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Pilgrim Nuclear Power Station
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BECo 91-005

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

License DPR-35
Docket 50-293

PROPOSED TECHNICAL SPECIFICATION
AVERAGE POWER RANGE MONITOR, ROD BLOCK MONITOR
AND TECHNICAL SPECIFICATION IMPROVEMENT PROGRAM

Boston Edison Company proposes the attached revisions to the Technical Specifications, Appendix A of Operating License DPR-35 for the Pilgrim Nuclear Power Station in accordance with 10CFR50.90.

The proposed revision to the Technical Specifications eliminates the setdown requirements for the Average Power Range Monitor flow referenced rod block and scram lines and changes the Rod Block Monitor rod block setpoints from flow-biased to power-dependent. The revisions will enhance plant availability by facilitating more rapid power ascensions.

The bases for our proposed Technical Specification Changes are described in General Electric Report, NEDC-31312-P. This GE proprietary document is submitted along with an affidavit, requesting that the GE Report be withheld from public disclosure in accordance with 10CFR2.790(b)(1).

G. W. Davis

Commonwealth of Massachusetts)
County of Plymouth)

Then personally appeared before me, George W. Davis, who being duly sworn, did state that he is Senior Vice President - Nuclear of Boston Edison Company and that he is duly authorized to execute and file the submittal contained herein in the name and on behalf of Boston Edison Company and that the statements in said submittal are true to the best of his knowledge and belief.

My commission expires: October 5, 1995 Peter M Kahler
DATE NOTARY PUBLIC

Attachments:
A. Description of Proposed Changes
B. Replacement Technical Specification Pages
C. Marked-Up Technical Specification Pages
D. GE Report, NEDC-31312-P (One Copy, Proprietary)

1 signed original and 37 copies
cc: See next page

A001 1/1 Change: NRC PDR 4cr encl 1 1 w/out Prop Section

250072

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ATTACHMENT A TO BECO 91-
DESCRIPTION OF PROPOSED CHANGE

PROPOSED CHANGES

Boston Edison Company proposes to implement Average Power Range Monitor, Rod Block Monitor, and Technical Specification (ARTS) Improvement Program for Pilgrim Nuclear Power Station (PNPS) during the scheduled Refueling Outage #8 (RFO#8). The ARTS improvement program is described in the attached General Electric Report, "ARTS Improvement Program Analysis for Pilgrim Nuclear Power Station (PNPS)", NEDC-31312-P. The principal objectives of the ARTS program are:

1) Elimination of setdown requirements for the Average Power Range Monitor (APRM) flow-referenced rod block and scram lines, and

2) Elimination of the rod block monitor (RBM) rod blocks during power ascensions.

Realization of these objectives will enhance plant availability by facilitating more rapid power ascensions and man-machine interface improvements in plant operations.

The ARTS Improvement Program affects the APRM system, the RBM system and Technical Specifications. The APRM system is affected by eliminating the requirement to setdown the APRM flow-referenced rod block and scram setpoints when the fraction of rated power (FRP) is less than the maximum fraction of limiting power density (MFLPD). No APRM system hardware changes are involved. The RBM is affected by replacing the flow-biased RBM trips with power dependent trips, eliminating RBM trip resets, reassigning local power range monitors (LPRMs) in the RBM selection matrix, normalizing the RBM signal to a fixed reference instead of the APRM signal, introducing filtering and delaying elements in the RBM circuitry, and simplifying the RBM operability criteria. Technical Specifications are affected by the changes just described for the RBM and APRM systems, and by thermal limits made dependent on both power and flow.

BASIS FOR CHANGE

The ARTS improvement program affects both the APRM and RBM systems. These are part of the Neutron Monitoring System. The bases for the ARTS improvement program are described in the attached GE Report, NEDC-31312-P.

A. Safety Functions of Affected Systems/Components

Of the APRM and RBM systems, only the APRM system has a safety design basis. This safety design basis requires the APRM to generate a scram signal in response to average neutron flux increases to prevent fuel damage resulting from abnormal operational transients or control rod drop accidents. The PNPS safety analyses are based upon this scram signal being generated at 120% of rated core thermal power. This setpoint is not affected by the ARTS Improvement Program.

In addition to generation of a reactor trip at 120% of rated core thermal power, the APRM provides a signal for comparison to recirculation-drive-flow-refererced control rod withdrawal block and reactor scram trip setpoints. A trip of the control rod block setpoint prevents withdrawal of control rods when core power approaches the flow-referenced reactor scram trip setpoint, possibly avoiding a reactor scram. A trip of the flow-referenced reactor scram setpoint anticipates a reactor scram from the 120% APRM setpoint. The safety analyses are not dependent upon the flow-referenced APRM setpoints because the recirculation drive flow converter is non-safety-related. (The flow converter is safety-related from a pressure boundary perspective, non-safety-related from an electrical trip standpoint.) Both flow-referenced APRM setpoints will be affected by the ARTS Improvement Program.

The RBM system has no safety design basis and, accordingly, is classified as a non-safety related system. Nevertheless, the RBM protects against fuel damage by preventing rod withdrawal when the RBM signal exceeds the RBM rod block setpoint. The RBM rod block setpoint is chosen such that no fuel damage occurs as a result of a single rod withdrawal error under the worst permitted conditions of LPRM or RBM bypass. The RBM system will be affected by the ARTS Improvement Program.

B. Effect on Functions of Affected Components

The ARTS Improvement Program does not affect the ability of the APRM and RBM to limit fuel damage in the event of abnormal operational transients or control rod drop accidents. The sole safety function required of the APRM system, the high-flux scram at 120% of reactor core thermal power, is unaffected by ARTS. The non-safety related functions performed by the APRM, the flow-referenced APRM rod block and scram, are affected by elimination of the setdown requirement when Maximum Fraction Limiting Power Density (MFLPD) exceeds Fraction of Rated Power (FRP). Elimination of the APRM setdown requirement not only increases the flow-referenced APRM rod block and scram setpoints but allows increased power peaking at reduced core power levels. The transient safety analysis does not depend upon the APRM flow-referenced rod block and scram setpoints, and, consequently, will not directly impact thermal operating limits. The thermal operating limits are indirectly impacted by the increased power peaking made possible by elimination of the APRM setdown requirement. This indirect impact is accounted for by the power-and-flow-dependent thermal operating limits introduced with ARTS.

The RBM has no safety-related function to be affected by ARTS. However, ARTS has a significant effect on the non-safety-related function of the RBM. ARTS eliminates the flow-referenced RBM setpoints, replacing these setpoints with power-dependent setpoints. The power-dependent setpoints continue to provide protection of the minimum critical power ratio (MCPR) safety limit in the event of a rod withdrawal error (RWE) while essentially eliminating RBM rod blocks during plant maneuvers. Also, ARTS provides a rigorous definition of the limiting rod pattern. Prior to reaching the limiting rod pattern, any rod may be fully withdrawn without violating the MCPR safety limit. Hence, RBM operability is not required. Finally, ARTS reassigns the LPRMs in the RBM selection matrix and introduces filtering and delaying elements in the RBM electronics. These modifications yield a RBM response which more accurately reflects the change in MCPR associated with a change in rod position. A more accurate RBM response permits RBM setpoints to be defined which protect the MCPR safety limit without unnecessarily penalizing operational flexibility.

C. Analysis of Effect on Safety Functions

Limiting transients were analyzed over the range of power and flow conditions permitted by the PNPS power/flow map to develop plant operating limits (MCPR and maximum average planar linear heat generation rate (MAPLHGR)) which assures margins to fuel integrity limits are equal to or larger than those in existence at the present time. All transient analyses were performed using the standard transient reload licensing methodology with the exception of the loss of feedwater heating (LFWH) event. The LFWH event was analyzed using standard steady-state physics methods, also part of the reload licensing methodology. These methodologies are documented in References 1 and 3 of GE Report, NEDC-31312-P. Results from these transient analyses were used to establish limits on MCPR and MAPLHGR versus both power and flow which are sufficiently conservative to be applicable on a generic basis for all GE fuel through GE fuel type GE7. At any given core state, both power- and flow-dependent MCPR and MAPLHGR limits must be determined. The governing limits will be the maximum MCPR and the minimum MAPLHGR.

Standard LOCA analyses are performed at or near rated power and flow conditions. At reduced core flow, boiling transition can occur sooner than in the licensing-basis LOCA analysis. Heat transfer is significantly reduced during the period between departure from nucleate boiling and core recovery. This earlier departure from nucleate boiling results in a longer period of reduced heat transfer and, hence, increased cladding heatup. To compensate, a MAPLHGR multiplier of 0.95 is applied for core flows less than 90% of rated. This multiplier was originally derived to take credit for the reduction in maximum linear heat generation rate (MLHGR) imposed by setdown of the flow-biased APRM rod block and scram. Since ARTS will eliminate the APRM setpoint requirement, the MAPLHGR multiplier was reevaluated. This reevaluation showed a MAPLHGR multiplier of 0.95 remains adequate with power peaking constrained by the power- and flow-dependent thermal limits introduced by ARTS.

The new RBM system for PNPS required a new Rod Withdrawal Error (RWE) analysis to determine RBM setpoints which protect the MCPR safety limit. This analysis is documented in GE Report NEDC-31312-P. This new statistically-based analysis provides 95% confidence that the MCPR safety limit will not be violated in 95% of the RWE initiated from a limiting rod pattern with the more sensitive RBM channel bypassed. This analysis is valid for application to all PNPS cores utilizing GE fuel designs through GE7 and covers the entire range of power/flow combinations permitted by the power/flow map. To provide a bounding analysis, rod patterns were modified to reduce MCPR in bundles near deep rods to approximately 1.20. The initial positions of the selected error rods were either fully inserted near the bundles with the limiting MCPR or withdrawn to the point where a RBM rod block was required to limit MCPR. LPRMs were conservatively assumed to fail randomly with a probability of 15%. This analysis also assumes a MCPR safety limit of 1.07, a value which conservatively bounds any lower MCPR safety limit.

The RBM automatically accounts for inoperative LPRMs by comparing the input signal from each LPRM with a predetermined reference signal. If the LPRM input signal is less than the reference signal, the LPRM is automatically bypassed in the RBM averaging electronics. A count of the active LPRMs providing input to the RBM averaging electronics is made and the rod withdrawal permissive removed if more than 50% of the LPRMs are bypassed. While the RWE analysis assumes a 15% LPRM failure probability as a failure rate which bounds historical performance, a sensitivity study in the ARTS analysis indicates the severity of a RWE is only weakly dependent on the LPRM failure rate. Hence, the 50% criteria for operability is acceptable.

Results from the RWE analysis are the basis for the RBM setpoints. The RBM setpoints are chosen such that the RWE is never the bounding transient. The power dependence of the RBM setpoints reflects the greater margin to the MCPR safety limit which must be preserved at lower powers for the bounding transient; that is, the RBM setpoints are increased as power is reduced. Below the low-power setpoint, the RBM is not required to protect the MCPR safety limit in the event of a RWE and RBM trips are automatically bypassed. An APRM signal is used by the RBM to determine core thermal power and the appropriate rod block setpoint. An allowable value for the downscale trip setpoint of 90% and a nominal trip setpoint of 94% provide sufficient margin to the 100% fixed reference signal to accommodate reverse power effects from rod withdrawals while serving to prevent control rod movement when RBM signals are abnormally low. An abnormally low RBM signal is an indication of a RBM system malfunction. The 90% allowable value for the downscale trip setpoint provides a maximum margin of 10% to the 100% reference level. The current RBM system has a minimum allowable downscale trip setpoint of 5%, providing a margin of 95% to a RBM signal normalized to an APRM reading of 100%. The 95% margin for the downscale trip setpoint for the current RBM system makes it apparent the 10% maximum margin for the ARTS RBM system is a conservative indication of RBM system inoperability.

Two adjustable filters are provided in the new RBM electronics. The RBM signal itself is filtered to reduce signal noise. Since the filtered signal lags the unfiltered signal, the RBM setpoint for the filtered signal is reduced from the value corresponding to the unfiltered signal to preserve the same MCPR margin. The RBM setpoints also reflect an allowance for instrument inaccuracy. A filter is also provided for the APRM signal input to the power-dependent trip selection logic. This filter improves the accuracy of the trip selection logic by reducing noise and oscillation between setpoints. This filter is compatible with the RBM setpoints over its full range of adjustment.

The new RBM electronics also include two adjustable time delay devices. One device delays the gain adjustment and signal normalization for a period following rod selection. This delay allows the filtered RBM signal to approach its asymptotic value. No rod withdrawal is possible during this period. Since a premature gain adjustment and signal normalization would result in a conservatively high RBM signal and a premature rod block, the magnitude of this delay is unrestricted. Pilgrim does not plan to use the second time delay device.

Operability of the RBM system is required when operating with a limiting rod pattern. A limiting rod pattern exists when the complete withdrawal of any rod in the core would result in violation of the MCPR safety limit. As part of the generic RWE analysis for PNPS, a limiting rod pattern was found to exist when:

For power $<$ 90%, MCPR $<$1.70
For power $\geq$ 90%, MCPR $<$1.40

The analytical methods supporting the ARTS Improvement Program for PNPS are documented in GE Report NEDC-31312-P together with results for reloads with GE fuel types through GE7. The same methodology will be applied as needed to future fuel types analyzed using reload licensing methodology and the results will be incorporated in the Core Operating Limits Report.

DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

The Code of Federal Regulations (10CFR50.91) requires licensees requesting an amendment to provide an analysis, using the standards in 10CFR50.92, that determines whether a significant hazards consideration exists. The following analysis is provided in accordance with 10CFR50.91 and 10CFR50.92 for the proposed amendment to Pilgrim's APRM and RBM Setpoints during power ascension.

1. APRM CHANGES

A. The proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated because the proposed change does not create new transients, increase the frequency of the transients analyzed, or change governing design criteria. The elimination of APRM setdown requirements provide the same extent of protection as the existing setpoints, because these setpoints have no influence or impact on the design basis accidents.

Information presented in NEDC-31312-P shows that the consequences of accidents and transient events which might be affected by implementation of the ARTS program are bounded by the consequences of the same events initiated from current licensing basis conditions, provided the appropriate adjustments to the operating limits are utilized. The proposed Technical Specification changes will assure that needed adjustments are made.

B The possibility of an accident or malfunction of a different type than analyzed in the FSAR does not result from this change. No changes are proposed which introduce new initiating events. No changes are proposed that affect the reliability or performance of equipment serving a safety function. Therefore, no new failure modes are introduced by the proposed changes in the setpoints for this instrumentation.

C. The proposed change does not involve a significant reduction in the margin of safety since the PNPS safety analyses are based upon an APRM scram signal at 120% of power. This setpoint is unchanged by this submittal. The elimination of the APRM setdown requirement is compensated by new flow and power dependent thermal operating limits which ensure safety margins equal to or larger than those in present Technical Specifications.

2. RBM CHANGES

A. The proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated because it does not create new transients, increase the frequency of existing transients, or change the governing design criteria.

Information presented in NEDC-31312-P shows that the consequences of accidents and transient events which might be affected by implementation of the ARTS program are bounded by the consequences of the same events initiated from current licensing basis conditions, provided the appropriate adjustments to the operating limits and RBM setpoints are utilized. The proposed Technical Specification changes will assure that needed adjustments are made.

B. The proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated because the upgraded setpoints in no way influence, impact or contribute to the probability or consequences of any accident. The Technical Specification will continue to require operation within the required margin of safety to ensure fuel cladding intergrity, which precludes release of radioactive materials, thereby assuring compliance with 10CFR 100 limits.

C. The proposed change does not involve a significant reduction in the margin of safety since the new power depenoent RBM setpoints continue to provide protection of the minimum critical power ration (MCPR) safety limit in the event of a rod withdrawal error.

REQUESTED SCHEDULE

The proposed Technical Specification Change will enhance plant operating efficiency by facilitating spectral shift operation and more rapid power ascensions. The proposed Technical Specification changes are planned to be utilized during the cycle 9 operation. We request NRC approval immediately after shutdown for RFO#8, to implement the APRM/RBM hardware, software and setpoint changes during the outage.

Attachment B

Replacement Technical Specification Pages