NORTHEAST UTILITIES

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

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May 3, 1979

Docket No. 50-336

Director of Nuclear Reactor Regulation
Attn: Mr. R. Reid, Chief
Operating Reactors Branch #4
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Reference: (1) W. G. Counsil letter to R. Reid, dated February 12, 1979.

Gentlemen:

Millstone Nuclear Power Station, Unit No. 2
Additional Information Concerning Cycle 3 Safety Analyses

During the past several weeks, our respective Staffs have been discussing the material presented in Reference (1) supporting Cycle 3 operation. The most recent set of questions was supplied in an undocketed fashion; nonetheless, formal responses are provided as Attachment 1.

The response to Question 2.2 contains material proprietary to Combustion Engineering. Accordingly, the response is provided as CEN-110(N)-P. Due to the proprietary nature of the material contained in CEN-110(N)-P, Northeast Nuclear Energy Company (NNECO) requests that the document be withheld from public disclosure in accordance with the provisions of 10CFR2.790 and that this material be safeguarded. The reasons for the classification of this material as proprietary are delineated in the attached affidavit provided by Combustion Engineering.

In light of the proximity of the scheduled start of Cycle 3 operation for Millstone Unit No. 2, your prompt and favorable disposition of the attached responses would be greatly appreciated.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

W. G. Counsil

W. G. Counsil
Vice President

Attachment

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DOCKET NO. 50-336

ATTACHMENT 1

MILLSTONE NUCLEAR POWER STATION, UNIT NO. 2

ADDITIONAL INFORMATION CONCERNING CYCLE 3 SAFETY ANALYSES

MAY, 1979

AFFIDAVIT PURSUANT

TO 10 CFR 2.790

Combustion Engineering, Inc.)
State of Connecticut)
County of Hartford) SS.:

I, A. E. Scherer depose and say that I am the Manager, Licensing of Combustion Engineering, Inc., duly authorized to make this affidavit, and have reviewed or caused to have reviewed the information which is identified as proprietary and referenced in the paragraph immediately below. I am submitting this affidavit in conformance with the provisions of 10 CFR 2.790 of the Commission's regulations and in conjunction with the application of Northeast Nuclear Energy Company for withholding this information.

The information for which proprietary treatment is sought is contained in the following document:

CEN-110(N)-P, Response to NRC Question 2.2 On The Millstone Unit No. 2 Cycle 3 Reload Application. Docket No. 50-336 May 2, 1979.

This document has been appropriately designated as proprietary.

I have personal knowledge of the criteria and procedures utilized by Combustion Engineering in designating information as a trade secret, privileged or as confidential commercial or financial information.

Pursuant to the provisions of paragraph (b) (4) of Section 2.790 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure, included in the above referenced document, should be withheld.

1. The information sought to be withheld from public disclosure is results of analyses in support of setpoint methodology which is owned and has been held in confidence by Combustion Engineering.

2. The information consists of test data or other similar data concerning a process, method or component, the application of which results in a substantial competitive advantage to Combustion Engineering.

3. The information is of a type customarily held in confidence by Combustion Engineering and not customarily disclosed to the public. Combustion Engineering has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The details of the aforementioned system were provided to the Nuclear Regulatory Commission via letter DP-537 from F.M. Stern to Frank Schroeder dated December 2, 1974. This system was applied in determining that the subject documents herein are proprietary.

4. The information is being transmitted to the Commission in confidence under the provisions of 10 CFR 2.790 with the understanding that it is to be received in confidence by the Commission.

5. The information, to the best of my knowledge and belief, is not available in public sources, and any disclosure to third parties has been made pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence.

6. Public disclosure of the information is likely to cause substantial harm to the competitive position of Combustion Engineering because:

a. A similar product is manufactured and sold by major pressurized water reactors competitors of Combustion Engineering.

b. Development of this information by C-E required hundreds of man-hours of effort and tens of thousands of dollars. To the best of my knowledge and belief a competitor would have to undergo similar expense in generating equivalent information.

c. In order to acquire such information, a competitor would also require considerable time and inconvenience related to obtaining access to computer facilities and conducting extensive computer programs.

d. The information required significant effort and expense to obtain the licensing approvals necessary for application of the information. Avoidance of this expense would decrease a competitor's cost in applying the information and marketing the product to which the information is applicable.

e. The information consists of supporting data for analyses, the application of which provides a competitive economic advantage. The availability of such information to competitors would enable them to modify their product to better compete with Combustion Engineering, take marketing or other actions to improve their product's position or impair the position of Combustion Engineering's product, and avoid developing similar data and analyses in support of their processes, methods or apparatus.

f. In pricing Combustion Engineering's products and services, significant research, development, engineering, analytical, manufacturing, licensing, quality assurance and other costs and expenses must be included. The ability of Combustion Engineering's competitors to utilize such information without similar expenditure of resources may enable them to sell at prices reflecting significantly lower costs.

g. Use of the information by competitors in the international marketplace would increase their ability to market nuclear steam supply systems by reducing the costs associated with their technology development. In addition, disclosure would have an adverse economic impact on Combustion Engineering's potential for obtaining or maintaining foreign licensees.

Further the deponent sayeth not.

A. E. Scherer

Manager, Licensing

Sworn to before me

this 2nd day of May, 1979

Notary Public

LISA G. WAICUNAS, NOTARY PUBLIC
State of Connecticut No. 54492
Commission Expires March 31, 1983

Question 2.1: Questions on the ΔT Power Calculator Time Delay Compensation Circuit (TDCC)

a. You have stated that the TDCC circuitry can be (and is) bypassed if the RTD time constant is less than or equal to eight seconds. Justify this statement. Is this result Cycle 3 specific, Millstone 2 specific, or CE Generic?

b. Is there an adjustment of the TM-LP coefficients to account for the bypassing of the TDCC?

c. Some transients which affect the TDCC coefficients are not reanalyzed in Cycle 3, e.g., Excess Load (Complete list appears in CENPD-199 Table 5-2). Could their reanalysis change your conclusion on the TDCC?

Response:

2.1.a.

The ΔT Power calculator (ΔTPC) circuitry as stated in CENPD-199, consists of two components, the static portion, and the dynamic portion. The dynamic portion ("a" and "τ" equipment coefficients) modulates the static portion of the signal in the ΔTPC during a transient. For Millstone 2, Cycle 3, the analysis justified zeroing out the dynamic coefficients in the ΔTPC for a RTD time constant $\leq$8 seconds. However, the circuitry was not bypassed as implied in the question. This procedure is specific to Millstone-2 Cycle 3 and not generic to all plants that CE reloads.

2.1.b.

The QR1 function, which augments the power reading, is boosted to compensate for zeroing out the dynamic portion of the ΔTPC in order to produce a conservative power reading, if necessary. This is, in fact, what was done for Cycle 3. It should be noted that the ΔT dynamic compensation is not "bypassed" per se, only the coefficients are set to zero.

2.1.c.

As stated in CENPD-199, all those events listed in Table 5-2 depend on the ΔTPC for a conservative power input to the RPS. Of all those events, the excess load and CEA withdrawal produce the greatest cooldown and heatup of the NSSS, respectively. If the ΔT Power reading for those events is conservative, then the ΔT Power will be conservative for all other events which are not as fast (e.g., loss of load). For Cycle 3, these two transients were re-analyzed to determine that input to the ΔTPC would produce conservative power readings. Although this seems to contradict the statement made in the reload license submittal on the Excess Load Event, our meaning then was that the Excess Load Event was not re-analyzed as in the FSAR. Instead, we ensured that the inputs to the TM/LP trip system were conservative to avoid violation of a 1.19 CE-1 DNBR for the Excess Load Event. Further discussion is provided in response to question 2.3.

Question 2.3: (Section 7.1.4, Excess Load Event)

You state "The Excess Load Incident analysis presented in the FSAR for 2560 MWT operation conservatively bounds Cycle 3 operation at 2700 MWT." This is not at all obvious, and may, in fact, be incorrect. In the FSAR analysis, the minimum W-3 DNBR reached was 1.80. For Cycle 3, the Core Power, Pressure, Temperature, Flow, and Radial Peaking Factor has changed from the values used in the FSAR analysis. The changes in all these parameters is roughly equivalent to a change in W-3 DNBR of -0.43. Thus, in a first approximation, it appears that if the FSAR analysis were performed with Cycle 3 parameters, the minimum W-3 DNBR reached would be roughly 1.80-0.43=1.37. In view of the potential inaccuracy in the computation of the DNBR=1.37 value, there appears to be considerable likelihood that if the FSAR analysis were performed using Cycle 3 parameters, the results would show a minimum W-3 DNBR less than the allowed limit of 1.30. In view of this, a reanalysis of the Excess Load event seems appropriate. Either provide such reanalysis or else provide justification for not performing this analysis.

Response:

2.3

The criteria for the Excess Load event is a minimum 1.19 (CE-1) DNBR. As stated in the FSAR, the high power trip, low steam generator pressure trip, low steam generator water level trip, or the Thermal Margin/Low Pressure trip will prevent the DNBR from going below its SAFDL. To verify that the DNBR for the Excess Load is $\geq$1.19 (CE-1), an explicit minimum DNBR can be generated (as in the FSAR) or all the inputs to the TM/LP trip can be demonstrated to be conservative for this event.

For MP-2, Cycle 3, the latter approach was utilized. If the combination of the power input, temperature input, and the bias term (γ) in the TM/LP is conservative for this event, a TM/LP trip will prevent a CE-1 DNBR below 1.19.

For Cycle 3, our evaluations showed that all the inputs to the TM/LP will be conservative for Excess Load.

To address your specific concern that the DNBR might go below a 1.19 DNBR (CE-1), an explicit case was run. The analysis of the full power Excess Load event, performed in the same manner as the FSAR initiated at the proposed Cycle 3 Tech Spec LCOs, results in a minimum DNBR of 1.41 (CE-1).

Question 2.4: (Section 7.2.1, Loss of RCS Flow Event)

The change in analytical methodology required to accomodate the RCP speed trip is not delineated in the Reload Application. From available information, we surmise the following paragraph explains the change in methodology. Please advise us if there are any errors in our understanding.

For both past analyses and the present analysis, the time-dependent core and individual loop flows and steam generator pressure drops are determined by using the COAST program (described in CENPD-98) which solves the conservation equations for mass flow and momentum. The general forcing functions for the fluid momentum equations consist of the pump torque values from the manufacturer's four quadrant curves, wherein the torque is related to the pump angular velocity and discharge rate. The output of COAST includes the time dependence of both the RCS flow and the RCP speed. In the Four Pump Loss of Flow analysis, the trip is assumed to occur at a pump speed of 839 rpm rather than the a specified flow, as has been the case in past analyses. In either case, COAST predicts a trip time. The only change in the analytical method required to accommodate the RCP speed sensing system is the determination of the trip time from the RCP speed curve rather than the RCS flow curve.

Response:

2.4

There has not been any change in analytical methodology to accommodate the RCP Speed Sensing System. In the reload license application, it is assumed that this system will assure a reactor trip at a flow rate greater than or equal to 91.5% of minimum guaranteed flow, with a trip signal delay time for the speed sensing system of 0.45 seconds. These were the values assumed in the analyses of the 4-pump Loss-of-Flow. The values are consistent with previously submitted Technical Specification changes.

The conversion from percent flow to rpm was made subsequent to completion of the 4-pump Loss-of-Flow analysis so that the appropriate value (829 rpm) could be provided for Technical Specifications.

Question 2.5 (Section 7.2.1, Loss of RCS Flow Event)

a. In Principle, the Required Over-Power Margin (ROPM) is determined by the most limiting of the Four Pump Loss of Flow, the Two Pump Loss of Flow, the CEA Drop, and the Malfunction of One Steam Generator events. Was the ROPM, in fact, computed for all these or was it only computed for the Four Pump Loss of Flow Event?

b. The ROPM is used to compute the DNBR LCO ASI Tent. This being the case, these transient(s) should be examined for a variety of Powers and ASI, and possibly other parameters such as Axial Shape, Rod Insertion, and Burnup. Enumerate the parameters that are varied for each transient analyzed, and indicate the range and number of values assumed for these parameters.

c. Are the analyses of the four transients under consideration which are reported in the Reload Application performed assuming the DNBR LCO ASI Tent determined from the limiting ROPM?

d. In the analyses of these four transients which are reported in the Reload Application, how are the initial conditions for the transients determined? In particular, do the initial conditions assumed produce the minimum DNBR, i.e., are the DNBR reported for these transients on the reload application the minimum possible DNBR?

Response

2.5.a

The ROPM was computed for all of these transients.

2.5.b

Complete discussions for these transients are provided in Sections 7.0 &8.0 of CENPD-199-P. As indicated in the report, sensitivity studies were made to determine the sensitivity of these transients to variations in different parameters. Results of these studies and the parameters considered are reported in CENPD-199-P.

2.5.c

Descriptions of methodologies for these four transients are provided in CENPD-199-P. The most limiting Required Overpower Margin's (ROPM) of all of these transients form the bases for the DNB LCO ASI Tent. Therefore, for any of these transients starting from within the LCO, the minimum CE-1 DNBR will automatically be at or higher than 1.19.

2.5.d

The selection of initial conditions for these transients is discussed in CENPD-199-P. These initial conditions produce the minimum DNBR and in those instances where the minimum DNBR is quoted in the license submittal, these are, in fact, the most limiting values one would see when the transient is initiated from within the DNBR LCO limits.

Question 2.6 (Section 7.2.5, Loss of Load to One SG)

What is the peak KW/ft predicted for this transient?

Response

2.6

The initial PLHR assumed for this analysis was 16 kw/ft. The 16 kw/ft value is the maximum allowable initial PLHR for non-LOCA transients. The maximum predicted PLHR during Loss of Load to one steam generator (based in this initial PLHR) is 19.0 kw/ft. Since for Millstone Unit No. 2 cycle 3 the maximum allowable PLHR is 15.6 kw/ft, the predicted maximum is less than 19.0 kw/ft.

Question 2.7: (Section 7.3.3, Steam Generator Tube Rupture Event)

The sequence of events delineated in Table 7.3.3-2 do not appear to correlate with the pressure plot of Figure 7.3.3-5. Explain what causes each pressure change in Figure 7.3.3-5 and explain how these pressure changes are related to the events of Table 7.3.3-2.

Response:

2.7

Table 7.3.3-2 in the license submittal lists the times when the dump valves and the bypass valves initially open and finally close. In between the initial opening and final closing of the bypass valves, predictions indicate that these valves reopen and close a couple of times. The attached table gives the detailed opening and closing of the valves.

The following is a descriptive sequence of events:

	Time (Sec)	Event
1)	825.6	The first decrease in pressure is caused by opening of the dump and bypass valves on turbine trip. The turbine admission valve also starts closing at this time.
2)	830.0	The pressure then starts to increase because of the turbine admission valve closure since the dump and bypass valves are unable to handle the full load rejection initially.
3)	839.0	The pressure decreases when the steam dump and bypass are able to keep pace with the load rejection. At this time, the capacity of the valves are greater than the steam flow.
4)	882.0	The pressure then increases when the steam dump and bypass valves close. The closure of the valves is caused by the primary T_{ave} dropping below the closing setpoint of the dumps and the secondary pressure being below the closing setpoint of the bypass valves.
5)	898.4	When the pressure again exceeds the opening pressure setpoint of the bypass valves, the bypass valves reopen, causing the pressure to decrease once again.
6)	913.2	The pressure then decreases below the bypass pressure setpoint and the bypass valves finally close.

SEQUENCE OF EVENTS FOR THE STEAM GENERATOR TUBE RUPTURE INCIDENT

Time (Sec)	Event	Setpoint or Value
0.0	Tube Rupture Occurs	--
825.2	Pressurizer Empties	--
825.2	Low Pressurizer Pressure Trip Condition	1728 psia
825.6	Dump Valves Open	--
825.6	Bypass Valves Open	--
826.6	CEAs Begin to Drop into Core	--
830.0	Turbine Valve Closes	--
839.0	Maximum Steam Generator Pressure	901.4 psia
882.0	Dump Valves Close	--
882.0	Bypass Valves Close	--
898.4	Bypass Valves Reopen	--
913.2	Bypass Valves Reclose	--
1800.0	Operator Initiates Appropriate Action and Begins Cooldown to 300^{o}F	--