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November 23, 1981

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U.S. NUCLEAR REGULATORY COMMISSION

United States Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Office of Nuclear Reactor Regulation
Mr. T. A. Ippolito, Chief
Operating Reactors Branch #2
Division of Licensing

References:
(a) License No. DPR-28 (Docket No. 50-271).
(b) Vermont Yankee Proposed Change No. 98 (FVY 81-128), dated September 2, 1981.
(c) Vermont Yankee Cycle 9 Core Performance Analysis Report, YAEC-1275, August 1981.
(d) Letter, R. L. Smith (VY) to T. A. Ippolito (NRC), "Validation of SIMULATE Thermal-Hydraulics and Thermal Margin Calculations by Comparisons to the FIBWR Code," FVY 81-167, November 23, 1981.
(e) Letter, D. E. Vandenburgh (VY) to Office of Nuclear Reactor Regulation, "Reload 5 Licensing Submittal", WVY 78-59, June 21, 1978.
(f) Supplemental Reload Licensing Submittal for Vermont Yankee Nuclear Power Station, Reload 6, NEDO-24208, August 1979.
(g) Supplemental Reload Licensing Submittal for Vermont Yankee Nuclear Power Station, Reload No. 7, Y1003J01A02, July 1980.

Subject: Justification for the Vermont Yankee MCPR Operating Limits: BOC to EOC-2000 Mwd/t Cycle Exposure

Dear Sir:

This letter provides justification for the establishment of the MCPR operating limits for Cycle 9 of the Vermont Yankee Nuclear Power Station based upon the calculation of the Control Rod Withdrawal Error ΔCPR values as presented in Reference (c). This procedure is demonstrated to be valid over the range of cycle exposure from BOC to EOC-2000 Mwd/t and is requested to allow a limited time period during which the Vermont Yankee methodology for calculating the MCPR limits for pressurization transients (turbine-trip-without-bypass and generator-load-rejection-without-bypass) and the loss-of-feedwater-heating transient from the RETRAN system transient calculations can be fully qualified for review and approval by the staff.

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The MCPR operating limits as proposed in Reference (b) and evaluated in Reference (c) are calculated as a function of rod block monitor (RBM) setpoint. For the initial operation of the cycle, BOC through EOC-2000 Mwd/t, the MCPR operating limits for RBM N values of 42% and 41%[(1)] are 1.29 and 1.25, respectively. These values are established as a result of the evaluation of the Local Control Rod Withdrawal Error (RWE) transient. At RBM N values at or below 40% the limiting value of MCPR was established within this cycle exposure range on the basis of the loss-of-feedwater heating transient. This letter proposes that the plant be administratively directed to use a RBM N value of $\geq$ 41% so that the MCPR operating limits are based upon the RWE transient evaluation results until a cycle exposure of EOC-2000 Mwd/t. This administrative action should continue until the issues with regard to the qualification of the thermal margin code, MAYU04-YAEC, are resolved with the staff.

The following discussion provides information supporting this recommended administrative action. Additionally, the proposed course to identify and resolve the issues regarding the MAYU04-YAEC code, including a workscope and timetable, is presented.

The calculation of MCPR limits for the RWE transient is performed in the YAEC methodology by means of the SIMULATE code. This code evaluates this transient through the calculation of quasi-static reactor states and establishes ΔCPR values directly with the GEXL correlation. The methodology is described in Reference (c). Additional information on the accuracy of the SIMULATE thermal hydraulic calculations which are used in the MCPR determination with the GEXL correlation is being provided to the staff in Reference (d).

MCPR Analysis Results from Previous VY Operational Cycles

The YAEC RWE methodology for Cycle 9 evaluates the ΔCPR for each bundle type and selects the most limiting value to be applied for all fuel types. When this current procedure is utilized to evaluate the RWE ΔCPR values for the previous three cycles of Vermont Yankee, a comparison for the cycle exposure range of BOC to EOC-2000 Mwd/t shows that the RWE ΔCPR has always been limiting for a RBM equation value of N $\geq$ 41%. The comparison through Cycle 9 is shown on the attached table. The values for Cycles 6 through 8 are determined from References (e) through (g). The Loss of 100°F Feedwater Heating transient is consistently the next most limiting transient and the MCPR values for this transient are always bounded by the RWE values at a setpoint corresponding to an N value of 41%.

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(1) The values are those of the variable "N" in the Rod Block Monitor (RBM) equation. The RBM trip setpoints are determined by the equation shown in Table 3.2.5 of the Vermont Yankee Technical Specifications.

Workscope on Thermal Margin Calculation Qualification Resolution

The MAYU04-YAEC code predictions of the Atlas 4x4 data set and the evaluations for VY Cycle 9 pressurization and loss-of-feedwater-heating transients have been performed utilizing the EPRI void model (1) to evaluate the transient void fraction and (2) to translate the calculated void fraction to a calculated quality for input to the critical quality correlation. Sensitivity studies on certain data points in the Atlas data set have shown the sensitivity of the predictions to the void model selected. Using the available high void fraction data base, a void model can be selected which demonstrates the best fit to that data using the current MAYU04-YAEC methodology. That model would then be used to re-evaluate the Vermont Yankee Cycle 9 transients, the Peach Bottom Licensing Basis Transient, and the Peach Bottom turbine trip tests If the results show a consistent improvement in the predictability of thermal margin, this void model could be adopted for MAYU04-YAEC calculations.

The MAYU04-YAEC code has shown reasonable accuracy in performing the solution to the analytical test case as presented in the MAYU code manual (GEAP-23517). However, the analytical solution and MAYU04 solution results are based upon different sets of water properties so that the solutions do not match exactly. Thus, it is not possible to evaluate absolutely that a slight calculational bias is not present in the MAYU04-YAEC code solution. The approach to resolve this problem would be to develop a new analytical solution based upon the current water properties in the MAYU04-YAEC code.

The accuracy of the MAYU04-YAEC code prediction is a function of the time-step and spatial mesh size. The current coding allows variation in the spatial mesh to a maximum of 24 axial nodes. This maximum value has been selected for calculations performed on the Atlas data set and for licensing transient analysis. To verify that this mesh size is appropriate, the coding will be modified to allow a finer mesh spacing. This will require the modification of the dimensionality and the calculational framework (iteration loop boundaries) of the code. The study will establish time-step and spatial mesh sizes to assure that important thermal and hydraulic parameters are predicted with adequate convergence.

As demonstrated in the previous section, the rod withdrawal error transient results for Cycle 9 with an administratively controlled RBM setpoint ($N \geq 41\%$) are limiting for Vermont Yankee operation from BOC to EOC-2000 Mwd/t. An EOC-2000 Mwd/t cycle exposure will occur during Cycle 9 on or about October 1, 1982. The program of work outlined above is scheduled to be completed within four calendar months (March 31, 1982). Therefore, this work schedule in conjunction with the proposed administrative action should allow ample time for staff review and resolution of this issue.

We trust that the approach and supporting information described herein are satisfactory and complete. However, should you have any questions, please contact us.

Very truly yours,

VERMONT YANKEE NUCLEAR POWER CORPORATION

L. H. Heider
Vice President

TABLE 1

Comparison of Rod Withdrawal Error ΔCPR Values to
Loss of 100°F Feedwater Heating ΔCPR
Vermont Yankee Cycles 6 - 9

Cycle Exposure: BOC to EOC-2000 Mwd/t

Cycle 6 (Reference (e))

	N%	Setpt	Most limiting RWE ΔCPR 8X8/8X8R
RWE[1]	41	107	0.19
	42	108	0.21
FW HT[2]			0.15

Cycle 7 (Reference (f))

	N%	Setpt	Most limiting RWE ΔCPR 8X8/8X8R/P8X8R
RWE	41	107	0.16
	42	108	0.20
FW HT			0.15

Cycle 8 (Reference (g))

	N%	Setpt	Most limiting RWE ΔCPR 8X8/8X8R/P8X8R
RWE	41	107	0.16
	42	108	0.20
FW HT			0.14

Cycle 9 (Reference (c))

	N%	Setpt	ΔCPR 8X8/8X8R/P8X8R
RWE	41	107	0.18
	42	108	0.22
FW HT (BOC)			0.15
FW HT (EOC-2000 Mwd/t)			0.17

(1) Rod Withdrawal Error Transient Analysis

(2) Loss of 100°F Feedwater Heating Transient Analysis