NORTHEAST UTILITIES

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June 27, 1980

Docket NO. 50-245
B10026

Director of Nuclear Reactor Regulation
Attn: Mr. Dennis M. Crutchfield, Chief
Operating Reactors Branch #5
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

References: (1) W. G. Counsil letter to D. L. Ziemann dated March 19, 1980.
(2) W. G. Counsil letter to D. L. Ziemann dated April 16, 1980.
(3) W. G. Counsil letter to D. M. Crutchfield dated April 29, 1980.
(4) W. G. Counsil letter to D. M. Crutchfield dated May 2, 1980.
(5) D. M. Crutchfield letter to W. G. Counsil dated May 8, 1980.

Gentlemen:

Millstone Nuclear Power Station, Unit No. 1
Recirculation Loop, Small Break, Flow Split Model

In References (1) and (2), Northeast Nuclear Energy Company (NNECO) proposed Technical Specification changes to add an automatic initiation of the Isolation Condenser on reactor vessel low-low water level and to allow credit for the Isolation Condenser System in the ECCS performance calculations. References (3) and (4) provided plant-specific calculations showing that without LPCI flow (versus partial LPCI flow), the peak clad temperatures would be lower and, therefore, thermal limits would be less restrictive. The Staff concurred in Reference (5) that this was due to the lower plenum quenching phenomenon associated with LPCI flow, which delays recovery of the hot node. Thus, in Reference (5), the Staff approved the proposed changes since they were conservative compared to taking partial credit for LPCI flow past the break. In the course of Staff review of Reference (2), however, seven questions were verbally transmitted to NNECO regarding the more conservative case of partial LPCI flow past the small break. These questions pertained to the actual methodology used to establish the break flow split thermal limits, even though it was clearly established that the flow split phenomenon conservatively bounds the no-LPCI flow case.

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NNECO hereby submits the responses to the questions and requests completion of Staff review of the flow split methodology since it may be used in future reload submittals. The Staff questions, followed by NNECO's responses are attached. Should you have any questions, please contact us.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

W. G. Counsil
Senior Vice President

Attachment

DOCKET NO. 50-245

ATTACHMENT

MILLSTONE NUCLEAR POWER STATION, UNIT NO. 1

RECIRCULATION LOOP, SMALL BREAK, FLOW SPLIT MODEL

RESPONSES TO NRC QUESTIONS

JUNE, 1980

MILLSTONE UNIT NO. 1
RESPONSES TO NRC QUESTIONS

1) Pg 1, Assumption C; does the test data (that was used to determine loss coefficients) apply to the full range of Millstone operation?

The maximum loss coefficient (for forward drive flow) occurs at zero M-Ratio (zero suction flow). Because maximum loss coefficient values are conservative* and because the downcomer water level is usually below the jet pump suction nozzles during LPCI injection, zero M-Ratio operating conditions were assumed. The Millstone jet pumps were tested between M-Ratios of ~0.5 to 2.0. The zero M-Ratio (maximum) values were extrapolated by use of a theoretical jet pump model that closely followed the test data. Ten percent was added for conservatism.

*Actually the equivalent LPCI flow is not very sensitive to small changes in jet pump loss coefficient.

(2) Page 2; is a K_B term missing from Equation (1)?

K_B is assumed to be 1.0.

(3) Page 2; should not K_E be K_B in Equation (2)?

No. However, the term A_B^2 should be A_E^2
(TYPOGRAPHICAL ERROR)

(4) Page 2; how is B developed in Equation (2)?

This term is derived (as shown below) for the SAFE code input and has been verified against startup test data to result in conservatively calculated LPCI flow rates.

B=LPCI system characteristic in SAFE03

The LPCI system curve is

$$\bar{P}_v = P_{vs} - BW_L^2$$

where $\bar{P}_v$ = Vessel pressure

P_{vs} = Shut off pressure

$$B = \frac{P_{vs} - \bar{P}_v}{W_L^2}$$

From SAFE03 Data

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$$P_{vs} = \frac{LPCIC(20) - 0.01}{144 \times LPCIC(26)} + 14.7$$

$$B = \frac{P_{vs} - P_1}{W_1^2}$$

where W_1 is the LPCI flow (lb/sec) at vessel pressure P_1

(5) Page 2; how is Equation (2) developed?

The LPCI System curve is

$$\bar{P}_v = P_{vs} - BW_L^2 \qquad \text{(i)}$$

The energy equation from the injection point to the vessel is (see sketch below)

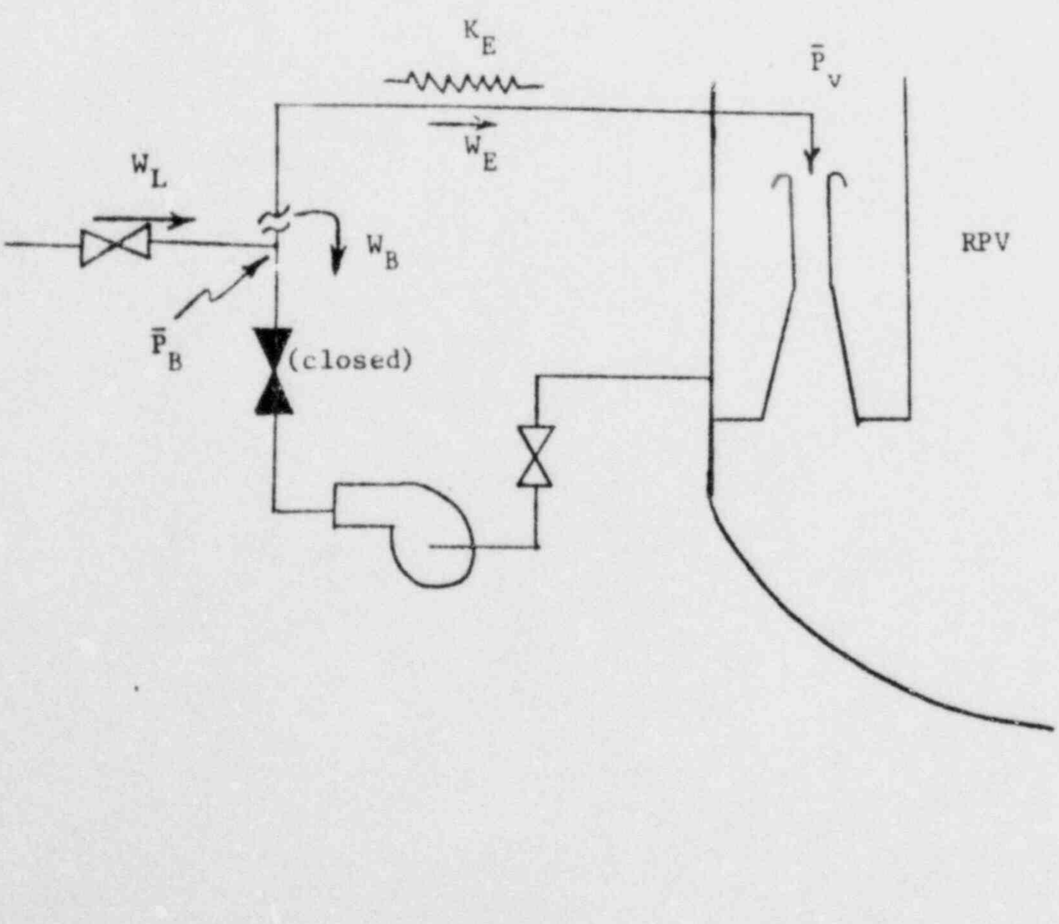
$$\bar{P}_B = \bar{P}_v + \frac{K_E}{288g\ \gamma\ A_E^2} W_L^2 \qquad \text{(ii)}$$

Substitution of Eqn (i) into (ii) gives

$$\bar{P}_B = P_{vs} - BW_L^2 + \frac{K_E}{288g\ \gamma\ A_E^2} W_L^2$$

or $$W_L = \sqrt{(\bar{P}_B - P_{vs})/(B - K_E/288g\ \gamma\ A_E^2)}$$

as Equation (2) in Page 2



(6) Page 2; should not A_B be A_E in Equation (4)?

Yes. (TYPOGRAPHICAL error in the subscript)

(7) Page 2; how is Equation (5) developed, from setting Equation (1) equal to Equation (2)?

Yes. $\bar{P}_{Bo}$ is the threshold pressure which allows LPCI flow to enter vessel.

The correct Equation should read

$$\bar{P}_{Bo} = \frac{P_{vs} + (A_B{}^2)(14.7)(288g\ \gamma\ B - K_E/A_E{}^2)}{1 + A_B{}^2(288g\ \gamma\ B - K_E/A_E{}^2)}$$