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October 24, 1995

Docket No. 50-336
B15399

Re: 10CFR50.90

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

Millstone Nuclear Power Station, Unit No. 2
Proposed Revision to Technical Specifications
Steam Generator Surveillance Requirement Extension

Pursuant to 10CFR50.90, Northeast Nuclear Energy Company (NNECO) hereby proposes to amend its Operating License, DPR-65, for Millstone Unit No. 2 by incorporating the attached Technical Specifications revision to the Surveillance Requirement of Section 4.4.5.1, "Steam Generators," and the Bases for Section 3/4.4.5, "Steam Generator." Typographical errors in Section 4.4.5.1.3.c.1 and Table 4.4-6 are also proposed to be corrected.

The proposed amendment will defer the next required surveillance to inspect steam generator tubes from October 20, 1996, to the next Millstone Unit No. 2 refueling outage or no later than October 20, 1997, whichever is earlier. This change will extend the maximum allowable inspection interval for steam generator tubes from 24 months (plus 25%) to 36 months. Extending the inspection interval to 36 months will eliminate the need to perform an inspection of the steam generator tubes prior to the next Millstone Unit No. 2 refueling outage (currently scheduled for May 1997). The NRC Staff has granted a similar request for Millstone Unit No. 3.[1]

This one-time extension of the steam generator tube inspection interval is technically justified for Millstone Unit No. 2 based on the following considerations:

- The steam generators tubes have only been inservice for one operating cycle. The inspection of the tubes following the initial cycle of operation revealed the absence of an active corrosion or mechanically induced

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(1) U.S. Nuclear Regulatory Commission letter from V. L. Rooney to J. F. Opeka, "Issuance of Amendment (TAC No. M86224)," dated August 19, 1993.

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steam generator tube degradation mechanism. In addition, no pluggable tubes were identified.

- The proposed 12-month extension of the inspection interval includes a recent 10-month period during which the plant was shutdown for an extended outage. During this time, the tubes were not exposed to the normal high-temperature operating environment.

- The steam generator tubes in the replacement steam generators are made of thermally treated Inconel 690, a material which is more corrosion resistant than the material used in the original steam generators for the anticipated operating environment.

Attachment 1 to this letter provides the safety assessment for the proposed change. Attachment 2 is the determination of no significant hazards considerations. Attachment 3 is a copy of the marked-up version of the appropriate section of the current Technical Specifications. Attachment 4 is the retyped Technical Specification section.

NNECO has reviewed the proposed Technical Specification changes in accordance with 10CFR50.92 and concludes that the changes do not involve a significant hazards consideration. NNECO has also reviewed the proposed license amendment against the criteria of 10CFR51.22 for environmental considerations and concludes that the changes do not increase the types and amounts of effluents that may be released offsite, nor significantly increase individual or cumulative occupational radiation exposures. Thus, NNECO concludes that the proposal satisfies 10CFR51.22(c)(9) for a categorical exclusion from the requirements for an environmental impact statement.

The Nuclear Safety Assessment Board concurs with the above determinations. In accordance with 10CFR50.91(b), NNECO is providing the State of Connecticut with a copy of this proposed license amendment.

In summary, NNECO requests an extension of the maximum inspection interval for steam generator tubes from 24 months to 36 months. This extension is technically justified, is required to eliminate the need to perform an inspection of the steam generator tubes prior to the next Millstone Unit No. 2 refueling outage, and is similar to a request previously granted by the NRC Staff for Millstone Unit No. 3.

NNECO requests that the NRC Staff review and process this proposed amendment prior to February 1, 1996, to be effective upon issuance.

An NRC decision is needed by this date in order to allow NNECO time to prepare for a steam generator tube inspection should the proposed extension not be granted. In view of this schedular constraint, NNECO will promptly provide any additional information the NRC Staff may need to respond to this request. If there are any questions regarding this submittal, please contact Mr. Mario Robles at (860) 440-2073.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

FOR: J. F. Opeka
Executive Vice President

BY: E. A. DeBarba
E. A. DeBarba
Vice President

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

Mr. Kevin T.A. McCarthy, Director
Bureau of Air Management
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Subscribed and sworn to before me
this 24th day of October, 1995
Notary Public
Date Commission Expires: 8/31/98

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Attachment 1

Millstone Nuclear Power Station, Unit No. 2

Proposed Revision to Technical Specifications
Steam Generator Surveillance Requirement Extension

Safety Assessment of Proposed Changes

October 1995

Millstone Nuclear Power Station, Unit No. 2
Proposed Revision to Technical Specifications
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Safety Assessment of Proposed Changes

Background

The most recent eddy current inspection of the Millstone Unit No. 2 steam generator tubes was completed on October 20, 1994, at the end of Cycle 12. The next refueling outage is currently scheduled for May 1997. This will result in a nominal 31 calendar month interval between tube eddy current inspections, assuming no unanticipated shutdowns. This time frame exceeds the 24 month maximum interval allowed by the Technical Specifications. Accordingly, a one-time extension of the maximum interval for steam generator tube inspections from 24 to 36 calendar months is proposed.

Description of Proposed Change

The proposed Technical Specifications revision will provide a footnote to the Surveillance Requirement of Section 4.4.5.1, "Steam Generators," that defers the next required surveillance to inspect steam generator tubes from October 20, 1996 to the next Millstone Unit No. 2 refueling outage or no later than October 20, 1997, whichever is earlier. Additionally, a brief description of the technical justification for the footnote will be provided in the Bases for Section 3/4.4.5, "Steam Generator." The typographical errors for Section 4.4.5.1 and Table 4.4-6 are editorial and the corrections have no safety significance.

Safety Assessment

Millstone Unit No. 2 recently completed the first full cycle (Cycle 12) of operation with the new replacement steam generators in October 1994. These steam generators were manufactured with tubing fabricated from thermally treated Inconel 690. The tubes were installed into the tubesheet using a full length hydraulic expansion process to ensure low residual stress. The U-bend area is provided with a fan bar support structure designed to minimize the potential for mechanically induced wear from flow induced vibrations. Other improvements include the use of lattice grid tube support structures manufactured from corrosion resistant 410 stainless steel which should preclude the development of steam generator tube denting.

To extend the inspection interval, the following items were technically evaluated:

- Eddy Current Inspection Following First Cycle of Operation
- Secondary Chemistry Control
- Corrosion Evaluation of Thermally Treated Inconel 690
- Steam Generator Tubesheet Visual Assessment
- Potential for Steam Generator Tube Corrosion During RFO 12

Each of these items are discussed below in more detail.

Eddy Current Test Inspection Following First Cycle of Operation

The Cycle 12 Refueling Outage (RFO 12) eddy current inspection was performed on approximately 30 percent of the steam generator tube population. The tubes selected included those regions of the tube bundle where tube degradation, based on industry experience, was most likely to occur. The tubes were determined to be in excellent condition. No repairs were required.

No pluggable indications were detected. Only one of the 4891 tubes examined was reported to contain degradation. This tube (steam generator #1, Row 140, Column 79), located on the perimeter of the tube bundle, had a shallow indication (approximately 22% through wall) on the OD surface. This indication is close to the eddy current detection limit of 20% throughwall. The flaw was located within the No. 1 lattice grid support on the hot leg and was not present on neither the pre-installation nor post-installation baseline eddy current data. The shallow nature of the flaw was verified by a rotating probe test. Based upon the shallow nature of the indication, the tube was left in service.

If it is conservatively postulated that this one shallow indication is due to a constant rate, active degradation mechanism, the depth of this indication would not be expected to exceed 65% of the tube wall thickness, prior to the end of cycle 13. Assuming that this 65% through wall indication behaved in a crack-like manner and extended 360° around the tube circumference, the affected tube would continue to meet the structural margins of safety as required by Regulatory Guide 1.121. Furthermore, this postulated indication would be expected to bound other potential corrosion mechanisms such as pitting and localized wastage.

Secondary Chemistry Review

To address the potential for tube material degradation, a review of the chemistry was performed using the quarterly chemistry reports for Cycle 12. These reports revealed that sulfate and chloride levels were essentially less than the target value set in the Secondary Water Chemistry Guidelines with one exception. During March 1993, the plant entered Action Level 1 (> or equal to 20 ppb)

for chlorides. A maximum chloride concentration of approximately 20 ppb was reached. The plant exited the action level approximately 10 hours later. During shutdown and down power events, no steam generator hideout return was reported. This is indicative of a non-corrosive environment in concentrating steam blanketed areas such as tube/support system crevices and within any tubesheet sludge pile accumulations.

Corrosion Evaluation of Thermally Treated Alloy 690

Thermally treated Alloy 690 represents one of the most corrosion resistant materials currently used in recirculating steam generators. This tubing material has a corrosion resistance comparable to or better than Alloy 600 for corrosion mechanisms currently faced by the industry.

Thermally treated Inconel 690 is superior in resistance to stress corrosion cracking and intergranular attack than both mill-annealed and thermally treated Inconel 600 in caustic environments. Testing of various Alloy 600 and 690 specimens under acidified conditions enriched with sulfates concludes, in part, that materials in the thermally treated condition are also much less susceptible to stress corrosion cracking and intergranular attack.

Secondary side impurity concentration is not a concern due to the lack of steam generator hideout return. This indicates a very low likelihood that secondary side corrosion will initiate. Both Alloy 690 in the mill-annealed and thermally treated conditions are as good or slightly better than Alloy 600 in resistance to pitting corrosion in a chloride containing environment. This information and the lack of impurity concentration within the steam generators and the fact that the secondary system is essentially copper free (copper would act as an initiator or accelerator for corrosion), provides the basis for the conclusion that there is a low likelihood for pitting corrosion of the thermally treated Alloy 690 tubing material.

Also, the hydraulic expansion process used to install the tubes into the tubesheet lowers the susceptibility of the tube material to primary water stress corrosion cracking. Therefore, primary side stress corrosion cracking is considered very unlikely to occur in these steam generators.

Thermally treated Alloy 690 appears to have the same resistance to wastage as Alloy 600. Since no steam generator hideout return has been observed, however, wastage of the thermally treated Alloy 690 steam generator tubing is not considered to be a credible concern.

Based upon the above, potential corrosion degradation of the thermally treated Alloy 690 steam generator tubes during Cycle 13 is considered to be unlikely.

Steam Generator Tubesheet Visual Assessment

A summary of the visual inspections performed during Cycle 12 was performed to assist in the evaluation of the condition of the steam generators. The tubesheet area was inspected pre- and post-sludge lancing. The pre-lancing sludge inspection consisted of a 360° inspection of the annulus region, views down the blowdown lane from both the hot and cold leg, inspecting down into the blowdown tube holes, and an inspection of the shroud lug to shell interface. The purpose of the inspection is to determine the sludge lancing effectiveness and perform a foreign object search and retrieval inspection. The results of these inspections are:

- Annulus regions showing only a small amount of sludge accumulating with "machine marks" visible on the tubesheet.

- The blowdown lane and blowdown holes showing little to no sludge buildup.

The tubes were found to be very clean at the top of the tubesheet. While the inner tube bundle area at the top of the tubesheet was inaccessible for video inspection, the post-sludge lancing inspection and mass of sludge removed by lancing are indicative of very low sludge accumulation.

Eddy current analysis for sludge corroborated that the top of tubesheet area is very clean. Of the 4891 tubes examined, only 27 had sludge indications. The maximum indicated height was 1.1 inches. This data and associated evaluation indicates that there is a lack of an overall sludge accumulation at the top of the tubesheet (sludge pile). This is the result of good chemistry practices and points out the effectiveness of the alternate amine chemistry program currently in used. Ethanolamine was used throughout Cycle 12 to provide enhanced pH control throughout the steam cycle.

Potential for Steam Generator Tube Corrosion During Refueling Outage 12

The steam generator secondary side hand holes were opened early during refueling outage 12 (RFO 12) for visual inspections and sludge lancing. The steam generators were subsequently allowed to remain open to the atmosphere with forced ventilation from the handholes for approximately forty-two (42) days. The steam generators also contained approximately one to two inches of water

on the top of the tubesheet at the beginning of the period in which they were open to the atmosphere. Following this period, the steam generators were placed into wet layup for the remainder of the refueling outage (approximately 255 days).

During the period of time when the steam generators were exposed to the atmosphere, there was one to two inches of water on top of the tubesheet. This water was the residual left behind following tubesheet sludge lancing. Sludge lancing was performed using primary water makeup (normal makeup to the condensate storage tank) that is comparable in quality to deionized water.

Based upon the expected low impurity concentration within the residual water, the low temperature and minimal tubesheet sludge accumulation, steam generator tube corrosion during this 42 days of exposure to the atmosphere is not believed to have occurred.

Conclusion

In summary, the proposed Technical Specification change to extend the steam generator tube inspection interval to 36 calendar months is justified based upon the following:

- There were no pluggable tubes following the first operating cycle with the replacement steam generators.

- The absence of an active corrosion or mechanically induced steam generator tube degradation mechanism after one cycle of operation.

- Thermally treated Inconel 690 represents one of the most corrosion resistant materials currently used in recirculating steam generators.

- The steam generators contain improved 410 stainless steel tube lattice grid support structures virtually eliminating the potential for the development of steam generator tube denting.

- The lack of hideout return from the steam generators during shutdown and downpower events. This is indicative of a non-corrosive environment in concentrating steam blanketed areas such as tube/support system crevices and within any sludge pile accumulations.

- Chemistry was controlled within EPRI Chemistry Guideline values. Sludge accumulations were not visually evident at the top of tubesheet. Less than fifty pounds of sludge was removed from the steam generator tubesheets during sludge lancing operations. This is the result of good chemistry practices and points out

the effectiveness of the alternate amine program currently in use. Ethanolamine was used throughout Cycle 12 to provide enhanced pH control throughout the steam cycle.

- Draft documents from ongoing EPRI Thermal Hydraulic Model development concludes that there is no immediate (i.e., near-term) or significant wear/fatigue potential due to low critical velocity ratios, and the absence of reported denting and wear.

Based on the above, the proposed Technical Specifications change is safe. No steam generator tubes are expected to exceed Regulatory Guide 1.121 structural limits due to corrosion or mechanical wear mechanisms through Cycle 13.

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Attachment 2

Millstone Nuclear Power Station, Unit No. 2

Proposed Revision to Technical Specifications
Steam Generator Surveillance Requirement Extension

Determination of No Significant Hazards Consideration

October 1995

Millstone Nuclear Power Station, Unit No. 2
Proposed Revision to Technical Specifications
Steam Generator Surveillance Requirement Extension
Determination of No Significant Hazards Consideration

Pursuant to 10CFR50.92, NNECO has reviewed the proposed one-time change to extend the maximum allowable inspection interval for steam generator tubes from 24 months to 36 months. NNECO concludes that these changes do not involve a significant hazards consideration since the proposed change satisfies the criteria in 10CFR50.92(c). That is, the proposed changes do not:

(1) Involve a significant increase in the probability or consequences of an accident previously analyzed.

This change involves one-time deferment of the eddy current inspection of the steam generator tubes until the end of the next refueling outage following the thirteenth fuel cycle, but no longer than 12 months beyond the original due date for the inspection. The steam generator tubes have only been exposed to one operating cycle and are made of thermally treated Alloy 690, one of the most corrosion resistant material currently used in recirculating steam generators. Following the first full fuel cycle of operation, the steam generator tube inspection found the tubes to be in excellent condition (i.e., no repairs were required and there was no evidence of an active degradation mechanism). Accordingly, no significant tube degradation is expected by the end of the thirteenth fuel cycle. Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously analyzed.

(2) Create the possibility of a new or different kind of accident from any previously analyzed.

This one-time change, allowing the steam generator tubes to be examined at the end of the refueling outage following Cycle 13 does not alter the physical design, configuration, or method of operation of the plant. The extension of the inspection interval is not expected to result in significant steam generator tube degradation. Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously analyzed.

(3) Involve a significant reduction in the margin of safety.

Steam generator tube degradation occurs primarily during operation. The change to extend the maximum allowable inspection interval for steam generator tubes from 24 months to 36 months will not significantly increase the total operating time during Cycle 13 (the plant was in an outage for at least 10 months of the 12 month extension). Therefore, there is no significant effect on the extent and severity of tube degradation. The improved corrosion resistance of the steam generators tubes (thermally treated Alloy 690) minimizes the threat of primary- and secondary-side corrosion. No indications of corrosion have been identified in inspections performed so far. Based on our assessment of the inspection data and corrosion potential, all tubes are expected to be within the Regulatory Guide 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes," limits by the end of Cycle 13. Also, correction of the typographical errors will improve the fidelity of the specification. Therefore, this change does not involve a significant reduction in the margin of safety.