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Docket No. 50-423
B14279

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

Gentlemen:

Millstone Nuclear Power Station, Unit No. 3
Supplementary Leak Collection and Release System/Auxiliary Building
Ventilation System - Event Summary

The purpose of this letter is to inform the Staff of the background, status, and course of action taken for the resolution of the design deficiencies related to the Auxiliary Building Ventilation System (ABVS) and Supplementary Leak Collection and Release System (SLCRS) for Millstone Unit No. 3. Millstone Unit No. 3 is presently at 100 percent power after having completed modifications and testing necessary to support system operability. The modifications are discussed in greater detail in this letter.

On September 29, 1992, the "B" train of the SLCRS was declared inoperable and it was determined that insufficient surveillance testing existed to prove the operability of the "A" train. Specifically, timing delays in the ABVS fan circuitry resulted in a 70-75 second delay in ABVS fan start from signal actuation. The ABVS system acts in parallel with the SLCRS and can affect the SLCRS drawdown results. In addition, Northeast Nuclear Energy Company (NNECO) determined that the timing sequence difference between an actual accident configuration and the existing SLCRS drawdown surveillance was large enough to consider the surveillance inadequate for verifying system operability.

The immediate corrective action based on Limiting Condition for Operation (LCO) 4.0.3 was to perform another in-service test (IST) to determine the operability of the "A" train of SLCRS.

While performing the second (IST) on September 30, 1992, the "A" train of the SLCRS failed to draw down the secondary enclosure within the required time frame and was declared inoperable. (The IST results showed that the 0.25-inch negative pressure criterion could not be met in the required 60 seconds [80 seconds actual]). NNECO began a shutdown of the unit. The shutdown to Mode 5 was completed on October 1, 1992.

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System Descriptions

The SLCRS is designed to produce a negative pressure in the secondary enclosure and provide a filtered exhaust path for air drawn into the SLCRS boundaries as a result of the pressure differential. The SLCRS is designed to handle up to approximately 10,000 cfm of leakage into the entire secondary containment.

NNECO's goal throughout this evaluation process has been for the ABVS and SLCRS to achieve these objectives: a) SLCRS draw down within 60 seconds, b) automatic operation of the ABVS, and c) operation of ABVS in compliance with the single failure criterion. These are the goals that NNECO was attempting to prove in testing and to achieve in subsequent design change activities.

The Auxiliary Building Ventilation and Filter System is designed to control the release of radioactive material from the area of the Charging Pump and Plant component cooling water pumps and heat exchangers in the auxiliary building during an accident by directing releases through a filtered path to assist the SLCRS in maintaining a negative pressure within the secondary enclosure around containment.

The two systems, Auxiliary Building Ventilation and Filter System and SLCRS, work together to maintain the required negative pressure. The two systems had been tested together to demonstrate the ability to achieve the negative 0.25 inches water gage pressure within the required time inside the secondary containment enclosure. However, the ventilation lineup during surveillance had not been consistent with accident conditions lineup.

The ABVS is a two-train system serving three purposes: cooling equipment in the auxiliary building; filtration prior to atmospheric release during an accident; and assistance in establishing and maintaining vacuum in the auxiliary building. (See Attachment 1 for a simplified ABVS drawing.)

During normal operation, the ABVS draws air from the outside atmosphere and distributes air to the charging pump cubicles, component cooling water heat exchanger area, and the motor control center (MCC)/rod control booster pump area, and exhausts the warm air to the auxiliary building vent stack. Temperature indicating controllers maintain temperatures by modulating supply and recirculation dampers.

During the accident mode, the ABVS isolates the normal exhaust path, routes the air flow through a plenum into filters, and exhausts it through the auxiliary building vent stack. During the accident mode, a safety injection signal (SIS) starts the exhaust fan; if the one exhaust fan fails to start, a logic sequence starts its redundant fan. The temperature indicating controllers continue to maintain area temperatures. Pressure indicating controllers, located in the plenum on the inlet side of the filtration exhaust fans, maintain building pressure by modulating the variable inlet vanes (VIV) at the inlet to the filtration exhaust fans.

During the accident mode, SLCRS draws a vacuum on the auxiliary building, the engineered safeguards features building, the main steam valve building, the hydrogen recombiner building, and the enclosure building, and exhausts filtered air to the atmosphere through the site stack.

In the event of an SIS or loss of power (LOP), the auxiliary building filter system is required to:

- Filter the air in the auxiliary building before discharge to the atmosphere. This is accomplished by directing the discharge of the charging pump and component cooling water area ventilation exhaust fans through the filters.

- Assist the SLCRS in maintaining a negative pressure in the auxiliary building. This is accomplished by exhausting more air than is brought into the building by the charging pump and component cooling water area ventilation supply fans.

Resolution of Design Deficiencies

A team of engineers was assembled to address the design deficiencies and develop solutions. It was determined that both short- and long-term solutions would be required. Short-term solutions are necessary to establish and maintain system operability to support plant operation. Those short-term solutions are necessary primarily due to the single failure concerns related to damper position. Final long-term solutions may require significant modifications to the system design. It is anticipated that these changes will require extensive lead times for equipment purchases, engineering, installation, and testing. This work will be scheduled for the next refueling outage.

All of the solutions are being implemented in stages. The resolution of the identified design deficiencies are being implemented in four stages.

Stage 1: Supports operation above 17°F outside air temperature.

Stage 2: Support plant operation at and below 17°F outside air temperature.

Stage 3: Support "warm weather" operations.

Stage 4: Long-term solution to be implemented in the upcoming refueling outage.

The original design deficiencies preventing fully automatic operation as required to satisfy design basis requirements of the ABVS filter exhaust and charging pump cubicles/component cooling water supply and exhaust ventilation systems are as follows:

a. The subject auxiliary building charging pump cubicles/component cooling pump areas do not have dedicated heating powered from emergency diesel generators to support operation of the ABVS filter exhaust system and charging pump cubicles/component cooling pump areas spply and ehaust fns system during winter conditions. FSAR Section 9.4.3.1 specifies a minimum indoor ambient design temperature of 65°F during a design basis outside ambient temperature of 0°F. For example: during an LOP on a 0°F design basis day, approximately 233 KW of heating would be required to maintain 65°F during operation of the ABVS flter sstem at its minimum flow point of 15,000 SCFM and approximately 466 KW of heating would be required at its maximum flow point of 30.000 SCFM. The minimum flow point of 15,000 SCFM was established by test to be the minimum flow capacity of fans 3HVR*FN6A/6B without stalling.

b. The subject ventilation system is vulnerable to several single failures. Several components in the system have failure modes which could render both trains of the ABVS filter system inoperable and/or result in adversely affecting the capability of maintaining ≥0.25-inch negative pressure in the secondary containment and/or result in exceeding design basis high/low temperature limits in the affected areas. Millstone Unit No. 3 Safety Technical Specifications 3/4.6.6, 3/4.7.9, and 3/4.7.14 and FSAR Sections 6.2.3, 6.5.1.2, and 9.4.3.1 define design basis parameters.

The primary document presently for the Stage 1, 2, and 3 solutions is a Plant Design Change Record (PDCR). Portions of this PDCR also support the long-term solutions (Stage 4). There are seven design changes specifically evaluated in the PDCR. These changes may not be exhaustive or final. However, for information, they are:

1. Fan Interlock Addition

The proposed design change modifies the auxiliary building filtration system by revising the control wiring for the charging (CHS) pump and component cooling water (CCP) pump area exhaust fans and the charging and pump component cooling water pump area supply fans. The design change interlocks the same train supply and exhaust - such that if one fan trips, the other same train fan also trips.

The reason for this change is that the control wiring allowed the supply fans to remain running when their corresponding exhaust fans failed. The failure of either exhaust fan caused the opposite train supply and exhaust fans to start. This resulted in having two supply fans running with one exhaust fan. This failure, coupled with an accident, could have resulted in the pressurization of the auxiliary building and reduce the ability of the SLCRS system to establish ≥0.25-inch negative pressure within the required time as per Technical Specification 4.6.6.1.

2. Sequencer Time Change

Change the auxiliary building filter exhaust fan sequencer timer from its present setting of thirty-five (35) seconds to one (1) second.

The reason for this change is that the auxiliary building filter exhaust fans are used to assist the SLCRS in establishing the secondary containment boundary at ≥0.25-inch negative pressure within the required time. Automatically starting these fans sooner than the present setpoint allows the secondary containment boundary to comply with the requirement provided in Technical Specification 4.6 6.1.

3. Manual Start Block Signal Removal

Removal of the sequencer manual start block signal from the start circuit of charging pump and component cooling water pump area supply fans.

The reason for this change is that the supply fans cannot restart following an LOP until the sequencer manual start block signal is removed (40 seconds after diesel generator 4kV supply breaker closure). These fans, due to their interlocks with the auxiliary building filter dampers are required to operate before auxiliary building filter exhaust fans can start. Therefore, in order to start the exhaust fans earlier to achieve a faster auxiliary building negative pressure, the supply fans also have to start earlier.

4. Damper Position Modification

Certain dampers are mechanically fixed in positions to accommodate a balanced minimum ABVS flow of approximately 15,000 SCFM. Other dampers are mechanically locked shut.

This change is necessary to meet design requirements that vary with temperature. If an accident occurs during warm weather, the inlet dampers are fully open. When the exhaust fan starts, there is a suction path established through filter banks to draw exhaust air. If, however, an accident occurs during cold weather, the inlet dampers are fully closed. When the exhaust fan starts, there is no suction path. Consequently the exhaust fan may trip off due to excessive vacuum as sensed by the pressure switch.

5. Fan Relay Setpoint Change

Change the setting on certain relays which are part of the auxiliary building exhaust fan circuitry from the earlier setting of 40 seconds to the current 20 seconds.

The reason for this change is that when the ABVS is started automatically, the auxiliary building exhaust fan is the lead fan and the redundant fan only operates when required by low flow conditions or low differential pressure conditions or if the lead fan fails to start after an accident signal coincident with an LOP. An engineering review determined that assuming the lead fan has not started, starting the redundant fan 95 seconds after an LOP SIS signal may prevent the ability of SLCRS and ABVS to develop a negative pressure $\geq$0.25 inches.

By adjusting the time setting of the relay from 40 seconds to 20 seconds, the redundant fan starts approximately 40 seconds after an SIS/LOP condition if the lead fan fails to start.

6. Temperature Alarm

Added a HI-LO temperature alarm at the ventilation panel to indicate a high or low temperature in the charging pump cubicle and component cooling pump areas of the auxiliary building. In addition, the two temperature loops have been modified to include an analog signal to the plant computer.

The reason for this change is that during normal and accident conditions, there is a possibility that the ventilation system will fail to control the temperature with the auxiliary building charging pump cubicles/component cooling pump areas between 65°F and 104°F. The system was not originally designed to alarm in the control room upon exceeding HI/LOW temperature in these areas. To do this, the control loop was modified to include a temperature alarm (HI/LOW) at ventilation panel VP1 and an analog signal (trending) for the plant computer.

7. Exhaust Fan Transfer Modification

Delete the existing pressure differential transfer scheme and add a control scheme to sense exhaust fan failure by interlocking high plenum pressure with safety signals SIS/CDA/LOP and miscellaneous fan start signals to start the auxiliary building filter exhaust fan.

The reason for this change is that IST testing revealed that the differential pressure instrumentation for exhaust fans in the ABVS cannot perform its control function of sensing fan failure and starting the exhaust fan in the duplicate train under all modes of fan operation. The instrumentation and the control scheme have been changed so that an instrumentation signal with appropriate control interlocks will reliably sense fan failure and initiate the redundant fan to start.

The damper alignment provided in the PDCR establishes the need for additional heating in the auxiliary building during normal operations. Temporary space heaters have been added to the auxiliary building.

Testing of the modifications was accomplished by a combination of various specific tests and integrated testing to verify system operability. As a longer term action, the integrated surveillance procedure will be revised.

Safety Assessment

The proposed changes have been reviewed and have been determined to be safe and to represent improvements to the current system. However, the changes block open dampers to temporarily address single failure concerns.

Blocking open the dampers may allow the temperatures in the auxiliary building to go below the current design basis minimum of 65°F during an LOP if the outdoor temperatures drop too low. Operation of the plant is limited to outside ambient temperatures for which it can be shown that the required safety-related equipment can be assured even if a LOP or design basis accident occurred. As long as the minimum temperature is met, there is no adverse impact on the safety systems as a result of these changes. This has been determined to be 17°F. This outdoor temperature limit assures that the auxiliary building remains at or above 32°F. For this temperature, it has been shown that equipment operability will be assured as long as a second charging pump is started and the 4 percent boric acid system isolated. Westinghouse has verified that a running charging pump will be operable for at least 30 days at temperatures ≥32°F. At least 30 minutes are available to start the second idle charging pump. As stated in Technical Specification 3.1.2.6, the boric acid system requires a minimum solution temperature of 67°F to be operable. However, this boration path is one of three available. The remaining two are sufficient to meet the technical specification requirements. Thus, as long as this path is isolated, there is no possibility of damage to the charging pump due to boron precipitation. Again, at least 30 minutes will be available to accomplish this action. These actions assure that the design basis accident analysis assumptions for equipment operability will be met even with the dampers blocked open. Thus, the blocking open of the dampers does not constitute an unreviewed safety question. In addition, some of the modifications involve the use of new microprocessors to perform control functions in only one application. A safety evaluation specific to the application of microprocessors to this modification was performed. The use of microprocessor technology for this application at Millstone Unit No. 3 is safe and does not constitute an unreviewed safety question.

Safety Significance of Past Conditions

NNECO determined that the SLCRS in conjunction with the auxiliary building ventilation system was inoperable because it could not have drawn down a negative 0.25 inches within the required time in the secondary enclosure building as required by technical specifications. There were no actual safety consequences of this condition. While the system conditions were clearly not optimal, potential safety significance was limited because potential releases would be minimized as follows:

- Using conservative design basis accident (DBA) assumptions, a delay in the draw down of the auxiliary building by SCLRS to a negative 0.25-inch vacuum to a time of up to two minutes would result in an unfiltered release that would remain below 10CFR Part 100 dose limits, i.e., using Regulatory Guide 1.109 dose conversion factors, a thyroid dose of 286 rem.

- If the same conditions are assumed, but ICRP 30 dose factors are applied, then the thyroid dose would be 180 rem.

- Furthermore, under the guidance of draft NUREG-1465, a significant release of fission products due to fuel failure is not expected for at least 30 minutes. NNECO's tests show that a negative 0.25-inch vacuum could be established well within this time period.

- Under realistic accident conditions, even though there may be a time delay to reach the negative 0.25-inch vacuum, the auxiliary building would still have a negative pressure and, thus, nearly all releases that might occur in that time period would be filtered. Moreover, in an accident situation, operators are required by procedures to verify the engineered safety features (ESF) status panels which include indication of the auxiliary building filter (ABF) system fans. Thus, any problems would be expected to be addressed within approximately five minutes.

Probabilistic Risk Assessment Insights Regarding SLCRS and Auxiliary Building Filtration System

As a measure of the significance of this issue from a public risk perspective, note that the SLCRS and auxiliary building ventilation/filtration were not modeled in the Millstone Unit No. 3 probabilistic safety study. The reasoning is as follows:

- Public risk, defined as probability and consequences of accidents, is dominated by core melt accidents with gross containment failure (intersystem loss-of-coolant accident (LOCA), gross containment isolation failure, containment rupture due to overpressure). The consequences for such accidents are in the range of 10^{6} to > 10^{7} man-rem.

- SLCRS and ABVS would be ineffective to mitigate such events because of the large magnitude of the release rate from the containment (i.e.. could not draw vacuum). Given that a core melt with gross containment failure occurred, the most likely reason is that it was because containment heat removal systems (sprays) had also failed. In turn, this is most likely caused by loss of support systems such as all AC power. Therefore, SLCRS/ABVS are also likely failed for the risk dominant accident sequences.

- SLCRS and ABVS do provide a benefit for core melt accidents with design leakage rates. However, these are low consequence events to begin with. For example, the TMI accident resulted in about 2000 man-rem dose to the public. For Millstone Unit No. 3, a consequence of approximately 1000 man-rem is used in the PRA for core melt with design leakage rates and successful containment sprays. Much of that dose is from noble gases.

- SLCRS/ABVS would reduce releases of iodine activity by a factor of approximately 20, but the dose from noble gases, a significant contributor to the overall dose, is unaffected.

- Even though the Millstone Unit No. 3 probabilistic safety study (PSS) is a very detailed and extensive undertaking by industry standards, the subject systems were not even modeled in the PSS. This was because their inclusion would have had a negligible effect on the results of the study. Much of this stems from the significant differences between the hypothetical design requirements for these systems, versus the mechanistic and more realistic methodology employed in the PSS. We suggest that the NRC consider this perspective in the context of any deliberation it may conduct on this issue.

Summary and Conclusion

In summary, NNECO has identified design deficiencies in the auxiliary building ventilation system and their effect on the SLCRS system operability. The design modifications required are extensive. Due to the extent of the modifications required, interim solutions are being implemented in stages. These stages are:

1) Operation above 17°F outside air temperature - This does not require regulatory action.

2) Operation at and below 17°F outside air temperature - This will require regulatory action.

3) "Warm Weather" modifications - It has not yet been determined if this will require regulatory action.

4) Long-term solution to be implemented next refueling outage - It has not yet been determined if this will require regulatory action.

Modifications and testing to support Stage 1 are complete and Millstone Unit No. 3 is now in Mode 1. The modifications associated with Stage 2 have been determined to constitute an unreviewed safety question. A license amendment in the form of a proposed change to technical specifications to address the unreviewed safety question will be submitted to the Staff. Engineering efforts to support warm weather operations (Stage 3) and long-term solution (Stage 4) are under way.

As noted previously, additional actions are required to support plant operation with an outside air temperature below 17°F. This is based on an analysis which indicates that additional heat would be required post-accident on a loss of offsite power to ensure equipment operability in the auxiliary building. A non-safety grade temporary heat system is being added inside the auxiliary building. This involves supplying electric heaters in the charging pump/reactor plant component cooling water pump area of the auxiliary building. Four heaters will be normally energized from Class 1E Load Centers 32R (Train A) and another four heaters will be normally energized from Class 1E Load Center 32W (Train B). It is anticipated that NNECO will be submitting this modification to the NRC for review and approval in the form of a license amendment request (i.e., a proposed change to technical specifications) to address an unreviewed safety question.

This letter is being provided for information only; no NRC action or response is requested. NNECO believes the preceding information will be helpful in understanding our handling of this event. Please contact us if you have any questions.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

J. F. Opeka
Executive Vice President

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

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Attachment 1

Millstone Nuclear Power Station, Unit No. 3

Simplified Drawing Auxiliary Building Ventilation System

November 1992

Auxiliary Building Ventilation System
and
Secondary Leak Collection & Release System