Station Support Department

PECO ENERGY

PECO Energy Company
Nuclear Group Headquarters
965 Chesterbrook Boulevard
Wayne, PA 19087-5691

December 21, 1995

Docket No. 50-352

License No. NPF-39

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: Limerick Generating Station, Unit 1
Response to Request for Additional Information Regarding
Technical Specifications Change Request No. 95-03-1

Gentlemen:

Attached is our response to your Request for Additional Information (RAI), discussed in our telephone conversation on December 18, 1995 regarding the change in the Minimum Critical Power Ratio (MCPR) Safety Limit due to the planned use of GE13 fuel product line at Limerick Generating Station (LGS), Unit 1. The new MCPR Safety Limit is the subject of Technical Specifications Change Request No. 95-03-1 which was forwarded to you by letter dated June 19, 1995.

Using the same methodology described in tne GE report NEDO-24229-1, "Peach Bottom Atomic Power Station Units 2 and 3 Single-Loop Operation," dated May 1980, which was forwarded to you by GE on December 18, 1995, the resulting MCPR Safety Limit for single loop operation with GE 13 fuel at LGS Unit 1 is 1.11. The method used for the MCPR Safety Limit calculation for dual loop and single loop operation is identical; the observed 0.02 MCPR difference is due to the increased core flow measurement uncertainty (i.e., from 2.5% to 6%) and the increased process computer Traversing In-Core Probe (TIP) uncertainty (i.e., from 8.7% to 9.1%) resulting in a MCPR Safety Limit value of 1.11 for single loop operation.

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This information is being submitted under affirmation, and the required affidavit is enclosed.

If you have any questions, please do not hesitate to contact us.

Very truly yours,

G. A. Hunger, Jr.,
Director - Licensing

Attachment

Enclosure

cc: T.T. Martin, Administrator, Region I, USNRC (w/attachment/enclosure)
N.S. Perry, USNRC Senior Resident Inspector, LGS (w/attachment/enclosure)
R.R. Janati, PA Bureau of Radiological Protection (w/attachment/enclosure)

COMMONWEALTH OF PENNSYLVANIA :

: ss.

COUNTY OF CHESTER :

D. B. Fetters, being first duly sworn, deposes and says:

That he is Vice President of PECO Energy Company, the Applicant herein; that he has read the enclosed response to the NRC Request for Additional Information involving the change in the Minimum Critical Power Ratio (MCPR) Safety Limit due to the use of GE13 fuel product line concerning Technical Specifications Change Request No. 95-03-1 for Limerick Generating Station, Facility Operating License No. NPF-39, and knows the contents thereof; and that the statements and matters set forth therein are true and correct to the best of his knowledge, information and belief.

Vice President

Subscribed and sworn to

before me this 21st day

of December 1995.

Mary Lou Skrocki

Notary Public

Notarial Seal
Mary Lou Skrocki, Notary Public
Tredyffrin Twp., Chester County
My Commission Expires May 17, 1999

ATTACHMENT

LIMERICK GENERATING STATION
UNIT 1

DOCKET NO.
50-352

LICENSE NO.
NPF-39

EXCERPT FROM NEDC-31300 "SINGLE -LOOP OPERATION ANALYSIS FOR LIMERICK GENERATING STATION UNIT 1", DATED AUGUST 1986
(5 PAGES)

2. MCPR FUEL CLADDING INTEGRITY SAFETY LIMIT

Except for core total flow and TIP reading, the uncertainties used in the statistical analysis to determine the MCPR fuel cladding integrity safety limit are not dependent on whether coolant flow is provided by one or two recirculation pumps. Uncertainties used in the two-loop operation analysis are documented in the FSAR. A 6% core flow measurement uncertainty has been established for single-loop operation (compared to 2.5% for two-loop operation). As shown below, this value conservatively reflects the one standard deviation (one sigma) accuracy of the core flow measurement system documented in Reference 1. The random noise component of the TIP reading uncertainty was revised for SLO to reflect the operating plant test results given in Subsection 2.2. This revision resulted in a process computer effective TIP uncertainty of 6.8% for initial cores and 9.1% for reload cores. Comparable two-loop process computer uncertainty values are 6.3% for initial cores and 8.7% for reload cores. The net effect of these two revised uncertainties is a 0.01 incremental increase in the required MCPR fuel cladding integrity safety limit.

2.1 CORE FLOW UNCERTAINTY

2.1.1 Core Flow Measurement During Single-Loop Operation

The jet pump core flow measurement system is calibrated to measure core flow when both sets of jet pumps are in forward flow; total core flow is the sum of the indicated loop flows. For SLO, however, some inactive jet pumps will be backflowing (at active pump speeds above approximately 40%). Therefore, the measured flow in the backflowing jet pumps must be subtracted from the measured flow in the active loop to obtain the total core flow. In addition, the jet pump coefficient is different for reverse flow than for forward flow, and the measurement of reverse flow must be modified to account for this difference.

In SLO, the total core flow is derived by the following formula:

$$\begin{pmatrix}\text{Total Core}\\ \text{Flow}\end{pmatrix} = \begin{pmatrix}\text{Active Loop}\\ \text{Indicated Flow}\end{pmatrix} - C\begin{pmatrix}\text{Inactive Loop}\\ \text{Indicated Flow}\end{pmatrix}$$

The coefficient C (=0.95) is defined as the ratio of "Inactive Loop True Flow" to "Inactive Loop Indicated Flow". "Loop Indicated Flow" is the flow measured by the jet pump "single-tap" loop flow summers and indicators, which are set to read forward flow correctly.

The 0.95 factor is the result of a conservative analysis to appropriately modify the single-tap flow coefficient for reverse flow.* If a more exact, less conservative, core flow is required, special in-reactor calibration tests can be made. Such calibration tests would involve: calibrating core support plate ΔP versus core flow during one-pump and two-pump operation along the 100% flow control line and calculating the correct value of C based on the core support plate ΔP and the loop flow indicator readings.

2.1.2 Core Flow Uncertainty Analysis

The uncertainty analysis procedure used to establish the core flow uncertainty for SLO is essentially the same as for two-pump operation with some exceptions. The core flow uncertainty analysis is described in Reference 1. The analysis of one-pump core flow uncertainty is summarized below:

For SLO, the total core flow can be expressed as follows (refer to Figure 2-1):

$$W_C = W_A - W_I$$

where:

W_C = total core flow,

W_A = active loop flow, and

W_I = inactive loop (true) flow.

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*The analytical expected value of the "C" coefficient for Limerick is 0.84.

By applying the "propagation of errors" method to the equation above, the variance of the total flow uncertainty can be approximated by:

$$\sigma^2_{W_C} = \sigma^2_{W_{sys}} + \left(\frac{1}{1-a}\right)^2 \cdot \sigma^2_{W_{A_{rand}}} + \left(\frac{a}{1-a}\right)^2 \cdot \left(\sigma^2_{W_{I_{rand}}} + \sigma^2_{C}\right)$$

where:

σ_{W_C} = uncertainty of total core flow;

$\sigma_{W_{sys}}$ = uncertainty systematic to both loops;

$\sigma_{W_{A_{rand}}}$ = random uncertainty of active loop only;

$\sigma_{W_{I_{rand}}}$ = random uncertainty of inactive loop only;

σ_C = uncertainty of "C" coefficient; and

a = ratio of inactive loop flow (W_I) to active loop flow (W_A).

From an uncertainty analysis, the conservative, bounding values of

$\sigma_{W_{sys}}$, $\sigma_{W_{A_{rand}}}$, $\sigma_{W_{I_{rand}}}$ and σ_C are 1.6%, 2.6%, 3.5%, and 2.8%, respectively.

Based on the above uncertainties and a bounding value of 0.36* for "a", the variance of the total flow uncertainty is approximately:

$$\sigma^2_{W_C} = (1.6)^2 + \left(\frac{1}{1-0.36}\right)^2 \cdot (2.6)^2 + \left(\frac{0.36}{1-0.36}\right)^2 \cdot \left[(3.5)^2 + (2.8)^2\right]$$
$$= (5.0\%)^2$$

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*This flow split ratio varies from about 0.13 to 0.36. The 0.36 value is a conservative bounding value. The analytical expected value of the flow split ratio for Limerick is ~ 0.33.

When the effect of 4.1% core bypass flow split uncertainty at 12% (bounding case) bypass flow fraction is added to the total core flow uncertainty, the active coolant flow uncertainty is:

$$\sigma^2_{\substack{\text{active}\\\text{coolant}}} = (5.0\%)^2 + \left(\frac{0.12}{1-0.12}\right)^2 \cdot (4.1\%)^2 = (5.1\%)^2$$

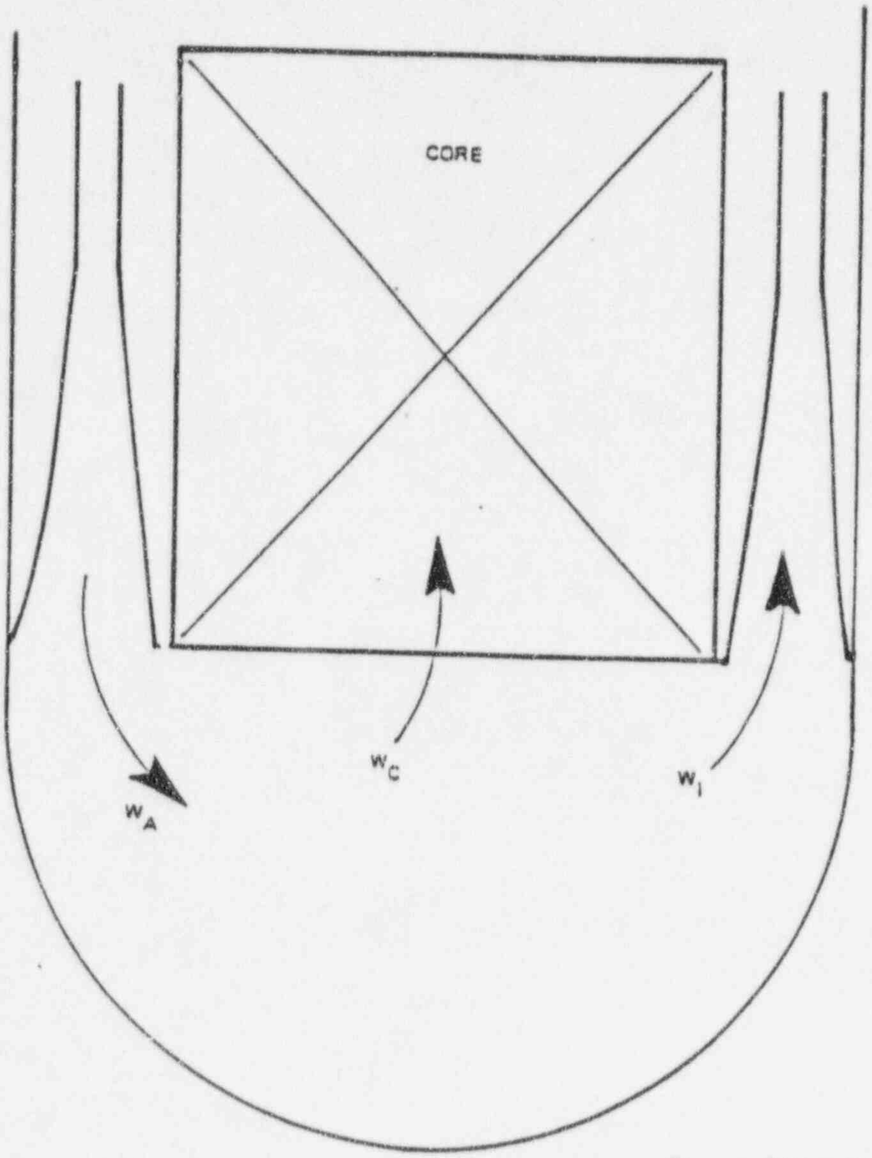
which is less than the 6% flow uncertainty assumed in the statistical analysis.

In summary, core flow during SLO is measured in a conservative way and its uncertainty has been conservatively evaluated.

2.2 TIP READING UNCERTAINTY

To ascertain the TIP noise uncertainty for single recirculation loop operation, a test was performed at an operating BWR. The test was performed at a power level 59.3% of rated with a single recirculation pump in operation (core flow 46.3% of rated). A rotationally symmetric control rod pattern existed during the test.

Five consecutive traverses were made with each of five TIP machines, giving a total of 25 traverses. Analysis of this data resulted in a nodal TIP noise of 2.85%. Use of this TIP noise value as a component of the process computer total uncertainty results in a one-sigma process computer total effect TIP uncertainty value for SLO of 6.8% for initial cores and 9.1% for reload cores.



W_C = TOTAL CORE FLOW
W_A = ACTIVE LOOP FLOW
W_I = INACTIVE LOOP FLOW

Figure 2-1. Illustration of Single Recirculation Loop Operation Flows