February 1, 1990

Docket No. 50-289

Mr. Henry D. Hukill, Vice President
and Director - TMI-1
GPU Nuclear Corporation
P. O. Box 480
Middletown, Pennsylvania 17057

Dear Mr. Hukill:

SUBJECT: THREE MILE ISLAND UNIT NO. 1 - ISSUANCE OF AMENDMENT (TAC NO. 75103)

The Commission has issued the enclosed Amendment No. 152 to Facility Operating License No. DPR-50 for the Three Mile Island Nuclear Station, Unit No. 1, in response to your letter dated October 4, 1989, as clarified by your letter dated December 22, 1989.

The amendment changes the value of moderator temperature coefficient required by the Technical Specifications, changes the definition of the maximum core tilt limit, reflects an increase in the allowable linear heat rate limit and reflects a higher level in the borated water storage tank. Your October 4, 1989 letter also proposed deleting the reference to a specific value for the refueling boron concentration from the bases for Technical Specification 3.8, "Fuel Loading and Refueling." For reasons discussed in the enclosed Safety Evaluation, the staff does not accept removal of this information. Therefore, that change has not been included in this amendment.

A copy of the related Safety Evaluation is also enclosed. Notice of Issuance will be included in the Commission's bi-weekly Federal Register notice.

Sincerely,

/S/

Ronald W. Hernan, Senior Project Manager
Project Directorate I-4
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosures:
1. Amendment No. 152 to DPR-50
2. Safety Evaluation

cc w/enclosures:
See next page

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NAME	:SNorris	:RHernan:lm	:JStolz	:	:	:	:
DATE	:1/8/90	:1/8/90	: / /90	: / /90	:	:	:

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Document Name: AMEND 75103

DATED: February 1, 1990

AMENDMENT NO. 152 TO FACILITY OPERATING LICENSE NO. DPR-50

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

METROPOLITAN EDISON COMPANY

JERSEY CENTRAL POWER & LIGHT COMPANY

PENNSYLVANIA ELECTRIC COMPANY

GPU NUCLEAR CORPORATION

DOCKET NO. 50-289

THREE MILE ISLAND NUCLEAR STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 152
License No. DPR-50

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by GPU Nuclear Corporation, et al. (the licensee) dated October 4, 1989 complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.c.(2) of Facility Operating License No. DPR-50 are hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No.152 , are hereby incorporated in the license. GPU Nuclear Corporation shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance, to be implemented within 30 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

John F. Stolz

John F. Stolz, Director
Project Directorate I-4
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: February 1, 1990

ATTACHMENT TO LICENSE AMENDMENT NO. 152

FACILITY OPERATING LICENSE NO. DPR-50

DOCKET NO. 50-289

Replace the following pages of the Facility Operating License and the Appendix A Technical Specifications with the attached pages. The revised pages are identified by amendment number and contain vertical lines indicating the area of change.

Remove	Insert
3-16	3-16
3-20	3-20
3-34a	3-34a
Figure 3.5-2m	Figure 3.5-2m

3.1.7 MODERATOR TEMPERATURE COEFFICIENT OF REACTIVITY

Applicability

Applies to maximum positive moderator temperature coefficient of reactivity at full power conditions.

Objective

To assure that the moderator temperature coefficient stays within the limits calculated for safe operation of the reactor.

Specification

3.1.7.1 The moderator temperature coefficient shall not be positive at power levels above 95% of rated power.

3.1.7.2 The moderator temperature coefficient shall be $\leq +0.9 \times 10^{-4}$ $\Delta k/k/F$ at power levels $\leq$ 95% of rated power.

Bases

A non-positive moderator coefficient at power levels above 95% of rated power is specified such that the maximum clad temperatures will not exceed the Final Acceptance Criteria based on LOCA analyses. Below 95% of rated power the Final Acceptance Criteria will not be exceeded with a positive moderator temperature coefficient of $+0.9 \times 10^{-4}$ $\Delta k/k/F$. All other accident analyses as reported in the FSAR have been performed for a range of moderator temperature coefficients up to and including $+0.9 \times 10^{-4}$ $\Delta k/k/F$.

A non-positive moderator coefficient at power levels above 95% of rated power is also required to prevent overpressurization of the reactor coolant system in the event of a feedwater line break (see Specification 2.3.1, Basis C, Reactor Coolant System Pressure).

The experimental value of the moderator coefficient will be corrected to obtain the hot full power moderator coefficient.

The Final Acceptance Criteria states that post-LOCA clad temperature will not exceed 2200°F.

REFERENCES

(1) UFSAR, Section 14
(2) UFSAR, Section 3

The quantity of boric acid in storage from either of the three above mentioned sources is sufficient to borate the reactor coolant system to a one percent subcritical margin in the cold condition at the worst time in core life with a stuck control rod assembly. Minimum volumes (including a 10 percent safety factor) of 906 ft^3 of 8700 ppm boron as concentrated boric acid solution in the boric acid mix tank or in a reclaimed boric acid storage tank or approximately 40,000 gallons of 2270 ppm boron as boric acid solution in the borated water storage tank(3) will each satisfy this requirement. The specification assures that at least two of these supplies are available whenever the reactor is critical so that a single failure will not prevent boration to a cold condition. The minimum volumes of boric acid solution given include the boron necessary to account for xenon decay.

The primary method of adding boron to the reactor coolant system is to pump the concentrated boric acid solution (8700 ppm boron, minimum) into the makeup tank using either the 10 gpm boric acid pumps or the 30 gpm reclaimed boric acid pumps. Using only one of the two 10 gpm boric acid pumps, the required volume can be injected in less than 13 hours. The alternate method of addition is to inject boric acid from the borated water storage tank using the makeup and purification pumps. The 40,000 gallons of boric acid can be injected in less than four hours using only one of the makeup and purification pumps.

Concentration of boron in the boric acid mix tank or a reclaimed boric acid storage tank may be higher than the concentration which would crystallize at ambient conditions. For this reason, the boric acid mix tank is provided with an immersion electric heating element and the reclaimed boric acid tanks are provided with low pressure steam heating jackets to maintain the temperature of their contents well above (10°F or more) the crystallization temperature of the boric acid solution contained in them. Both types of heaters are controlled by temperature sensors immersed in the solution contained in the tanks. Further, all piping, pumps and valves associated with the boric acid mix tank and the reclaimed boric acid storage tanks to transport boric acid solution from them to the makeup and purification system are provided with redundant electrical heat tracing to ensure that the boric acid solution will be maintained 10nF or more above its crystallization temperature. The electrical heat tracing is controlled by the temperature of the external surfaces of the piping systems. Once in the makeup and purification system, the boric acid solution is sufficiently well mixed and diluted so that normal system temperatures assure boric acid solubility.

<u>References</u>

(1) UFSAR, Sections 9.1 and 9.2

(2) UFSAR, Figure 6.2

(3) Technical Specification 3.3

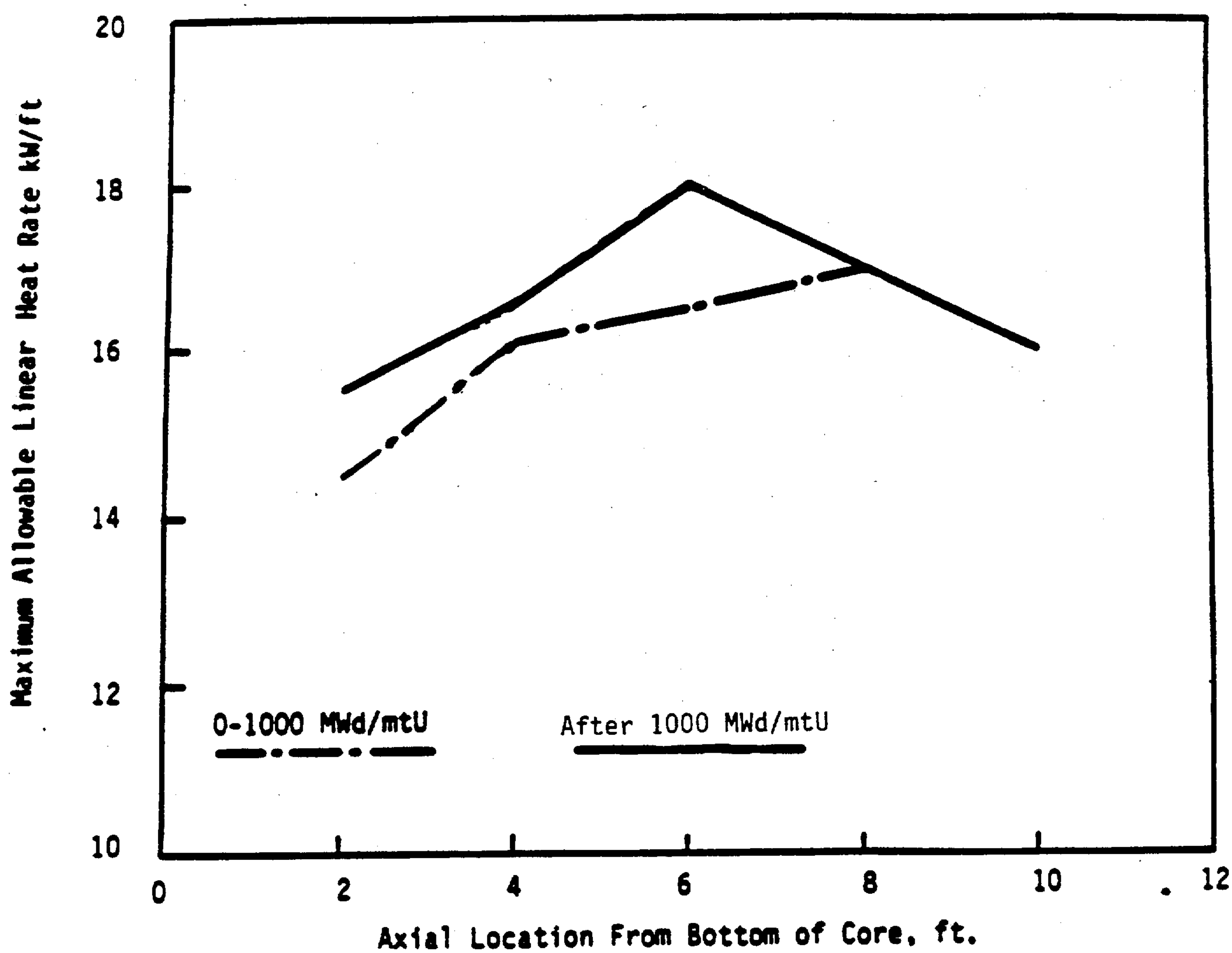
1. The protection system reactor power/imbalance envelope trip setpoints shall be reduced 2 percent in power for each 1 percent tilt, in excess of the tilt limit, or when thermal power is equal to or less than 50% full power with four reactor coolant pumps running, set the nuclear overpower trip setpoint equal to or less than 60% full power.

2. The control rod group withdrawal limits in the CORE OPERATING LIMITS REPORT shall be reduced 2 percent in power for each 1 percent tilt in excess of the tilt limit.

3. The operational imbalance limits in the CORE OPERATING LIMITS REPORT shall be reduced 2 percent in power for each 1 percent tilt in excess of the tilt limit.

f. Except for physics or diagnostic testing, if quadrant tilt is in excess of the maximum tilt limit defined in the CORE OPERATING LIMITS REPORT and using the applicable detector system defined in 3.5.2.4.a, b, and c above, the reactor will be placed in the HOT SHUTDOWN condition. Diagnostic testing during power operation with a quadrant tilt is permitted provided that the thermal power allowable is restricted as stated in 3.5.2.4.d above.

g. Quadrant tilt shall be monitored on a minimum frequency of once every two hours during power operation above 15 percent of rated power.



LOCA LIMITED MAXIMUM
ALLOWABLE LINEAR HEAT RATE

TMI-1

Figure 3.5-2M

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 152 TO FACILITY OPERATING LICENSE NO. DPR-50

METROPOLITAN EDISON COMPANY
JERSEY CENTRAL POWER & LIGHT COMPANY
PENNSYLVANIA ELECTRIC COMPANY
GPU NUCLEAR CORPORATION

THREE MILE ISLAND NUCLEAR STATION, UNIT NO. 1

DOCKET NO. 50-289

INTRODUCTION

By letter dated October 4, 1989, GPU Nuclear Corporation (GPU), the licensee, submitted the following proposed Technical Specification changes for TMI-1:

(1) The moderator temperature coefficient (MTC) specified in Technical Specification Section 3.1.7.2 would be increased from $+0.5 \times 10^{-4}$ delta k/k/°F to $+0.9 \times 10^{-4}$ delta k/k/°F at power levels less than or equal to 95 percent of rated power. The MTC would still be required to be non-positive at power levels above 95 percent of rated power.

(2) The boric acid solution volume in the borated water storage tank (BWST) for emergency shutdown requirements specified in Technical Specification Section 3.2 Bases would be increased from 32,112 gallons to 40,000 gallons.

(3) Technical Specification Section 3.5.2.4.f would clarify that the "maximum" tilt limit specified in the Core Operating Limits Report (COLR) shall be used to comply with this specification.

(4) Technical Specification Figure 3.5-2M would reflect an increase in the allowable linear heat rate (LHR) limits at the 2-foot elevation from 14.0 to 14.5 kw/ft for 0 to 1000 MWD/MTU and from 15.0 to 15.5 kw/ft after 1000 MWD/MTU.

(5) Reference to a specific value for the refueling boron concentration would be removed from the Bases of Technical Specification Section 3.8.

EVALUATION

MTC

The most limiting accident adversely affected by the positive MTC is the startup accident in which an uncontrolled addition of reactivity is caused by a rapid withdrawal of control rods from a subcritical or low power condition.

A positive MTC would yield the maximum peak heat flux. The accident analyses presented in Chapter 14 of the TMI-1 FSAR provided a sensitivity study which examined the effects of variations in the MTC from -0.6×10^{-4} to $+1.0 \times 10^{-4}$ delta k/k/°F. The resulting peak thermal power and reactor coolant system peak pressure remained well below the acceptance criteria for this accident. The staff concurs that the proposed increase in the MTC limit to $+0.9 \times 10^{-4}$ delta k/k/°F for power levels less than 95 percent of rated power has been adequately considered and is bounded by the existing FSAR safety analyses. Above 95 percent of rated power, the MTC is still required to be negative by Technical Specifications. A full power negative MTC is specified such that the maximum clad temperatures will not exceed 2200 °F as specified in the Final Acceptance Criteria based on loss of coolant accident (LOCA) analyses. A non-positive MTC at power levels above 95 percent of rated power is also required to prevent overpressurization of the reactor coolant system in the event of a feedwater line break. In addition, no adverse impact is expected on the hydraulic and neutronic stability of TMI-1 due to the slightly larger positive MTC. The hydraulic and neutronic stability of TMI-1 is not expected to be different from the other B&W reactors at Crystal River 3, Oconee 1, 2, and 3, Rancho Seco, and Davis-Besse, which are already licensed for an MTC limit of $+0.9 \times 10^{-4}$ delta k/k/°F from 0 to 95 percent full power. Therefore, the proposed change is acceptable.

BWST Volume

The BWST boric acid solution minimum volume of 40,000 gallons of 2270 ppm boron is sufficient to borate the reactor coolant system to a 1 percent subcritical margin in the cold condition at the worst time in core life with a stuck control rod assembly. This minimum volume includes the boron necessary to account for xenon decay as well as a 10 percent safety factor. The value of 40,000 gallons is provided in the Bases of Technical Specification Section 3.2 for information only and is not related to any existing technical specification requirement. Existing Technical Specification Section 3.3.1.1 bounds this value by specifying that the BWST shall contain a minimum volume of 350,000 gallons of water having a minimum concentration of 2270 ppm boron to ensure that a sufficient supply of borated water is available to satisfy the ECCS requirements. Therefore, the proposed change is administrative in nature and is acceptable.

Maximum Tilt Limit

The proposed change to Technical Specification Section 3.5.2.4.f merely clarifies that the "maximum" tilt limit defined in the COLR shall be used to comply with this specification. This clarification was inadvertently omitted when the tilt limits were removed from the Technical Specifications and placed into the COLR. The proposed change merely provides additional clarification and is administrative in nature. Therefore, the staff finds the proposed change acceptable.

LHR Limit

One of the proposed changes to Technical Specification Figure 3.5-2M reflects an increase in the allowable LHR limit at the 2-foot core elevation from 14.0 to 14.5 kw/ft for the burnup range between 0 to 1000 MWD/MTU. To support this proposed LHR increase, the licensee submitted the results of an ECCS analysis which was performed generically for the Babcock and Wilcox (B&W) lowered loop configuration plant with the Mark-B4 fuel rod design using the BAW-2 critical heat flux (CHF) correlation. The analysis was performed assuming a 50 psi reduction in fuel rod pre-pressure (fill gas pressure) for the most restrictive LOCA case. This is defined as the 8.55 ft^2 double ended rupture at the reactor coolant pump discharge cold leg piping location with the peak power at the 2-foot core elevation (core inlet) during beginning-of-life conditions. The results of the analysis, reported in BAW-2001P, indicate that the reduced internal fuel pin pressure allows for longer burnup periods (fuel cycles) and delays cladding rupture during a LOCA. An evaluation by the licensee indicated that the 50 psi pin pre-pressure reduction would delay rupture by a time increment equal to a rise in the LHR of 0.5 kw/ft. The LOCA analysis, therefore, utilized an increased LHR of 14.5 kw/ft, as compared to the 14.0 kw/ft current generic LOCA limit, at the 2-foot core elevation for the burnup interval between 0 and 1000 MWD/MTU. The licensee used the current NRC-approved LOCA analysis computer codes for the analysis and the results were in conformance with the ECCS acceptance criteria of 10 CFR 50.46. The Mark-BZ fuel used in TMI-1 is not expected to affect the LOCA limits established for the Mark B-4 used in the analysis at the 2-foot elevation. In addition, the change in CHF correlation from the BAW-2 to the BWC correlation, used in the TMI-1 analyses, has no effect on the predicted time of DNB at the 2-foot elevation. Therefore, the proposed increase in allowable LHR from 14.0 to 14.5 kw/ft between 0 to 1000 MWD/MTU at the 2-foot elevation is acceptable.

The licensee has also proposed a further change to Figure 3.5-2M which would increase the LHR limit after 1000 MWD/MTU from 15.0 to 15.5 kw/ft. This would make the LHR limit for the 1000 to 2600 MWD/MTU burnup window identical to that for after 2600 MWD/MTU and eliminate the need for a 1000-2600 MWD/MTU window. The extrapolation of the ECCS analysis results to the next burnup window, allowing it to also be increased by 0.5 kw/ft, has been previously approved by the NRC in a letter from A. C. Thadani (USNRC) to C. N. Turk (B&W Owners Group Analysis Committee), dated October 12, 1987. Therefore, the proposed change to eliminate the 1000 to 2600 MWD/MTU burnup window and to relabel the "After 2600 MWD/MTU" window "After 1000 MWD/MTU" is acceptable.

Refueling Boron Concentration

The staff does not accept the proposed removal of the specific refueling boron concentration from the Bases of Technical Specification Section 3.8. All of the current PWR Standard Technical Specifications contain a minimum required boron concentration during refueling to ensure that the reactor will remain subcritical by at least 5 percent delta k/k. Since the older TMI-1 Technical Specifications do not contain this LCO, the boron concentration should remain in the Bases for consistency both with the intent of the current Standard Technical Specifications and the initial conditions assumed for boron dilution events in the FSAR accident analyses. This value may, of course, change from the present value of 1800 ppm for longer cycle lengths.

SUMMARY

The staff has reviewed the proposed TMI-1 Technical Specification changes submitted by letter dated October 4, 1989 (Technical Specification Change Request No. 196) by GPU. Based on the above evaluation, these changes are found to be acceptable except for the proposed removal of the refueling boron concentration from the Bases of Technical Specification Section 3.8. The licensee letter dated December 22, 1989, also provided part of the basis for our approval.

ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted areas as defined in 10 CFR Part 20. We have determined that the amendment involves no significant increase in the amounts and no significant change in the types of any effluents that may be released off site, and that there is no significant increase in individual or cumulative occupational radiation exposure. The staff has previously issued a proposed finding that this the amendment involves no significant hazards consideration, and there has been no public comment on such finding. Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment.

CONCLUSION

We have concluded, based on the considerations discussed above, that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: Lawrence Kopp

Dated: February 1, 1990