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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May 2, 1985

Docket No. 50-423
B11530

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) B. J. Youngblood letter to W. G. Counsil, Issuance of Safety Evaluation Report - NUREG-1031 - Millstone Nuclear Power Station, Unit No. 3, dated August 2, 1984.

(2) W. G. Counsil letter to B. J. Youngblood, Submittal of Draft Standard Technical Specifications, dated December 7, 1984.

Gentlemen:

Millstone Nuclear Power Station, Unit No. 3
Response to SER Confirmatory Item #14

Attached is Northeast Nuclear Energy Company's (NNECO) response to SER Confirmatory Item #14 concerning the margin available to accommodate DNBR penalties resulting from fuel rod bowing which was identified in Reference (1). Revisions to Section 4.4 of the FSAR are also attached and will be included in a subsequent amendment to the FSAR.

We trust that this information will fully resolve the Staff's concerns regarding Confirmatory Item #14. However, if you have any further questions, please feel free to contact our licensing representative directly.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY
et. al.

BY NORTHEAST NUCLEAR ENERGY COMPANY
Their Agent

J. F. Opeka
Senior Vice President

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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

SER Confirmatory Item #14 - Margins Itemized in WCAP-8691 (SER Section 4.4.4.1)

The FSAR stated that there is a 9.1% margin to accommodate full- and low-flow DNBR penalties resulting from fuel rod bowing. The applicant should verify that (1) the breakdown of this margin into individual factors is consistent with WCAP-8691 and (2) this margin (in whole or part) was not used in any other analysis.

Also, the applicant should insert into the bases of the Technical Specification any of the generic or plant-specific margins that may be used to offset the reduction in DNBR resulting from rod bowing.

Response (April 1985)

(1) The breakdown of DNBR margin into individual factors is shown in the revised Note 1 to FSAR Section 4.4.2.2 and is consistent with WCAP-8691.

(2) The worst case DNBR penalty due to rod bow is less than 3% while the total DNBR margin is 9.1%. The DNBR margin used to offset the worst case rod bow penalty is not used in any other analysis. Refer to revised FSAR Section 4.4.2.2.

(3) The DNBR margins are itemized in the attached Technical Specification bases (Page B3/4 2-4) which were submitted with Reference (2).

The safety analysis for the Millstone 3 core maintained sufficient margin (9.1 percent)[1] to accommodate full and low flow DNBR penalties (the worst case DNBR penalty is less than 3%, which corresponds to a burn-up of 33,000 MWD/MTU as described in responses to requests for additional information on WCAP-8691, Rev. 1).

The maximum rod bow penalties accounted for in the design safety analysis are based on an assembly average burn-up 33,000 MWD/MTU. At burn-ups greater than 33,000 MWD/MTU, credit is taken for the effect of $F_{\Delta H}^{N}$ burndown, due to the decrease in fissionable isotopes and the buildup of fission product inventory, and no additional rod bow penalty is required.

4.4.2.3 Linear Heat Generation Rate

The core average and maximum linear heat generation rates are given in Table 4.4-1. The method of determining the maximum linear heat generation rate is given in Section 4.3.2.2.

4.4.2.4 Void Fraction Distribution

The calculated core average and the hot subchannel maximum and average void fractions are presented in Table 4.4-2 for operation at full power with design hot channel factors. The void fraction distribution in the core at various radial and axial locations is

NOTE:

1. Design limit DNBR of 1.30 vs. 1.28
   Pitch reduction
   Grid spacing (K_s) of 0.046 vs. 0.059
   Thermal diffusion coefficient of 0.038 vs. 0.059
   DNB multiplier of 0.86 vs. 0.88

presnted in WCAP-7956. The void models used in the THINC-IV Code are described in Section 4.4.2.7.3. Normalized core flow and enthalpy rise distributions are shown on Figures 4.4-3 thru 4.4-5.

4.4.2.5 Core Coolant Flow Distribution

Assembly average coolant mass velocity and enthalpy at various radial and axial core locations are given on Figures 4.4-3 thru 4.4-5. Typical coolant enthalpy rise and flow distributions for the 4-foot elevation (1/3 of core height) are shown on Figure 4.4-3, for the 8-foot elevation (2/3 of core height) on Figure 4.4-4, and at the core exit on Figure 4.4-5. These distributions are for the full-power conditions as given in Table 4.4-1 and for the radial power density distribution shown on Figure 4.3-7. The THINC Code analysis for this case utilized a uniform core inlet enthalpy and inlet flow distribution. No orificing is employed in the reactor design.

4.4.2.6 Core Pressure Drops and Hydraulic Loads

4.4.2.6.1 Core Pressure Drops

The analytical model and experimental data used to calculate the pressure drops shown in Table 4.4-1 are described in Section 4.4.2.7. The core pressure drop includes the fuel assembly, lower core plate, and upper core plate pressure drops. The full power operation pressure drop values shown in Table 4.4-1 are the unrecoverable pressure drops across the vessel, including the inlet and outlet nozzles, and across the core. These pressure drops are based on the best estimate flow for actual plant operating conditions as described in Section 5.1.1. This section also defines and describes the thermal design flow (minimum flow) which is the basis for reactor core thermal performance and the mechanical design flow (maximum flow) which is used in the mechanical design of the reactor vessel internals and fuel assemblies. Since the best estimate flow is that which is most likely to exist in an operating plant, the calculated core pressure drops in Table 4.4-1 are based on this best estimate flow rather than the thermal design flow.

Uncertainties associated with the core pressure drop values are discussed in Section 4.4.2.9.2.

4.4.2.6.2 Hydraulic Loads

The fuel assembly hold-down springs (Figure 4.4-2) keep the fuel assemblies in contact with the lower core plate under all Condition I and II events with the exception of the turbine overspeed transient associated with a loss of external load. The holddown springs are designed to tolerate the possibility of an over deflection associated with fuel assembly liftoff for this case and provide contact between the fuel assembly and the lower core plate following this transient. More adverse flow conditions occur during a loss-of-coolant accident. These conditions are presented in Section 15.6.5.

492.2 WCAP-8691, Revision 1 (Proprietary) and WCAP-8692, Revision 1 (Nonproprietary) 1979. Skaritka, J., (Ed.). Fuel Rod Bow Evaluation.

"Partial Response to Request Number 1 for Additional Information on WCAP-8691, Revision 1" letter, E. P. Rahe, Jr., (Westinghouse) to J. R. Miller (NRC), NS-EPR-2515, dated October 9, 1981; "Remaining Response to Request Number 1 for Additional Information on WCAP-8691, Revision 1" letter, E. P. Rahe, Jr., (Westinghouse) to J. R. Miller (NRC), NS-EPR-2572, dated March 16, 1982.

Weisman, J. 1959. Heat Transfer to Water Flowing Parallel to Tube Bundles. Nucl. Sci. Eng., 6, 78-79. 26.45

BASES

HEAT FLUX HOT CHANNEL FACTOR, and RCS FLOW RATE AND NUCLEAR ENTHALPY RISE HOT CHANNEL FACTOR (Continued)

c. The control rod insertion limits of Specifications 3.1.3.5 and 3.1.3.6 are maintained.

d. The axial power distribution, expressed in terms of AXIAL FLUX DIFFERENCE, is maintained within the limits.

$F_{\Delta H}^{N}$ ~~$F_{\Delta H}^{N}$~~ will be maintained within its limits provided conditions a. through d. above are maintained. As noted on Figures 3.2-3 ~~and 3.2-4~~, RCS flow rate and $F_{\Delta H}^{N}$ may be "traded off" against one another (i.e., a low measured RCS flow rate is acceptable if the measured $F_{\Delta H}^{N}$ is also low) to ensure that the calculated DNBR will not be below the design DNBR value. The relaxation of $F_{\Delta H}^{N}$ as a function of THERMAL POWER allows changes in the radial power shape for all permissible rod insertion limits.

R_1 as calculated in 3.2.3 and used in Figure 3.2-3, accounts for $F_{\Delta H}^{N}$ ~~$F_{\Delta H}^{N}$~~ less than or equal to 1.49. This value is used in the various accident analyses where $F_{\Delta H}^{N}$ influences parameters other than DNBR, e.g., peak clad temperature, and thus is the maximum "as measured" value allowed. ~~R_2, as defined, allows for the inclusion of a penalty for rod bow on DNBR only. Thus, knowing the "as measured" values of $F_{\Delta H}^{N}$ and RCS flow allows for "tradeoffs" in excess of R equal to 1.0 for the purpose of offsetting the rod bow DNBR penalty.~~

INSERT A

~~Fuel rod bowing reduces the value of DNB ratio. Sufficient credit is available to offset this reduction. This credit comes from generic design margins totaling 9.1% and 3% margin in the difference between the 1.3 DNBR safety limit and the minimum DNBR calculated for the Complete Loss of Flow event. The penalties applied to $F_{\Delta H}^{N}$ to account for Rod Bow (Figure 3.2-4) as a function of burnup are consistent with those described in Mr. John F. Stolz's (NRC) letter to T. M. Anderson (Westinghouse) dated April 5, 1979 and W-8691 Rev. 1 (partial rod bow test data).~~

When an F_Q measurement is taken, an allowance for both experimental error and manufacturing tolerance must be made. An allowance of 5% is appropriate for a full-core map taken with the incore detector flux mapping system, and a 3% allowance is appropriate for manufacturing tolerance.

INSERT A

ATTACHMENT I

(Tech Spec Insert)

REVISED VERSION

Fuel rod bowing reduces the value of DNB ratio. Credit is available to offset this reduction in the generic margin. The generic design margins, totaling 9.1% DNBR, completely offset any rod bow penalties. This margin includes the following:

1) Design limit DNBR Of 1.30 vs. 1.28
2) Grid Spacing (K_S) of 0.046 vs. 0.059
3) Thermal Diffusion Coefficient of 0.038 vs. 0.059
4) DNBR Multiplier of 0.86 vs. 0.88
5) Pitch reduction

The applicable values of rod bow penalties are referenced in the FSAR.