conditions are not a concern due to the automatic containment isolation of the CCP piping feeding the CAR fan coolers and available elevation head from the CDS and CCP surge tanks to the CCP piping loop. Relief valves in the CCP piping loop provide piping and equipment protection given fluid thermal expansion after closure of the containment isolation valves.

3.4 Events With SIS Signal And Offsite Power Available

Given an SIS signal without a LOP, switchover from CDS to CCP flow for the CAR fans is expected to occur with the CAR fans in operation. The CCP pumps, which are in operation prior to the event, provide the necessary head to move flow through the coolers. If switchover from CDS to CCP is not accomplished due to valve failure, the relief valves in the CAR fan system provide piping and equipment protection given fluid thermal expansion. Also, operation of the CDS pumps and surge tank static head prior to valve switchover ensures that sufficient head is available to preclude steam formation in the piping.

3.5 Loss Of Offsite Power Event

The CAR fans are operated during a LOP event for equipment protection. However, this event alone does not result in steam voiding or two-phase flow inside the CAR cooling coils because the normal containment heat load during this event is well within the capacity of the CAR fan coolers. Therefore, Millstone Unit No. 3 CAR cooling coils are not susceptible to two-phase flow, steam formation, or waterhammer events during this event.

3.6 Other Containment Heat Removal Systems

The nuclear safety related method for containment heat removal during design basis accident is provided by the Quench Spray System (QSS) and Recirculation Spray System (RSS). The QSS system takes suction from the refueling water storage tank (RWST) and is activated during the LOCA injection phase. QSS piping two-phase flow or waterhammer should not occur since there are no heat exchangers or piping loops where void or steam pockets could be trapped, and the water coming from the RWST is maintained between 40 °F and 50 °F, per plant Technical Specifications.

The RSS system, however, is automatically activated at approximately 11 minutes after a CDA signal is initiated (assuming offsite power available). During a DBA, the RSS pumps take suction from the containment sump, and the containment heat is removed by the RSS heat exchangers located downstream of the RSS pumps. A review of system configuration shows that the RSS heat exchangers and associated piping could experience water column separation, if the RSS pumps are restarted after being stopped. This concern was reported on January 13, 1997 as a condition that is outside the plant design basis, pursuant to 10CFR50.72. Millstone Unit No. 3 is particularly susceptible to RSS system water column separation because no in-line check valves exist to prevent reverse flow to the sump and a check valve exists after a system high point, thus preventing system drain down. This RSS piping configuration is susceptible to water column separation, if the RSS pump stops. Column rejoining after the pumps are started has the potential for creating unacceptable waterhammer loads. This condition will be investigated further and resolved in accordance with the Corrective Action Program and reported in accordance with the provisions of 10CFR50.73.

4.0 Safety Significance

The engineering evaluation has determined that the Millstone Unit No. 3 containment fan coolers are not susceptible to steam void formation, two-phase flow and waterhammer issues discussed in NRC GL 96-06. Also, the containment air recirculation fan coolers are not credited for mitigating the consequences of any accident described in the Final Safety Analysis Report (FSAR). The evaluation demonstrates that the two-phase flow or waterhammer events described in NRC GL 96-06 are not expected to occur for the CAR fan cooling system. Thus, there is no adverse safety significance to the CAR fan coolers.

However, the evaluation determined that one of the safety grade systems used for containment heat removal during the recirculation phase of a DBA (i.e., the Recirculation Spray System) may be susceptible to water column separation and waterhammer during post-accident conditions. This condition will be investigated further as indicated above.

5.0 Conclusion

Millstone Unit No. 3 is not susceptible to CAR fan cooling system steam formation, two-phase flow and/or waterhammer for the conditions reported in NRC GL 96-06.

The evaluation identified a condition in which a water column separation and subsequent waterhammer could be experienced in the RSS system during a design basis accident. Issues discovered as a result of the review will be

investigated in accordance with the Corrective Action Program and reported in accordance with the provisions of 10CFR50.73.