NORTHEAST UTILITIES

THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

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September 26, 1985

Docket No. 50-423
B11729

Director of Nuclear Reactor Regulation
Mr. B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Reference: B. J. Youngblood letter to J. F. Opeka, Request for Additional Information for Millstone Nuclear Power Station, Unit No. 3, dated September 10, 1985.

Gentlemen:

Millstone Nuclear Power Station, Unit No. 3
Response to Questions 220.39 through 220.41
Containment Liner Review

Northeast Nuclear Energy Company (NNECO) herein submits the responses to the Structural and Geotechnical Engineering Branch's request for additional information regarding the Millstone Unit No. 3 containment liner anchor stud spacing (Enclosure (1) of Reference).

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We trust this information resolves your concerns regarding this issue and closes Significant Deficiency No. 38 (SD-38). If you have additional questions regarding this information, please contact our licensing representative directly.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY
et. al.

BY NORTHEAST NUCLEAR ENERGY COMPANY
Their Agent

J. F. Opeka
J. F. Opeka
Senior Vice President

cc: Ms. E. L. Doolittle, Licensing Project Manager
Mr. Sang Bo Kim, Structural and Geotechnical Engineering Branch

STATE OF CONNECTICUT)
) ss. Berlin
COUNTY OF HARTFORD)

Then personally appeared before me J. F. Opeka, who being duly sworn, did state that he is Senior Vice President of Northeast Nuclear Energy Company, an Applicant herein, that he is authorized to execute and file the foregoing information in the name and on behalf of the Applicants herein and that the statements contained in said information are true and correct to the best of his knowledge and belief.

Lorraine J. D'Amico
Notary Public

My Commission Expires March 31, 1988

Millstone Nuclear Power Station, Unit No. 3
Response to Request for Additional Information
Containment Liner Review
Structural and Geotechnical Engineering Branch

Question No.

220.39 In obtaining liner boundary displacements, tension strength of the concrete was assumed to be negligible. Even though such assumption is conservative for most of the reinforced concrete design, it may be unconservative in the liner analysis since concrete together with reinforcing steel acts as a restraint to liner temperature expansion. Please provide a justification for the assumption.

Response

In evaluating the stresses in the liner and the anchors, the containment wall concrete was assumed to be precracked. The reinforced concrete was cracked when the containment was pressurized to 52 psig as part of the structural integrity test (SIT). Therefore, the concrete section will be cracked for the service life of the plant and justifies the assumption of precluding the concrete strength in tension used in obtaining the boundary displacements.

Millstone Nuclear Power Station, Unit No. 3
Response to Request for Additional Information
Containment Liner Review
Structural and Geotechnical Engineering Branch

Question No.

220.40 The worst case loading was selected as combination of temperature differential of 120°F and negative pressure of 6.7 psi. It is implied that higher temperature differential with positive internal pressure will produce lower stresses in anchors as well as in liner since pressure will prevent liner from buckling. Provide a justification with a supporting evidence which demonstrates that applied positive pressure is sufficient to increase buckling load of the liner significantly.

Response

A finite element analysis was performed to evaluate the liner stresses and the forces in the anchors in the local areas of the missing anchors. A 3'-0" x 5'-0" area was selected and the computer code ANSYS was used to analyze the area. The worst loading case was selected as the combination of temperature differential of 120.5°F and negative pressure of 6.7 psi. The results of this loading combination was submitted for Staff review.

The selection of this worst case loading combination was based upon the results of a study made on a simplified 12 inch wide strip. A finite element model selected at the middle of the local area, with one-way action of the plate spanning between the anchors, was assumed. Again, the computer code ANSYS was used in this sensitivity study. Two loading cases were used to determine the most limiting loading condition. These were the following:

Case 1. Maximum differential temperature (ΔT), and corresponding positive pressure (P).

$$P = 20 \text{ psi}$$
$$\Delta T = 167.5^{\circ}F$$

Case 2. The maximum differential temperature (ΔT), and maximum negative pressure (P).

$$P = (-)6.7 \text{ psi}$$
$$\Delta T = 120.5^{\circ}F$$

The summary of the results for this sensitivity study are shown in Table 220.40-1 (enclosed).

By comparing the results, it is clear that the worst loading will be the load Case 2, with the maximum temperature combined with the negative pressure. This produces much higher radial liner displacements and high stress intensity caused by bending. The pressure load of 20 psi used in loading Case 1 prevents the liner from buckling

inwards and results in small radial displacements and stresses. Additionally, the tension and the shear force in the anchor loading studs are much larger due to Case 2 as compared to loading Case 1. It should be noted that Case 2 represents a conservative load combination. The temperature differential used in the combination conservatively bounds all negative pressure cases. Therefore, based upon this study, the results submitted for the loading combination of the negative pressure 6.7 psi and the differential temperature of 120.5°F as the worst case loading combination is justified.

Millstone Nuclear Power Station, Unit No. 3
Response to Request for Additional Information
Containment Liner Review
Structural and Geotechnical Engineering Branch

Question No.

220.41 Millstone 3 FSAR criteria (Table 3.8.13) specify that SSE be included in the liner and anchor analysis. Provide justification for not including SSE.

Response

The seismic forces due to SSE were used as a loading condition in the overall analysis of the reactor containment as well as in the design of the reinforced concrete wall, steel liner, and the anchor studs. The forces produced from the SSE that must be designed for are in-plane shear and the normal forces produced by the overturning moment. The in-plane shear and the normal forces are maximum at the base of the containment. These forces linearly reduce to a minimum at the spring line about 130 feet from the base. The reinforcement in the concrete wall has been designed for the maximum in-plane shear combined with the normal force (couple) due to overturning moment. The liner and the anchor are not load carrying components required to resist these forces in the membrane zone.

The location of missing anchors is in the membrane zone. Therefore, the effects of the global SSE forces on the anchors need not be considered. However, in the local area of the missing anchors, the effect of the seismic horizontal excitation due to the SSE does produce an out-of-plane inertia force on the liner. Consequently, the anchors will have an additional tensile force from the 3/8 inch thick liner with an acceleration of 0.6g. Based upon this horizontal response of the containment at the spring line, a tensile force of about 15 pounds/anchor is produced. This additional 15 pounds/anchor tensile force is small enough to be considered negligible in the overall anchor evaluation.

Therefore, the effects of the SSE have been considered in the evaluation, and these effects are insignificant.

TABLE 220.40-1

	Liner Stresses*				Anchor Studs Force/Stud	
	At Center Span ksi	At An Anchor ksi	Stress Intensity ksi	Radial Displacm. Inches	Axial Tension kips	Shear kips
Case 1						
P = 20 psi Δ T = 167.5°F	15.67	22.99	30.53	.037	1.71	1.09
Case 2						
− P = 6.7 psi Δ T = 120.5°F	80.7	73.4	80.67	.83	5.42	7.26

* NOTE: The stress data is an extract from calculation No. 12179-SEO-V1.3, Rev. 0