



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO AMENDMENT NO. 69 TO FACILITY OPERATING LICENSE NO. NPF-43

DETROIT EDISON COMPANY

FERMI-2

DOCKET NO. 50-341

1.0 INTRODUCTION

By letter dated August 20, 1990, (Reference 1), the Detroit Edison Company (DECO or the licensee) requested amendment to the Technical Specifications (TSs) appended to Facility Operating License No. NPF-43 for Fermi-2. The proposed amendment would change Technical Specifications (TS) and associated Bases to provide for the implementation of operation in an expanded region of the power-flow map called the Maximum Extended Operating Domain (MEOD), which for this submittal includes operation in partial feedwater heating (PFH) conditions and a group of "Average Power Range Monitor (APRM)/Rod Block Monitor (RBM) Technical Specification" (ARTS) improvements. MEOD involves (1) operation above the 100 percent (control) rod line below 100 percent flow with operation permitted at 100 percent power down to 75 percent flow in the Maximum Extended Load Line Limit (MELLL) region, and (2) operation with increased flow (to 105 percent at full power) in the Increased Core Flow (ICF) region. PFH includes feedwater heaters out-of-service (FWHOS) before the end of cycle and final feedwater temperature reduction (FFWTR) beyond the end of the normal fuel cycle, both of which would be implemented only to a maximum of 50°F feedwater temperature reduction in this proposal. MELLL and ICF involve changes to the APRM rod block and thermal power scram trip setpoints. ARTS involves implementation of power and flow dependent fuel thermal limits to eliminate APRM trip setpoint and supports power dependent RBM trips rather than the current flow dependent trips, (3) reconfiguration of Local Power Range Monitor (LPRM) inputs to the RBM and new trip logic, and (4) redefinition of RBM operability requirements.

In support of its request the licensee has submitted (1) a description and evaluation of the change, (2) the proposed new TS, (3) a sample Core Operating Limits Report (COLR) for the revised operation, and (4) General Electric topical report NEDC-31843P (Ref. 2) describing the changes, and presenting the analysis and evaluations used to justify the changes for Fermi 2, and operation with the revised analytical and physical systems and within the new limits resulting from the changes.

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2.0 EVALUATION

These proposed changes for Fermi 2 are not unique or new for GE reactors. They have all become part of standard "Operating flexibility options" and are listed as such in the GE standard application for reactor fuel (GESTARII) NEDE-24011-P-A-9. Extended operating regions, increased flow and reduced feedwater temperature have been approved on many BWRs over the past decade, and several ARTS upgrades have been reviewed and approved, beginning with Hatch in 1984. The methodologies used for safety analyses involved in the justifications for the changes and determination of new operating limits have been previously reviewed and approved by the staff. The proposed new operating regions, and modes and limits of operation, and changes to the APRM and RBM systems are all bounded by changes previously approved for other reactors.

Since the changes proposed for Fermi 2 have become standard improvements or operating options which have been described and approved in past staff reviews, only a brief discussion of the changes and the GE analyses justifying the changes will be provided here. Descriptions and explanations of the changes, accompanying analyses and results and limits provided by the analysis are provided in NEDC-31843P, which in turn draws on results from NEDC-31515. The NEDC-31843P analysis were based on Fermi 2 Cycle 2 conditions, although the MEOD-ARTS changes will not be implemented until Cycle 3. Some of the analyses and results are generic and some are cycle specific and must be reexamined for each reload. Sample Core Operating Limits Report (COLR) TS values based on Cycle 2 were submitted with the proposal. The first implementation of the TS changes, however, is expected to be for Cycle 3, and reload specific analyses and COLR values will be prepared for that reload.

The MEOD-ARTS improvements, in addition to the power-flow operating region expansion previously indicated, consists primarily of the following changes.

- (1) The APRM flow-biased rod block and thermal power scram trip setpoints are changed (increased) to allow operation in the expanded region. This change includes hardware changes for clamping the trips in the high flow region to provide appropriate setpoints in the region from 75 to 105 percent flow. These trip functions are the same as those approved for, other Boiling Water Reactors e.g., Grand Gulf 1.
- (2) The APRM flow biased scram setpoint setdown requirement of Fermi 2 TS 3/4.2.2, which lowered the setpoint when local power peaking is such that the Maximum Fraction of Limiting Power Density is greater than the Fraction of Rated Thermal Power, is removed. This is replaced by power and flow dependent limits on Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) and Minimum Core Power Ratio (MCPR). Multipliers, K_p and $MAPPAC_p$, as a function of power and MCPR(F) limits and $MAPPAC_f$ multipliers as a function of flow to modify the basic operating limit MCPR (OLMCPR) and MAPLHGRs are developed from the analysis of the core-wide operating occurrences described in the Fermi Updated Final Safety Analysis Report (UFSAR). These become a part of the Fermi 2 TS (via the COLR). At any given power/flow state all four limits must be determined, with the most limiting governing the operation. GE loss of coolant accident (LOCA) analyses, including results from the

review of NEDC-31515, indicate that the combination of the elimination of the setdown requirement and the new MAPLHGR limit still provide for LOCA requirements for Fermi 2.

- (3) The changes to provide the Fermi 2 ARTS RBM are identical to those approved in previous ARTS improvement reviews (e.g., Hatch and Monticello). The RBM is used to block rod motion to prevent exceeding MCPR limits during control rod withdrawal at power. For ARTS there is a change in the assignment of LPRMs to RBM channels. This change provides better and more uniform sensitivity to rod motion. ARTS has a more direct trip logic including a calibration to a fixed reference upon rod selection rather than calibration to the APRM, and an upscale trip level which is a step function of core power rather than a flow biased trip. A downscale trip is still used to detect abnormally low signals. The changes to the system require a reevaluation of the rod withdrawal event and new analyses to provide setpoints for the system.

The previous deterministic analysis is replaced with a statistical analysis using a large number of calculations of various operating states and giving results valid for all Fermi 2 cores using GE fuel through types GE9. Currently approved methods were used in the calculations. The calculations give, as a function of RBM trip setting, values of an initial MCPR which assure that 95 percent of withdrawal errors do not violate the MCPR safety limit (1.07) with a 95 percent confidence level. This can be used to select setpoints for the RBM, chosen with respect to the other ARTS APRM limits so that the withdrawal event is not limiting. Calculations have been done for Fermi 2 with both GEXL and GEXL-PLUS. The setpoints (for the Cycle 2 example) for power intervals of 27-62, 62-82, and 82-100 percent power are 114, 108.2, and 104.4 percent of the reference signal respectively. Calculations were done to examine the sensitivity of the results for core periphery rods (with fewer LPRM strings) and for LPRM failures (up to a 30 percent failure rate). The results indicated that the setpoints were suitable. An analysis of the effects of filters and time delays in the system was made. Use of filters requires a reduction of setpoints, and values for adjustments required, if used, is given in NEDC-31843P. The above setpoints used values provided in the Cycle 2 sample COLR.

The data base described above has been used to determine operating limit MCPRs such that no rod withdrawal error could lead to exceeding limits. Two MCPR values are defined, for below 90 percent power and for above 90 percent power, which are 1.70 and 1.40 respectively. When the operating MCPR is below these values the plant is on a "limiting control rod pattern" and the RBM system must be operable. When above these values bypass is allowed. For single loop operation with a MCPR safety limit of 1.08 the 1.70 value is increased to 1.71.

To justify operation of Fermi 2 with MELL, ICF, ARTS and PFH and to determine values for the limits previously described, GE has evaluated the FSAR core-wide transients, considering the extremes of operation within this MEOD scope. The evaluation determined the events most significantly impacted by MEOD, Fermi 2 Cycle 2 parameters and approved GEMINI methods were used in

most of the analyses. Extended Cycle 2 parameters at ICF and FFWTR conditions were used; the primary impacted events turbine generator trip (TGT) and feedwater controller failure (FWCF), and Cycle 3 parameters for the third event, rod withdrawal error (RWE), in conjunction with the core simulator. The relevant analyses also considered combinations of "Moisture Separator Reheater" and "Turbine Bypass" inoperable conditions, and the sample COLR MCPR and MAPLHGR limits are a function of the applicable combination.

In addition to the transient analyses, GE examined the effect of MEOD-ARTS on overpressure protection, thermal-hydraulic stability, LOCA, containment response, feedwater nozzle and sparger fatigue, flow induced loads and vibration, and standard relevant events in the accident category. These evaluations considered the areas examined, and followed the methods used in previous staff approved reviews of similar operation extensions. It was determined that with the limits used and derived for the MEOD-ARTS improvement all required safety associated limits within the above areas are met. The feedwater nozzle and sparger review, as in previous similar reviews provided a GE recommendation for seal refurbishment. For thermal-hydraulic stability, Fermi 2 is operating under the "Interim Recommendations for Stability Actions" of NRC Bulletin No. 88-07, Supplement 1. These operations are applicable to the Fermi operations with MEOD-ARTS, as is the case for other operating reactors with similar systems.

These evaluations and transient analyses have examined the same areas examined in previous MEOD-ARTS related reviews by the staff. The method used in the evaluation have been previously approved by the staff and the results and conclusion of the evaluation fall within expected ranges. There are no significantly new regions of operation or parameter values or limits compared to those previously examined and approved. This review has concluded that the safety evaluation results presented in the GE report NEDC-31843P justify the proposed MEOD-ARTS improvements and operation within the power-flow and temperature boundaries and operating limits described in the report. As in previous reviews of similar ARTS programs for other reactors the instrumentation changes, analyses, methods used, criteria and setpoints proposed are acceptable.

3.0 TECHNICAL SPECIFICATIONS

There are changes to limits and operability requirements necessary for MEOD-ARTS. These include (1) deletion of the current setdown requirements, (2) new power and flow dependent MCPR and MAPLHGR limits, (3) changes to the APRM and RBM flow-biased scra. (4) new RBM limits and operability requirements.

There are a number of TS changes required to implement these changes. However, most of the TS related are proposed to be in the Fermi 2 Core Operating Limits Report. The values used for the RBM and the changes to the MCPR and MAPLHGR limits, i.e., the new multipliers and limits which are, or may be, cycle specific, are proposed to be in the COLR, which is designed for such parameters. The standard MCPR and MAPLHGR values already appear in the COLR. Directions for applying the multiplying factors and new limit curves are also provided in the COLR along with the corresponding limits. NEDC-31843, which describes the changes and methodology, becomes a reference in the COLR and the TS Bases.

The COLR presented with this submittal is only a sample. The values in it have been calculated for Fermi 2 Cycle 2. It is not intended that the MEOD-ARTS changes and the COLR changes be implemented until the beginning of Cycle 3. The reload period for Cycle 3 will be used to make the changes to the plant for ARTS. The COLR for Cycle 3 will be based on calculations done specifically for Cycle 3. However, the sample COLR provides a suitable example for this review.

The review has indicated that the parameters proposed for the COLR are likely to be cycle specific and are directly related to parameters already approved for the Fermi 2 COLR. They arise directly from TSs 3/4.2.1, .2.3, .2.4, and .3.6. It is appropriate that the instructions for using these parameters to provide the MCPR or MAPLHGR limits for a given reactor state point also be directly associated with the limits in the COLR. It is thus concluded that the placement of these values in the COLR is acceptable. This review has also indicated that the material, organization of the material and values (for the sample for Cycle 2) in the COLR are reasonable and provide an acceptable change to the COLR.

There are also several direct changes to the TS supporting the MEOD-ARTS changes.

- (1) The Index is changed to delete TS 3/4.2.2. This TS on APRM setpoint setdown is deleted since, as previously discussed, this action is no longer needed with the ARTS improvement.
- (2) Table 2.2.1-1 of TS 2.2 is changed. The flow-biased APRM trip setpoints and corresponding allowable values are changed (increased) to allow operation in the expanded MELL power-flow operating region. This is changed for both two loop and single loop operation. This change is necessary for MEOD operation, and is similar to previously approved MEOD setpoints. It is acceptable.
- (3) Bases 2.2.1 is changed to reflect the deletion of TS 3.2.2. It is acceptable.
- (4) TS 3.1.4.3, Applicability, is changed to reflect the new power level/MCPR values for which the operability of the RBM is not required. This has been previously discussed along with the ARTS RBM changes and is acceptable.
- (5) TS 3/4.2.2, APRM Setpoints, is deleted as no longer necessary (see above). This is acceptable.
- (6) Table 4.3.1.1-1, note (d) of TS 3/4.3.1 is partially deleted. It referred to changes related to APRM setpoint setdown, and is therefore no longer needed. The change is acceptable.
- (7) TS 3.3.6, footnote, has reference to flow-biased RBM deleted since the RBM is no longer flow-biased. The change is acceptable.
- (8) Table 3.3.6-1 of TS 3.3.6 has a footnote changed similar to that discussed above for TS 3.1.4.3. The change is acceptable.

- (9) Table 3.3.6-2 of TS 3.3.6, has the RBM and APRM rod block trip setpoints changed similarly to that for the APRM scrams in TS 2.2.1 discussed above. The rod block changes are acceptable, as they were for the scram changes. The footnote referring to TS 3.2.2 is deleted since TS 3.2.2 has been deleted.
- (10) Table 3.3.6-2, has the recirculation flow upscale rod block trip setpoints changed to reflect the expanded operating domain. It is acceptable.
- (11) Table 4.3.6-1, TS 3/4.3.6, has a footnote changed to be consistent with TS 3.1.4.3, discussed above. The change is acceptable.
- (12) TS 3/4.4.1, Action 1.f and footnote are changed to reflect elimination of RBM flow bias and deletion of TS 3.2.2. The changes are acceptable.
- (13) TS 4.4.1.1.2 has the recirculation pump MG set scoop tube mechanical and electrical stop overspeed setpoints increased to provide for the increased operating domain. The changes are acceptable.
- (14) Bases 3/4.2.1. A discussion of the MAPLHGR multipliers which have been added to the COLR is added to the Bases. It is acceptable.
- (15) Bases 3/4.2.2. The Bases are deleted since the specification has been deleted. This is acceptable.
- (16) Bases 3/4.2.3. The discussion of the k_f factor is deleted since this factor has been removed from the TS. Reference is made to the COLR and to NEDC-31843. This is acceptable.

4.0 CONCLUSIONS

The Detroit Edison Company has proposed MELLL, ICF, and PFH changes to the allowed operating region for Fermi 2 and operating and physical changes to change to ARTS operation, along with TS and COLR changes to implement these changes. We have reviewed the information, including the GE reports, submitted with these proposed changes. Based on this review we conclude that appropriate material has been submitted to justify the changes, that the changes fall within the scope and bounds of past staff reviews in these areas, and that the changes to and values proposed for the Fermi TS and sample COLR are acceptable. The use of the GE report NEDC-31843P in the TS Bases and in the COLR as a reference to the MEOD-ARTS changes, methodology and analyses approved here is also acceptable.

5.0 REFERENCES

1. Letter and enclosures from W. Orser, Detroit Edison Company, to USNRC, dated August 20, 1990, "Proposed Technical Specification Changes - Maximum Expanded Operating Domain."

2. NEDC-31843P, "Fermi-2 Maximum Extended Operating Domain Analysis," July 1990.
3. NEDC-31515, Rev. 1, "Maximum Extended Load Line Limit and Feedwater Heater Out-of-Service Analysis for Enrico Fermi Atomic Power Plant Unit 2," August 1989.

6.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Michigan State official was notified of the proposed issuance of the amendment. The State official had no comments.

7.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes in surveillance requirements. The staff has determined that this amendment involves no significant increase in amounts, and no significant change in the types, of any effluents which may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that this amendment involves no significant hazards consideration and there has been no public comment on such finding. Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR Section 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.

8.0 CONCLUSION

The staff has 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, (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. The staff therefore concludes that the proposed changes are acceptable.

Principal Contributor: H. Richings

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