



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR RELIEF FROM ASME CODE MATERIALS

NORTHEAST NUCLEAR ENERGY COMPANY

MILLSTONE NUCLEAR POWER STATION, UNIT NO. 3

DOCKET NO. 50-423

1.0 BACKGROUND

According to the provisions of 10 CFR 50.55a(a)(1), "structures, systems, and components . . . [at nuclear power generating facilities are required to be] . . . designed, fabricated, erected, constructed, tested, and inspected to quality standards commensurate with the importance to the safety function to be performed." According to the 1971 edition of the American Society of Mechanical Engineers Code (henceforth referred to as the ASME Code) Section III, Paragraph NA-2131, components which are designed to ASME Code Class 3 are to be constructed in accordance with the applicable rules of the ASME Code Section III, Subsection ND. The provisions of Article ND-2000 of the 1971 Edition of the ASME Code Section III require that pressure retaining materials, in part, "shall conform to one of the specifications for materials listed in Tables I-7.0 and I-8.0 of Appendix I . . . [found in this Section of the ASME Code]. However, proposed alternatives to these materials may be approved by the Director of the Office of Nuclear Reactor Regulation if the proposed alternatives would provide an acceptable level of quality and safety, as granted under the provisions of 10 CFR 50.55a(a)(3)(i).

2.0 RELIEF REQUEST

Millstone 3 is a Westinghouse Electric four-loop design nuclear facility, constructed according to the provisions contained in the 1971 edition of the ASME Code Section III, up to and including the Summer 1993 Addenda. On August 30, 1993, the staff of the Northeast Nuclear Energy Company (NNECO, a subsidiary of Northeast Utilities, the licensee), submitted a letter requesting relief from the Code requirements in regard to structural design of the Millstone 3 service water system. The Millstone 3 Service Water System (SWS) is an ASME Code Class 3 system designed and constructed in accordance with the 1971 Edition of the ASME Code Section III, inclusive of the Summer 1973 Addenda. Pressure retaining components in this system are required to be fabricated from ASME Code Section III approved materials. The bellows expansion joints in the Millstone 3 SWS were originally fabricated from Monel 400, which is an acceptable ASME Code Section III structural material. The Monel 400 in some of these expansion joints were subsequently replaced with Inconel 625, which is also an ASME Code Section III approved material.

NNECO seeks relief, however, to allow replacement of the existing expansion joints fabricated from Monel 400 or Inconel 625 with expansion joints fabricated from chlorobutyl rubber. Chlorobutyl rubber has not been approved by the ASME Code Main Committee as an acceptable ASME Code Section III material. NNECO originally submitted their request for relief on a generic basis without specifying the exact bellows expansion joints which were to be involved in the plant modifications. The staff informed NNECO on November 18, 1993 that the NRC could not accept the licensee's request for relief as submitted, since relief requests are evaluated by the staff on a specific, case-by-case basis. Therefore, on November 23, 1993, at the staff's request, NNECO submitted and placed additional information on Docket No. 50-423 which specified the exact locations of the bellows expansion joints involved in the licensee's proposed modifications.

3.0 PROPOSED ALTERNATIVE PROGRAM

NNECO proposes to replace the following bellows expansion joints fabricated from either Monel 400 or Inconel 625 with bellows expansion joints fabricated from chlorobutyl rubber:

- . Bellow expansion joints 3SWP*EJ1A through D, in the 30" Service Water Pump Outlets - these components were originally fabricated from Monel 400, but were later replaced with Inconel 625.
- . Bellow expansion joints 3SWP*EJ6A through D, in the 6" SWP Cooling to the Diesel Jacket Water Coolers - these components were originally fabricated from Monel 400, but were later approved for chlorobutyl rubber as a temporary acceptable alternative material. NNECO now seeks approval (relief) to use chlorobutyl rubber on a permanent basis.
- . Bellow expansion joints 3SWP*EJ10A through D, in the 30" SWP Cooling to Control Building Chillers - these component were originally fabricated from Monel 400, but were later replaced with Inconel 625.

NNECO will demonstrate compliance with the intent of the ASME Code and ensure the mechanical/structural adequacy of all future installation of chlorobutyl rubber expansion joints, through evaluation of the following attributes:

1. design pressure
2. design temperature
3. materials properties - durometer reading
4. process fluid
5. cycle life
6. allowable deflections
7. spring rates
8. shelf life
9. service life
10. environmental (aging) conditions
11. system operating transients

The expansion joint design pressure, design temperature, materials properties, process fluid restrictions, and fatigue resistance will be specified in the NNECO procurement documents and will be compared to the applicable ASME Code design requirements for Class 3 components. The service life, shelf life, and environmental (aging) conditions will be evaluated at the time of installation and compared to the date of manufacture to determine the replacement intervals of the chlorobutyl rubber spools in the expansion joints. Environmental conditions will be considered if they adversely impact the shelf or service life of the rubber spools.

The allowable spool deflections and spring rates will be qualified by piping stress analysis to demonstrate that displacements and tie-rod loads resulting from installation of the alternative chlorobutyl rubber expansion joints are within specified vendor limits. The piping stress analysis takes into account the actual rubber expansion joint stiffness.

System operating transients are a concern from the standpoint of an expansion joint failure as a result of sudden system overpressurization. The Millstone 3 Service Water System is a Class 3 moderate energy system, and therefore is not significantly susceptible to water hammer or fluid transient events. However, the chlorobutyl rubber expansion joints are designed to have a minimum margin of safety of 4 between system operating pressure and burst pressure. The results of system transients on the expansion joints will be evaluated on a case-by-case basis at the location of each specific installation.

4.0 STAFF EVALUATION

The staff has determined that the licensee's general approach for assessing the mechanical and structural adequacy of bellows expansion joints fabricated from chlorobutyl rubber is sound. The staff finds that the licensee's relief request is acceptable for the following reasons:

1. The technical evaluations, which are to be performed for determining the structural adequacy of rubber expansion joints to be placed in service, will ensure that those placed in service will be capable of maintaining their structural integrity during normal, transient, and accident conditions. In this case, the licensee's submittal indicates that the licensee will perform a piping stress analysis on the chlorobutyl rubber spools to evaluate the spools for allowable deflections and spring rates. The results of the analyses will be compared to the design allowables specified in the certified procurement records, and to the allowables in the ASME Code Section III.
2. The licensee has previously been granted temporary relief to allow use of chlorobutyl rubber as an alternative structural material in expansion joints 3SWP*EJ6A through D in the Millstone Unit 3 SWS. Experience with this use has been satisfactory.

3. The structural integrity of chlorobutyl rubber expansion joints placed in service will be monitored every 8 hours during appropriate plant walkdowns by plant operators.

In this case, the staff finds that chlorobutyl rubber is an acceptable alternative structural material for use in the expansion joints listed above.

5.0 CONCLUSION

The licensee's proposed alternative to use chlorobutyl rubber expansion joints for the components listed previously will provide an acceptable level of quality and safety. Therefore, pursuant to the provisions of 10 CFR 50.55a(a)(3)(i), relief is granted to allow use of chlorobutyl rubber as a permanent, acceptable alternative material in expansion joints 3SWP*EJ1A through D, 3SWP*EJ6A through D, and 3SWP*EJ10A through D in the Millstone 3 Service Water System, with the qualifying conditions that chlorobutyl rubber spool pieces be used within the 2-5 year allowed shelf life of the spool, as specified in the appropriate vendor procurement record for the spool referenced, and that the acceptable life of the rubber spools placed in service be limited to the 5-10 year allowed service life, as specified in the appropriate vendor procurement record for the spool referenced. At the end of the acceptable service lives, chlorobutyl rubber expansion joints placed in service in the Millstone 3 Service Water System shall be replaced with freshly procured chlorobutyl rubber expansion joints, or with chlorobutyl rubber expansion joints which have been stored on site and which have acceptable remaining shelf life, or with a Code acceptable joint.

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