UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 162

TO FACILITY OPERATING LICENSE NO. NPF-49

NORTHEAST NUCLEAR ENERGY COMPANY, ET AL.

MILLSTONE NUCLEAR POWER STATION, UNIT NO. 3

DOCKET NO. 50-423

1.0 INTRODUCTION

By letter dated January 22, 1998, as supplemented by letter dated July 17, 1998, the Northeast Nuclear Energy Company, et al. (the licensee), submitted a request for a change to the Millstone Nuclear Power Station, Unit 3 design basis. The requested change would revise the Millstone Unit 3 licensing basis to accept the existing use of epoxy coatings on safety-related components. The July 17, 1998, supplement provided clarifying information that did not change the scope of the January 22, 1998, application and the initial proposed no significant hazards consideration determination.

2.0 BACKGROUND

ARCOR epoxy coatings are applied to the inside diameter of large bore service water system (SWS) piping, heat exchanger channel heads, and some pump and valve components. The purpose of the coating material is to protect the surface of the substrate material from erosion and corrosion. In a previous analysis, the licensee assumed that the ARCOR epoxy coatings were unlikely to fail, but if they did fail, they would do so in small chips. Recent experience has shown that the ARCOR epoxy coatings can fail in large sheets. The licensee conducted a root cause evaluation that indicated that these failures were a result of improper application of the epoxy coatings. The application parameters have been modified and documented to reduce the probability of future failures. The licensee is proposing to modify Chapter 9 of the Final Safety Analysis Report (FSAR) to describe the use of epoxy coatings in the SWS piping and is proposing periodic surveillances to monitor coating degradation and heat exchanger performance.

3.0 EVALUATION

3.1 NRC Requirements and Regulatory Guidance

Nuclear power plants, such as Millstone Unit 3, whose construction permits were issued after May 21, 1971, are designed to meet minimum requirements established in general design criteria (GDC) specified in 10 CFR Part 50, Appendix A. GDC 44, "Cooling Water," requires

that a service water system exists to transfer heat from structures, systems, and components important to safety to an ultimate heat sink. GDC 45, "Inspection of Cooling Water System," requires the system be designed to permit appropriate periodic inspection of important components, such as heat exchangers and piping, to ensure the integrity and capability of the system. GDC 46, "Testing of Cooling Water System," requires the system be designed to permit appropriate periodic pressure and functional testing of the service water system.

Generic Letter (GL) 89-13, "Service Water System Problems Affecting Safety-Related Equipment," dated July 18, 1989, deals specifically with service water problems. GL 89-13 recommends the establishment of a routine maintenance program to ensure adequate performance of safety-related systems cooled by service water. This includes the repair of defective protective coating systems that could potentially impair the heat transfer capability of safety-related heat exchangers cooled by service water.

On March 24, 1997, the staff issued NRC Information Notice (IN) 97-13, "Deficient Conditions Associated with Protective Coatings at Nuclear Power Plants." This IN describes the ARCOR failure at Millstone Unit 3 along with other protective coating failures. The IN states that industry standards for coatings as well as vendor instructions and recommendations provide guidance pertaining to various aspects of coating such as surface preparation, temperature control, humidity control, timing requirements for multiple coating applications, application methods, and personnel qualification and training requirements.

3.2 Licensee's Proposed Change

The licensee proposed to change the FSAR to include a description of the use of epoxy coatings on the interior of large bore SWS piping, heat exchanger channel heads, and some pump and valve components. The change includes a discussion on the use of periodic surveillance to monitor coating degradation and heat exchanger performance.

The licensee stated that the preponderance of evidence indicated that the ARCOR material in the SWS is unlikely to fail, but if it does fail, it will fail as chips. However, the licensee further stated that there is also evidence that ARCOR material can fail by delamination if it is not properly applied. It can fail by the top coat delaminating from the base coat or by delamination of the base coat from the carbon steel pipe or component surface. A single sheet of ARCOR was retrieved that was 2 ft^2. Another 15 ft^2 area was discovered missing the top coat. It is not known if this area delaminated and then broke up into smaller chips or if it failed as chips.

In the January 22, 1998, submittal, the licensee provided its conclusions about the effect of ARCOR material failure on the various components in the SWS. The licensee concluded that coating failure will not adversely affect the performance of SWS pumps or valves. Each SWS train has two small booster pumps that are not likely to be a primary flow path for system debris. Any material that enters the pumps would be fragmented and would not likely result in degraded pump performance for any extended time. The active valves in the SWS are mostly large butterfly valves with rubber seats which are not susceptible to positioning problems due to ARCOR pieces. The licensee looked at flow orifices and concluded that flow orifices in lines less than 2 inches in diameter could become plugged with failed ARCOR coating. The licensee postulated that this could occur in the emergency diesel generator heat exchanger bypass flow

line; however, the licensee stated that if this bypass line were to become clogged, it would not affect the operability of the diesel generators. Since there is no flow through pressure and temperature indicators in the SWS, the licensee determined that flow-related blockage of temperature and pressure indicators is not a concern. The licensee conducted a review of flow-related instrumentation signals and the review indicated that there are no automatic actions/signals which could be adversely affected by blockage caused by ARCOR material.

The licensee conducted an engineering evaluation to determine what equipment important to safety could be affected by the proposed change in the FSAR. The main finding was that only a small fraction of the ARCOR material would have to fail to cause blockage, which exceeds currently analyzed plugging limits and/or flow margins for heat exchangers. Equipment supported by the SWS whose functionality is potentially degraded by released ARCOR material includes emergency diesel generators, safety injection pumps, charging pumps, containment recirculation heat exchangers, reactor plant component cooling water heat exchangers, residual heat removal, quench spray, safety injection pump ventilation units, containment recirculation pump ventilation units, and control room chillers.

The licensee stated that the primary root cause of the ARCOR failures was improper environmental controls placed on the application process. The corrective action was to replace a significant portion of the coatings using a modified coating procedure that has strict environmental controls on the application process. ARCOR coatings that were not replaced were X-cut tested to differentiate sound coating from disbonded material.

The licensee proposed conducting weekly heat exchanger performance surveillance's to minimize the potential for disbonded ARCOR coating to degrade SWS components. The frequency of the surveillance's is based on GL 89-13 commitments. The frequencies have been modified based on actual system performance and inspection results. Results to date indicate that the present steps are adequate to find developing problems.

The licensee concluded that the application of ARCOR within the SWS is acceptable because (1) strict procedural controls have been placed on new ARCOR applications; (2) as-left coatings will be tested using a more effective method; (3) frequent monitoring and surveillance of SWS heat exchangers for tubesheet fouling will detect coating degradation; and (4) a coating failure assessment and impact determination procedure has been developed to ensure that the SWS heat exchangers remain operable.

3.3 Staff Evaluation

The staff concludes that the proposed revision to the FSAR to permit the application of ARCOR material on the inside surfaces of large bore SWS piping, heat exchanger channel heads, and some pump and valve components is acceptable. This conclusion is based on that (1) a sample of the existing ARCOR coating has been tested for bond of the top coat to the base coat and base coat to the substrate; (2) any defective coating detected in this manner has been removed and new ARCOR coating has been applied using the new application procedures; (3) a monitoring and surveillance program has been established for safety-related SWS heat exchangers that will detect coating degradation; and (4) the licensee has developed a coating

failure assessment and impact determination procedure to ensure that the SWS heat exchangers remain operable.

4.0 LICENSEE COMMITMENTS RELIED UPON

By letter dated July 17, 1998, the licensee committed to incorporate the changes requested in the January 22, 1998, letter into the Millstone Unit 3 FSAR. The licensee committed to incorporate the changes during the next revision of the FSAR required by 10 CFR 50.71(e) or no later than June 30, 1999. The NRC staff finds this commitment and schedule acceptable and has placed it in Appendix C of the Millstone Unit 3 Facility Operating License. The licensee must notify the staff, in writing, when the condition in Appendix C is satisfied.

5.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Connecticut State official was notified of the proposed issuance of the amendment. The State official had no comments.

6.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (63 FR 9606 dated February 25, 1998). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

7.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner; (2) such activities will be conducted in compliance with the Commission's regulations; and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

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Date: August 7, 1998