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May 20, 1980
TLL 238

Director of Nuclear Reactor Regulation
Attn: R. W. Reid, Chief
Operating Reactors Branch No. 4
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir:

Three Mile Island Nuclear Station, Unit I (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
HPI/LPI, Technical Specification Change Request No. 61B

This letter and enclosure are in response to questions transmitted to Met-Ed via a telephone conversation between Mr. D. DiIanni of your staff and Mr. D. G. Mitchell of Met-Ed on April 30, 1980. The questions were to clarify items of our Technical Specification Change Request No. 61B which concerns High Pressure Injection/Low Pressure Injection.

Sincerely,

J. G. Herbein
Vice President
TMI-I

JGH:DGM:hah

Enclosure

cc: J. T. Collins
B. J. Snyder

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RESPONSE TO DIIANNI'S 6 QUESTIONS ON HPI/LPI

Q. 1 Justify deleting the need for limit switch settings.

A. 1 The limit switch settings of MU-V16, A, B, C, D noted in specification 4.5.2.1.c, of Change Request 61A, were required to ensure proper flow distribution of the High Pressure Injection System. The settings specification was deleted in Change Request 61B because of the installation of passive mechanical devices (cavitating venturi). For additional information see the TMI-I Restart Report Supplement 1, Part 3, response to questions 1, 2, and 3.

Q. 2 Justify not verifying 200 gpm flow per leg.

A. 2 Specification 4.5.2.1.b of Change Request 61A stated a minimum acceptable flow of greater than or equal to 200 gpm of High Pressure Injection per leg was required. Change Request 61B deleted that verification requirement. Passive mechanical devices will accomplish the required distribution of flow. See the above referenced items of the Restart Report for additional information.

Q. 3 Justify the 500 gpm flow when RC pressure is less than or equal to 600 psig.

A. 3 Specification 4.5.2.1.c of Change Request 61A required a minimum flow per HPI pump of 500 gpm. Change Request 61B modified that requirement to require at least 500 gpm per HPI pump when the RC pressure is less than or equal to 600 psig. The changes of Change Request 61B reflect that the amount of flow delivered by the HPI pumps is dependent on RC System pressure and that above 600 psig less than 500 gpm will be delivered. For RC pressures less than 600 psig, the venturi will begin to cavitate and limit the flow, preventing run out of the HPI pumps. The predicted performance of the system is contained in Supplement 1, Part 3 of the TMI-I Restart Report along with detailed justification of the predicted system performance. Additional supporting justification is contained in the attached B&W letter of April 26, 1980.

Q. 4 Answer 3 items in the NRC letter of July 1, 1977:
Maintenance of proper flow resistance and presure drop in the piping

system to each injection point is necessary to a) prevent total pump flow from exceeding run out conditions when the system is in its minimum resistance configuration; b) provide a proper flow split between injection points in accordance with the assumptions used in the ECCS-LOCA analysis, and c) provide an acceptable level of total ECCS flow to all injection points equal to or above that assumed in the ECCS-LOCA analysis.

A. 4 Supplement 1, Part 3 of the TMI-I Restart Report contains the information requested. The subject report demonstrates that the HPI cross-connect design with cavitating venturi; a) prevents pump run out; b) provides proper flow split between injection points and c) provides acceptable levels of total flow to all injection points equal to or above that assumed in the ECCS-LOCA analysis. Valves are not used to throttle flow (See paragraph 3 of NRC letter dated July 1, 1977).

Q. 5 Verify 500 gpm HPI flow value.

A. 5 500 gpm HPI pump flow at 600 psig RCS pressure assures that the delivered flow will be greater than that assumed in the ECCS analysis.

Q. 6 Discuss justification section having to do with positive stops.

A. 6 Change Request 61B requests, in the justification, an exception to the suggested surveillance of the position stops of the decay heat throttle valves. The LPI throttle valves, DH-V19 A/B do not have electrical or mechanical position stops in that these valves are manually operated, and are set according to flow indications received in the control room. However, the intent of the suggested surveillance would be met by verifying that the valves be locked in the correct position by observation of the position indicators.

Enclosure 2
TLL 238

Babcock & Wilcox

Power Generation Group

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April 16, 1980
TMI-80-076

Mr. D. G. Slear (3)
TMI-I Project Engineering Manager
GPU Service Corporation
100 Interpace Parkway
Parsippany, NJ 07054

Subject: HPI Flows During Small Break Transients

Dear Mr. Slear:

Attached for your information and use is the information requested by your Mr. J. F. Fritzen and the NRC during a telecon on March 4, 1980. Attachment A documents the HPI flows used by B&W in performing the core flood line break analysis. Attachment B provides a writeup concerning the applicability of the HPI flows used by B&W in the small break analysis relative to the TMI Unit I HPI flows. Attachment C provides suggested corrections to Table 1, Column B of System Design Description for High Pressure Injection Cross-Connect, SDD 211A, Rev. 1.

If you have any questions or require additional information, please advise.

Very truly yours,

G. T. Fairburn
Service Manager

GTF/cw
cc: J. G. Herbein
L. L. Lawyer
J. J. Colitz
J. F. Fritzen
T. J. Toole
R. W. Keaten - GPUSC
F. R. Faist
J. C. Lewis - Phila. Sales

ATTACHMENT A

HPI Flows During CFT Line Break

Flow, gpm	Pressure, psia
454.5	0.0
440.	615.
365.	1315.
340.	1515.
325.	1615.
325.	3000.

ATTACHMENT B

Applicability of the Small Break B&W Model to the TMI-1 Plant Characteristics

On March 6, 1980, a joint telephone conversation took place with GPU, NRC, and B&W, concerning the TMI-1 HPI system. The NRC raised the question of the applicability of the B&W small break model (references 1, 2, and 3) to TMI-1, since the flows delivered by the TMI-1 HPI system are lower than those assumed in the B&W analyses for pressures below 600 spig (reference 2).

The HPI flows used by B&W are listed in the attached Table A. Flows in Column I are used for the first 10 minutes of the transient. Following manual cross-connecting of the HPI valves at this time, the flows in Column II are assumed for the remainder of the transient. The difference arises because, for a pressure of 0 psig, the TMI-1 system delivers 500 gpm instead of delivering a flow equal to or greater than the 548 gpm analysis value. This is shown in Table A.

It should be pointed out that the spectrum analyses documented in references 2 and 3 were performed at 2772 MWt, while the rated power of the TMI-1 plant is 2535 MWt. Table B lists the HPI flows which should be used following operator action at 600 seconds, if the TMI-1 initial core power were modeled in order to calculate the same system responses presented in reference 2. It can be seen that at 0 psig, the HPI flow should be 501 gpm. Therefore, there is a discrepancy of only 1 gpm, between the injection flow needed at 0 psig, and the TMI-1 HPI flows delivered at that pressure.

In order to assess the impact of the smaller HPI flows in the analyses described in reference 2, two of the cases presented there have been re-evaluated using hand calculations. Specifically, the 0.15 ft^2 break at pump discharge has been considered since this break depressurizes the system to 600 psig more quickly. The second break to be studied was the 0.07 ft^2 at pump discharge, which turned out to be the worst case.

Results of the 0.15 ft^2 at pump discharge small break analysis show that the primary system pressure reaches 600 psig at about 500 seconds, i.e., before the operator action (Figure 3, reference 2). At this time the HPI pump is delivering 450 gpm (Table A, Column I), of which 50% enters the system, and the other 50% is lost through the break. This pressure also coincides with the actuation of 2 core flood tanks, which, for this case, inject an average of about 55 lbm/s of additional flow to the reactor vessel. Core boil-off is matched in the analysis at about 550 seconds.

The mixture height in the reactor vessel at this time is about 1 ft above the top of the core. Following operator action at 600 seconds, which results in an increase of the flow delivered to the reactor vessel, the mixture level in the vessel starts to increase. Assuming, for conservatism, the small break model power of 2772 MWt, as opposed to 2535 MWt, the mixture level in the vessel is estimated to increase at a slightly slower rate than calculated in the analysis, due to the difference in HPI flows between the model and the TMI-1 plant. The core never uncovers, thus preventing any cladding temperature excursion, assuring conformance with 10 CFR 50.46.

The 0.07 ft^2 break at PD, which, in reference 2 was found to be the worst small break, resulted in a minor core uncovery and a peak cladding temperature of 1095F, which is well below the 2200F criteria of 10 CFR 50.46. Figure 3 of reference 2 shows that the system reaches 600 psig at about 1500 seconds, which also corresponds to the minimum core mixture level (reference, Figure 4). The top of the core is re-covered at about 1800 seconds. Using TMI-1 flows, and the model core initial power of 2772 MWt, a deficiency of about 350 pounds of liquid water exists in the vessel at this time, as compared to liquid inventory calculated in the analysis. Because of this difference, the vessel refills to the top of the core with a 15 seconds delay. Thus the peak temperature remains in the neighborhood of 1100F, as calculated in reference 2, ensuring compliance to the 10 CFR 50.46 criteria.

Reference 3, Appendix C, documents a core flood tank line break (0.44 ft^2) analysis, performed for a typical 177 low-loop plant, having an initial power of 2772 MWt. The HPI flows assumed in that analysis are lower than the HPI flows used in reference 2 (see Attachment A). Again, the calculated system responses following the initiation of the transient comply wholly with the 10 CFR 50.46 criteria.

In summary, the TMI-1 HPI system, when used in a single failure mode in an hypothisized small break LOCA, can safely mitigate the transient within the limitations of Appendix K.

Table A. HPI Flows Assumed in the HPI Small Break Model

Pressure, psig	Assumed HPI flows the first 10 min (50% is lost through the break)	Assumed HPI flows after 10 min (30% is lost through the break)
0	515	548
600	430	500
1200	380	438
1500	342	404
1600	328	391.7
1800	300	364.3
2400	210	260.0

Table B

Pressure, psig	Assumed HPI flow for TMI-1 after 10 min (30% is lost through the break)
0	501
600	457
1000	400
1500	369
2000	358
2400	333

REFERENCES

1. Topical Report BAW-10104, Rev. 3, "B&W's ECCS Evaluation Model," August 1977.
2. Letter from J.H. Taylor (B&W) to S.A. Varga (NRC), July 18, 1978.
3. Topical Report BAW-10103A, Rev. 3, "ECCS Analysis of B&W's 177-FA Lowered-Loop NSS," July 1977.

ATTACHMENT C

Table 1. HPI Flow Requirements[1]

RC pressure, psig	Column A Pump flow undegraded, gpm	Column B Pump flow degraded, gpm
0	550	515
600	500	450
1200	437.1	380
1500	404.3	342
1600	391.4	328
1800	364.3	300
2400	260	210
2500	216.0	191.7

(1) Only for small break conditions other than a HPI line break. See reference (0) for flow assumed under HPI line break conditions.