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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February 1, 1985

Docket No. 50-423
B11436

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: (1) W.G. Counsil letter to B. J. Youngblood, Response to Core Performance Branch (CPB) Open Item CPB-11, dated May 3, 1984.

Millstone Nuclear Power Station, Unit No. 3
Response to SER Confirmatory Item 13

As committed in Reference (1), Northeast Nuclear Energy Company (NNECO) hereby provides additional information regarding compliance with Appendix A of SRP Section 4.2, regarding fuel assembly mechanical response to various accidents and transients. Section 4.2.3.4 of the FSAR has been revised and will be incorporated in a future amendment. This information should be sufficient to close out Confirmatory Item 13. If you have any questions, please contact our licensing representative directly.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY
et. al.

BY NORTHEAST NUCLEAR ENERGY COMPANY
Their Agent

W. G. Counsil

W. G. Counsil
Senior Vice President

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

Then personally appeared before me W. G. Counsil, 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

4.2.3.4 SPACER GRIDS

The reactor core coolant flow channels were established and maintained by the fuel assembly structure composed of grids and guide thimbles. The lateral spacing between fuel rods is provided and controlled by the support dimples of adjacent grid cells. Contact of the fuel rods on the dimples is maintained through the clamping force of the grid springs. Lateral motion of the fuel rods is opposed by the spring force and the internal moments generated between the spring and the support dimples.

Time history numerical integration techniques were used to analyze the fuel assembly responses resulting from the lateral safe shutdown earthquake, SSE, and the most limiting main coolant pipe break accident, LOCA. The reactor vessel motions resulting from the transient loading were asymmetric with respect to the geometrical center of the reactor core. The complete fuel assembly core finite element model was employed to determine the fuel assembly deflections and grid impact forces.

A comparison of the seismic (SSE) response spectrum of the reactor vessel supports versus the response spectrum of the time history indicated that the time history spectrum generally enveloped the plant design spectrum with the exception of a small frequency range at the second mode of the fuel assembly. The seismic analyses performed for a number of plants indicated that the maximum impact response was, in general, influenced by the acceleration level of the input forcing function at the fuel assembly fundamental mode. Thus, the data in seismic time histories corresponding to the design envelope were conservatively used for the fuel evaluation.

The reactor core finite element model consisting of the maximum number of fuel assemblies across the core diameter was used. The Millstone Unit 3 Plant has fifteen (15) 17x17 8-grid (Inconel) fuel assemblies arranged in a planar array. Gapped elements simulated the clearances between the peripheral fuel assemblies and the baffle plates.

The fuel assembly essential dynamic properties, such as the fuel assembly vibration frequencies, mode shapes, and mass distribution were presented in the finite element model. The time history motions for the upper and lower core plates and the motions for the core barrel at the upper core plate elevation were simultaneously introduced into the simulated core model. The analytical procedures, the fuel assembly and core modeling, and the methodology are detailed in WCAPS 8236/8288 and 9401/9402. The time history inputs representing the safe shutdown earthquake motions and the coolant pipe rupture transients were obtained from the time history analyses of the reactor vessel internals. In WCAPS 8236/8288 and 9401/9402 it is shown in grid crush tests and seismic and loss-of-coolant accident evaluations that the grids will maintain a geometry that is capable of being cooled under the worst-case accident Condition IV event.

4.2.3.4.1 GRID ANALYSIS

The maximum grid impact forces for both the seismic and asymmetric LOCA accidents occur at the peripheral fuel assembly locations adjacent to the baffle wall. The maximum grid impact force for the safe shutdown earthquake analysis was 46 percent of the allowable grid strength. The corresponding value for the nozzle inlet break was 66 percent. In order to comply with the requirements in the USNRC 4.2 Standard Review Plan, the maximum grid impact responses obtained from the two transient analyses were combined. The square-root-of-sum-of-squares (SRSS) method was used to calculate the results. The maximum combined impact force for the Millstone Unit 3 fuel assemblies was 80 percent of the allowable grid strength. The grid strength was established experimentally. It was based on the 95% confidence level on the true mean as taken from the distribution of measurements.

4.2.3.4.2 NON-GRID COMPONENT ANALYSES

The stresses induced in the various fuel assembly non-grid components were calculated. The calculations were based on the maximum responses obtained from the most limiting seismic and LOCA accident conditions. The fuel assembly axial forces resulting from the LOCA accident were the primary sources of stresses in the thimble guide tube and the fuel assembly nozzles.

The induced stresses in the fuel rods result from the relative deflections during the simulated seismic and LOCA accidents. The fuel rod stresses were generally small. The combined seismic and LOCA induced stresses of the various fuel assembly components presented in Table 4.2.1 were expressed as a percentage of the allowable limit. Consequently, the fuel assembly components are structurally acceptable under the postulated accident design conditions for the Millstone Unit 3.

TABLE 4.2.1

FUEL ASSEMBLY COMPONENT STRESSES
(PERCENT OF ALLOWABLE)

Component	Uniform Stresses (Direct/Membrane)	Combined Stresses (Membrane + Bending)
Thimble	76.4	58.0
Fuel Rod*	23.7	20.0
Top Nozzle Plate	----	6.7
Bottom Nozzle Plate	----	44.7
Bottom Nozzle Leg	7.3	8.2

*Including primary operating stresses
---- a negligible value

section is then visibly inspected for mechanical integrity, replaced in the fuel assembly and stored with the fuel assembly.

4.2.5 References for Section 4.2

Appendix A, "Hafnium" to Reference 2, 1980.

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