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MAR 2 1 2001

Docket No. 50-423
B18359

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

Millstone Nuclear Power Station, Unit No. 3
Control Building Purge System

This letter responds to the NRC's request regarding Northeast Nuclear Energy Company's (NNECO) evaluation of the results of a full discharge test performed on the Millstone Unit No. 3 Cable Spreading area CO_2 system. The information provided in Attachment one addresses the impact of the test results on the Millstone Unit No. 3 licensing and design basis requirements for maintaining safe shutdown capability in the event of a fire and for maintaining control room habitability in accordance with 10 CFR 50, Appendix A, General Design Criterion 19. NNECO's evaluation concludes that the unit is being operated in compliance with these regulatory standards.

The Millstone Unit No. 3 Cable Spreading Area (CSA) Carbon Dioxide (CO_2) system was locked out following an inadvertent actuation of the system on January 15, 1999.[(1)] On February 19, 2001, a full discharge test of the CSA CO_2 fire suppression system was conducted to verify the effectiveness of repairs and modifications made to support restoration of the system. Data obtained from this test was insufficient to support system restoration as the test was terminated prior to completion. However, evaluation of the data obtained did lead to a conclusion that use of the Control Building Purge System (CBPS) for CSA smoke removal should also be restricted. For these reasons, NNECO intends to operate Millstone Unit No. 3 for an additional fuel cycle with the CSA CO_2 system locked out and operation of the CBPS restricted.

To address the impact of not using the total flooding CO_2 system and CBPS for a fire in the CSA, Millstone Unit No. 3 fire fighting strategies have been revised to require the use of manual fire fighting techniques and portable ventilation. These changes provide adequate assurance that habitability of the Control Room and the East and West Switchgear areas will be maintained in the event of a fire in the CSA. It should be

(1) NNECO letter, "Millstone Nuclear Power Station, Unit No. 3, LER 99-002-00, Inadvertent Carbon Dioxide Fire suppression System Actuation In The Cable Spreading Room," dated February 16, 1999.

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noted that CSA fire response strategies address a wide range of fire conditions and include abandoning the Control Room if habitability or essential control functions are lost. The East and West Switchgear areas have been established as alternate shutdown locations for these circumstances. The capability to shut down from these locations outside the Control Room is in accordance with the Millstone Unit No. 3 design and licensing basis.

The CBPS will continue to be used to purge smoke and CO_2 in the event of a fire in the East or West Switchgear areas. This is acceptable because gross leakage of smoke and CO_2 into the Control Room during purging of the East or West Switchgear Rooms is not considered credible. Gross leakage of smoke and CO_2 is not considered credible based on there being two intervening boundaries between the Control Room and the East and West Switchgear areas. While small amounts of smoke and CO_2 may enter the Control Room due to leakage across these boundaries, adequate assurance of continued Control Room operability exists based on the ability to purge the Control Room and stairwells with portable fans and by maintaining Self Contained Breathing Apparatus (SCBA's) available for operator use. These provisions are reflected in the Millstone Unit No. 3 licensing basis.

NNECO's operability assessment reflects the principal conclusions derived to date from the data obtained during the February 19, 2001 test. If necessary, additional enhancements to the Millstone Unit No. 3 fire response procedures and strategies will be implemented as review of the test data proceeds. Additionally, NNECO is investigating the feasibility of replacing CO_2 as the suppression agent of choice in the CSA. It is expected that alternatives will be evaluated and a final resolution specified and implemented prior to startup from the eighth refueling outage.

Attachment 1 to this letter documents the basis for NNECO's responses to the NRC's questions on use of the CBPS.

There are no regulatory commitments contained within this letter.

If you should have any questions on the above, please contact Mr. David W. Dodson at (860) 447-1791, extension 2346.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

Robert G. Lizotte
Master Process Owner - Assessment

Attachment (1)

cc: See next page

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

Attachment 1

Millstone Nuclear Power Station, Unit No. 3

Evaluation Of Cable Spreading Area CO_2 Test Results

Background

Following an inadvertent CO_2 discharge event which occurred on January 15, 1999,[1] the Millstone Unit No. 3 Cable Spreading Area (CSA) CO_2 fire suppression system was locked out. The CSA CO_2 system is a total flooding system designed to automatically actuate in the event of a fire in the CSA. During this event, CO_2 leakage across the CSA boundary resulted in CO_2 levels in the Control Room and East and West Switchgear areas reaching unacceptable levels. Operator access to these areas is required to support equipment operation necessary to bring the plant to a safe shutdown condition in response to analyzed fire scenarios. In accordance with the requirements of the Millstone Unit No. 3 licensing basis, Northeast Nuclear Energy Company (NNECO) established a continuous fire watch to compensate for the lack of suppression in the CSA. The continuous fire watch coupled with the installed and operable fire detection system and enhanced fire fighting strategies provides reasonable assurance that the safety risk associated with a CSA fire is low.

Following the January 15, 1999 event, NNECO implemented an aggressive action plan directed at restoration of the CSA CO_2 system. The action plan included physical inspections of seals and ventilation system components, repairs and enhancements to penetration seals, modification of ventilation dampers, sealing of ventilation ductwork and pressure testing of the CSA using a tracer gas to evaluate boundary integrity. Tracer gas test showed that these actions had significantly reduced leakage from the CSA to adjacent plant areas. However, NNECO was not able to establish an adequate correlation between tracer gas results and CO_2 leakage. This led to a decision to conduct a full discharge test of the CSA CO_2 system during the seventh refueling outage. The full discharge test was performed following the completion of the core offload to the spent fuel pool. The test was inconclusive, as unexpected equipment failures required that the test be terminated after approximately four minutes.

The following are observations made during the test and post test recovery period, and following a review of the data collected during the test.

- The quantity of CO_2 discharged to the CSA in the January 15, 1999 event and during the February 19, 2001 test was approximately the same. The duration of these discharges was approximately seven minutes and four minutes, respectively. This is notable because the volume of CO_2 discharged in these instances was approximately ten percent more than that which was discharged during the startup qualification test. Additionally, the normal design discharge lasts for approximately twenty-two minutes.

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[1] NNECO letter, "Millstone Nuclear Power Station, Unit No. 3, LER 99-002-00, Inadvertent Carbon Dioxide Fire suppression System Actuation In The Cable Spreading Room," dated February 16, 1999.

- CO_2 levels in the Control Room proper were acceptable up to and following termination of the test and gradually increased above the OSHA recommended normal occupancy level of 5000 ppm (e.g., 8 hours/day occupancy) after the Control Building Purge System (CBPS) was placed in service to purge the CSA.

- CO_2 levels in the instrument rack room adjacent to the Control Room exceeded the OSHA normal occupancy level of 5000 ppm shortly after the start of the test. These concentrations trended downward as a function of the differential pressure between the Control Room and CSA and CSA CO_2 concentration.

- CO_2 levels in the East Switchgear area rose quickly after the start of the test and, in one location, exceeded the OSHA recommended normal occupancy limit. The concentration in this same location quickly declined upon test termination. All measurement locations trended towards a peak of approximately 7000 ppm after approximately five hours.

- CO_2 levels in the West Switchgear area exceeded the recommended level of 5000 ppm within 30 minutes after the start and rose steadily to a peak of approximately 7000 ppm after approximately two hours.

- The highest CO_2 concentrations (other than the CSA) were recorded in the mechanical equipment room and back stairwell. The concentrations in these areas at the point of measurement spiked quickly after CO_2 discharge and quickly dropped following termination of the test. Levels began rising slowly again after the CBPS was aligned.

- Initial use of the CBPS was effective at reducing CO_2 concentrations in the CSA. Supplemental purging using portable fans was effective at removing CO_2 which had stratified at the floor level of the CSA. The use of portable fans to remove CO_2 from the Control Room proper while purging the CSA with the CBPS was also effective.

- The East and West Switchgear areas were effectively purged using their normal ventilation systems.

The CBPS is described in Section 9.4 of the Millstone Unit No. 3 Final Safety Analysis Report (FSAR) and consists of a supply and exhaust fan, ductwork, isolation dampers and associated controls. The purge supply and exhaust fans are located on the 64' elevation of the control building in the mechanical equipment room. The purge exhaust duct is separate from the purge supply duct. The CBPS exhausts to the control building roof. The system shares a common fresh air intake duct with the Control Room Emergency Filtration System (CREFS). The CBPS is seismically designed, and classified as non-safety related. Isolation of the non-safety related CBPS from the safety related CREFS is accomplished by use of single isolation dampers which are maintained in the closed position with their associated air supplies manually isolated.

The East and West Switchgear area CO_2 systems are manually actuated after consultation between operations personnel and the fire brigade. Actuation of the system can be accomplished from several locations depending on specific circumstances at the time (i.e., availability of normal power). The CBPS is a manually operated system, placed in service by Control Room operators at the request of the fire brigade to facilitate smoke and/or CO_2 removal from the Instrument Rack and Computer Room, the CSA, the East and West Switchgear areas and the mechanical equipment room. CBPS controls are located within the Control Room habitability boundary.

The Control Room pressurization system maintains habitability of the Control Room during the first hour of radiological accidents as required by the 10 CFR 50, Appendix A, General Design Criterion 19. Habitability of the Control Room beyond the first hour is maintained by the CREFS. The CREFS is manually aligned to maintain a positive pressure in the Control Room by drawing in a limited amount of filtered outside air. Because of the shared air supply duct, operation of the CBPS in response to fire results in a breach of the Control Room habitability boundary rendering the Control Room emergency pressurization system and the CREFS inoperable. This is acceptable as the probability of a design basis accident coincident with a fire event is very low and the plant Technical Specifications limit continued plant operation in this condition to a very short duration.

Technical Evaluation

Control Room

The Control Room habitability boundary includes the Control Room proper and adjoining office areas, instrument rack room, computer room, back stairwell, and the mechanical equipment room. The migration of CO_2 into the Control Room proper was primarily through the back stairwell of the Control Room and the adjacent instrument rack room based on CO_2 measurements recorded during the inadvertent discharge event and the full discharge test. The foam penetration seals used to seal electrical penetrations and boot seals used to seal ductwork in these areas are part of the boundary between the Control Room and the CSA. Testing performed using smoke pencils indicated these penetration seals as the most likely source of leakage. With multiple cables going through many of these penetrations, a certain amount of leakage is expected. The driving force for migration of CO_2 to the adjacent instrument rack room and back stairwell was the higher pressure created in the CSA during the CO_2 discharge.

The use of the CBPS enhanced migration of CO_2 from the CSA to the adjacent Control Room areas. This conclusion is based on operator observation of a notable decrease in Control Room differential pressure indication upon placing the CBPS in service following the full discharge test. The decrease in Control Room differential pressure confirms that some fresh air from the Control Room proper was diverted to the purge supply fan. This condition creates a differential pressure between the CSA and adjacent Control Room areas, which would favor CO_2 migration into the Control Room.

The CO_2 concentration increased in the Control Room proper primarily from dispersion of the higher concentrations present in the instrument rack room, mechanical equipment room and the computer room into the Control Room through closed doors, and by mixing of these volumes within the normal Control Room ventilation system.

The conclusion stated above is also supported by the following observations. The CBPS lineup on January 15, 1999, was different from the lineup on February 19, 2001. On January 15, 1999, when the CBPS was put in service, the Control Room was put on filtered recirculation mode. With the filter running in the recirculated filtered outside air mode, the purge fan draws air directly from the Control Room as well as fresh air from the outside. The negative pressure created in the Control Room from the alignments allowed continued leakage through the penetration seals between the Control Room and the CSA and pulled CO_2 from the instrument rack room into the Control Room proper.

The purging lineup on February 19, 2001, did not put the Control Room in filtered recirculation mode. This alignment eliminated a direct path from the Control Room to the suction side of the purge fan. The kitchen exhaust fan was turned off prior to discharging CO_2 and remained off for purging. This put the Control Room at a higher pressure than during the inadvertent CO_2 discharge and purging activities. The filters remained isolated after the purge fan was started. The normal fresh air supply dampers remained open. This alignment created a reduced negative pressure as evidenced by the inleakage of air around the jams of the northwest stairwell door entering into the Control Room.

Back leakage of CO_2 from the purge supply and exhaust ducts into the Control Room envelope is not considered to be a significant contributor to Control Room CO_2 concentrations. This assumption is verified through periodic testing which demonstrates the integrity of the Control Room boundary. This testing involves pressurization of the Control Room using the CREFS and measuring the outside air flow necessary to achieve the required pressure. This test ensures that in-leakage to the Control Room from all sources is limited to an acceptably low value.

East and West Switchgear areas

During the January 15, 1999 event, unacceptable levels of CO_2 were measured in the East and West Switchgear areas. NNECO concluded that CO_2 leakage was the result of penetration seal leakage facilitated by the differential pressure between the CSA and the switchgear rooms. This leakage continued due to the delay in purging the CSA.

Differential pressure achieved during the CO_2 discharge test on February 19, 2001, was also the driving force for migration of CO_2 between the CSA and the adjacent East and West Switchgear areas. While CO_2 levels increased quickly after the CO_2 discharge, concentrations were less than those achieved during the January 15, 1999 event. This result was consistent with NNECO expectations. As discussed previously,

NNECO completed significant repairs and/or upgrades on the seals in the CSA in year 2000. The majority of seals repaired were between the CSA floor and the switchgear room ceilings.

Conclusions

Removing the CSA CO_2 system from service has eliminated the differential pressure between adjacent rooms created by the discharge of CO_2 into the CSA. Additionally, by eliminating the use of the CBPS for smoke removal in the CSA, the Control Room ventilation system will maintain the Control Room at a positive pressure. This precludes the development of differential pressures that would facilitate CO_2 and smoke migration across the Control Room habitability boundary. Portable fans will be used to purge smoke and gasses out of the CSA. These changes are reflected in the fire brigade's fire fighting strategies. Therefore, the Control Room and East and West Switchgear areas will remain habitable for a fire in the CSA.

The CBPS will be used for smoke and CO_2 removal due to a fire in either the East or West Switchgear areas. NNECO considers this to be acceptable for the following reasons:

- As stated above, the initial introduction of CO_2 into the Control Room boundary was caused by the pressure created from discharging CO_2 into the CSA which forced CO_2 through penetration seals located primarily in the instrument rack room and the back stairwell. This occurs because the boundary is immediately adjacent to the CSA. The East and West Switchgear areas are located below the CSA. This configuration puts two boundaries between the Control Room and the switchgear areas. Therefore, there are no direct leakage paths to the Control Room during an initial CO_2 discharge into the East and West Switchgear areas.

  Operation of the CBPS creates a negative pressure in the Control Room relative to adjacent locations for the reasons stated previously. However, the transport of gross amounts of CO_2 or smoke into the Control Room boundary is not credible because these CO_2 or smoke filled areas are not immediately adjacent to the Control Room boundary thereby minimizing the consequences of the negative pressure. Additionally, the East and West Switchgear areas are designed as CO_2 boundaries. The rooms have a designed relief path to minimize pressures that develop within the rooms. The doors are part of the boundaries defined by the rooms and are designed to maintain boundary integrity in the event of a fire and a CO_2 discharge. It is recognized that some amount of CO_2 and/or smoke may enter adjacent areas due to leakage past seals or as a result of fire brigade entry into the space. Small quantities of CO_2 and/or smoke reaching the Control Room during a fire can be easily removed using portable fans. This strategy was proven effective following the February 19, 2001 discharge test. As a final consideration, self contained breathing apparatus (SCBA) are maintained available for the Control Room crew.

- The purge supply fan is located in the mechanical equipment room on the 64' elevation and develops approximately 5 inches water gauge (w.g.) pressure based on vendor information. Should leakage in this duct occur, this pressure would force fresh air into the Control Room from the supply duct passing through the back stairwell.

- The purge exhaust fan is also located in the mechanical equipment room on the 64' elevation. Leakage on the suction side of the fan into the Control Room is not credible because the negative pressure created from the fan would draw air out of the Control Room. This fan has the same capacity as the purge supply fan. The large difference in volumes (Control Room volume versus exhaust duct volume) and distances from the suction of these two fans, ensures that the purge exhaust duct is more negative than the Control Room envelope. The start-up test measured pressures in the exhaust duct to be greater than 2 inches w.g. for the East and West Switchgear areas. Leakage on the discharge side of the exhaust fan is not credible, because the discharge is comprised of safety related ASME Section III pipe and low leakage duct work.

Summary

For the reasons stated above, it is NNECO's opinion that Millstone Unit No. 3 is being operated in compliance with 10 CFR 50, Appendix A, General Design Criterion 19, and can be safely shutdown in the event of a fire in either the CSA or the East and West Switchgear areas. For CSA fires, alternate shutdown capability is preserved within the East and West Switchgear areas by locking out the CSA CO_2 system. This eliminates the differential pressure between the CSA and East and West Switchgear areas which would facilitate CO_2 and smoke migration. For fires in either the East and West Switchgear areas, the ability to shutdown from the Control Room is also preserved given the ability to purge small amounts of smoke or CO_2 from the Control Room with portable equipment and the availability of SCBA's for the Control Room staff. As previously discussed, gross leakage of smoke and/or CO_2 into the Control Room from a fire in the East and West Switchgear areas is not considered credible given two intervening boundaries.