



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
SUPPORTING AMENDMENT NO. 40 TO FACILITY OPERATING LICENSE NO. DPR-50

METROPOLITAN EDISON COMPANY
JERSEY CENTRAL POWER AND LIGHT COMPANY
PENNSYLVANIA ELECTRIC COMPANY

THREE MILE ISLAND NUCLEAR STATION, UNIT NO. 1

DOCKET NO. 50-289

Introduction

By letters dated May 10 and 16, 1978, Metropolitan Edison Company (Met Ed) requested amendment of Appendix A to Facility Operating License No. DPR-50 for Three Mile Island Nuclear Station, Unit No. 1 (TMI-1). The change requested by the letter of May 10, 1978 (Item 1), would amend the TMI-1 Technical Specifications to reduce the maximum allowable value of neutron flux tilt as measured in each quadrant of the reactor core by in-core or out-of-core neutron detectors. The change requested by the letter of May 16, 1978 (Item 2), would amend the TMI-1 Technical Specifications to reduce the allowable limits on axial power imbalance and the allowable position limits of the axial power shaping control rods (APSR's).

Background

Item 1. Certain maximum allowable values of neutron flux tilt and axial power imbalance have been established for TMI-1 for the first 125 effective full power days (EFPD) of operation in the current operating cycle (Cycle 4). These limits were established by Babcock & Wilcox (B&W), the NSSS vendor for TMI-1, to assure that the reactor fuel does not suffer unacceptable damage in the event of postulated accidents, including a loss of coolant accident (LOCA). A number of neutron detectors are provided, both inside the reactor core and outside the reactor vessel, to monitor the neutron flux tilt and axial power imbalance and thus assure that the actual operating values remain within the acceptable limits.

To allow for the uncertainty associated with these measurements, B&W has estimated the magnitude of the uncertainty for various types and conditions of measurements and established a maximum allowable measured value for flux tilt and axial imbalance. These allowable measured values are smaller than the allowable actual values by the amount of the

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uncertainty. The allowable measured values also vary with the type and extent of instrumentation used for the measurement. For example, B&W has established different maximum allowable measured flux tilt values for measurements using the full in-core detector system (FIT), the minimum in-core detector system (MIT) and the out-of-core detector system (OCT).

The allowable values of measured flux tilt and axial imbalance presently in use* are based on an error analysis performed by B&W in 1974 using data obtained with prototype detectors. Operating experience obtained since that time, however, has indicated the need for a reevaluation of these uncertainties. Such a reevaluation program was initiated by B&W in early 1978 and a report describing the program and its results was transmitted to the NRC staff by B&W letter of May 11, 1978. In addition, on May 5, 1978, B&W notified Met Ed of the results of the reevaluation program and recommended more conservative maximum allowable measured values of flux tilt and axial imbalance alarm setpoints as appropriate for the detectors installed at TMI-1**. The present request by Met Ed is a result of the B&W recommendations.

Item 2. In the course of performing physics measurements at TMI-1 following the recent refueling for operation in Cycle 4, it was determined that the measured radial and total maximum local power densities (power peaks) exceeded the predicted peaks by more than permitted by the previously established acceptance criteria. Because Met Ed has not been able to identify an error in either the calculations or measurements that would account for the discrepancy, they are concluding at this time that the discrepancy is valid. Based on this, Met Ed has drawn the consequential further conclusion that the calculational uncertainties for TMI-1 with the present fuel loading must be increased.

Accordingly, Met Ed has considered the effect of an additional 6% calculational uncertainty*** on LOCA, departure from nucleate boiling (DNB) and fuel center melt (FCM) limits. Based on their evaluation,

* Prior to the change in Technical Specifications approved by this license action.

** Only the maximum allowable measured flux tilt values are specified in the TMI-1 Technical Specifications. The alarm setpoints used in conjunction with the measured axial imbalance are an operational aid.

*** 6% conservatively envelopes the amount by which the acceptance criteria were exceeded.

Met Ed has concluded that these thermal limits can continue to be met if the allowable limits on axial power imbalance and APSR positions are reduced. Consistent with this objective, Met Ed has also identified the necessary form and extent of these reductions, and requested their incorporation in the TMI-1 Technical Specifications.

Because the proposed revision would reduce the actual axial power imbalance limits stated in the Technical Specifications, the axial imbalance alarm set points discussed in Item 1. above. would require a corresponding reduction. Met Ed has stated that they have identified the necessary reductions and have indicated their intention to implement the revised setpoints.

Evaluation

Item 1. We have reviewed the B&W report of May 11, 1978, on in-core detector measurement errors. The report considers the observed uncertainties associated with the various types of detectors in use and the effect of detector neutron exposure on the uncertainty. The report also describes the error propagation and statistical analyses that were performed to develop conservative uncertainty corrections for each type of detector as a function of neutron exposure. Based on the analyses, the report recommends the maximum allowable measured flux tilt and axial imbalance alarm setpoints for various measurement techniques (FIT, MIT, etc.).

Based on our review of the B&W report, we conclude that the analytical methods employed are acceptable. We have also reviewed the recommended maximum allowable measured flux tilt and axial imbalance alarm setpoints applicable to TMI-1 and conclude that these recommended values are also acceptable and conservative. Since the changes to the TMI-1 Technical Specifications requested by Met Ed follow the applicable B&W recommendations, we conclude the requested changes are likewise acceptable.

It is noted that the staff's review of the B&W submittal of May 11, 1978, has not been fully completed. It is further noted, however, that the review has progressed sufficiently that the staff has been able, as noted above, to evaluate and find acceptable the specific changes requested for TMI-1 in the Met Ed submittal of May 10, 1978.

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Item 2. Met Ed has proposed to account for the discrepancy between measured and predicted power distributions by increasing the calculational error allowance assumed in the setpoint and safety limit calculations. That is, the peaking factor vs. imbalance points (called "flyspeck" points) upon which the power vs. axial imbalance limits are based were adjusted upward by a larger-than-normal error allowance, and new limit lines were drawn. In addition, more restrictive APSR position limits were proposed to eliminate certain points as possible states of the core. The result was proposal of more restrictive power vs. imbalance limits and APSR position limits for the Technical Specifications.

The calculational error allowances normally used are 5% and 7.5% for the radial and total peaking, respectively. To account for the observed discrepancy, 6% was added to each of these, giving a new allowance of 11% and 13.5%. Since the measured discrepancies were 9.6 and 11.29%, the new allowances conservatively bound the actual values.

The above procedures are valid only if the measurement-calculational discrepancies in radial and total peaking factors remain less than 11% and 13.5%. Because the cause of the discrepancy is not known, it is possible that the actual discrepancy could increase with burnup. Therefore, we will require, as a condition of the license, that power maps be taken at an exposure of about 25 EFPD in the present cycle, and the resulting measured peaking factors be compared with FLAME calculations for the same reactor state. If the radial or total discrepancies are greater than 11% and 13.5%, respectively, we will require that the core thermal power be reduced proportionally and that the matter be promptly reported to the NRC. This license condition has been discussed with and agreed to by Met Ed.

No other changes have been proposed by Met Ed because the other physics parameters in the startup program (e.g., rod worths) were within their acceptance criteria when measured.

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Therefore, based on our review of the licensee's submittal, including the results of the physics startup tests for Cycle 4, we conclude that, subject to the license condition noted above, the more restrictive limits proposed by the licensee are appropriate and acceptable.

Environmental Consideration

We have determined that the amendment does not authorize a change in effluent types or total amounts nor an increase in power level and will not result in any significant environmental impact. Having made this determination, we have further concluded that the amendment involves an action which is insignificant from the standpoint of environmental impact and, pursuant to 10 CFR §51.5(d)(4), that an environmental impact statement, or negative declaration and environmental impact appraisal need not be prepared in connection with the issuance of this amendment.

Conclusion

We have concluded, based on the considerations discussed above, that: (1) because the amendment does not involve a significant increase in the probability or consequences of accidents previously considered and does not involve a significant decrease in a safety margin, the amendment does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (3) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Dated: May 19, 1978

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