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

August 6, 1980

Docket No. 50-336

Mr. W. G. Counsil, Vice President
Nuclear Engineering & Operations
Northeast Nuclear Energy Company
P.O. Box 270
Hartford, Connecticut 06101

Dear Mr. Counsil:

In our letter of June 20, 1980, we requested additional information related to fuel design and physics calculations presented in the Basic Safety Report (BSR) supporting the Cycle 4 reload of Millstone, Unit No. 2. We now find that additional information, as detailed in Enclosure 1, is necessary to complete our review of the thermal-hydraulics and transient and accident analyses sections of the BSR. In addition, the Enclosure 2 request for additional information is necessary to complete our review of the reactor fuels and physics aspects of the Cycle 4 reload safety analysis, and the small and large break LOCA/ECCS performance results.

In order to meet the agreed upon schedule for this review, please provide the additional information, previously telecopied to Mr. M. Cass of your staff on July 10, 18, and 29, 1980, by August 15, 1980.

Sincerely,

Thomas M. Novak, Assistant Director
for Operating Reactors
Division of Licensing

Enclosures:
As stated

cc w/enclosures:
See next page

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ENCLOSURE 1

REQUEST FOR ADDITIONAL INFORMATION

ON THE BASIC SAFETY REPORT FOR

MILLSTONE, UNIT NO. 2

1. In Section 3.2, Design Basis, you state that a maximum of 3.7% of the design flow is bypass flow. Provide the basis for the 3.7% bypass flow assumption.

2. In Section 3.3, Hydraulic Compatibility, the BSR states that the Fuel Assembly Test System (FATS) hydraulic test loop is capable of obtaining flows in excess of that required to lift the fuel assembly off the bottom core plate. Provide information on the test conditions, including flow rates, temperature and pressure, used for the FATS test of the Westinghouse fuel assemblies and show how these conditions compare with the actual Millstone 2 operating conditions. Discuss any differences in these comparisons and their effect on the hydraulic compatibility. Also, provide information on the flow rate that would lift off the Westinghouse assembly from the bottom core plate as compared to the flow rate that would lift off the reference Millstone 2 flow assembly.

3. In Section 3.3, Hydraulic Compatibility, the BSR states that the FATS test analyses show that the Westinghouse grid loss coefficient was within 6 percent of the Millstone 2 Reference Cycle grid loss coefficient given in the FSAR. Also, the BSR states that this is within the experimental uncertainty of the test, and thus it is concluded that the grids can be treated as having identical resistance. Provide the experimental uncertainty value for these tests. Was the Westinghouse grid loss coefficient 6 percent higher or lower than the Millstone 2 Reference Cycle grid loss coefficient. Discuss the effects of this variation between the Westinghouse and Millstone 2 fuel assemblies on hydraulic compatibility.

4. In Section 3.3, Hydraulic Compatibility, the BSR states that the results of the FATS test showed that the effect on pressure drop of the differences between the rods-on (Millstone 2 design) and rods-off 0.17" to 0.20" (Westinghouse design) the bottom nozzle was negligible. Were specific measurements taken to arrive at this conclusion. If so, provide the results for comparison.

5. In Section 3.6, Hot Channel Factors, you state that the effect of inlet flow maldistribution on core thermal performance is considered by using a 5 percent reduction in flow to the hot assembly in the THINC analysis. Describe the basis for the 5% flow maldistribution.

6. In Section 3.6, Hot Channel Factors, you state that the subchannel mixing mode incorporated in the THINC code and used in reactor design is based on tests conducted with spacer grids (no mixing vanes) as described in Reference 4 (Shefcheck, J., "Application of the THINC Program to PWR Design," WCAP-7838, January, 1972). You also state that a conservative value of the thermal diffusion coefficient of 0.019, determined from these tests, is used in the Millstone 2 THINC analysis. Provide the following information:

a. Compare the grid loss coefficients used in the tests above versus the values for the Millstone 2 reference spacer grids. How do these values compare to the Westinghouse grid loss coefficient in the FATS test analysis.

b. Compare the thermal diffusion coefficient selected versus the Westinghouse design with the mixing vane grids.

c. Provide the basis for stating that the 0.019 diffusion coefficient obtained from tests is conservative.

7. In Section 5.3.9, Complete Loss of Forced Reactor Coolant Flow, Table 5.3.9-1 shows that the low flow trip (LFT) response time for four pump loss of flow for cycle 3 of Millstone 2 was 0.45 seconds versus the 0.65 seconds used in the BSR. Explain how the longer response time used in the analysis was determined.

8. In Section 5.3.9, the BSR states that the analysis for the transient for complete loss of forced reactor coolant flow demonstrates that the DNBR does not decrease below 1.30 during the transient. Figure 5.9.9-3, DNB Ratio Versus Time, shows a minimum DNB Ratio very close to 1.30 at about 3.5 sec. Provide the numerical value of DNBR calculated and compare to Millstone 2, cycle 3, for this analysis.

9. In Section 5.3.17, Single Reactor Coolant Pump Seized Rotor, the BSR states that for the analysis for the transient for single reactor coolant pump seized rotor, the evaluation of the pressure transient assumes that control rod motion begins 1.2 seconds after the flow reaches 87 percent of nominal flow. Explain the basis for this assumption and why it is conservative.

10. Table 5.3.17-1, "Key Parameters Assumed in Seized Rotor Analysis," shows a value of 2200 psia for the reactor coolant system pressure for Millstone 2, cycle 3, and a value of 2280 psia for the BSR analysis. Provide the basis for using 2280 psia in the BSR analysis and the effect of using 2280 psia instead of 2200 psia on the thermal margin.

11. In support of your discussions of the FATS tests, provide a copy of the test report.

12. Section 1.2 of the BSR states that many documents serve as the lic[illegible] basis for the "reference cycle." In order to performan an accep[illegible] review, we find it necessary to compare the "reference cycle" tra[illegible] and accident analyses with the comparable analysis in the BSR. Please provide a comparison of the results of the "reference cycle" transient and accident analyses with the BSR to help us determine the sensitivity of fuel differences in the transient and accident analysis.

ENCLOSURE 2

REQUEST FOR ADDITIONAL INFORMATION ON

THE CYCLE 4 RELOAD SAFETY ANALYSIS FOR MILLSTONE, UNIT NO. 2

1. Provide a list of physics tests to be performed during Cycle 4 testing including the acceptance criterion for each test as well as the actions to be taken if the acceptance criteria are not met.

2. Previous cycles have used an augmentation factor to account for the power density spikes due to axial gaps caused by fuel densification. These previous cycle augmentation factors were included in the determination of F_{xy}. How are densification spikes accounted for in Cycle 4?

3. A partial list of physics characteristics for Cycles 2 and 3 and preliminary Cycle 4 data was presented in the BSR. Provide a list of final Cycle 4 physics characteristics and comparisons with previous cycle values including the maximum radial power peaks expected to occur (F_r and F_{xy} with uncertainties and biases).

4. Discuss the effects of using a different DNBR correlation for Cycle 4 transient analyses than was used in Cycle 3.

5. For the CEA ejection accident at both HFP and HZP, how many fuel rods go into DNB and what is the maximum RCS pressure attained?

6. Previous cycle (Cycle 3) parameters assumed in the CEA drop analysis are identical to those assumed for Cycle 4 except for the more negative moderator temperature coefficient in Cycle 4. The minimum DNBR attained in the previous cycle analysis using the CE-1 correlation was 1.21. Since the maximum negative moderator temperature coefficient results in the minimum transient DNBR, why is the minimum DNBR obtained in the Cycle 4 analysis higher than that obtained in the Cycle 3 analysis? Also, since the EOC moderator temperature coefficient is much more negative than the BOC coefficient, why is it not used in the CEA drop analysis?

7. The PALADON computer code has not been approved by the staff for three-dimensional calculations. Provide a description of the types of calculations performed by PALADON for the Cycle 4 analysis.

8. Please submit values for the following variables that were not provided in the Millstone 2 small-break LOCA ECCS performance results.

   a. Hod rod

      (1) differential pressure at time of rupture
      (2) temperature at time of rupture
      (3) axial distribution of circumferential strain

   b. Hot assembly

      (1) time of blockage
      (2) differential pressure at time of blockage
      (3) temperature at time of blockage
      (4) axial distribution of reduction-in-flow area

9. Please submit values for the following variables that were not provided in the Millstone 2 large-break LOCA ECCS performance results.

   a. Hot rod

      (1) differential pressure at time of rupture
      (2) temperature at time of rupture
      (3) axial distribution of circumferential strain
      (4) time of peak cladding temperature

   b. Hot assembly

      (1) time of blockage
      (2) differential pressure at time of blockage
      (3) temperature at time of blockage
      (4) axial distribution of reduction-in-flow area

10. The NRC staff has been generically evaluating three materials models that are used in ECCS evaluation models. Those models are cladding rupture temperature, cladding burst strain, and fuel assembly flow blockage. Subsequent to Westinghouse submittals and your applications of WCAP-9528, "ECCS Evaluation Model for Westinghouse Fuel Reloads of Combustion Engineering NSSS," and its addendum, we have (a) met and discussed our review with Westinghouse and other industry representatives, (b) published NUREG-0630, "Cladding Swelling and Rupture Models for LOCA Analysis, and (c) required fuel vendors and licensees to confirm that their plants would continue to be in conformance with the ECCS criteria of 10 CFR 50.46 if the materials models of NUREG-0630 were substituted for those models of their ECCS evaluation models and certain other compensatory model changes were allowed.

    The Westinghouse materials models that are described in WCAP-9528 are virtually the same as those used in prior Westinghouse ECCS evaluation models, and they were evaluated in NUREG-0630. Small differences are attributable to modifications that were made to reflect the geometrical differences in fuel designs for the Millstone 2 plant. Therefore, until we have completed our materials model review, we will require plant analyses performed with the ECCS evaluation model as described in WCAP-9528 to be accompanied by supplemental analyses to be performed with the materials models of NUREG-0630. Therefore we request that NNECO submit a sample calculation as described above.