Northeast
Nuclear Energy

Rope Ferry Rd. (Route 156), Waterford, CT 06385

Millstone Nuclear Power Station
Northeast Nuclear Energy Company
P.O. Box 128
Waterford, CT 06385-0128
(860) 447-1791
Fax (860) 444-4277

The Northeast Utilities System

NOV 30 2000

Docket No. 50-423
B18254

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

Millstone Nuclear Power Station, Unit No. 3
Notification of Closed Commitment
Licensee Event Report 97-041-00

On August 13, 1997,[1] Northeast Nuclear Energy Company (NNECO) submitted to the Nuclear Regulatory Commission (NRC) Licensee Event Report (LER) 97-041-00 for Millstone Unit No. 3. This LER described a condition whereby individual service water (SW) pumps were being removed from service for maintenance during plant operation without consideration of the impact on long term cooling of the Spent Fuel Pool (SFP) following a design basis accident. In accordance with the stated corrective action commitment, NNECO developed a Technical Requirements Manual administrative control to require entry into the associated action statement of Technical Specification 3.7.4, "Plant Systems - Service Water System," whenever a single SW pump should become inoperable, either due to equipment failure or planned maintenance.

While the corrective action described in LER 97-041-00 has been effective in ensuring the design basis of the SFP cooling function is maintained, it has the potential to increase risk with no commensurate safety benefit . Upon further evaluation, NNECO has determined that compliance with the SFP Cooling System design basis can be assured using alternative controls which provide operational flexibility and support risk reduction through on-line maintenance of the SW pumps.

---

(1) Letter from G. D. Hicks, Northeast Nuclear Energy Company to U.S. Nuclear Regulatory Commission, "Millstone Nuclear Power Station Unit No. 3, Licensee Event Report 97-041-00," dated August 13, 1997.

IE22

Attachment 1 provides the basis for and a description of the alternative controls that will be used to manage SW pump availability. It is our intent to implement revised controls for SW pump availability within 45 days of the date of this letter. Because the revised controls maintain compliance with the NRC approved Millstone Unit No. 3 design basis, they do not constitute a new commitment. The original commitment contained in LER 97-041-00 will be closed upon implementation of the revised controls.

Should you have any questions regarding the information contained in this letter, please contact Mr. David W. Dodson at (860) 447-1791, extension 2346.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

Raymond P. Necci
Vice President - Nuclear Technical Services

Attachment (1)

cc: H. J. Miller, Region I Administrator
V. Nerses, NRC Senior Project Manager, Millstone Unit No. 3
A. C. Cerne, Senior Resident Inspector, Millstone Unit No. 3

Docket No. 50-423
B18254

Attachment 1

Millstone Nuclear Power Station, Unit No. 3

Alternative Controls for Assuring Spent Fuel Pool Cooling
Description and Basis

**Millstone Nuclear Power Station, Unit No. 3**
**Alternative Controls for Assuring Spent Fuel Pool Cooling**
**Description and Basis**

Introduction

On August 13, 1997,[1] Northeast Nuclear Energy Company (NNECO) submitted to the Nuclear Regulatory Commission (NRC) Licensee Event Report (LER) 97-041-00 for Millstone Unit No. 3. This LER described a condition whereby individual service water (SW) pumps were being removed from service for maintenance during plant operation without consideration of the impact on long term cooling of the Spent Fuel Pool (SFP) following a design basis accident. In accordance with the stated corrective action commitment, NNECO developed a Technical Requirements Manual (TRM) administrative control to require entry into the associated action statement of Technical Specification 3.7.4, "Plant Systems - Service Water System," whenever a single SW pump should become inoperable, either due to equipment failure or planned maintenance.

The TRM administrative controls in their current form restrict performance of preventative maintenance, such as SW pump overhauls, to refueling outages. Additionally, given the time necessary to conduct a pump overhaul (i.e., seven to ten days), failure of a pump with the unit at power would require an unplanned shutdown of the unit. Both of these conditions have the potential to increase risk. Conducting SW pump overhauls during refueling outages adds additional work during a time when all available resources are directed towards completion of a significant number of safety significant activities, thereby increasing the potential for human error. Extending SW loop operability requirements to individual SW pumps and thereby restricting pump maintenance to outage periods can also extend the length of time that a service water header is removed from service and unavailable for core decay heat removal.

The risks described above can be reduced by performing significant SW pump maintenance activities during plant operation at power. The balance of this document provides an assessment of the regulatory implications associated with revising the current TRM controls, and a description of the alternative approach to control SW pump availability.

---

[1] Letter from G. D. Hicks, Northeast Nuclear Energy Company to U.S. Nuclear Regulatory Commission, "Millstone Nuclear Power Station Unit No. 3, Licensee Event Report 97-041-00," dated August 13, 1997.

System Descriptions and Interactions

A brief description of each of the Millstone Unit No. 3 plant systems associated with this issue is presented below. This is followed by a brief discussion of the specific accident scenario of concern, and the associated impact on the SFP cooling function.

Service Water System

The Service Water System consists of two redundant flow paths (loops or headers), each consisting of two SW pumps, two SW self-cleaning strainers, two booster pumps, piping, heat exchangers, and valves. The SW pumps and strainers are located in the circulating and service water pumphouse. The SW pumps are 15,000 gpm ac motor driven pumps. Each pump discharges through a separate self cleaning strainer.

During normal operation and plant cooldown, one SW pump on each redundant header provides cooling water flow to the Reactor Plant Component Cooling Water (CCP) heat exchangers, Turbine Plant Component Cooling Water (CCS) heat exchangers, charging pump coolers, safety injection pump coolers, Control Building air conditioning heat exchangers, and other miscellaneous small loads. The remaining pump on each header is on standby and starts automatically on a low pressure signal from its service water discharge header.

Whenever an emergency diesel generator (EDG) automatically starts due to either a Safety Injection or Loss of Power actuation signal, service water is supplied to the EDG engine coolers by the automatic opening of air operated valves located in the discharge lines of each EDG engine cooler. Under all operating conditions, including a single failure, flow is maintained through at least one of the two charging pump coolers and safety injection pump coolers.

The Service Water System is designed to be able to perform its safety function following a single failure. The two SW pumps on a header are supplied from the respective emergency bus. The SW pumps on the opposite header are supplied from the redundant emergency bus. A single SW pump can supply the minimum cooling water flow requirements to mitigate all design basis accidents.

Reactor Plant Component Cooling Water

The Reactor Plant Component Cooling Water System is a closed loop cooling system that transfers heat from reactor auxiliaries, including residual heat removal, to the Service Water System during plant operation and during normal cooldown/shutdown. It provides an intermediate barrier between radioactive or potentially radioactive heat sources and the Service Water System. It is designed to remove heat from various plant components in a manner which precludes potential leakage of radioactive fluids to the environment. The Reactor Plant Component Cooling Water System is designed to be able to perform its safety function following a single failure.

During normal operation, two CCP pumps and two CCP heat exchangers accommodate the heat removal load. A swing pump and swing heat exchanger are provided to allow pump or heat exchanger maintenance. One CCP pump is fed by one emergency bus, a second CCP pump is fed by the other redundant emergency bus, while the spare CCP pump may be manually connected to either emergency bus. During accident conditions which do not cause a Containment Depressurization Actuation (CDA) signal, one CCP pump and one CCP heat exchanger accommodate the heat removal load. During accident conditions which cause a CDA signal, the CCP pumps trip and CCP heat exchanger service water flow is automatically isolated since the CCP system is not required for transferring heat from the containment or the reactor core to the ultimate heat sink (Long Island Sound).

Spent Fuel Pool Cooling System

The SFP has been designed to hold irradiated fuel assemblies that have been removed from the reactor core. Water from the SFP flows from the SFP outlet through either of the two SFP cooling pumps and SFP heat exchangers, and then returns to the SFP. Cooling for the SFP heat exchangers is provided by the Reactor Plant Component Cooling Water System. One SFP pump and one SFP heat exchanger are sufficient to maintain the SFP temperature. The Spent Fuel Pool Cooling System is designed to be able to perform its safety function following a single failure.

System Interaction Following Design Basis Accidents

In the event of a large break loss of coolant accident (LBLOCA) or high energy line break (HELB) inside containment, a CDA signal is generated on high containment pressure. The CDA signal automatically closes the motor operated valves in the service water supply lines to the CCP and CCS heat exchangers and opens motor operated isolation valves in the service water supply lines to the containment Recirculation Spray System (RSS) coolers. If a loss of power also occurs, the EDGs, which have already received an automatic start signal, will automatically energize the associated emergency buses, and one SW pump per header will automatically start.

After the LOCA or HELB accident inside containment and initiation of the CDA signal, it may be necessary to supply service water to a CCP heat exchanger to reestablish SFP cooling. The Reactor Plant Component Cooling Water System is not immediately available after these accidents to cool the SFP heat exchangers because it is not immediately needed, and power from the EDGs is not immediately available due to loading considerations. After power is available, a second SW pump will be started to supply service water flow to the CCP heat exchanger. After the second SW pump is started, a CCP pump and heat exchanger can be started as well as a SFP pump and heat exchanger.

The limiting design basis accident (DBA) from the standpoint of restoration of SFP cooling is the LBLOCA with a loss of offsite power and a single failure. This is due to

the continued need for heat removal from containment via the RSS. As a result, a second SW pump is required to support the restoration of reactor plant component cooling water flow to the Spent Fuel Pool Cooling System. This SW pump can be on the same, or opposite header, depending on plant conditions. It should be noted that the plant specific annual probability of occurrence of this accident sequence is conservatively estimated to be approximately 3.84E-08 per year.

In summary, the SW pump requirements are:

- 1 of 4 SW pumps is required to provide core (and containment) decay heat removal during a design basis accident coincident with a loss of offsite power. This requires the availability of 2 SW pumps, 1 pump per header, to meet single failure requirements.

- 2 of 4 SW pumps are required during recovery from a LBLOCA to provide SFP cooling in addition to core and containment heat removal. This requires the availability of 4 SW pumps, 2 pumps per header, to meet single failure requirements.

Regulatory Analysis

NNECO has further evaluated the regulatory implications and requirements surrounding the original concern in support of identifying alternatives to provide operational flexibility while minimizing plant risk. The significant regulatory aspects associated with this issue are compliance with Technical Specifications and General Design Criteria (GDC) requirements.

Technical Specification Requirements

Technical Specifications have been established for Millstone Unit No. 3 in accordance with 10 CFR 50.36. As is typical, a Limiting Condition for Operation (LCO) of the Service Water System is contained in the Millstone Unit No. 3 Technical Specifications. The Millstone Unit No. 3 Technical Specifications require that two SW loops shall be operable for plant operation in Modes 1 through 4. A seventy-two hour AOT for plant operation with a single operable SW loop has been established.

The Millstone Unit No. 3 Final Safety Analysis Report (FSAR) describes the function of the Service Water System for normal and accident conditions. As previously stated, operation of one SW pump in only one SW loop is sufficient to assure adequate heat removal capability from the containment and reactor core during accident conditions. A second SW pump is required to be operated at some later point during LBLOCA recovery to allow restoration of SFP cooling. The FSAR indicates that SFP cooling can be restored after approximately four hours. This is the only post accident function of the second SW pump.

The function of the Spent Fuel Pool Cooling System to provide SFP cooling is not controlled by Technical Specifications. Technical Specification controls exist for SFP water level and soluble boron concentration. However, neither of these are affected by this activity.

General Design Criteria

The Service Water System, Reactor Plant Component Cooling Water System, and Spent Fuel Pool Cooling System are designed in accordance with 10 CFR 50, Appendix A, GDC 44, "Cooling Water." This GDC requires:

> A system to transfer heat from structures, systems, and components important to safety, to an ultimate heat sink shall be provided. The system safety function shall be to transfer the combined heat load of these structures, systems, and components under normal operating and accident conditions. Suitable redundancy in components and features, and suitable interconnections, leak detection, and isolation capabilities shall be provided to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available) the system safety function can be accomplished, assuming a single failure.

The capability to withstand a single failure in fluid and electrical systems is a plant specific design requirement that is contained in numerous GDCs.

Analysis

The relationship between the GDCs and plant operational requirements is addressed in Section 8.1.4 of the NRC Enforcement Manual.[2] This guidance indicates that the Technical Specifications provide the controlling parameters for plant operation, and the GDC in and of themselves are not directly applicable to operating requirements. The GDC are characterized as overall performance goals for the design of systems and structures, and not absolute operational limitations. The guidance further describes the relationship between the GDC and the Technical Specifications to be that established under 10 CFR 50.36(b), which requires the operational limits in Technical Specifications be based on the analyses documented in the FSAR. It can be inferred from this discussion that an operational limitation associated with the SFP cooling function would be appropriate only if the event probability and consequences justified addressing the loss of cooling scenario as a DBA in the FSAR. An examination of the Millstone Unit No. 3 FSAR clearly indicates that the loss of SFP cooling, concurrent with or without a LBLOCA, is not addressed as a DBA (Chapter 15).

---

[2] NUREG/BR-0195, Revision 3 (Draft), NRC Enforcement Manual, while this is a draft document the passage referenced is footnoted to a 1997 memorandum from the NRC General Counsel to the Commission. Consequently, this does not appear to represent a new or different position on the subject.

Insights into the probability and consequences associated with loss of SFP cooling events are discussed in the NRC study of decommissioning risks for nuclear plants.[3] This draft NRC Technical Study provides conclusions on spent fuel pool risks, and reflects the NRC resolution of significant public and industry comments on an earlier version. Even though this study is based on decommissioned nuclear plants, the general conclusion of the report, that significant risk to the public potentially occurs for those event sequences leading to uncovering of stored fuel, is applicable to Millstone Unit No. 3. Section 3.3.1 of this study discusses the loss of cooling scenario and concludes that the probability of uncovering stored fuel is very low. For fuel uncovery to occur, the plant operators would have to fail to recover the SFP Cooling System, and then fail to provide makeup cooling using either on-site or off-site water sources. Since Millstone Unit No. 3 has many indications to warn the plant operators of a loss of SFP cooling (e.g., control room alarms, temperature and level indications), and numerous spent fuel pool makeup water sources are available, it is very unlikely a loss of SFP cooling would lead to stored fuel uncovery. For these reasons, it is appropriate that a loss of SFP cooling not be considered a design basis event.

On this basis, NNECO concludes that operational restrictions to address SFP cooling capability do not meet 10 CFR 50.36 criteria for inclusion in Technical Specifications. Consequently, extending the Technical Specification operability requirements for service water loops to address support of the SFP cooling function is not necessary, and not required.

Maintaining the Spent Fuel Pool Cooling Function

The function of the Service Water System to provide support for SFP cooling is an important safety feature that should be controlled, but not within Technical Specifications. The FSAR describes the SFP cooling function as being restored approximately four hours after the initiation of the limiting design basis accident. In reality, the required timeframe for restoration of SFP cooling increases with time after a refueling outage and is dependent on pool heat load and the existing operating temperature of the SFP. In essence, there will be a point in time following each refueling outage when the SFP heat up rate will be reduced to a level where extended time is available to support restoration in the event forced cooling is lost, even under limiting DBA assumptions. For example, SFP temperature would stabilize below the maximum Spent Fuel Pool Cooling System design temperature upon loss of forced cooling by crediting ambient cooling only for the current Millstone Unit No. 3 SFP conditions.

Appropriate operational constraints to address inoperable SW pump combinations not specifically covered by the Technical Specification 3.7.4, will continue to be addressed in the TRM. TRM requirements for controlling SW pump availability, including allowed

---

[3] Nuclear Regulatory Commission, "Draft Final Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants," February 2000.

outage times, will consider the plant specific risk insights associated with SW pump availability for events such as the beyond design basis loss of all service water, as well as the relative risk associated with the potential loss of the SFP cooling function following the limiting DBA.

The TRM requirements for SW pumps will address unintentional (e.g., unexpected pump failure or inoperability) as well as intentional (e.g., maintenance activities) SW pump inoperability. Prior to authorizing extended maintenance activities (e.g., pump overhauls), it will be necessary to evaluate the SFP heat load to determine how much time would be available following a potential loss of SFP cooling until the maximum Spent Fuel Pool Cooling System design temperature would be reached. This time will need to be of sufficient length to allow reasonable remedial actions necessary to restore SFP cooling if it is lost during extended maintenance. Remedial actions would include restoration of power to available equipment or repair/replacement of failed components. In addition, the plant configuration will be controlled during maintenance activities to minimize plant risk. This is consistent with the Maintenance Rule requirements of 10 CFR 50.65(a)(4), which have been implemented at Millstone Unit No. 3.

It is noted that the opportunity to perform online SW pump maintenance will be reduced gradually over the operating life of the plant due to the gradual increase in background heat load resulting from the addition of irradiated fuel assemblies to the SFP. Recognizing this, NNECO has included procurement of spare components into its future business plan to facilitate further reductions in the time necessary to support restoration of a SW pump.

Conclusion

The SFP cooling function can be adequately assured by establishing appropriate TRM constraints to control the unavailability of SW pump combinations not covered by Technical Specification 3.7.4. The current plant conditions confirm that single SW pump outages can be accommodated safely during plant operation. Additionally, a review of recent NRC studies regarding spent fuel pool risk lead us to conclude that there is no safety basis which would require linking the operability requirement of Technical Specification 3.7.4 to the SFP cooling function.