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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 149 TO FACILITY OPERATING LICENSE NO. DPR-62

CAROLINA POWER & LIGHT COMPANY, et al.

BRUNSWICK STEAM ELECTRIC PLANT, UNIT 2

DOCKET NO. 50-324

1.0 INTRODUCTION

By letter dated September 4, 1987, the Carolina Power & Light Company submitted a request for changes to the Brunswick Steam Electric Plant, Unit 2, (BSEP-2) Technical Specifications (TS) to incorporate operating limits using General Electric (GE) manufactured fuel assemblies and GE analyses and methodologies.

The amendment relates to the inclusion of new and/or revised Minimum Critical Power Ratio (MCPR) limits, Average Power Range Monitor (APRM) setpoints, Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) limits, and Linear Heat Generation Rate (LHGR) limits for all of the fuel using Cycle 8 core and transient parameters. The new fuel is the extended burnup type, which has been used in several recent GE reloads.

This evaluation does not address the acceptability of fuel with a burnup rate beyond 33,000 MWD/MT with respect to the environmental effects of transportation. Specifically, the environmental effects of the transportation of fuel with a higher burnup rate is still being reviewed. Therefore, a footnote has been added to TS figures 3.2.1-1 through 3.2.1-5. Upon completion of its assessment, if favorable, the staff will complete the processing of the September 4, 1987 amendment requested by deleting the footnotes.

2.0 EVALUATION

2.1 Reload Description

The BSEP-2, Cycle 8 reload will retain 44 P8x8R and 332 BP8x8R GE fuel assemblies from the previous cycle and add 184 new GE8x8EB fuel assemblies. The reload is based on a previous cycle core nominal average exposure of 20,449 megawatt days per metric ton (MWD/MT) and Cycle 8 end of cycle (EOC) exposure of 20,814 MWD/MT. The loading will be a conventional scatter pattern with low reactivity fuel on the periphery. This loading is acceptable to the NRC staff.

2.2 Fuel Design

The new fuel for Cycle 8 is the GE extended burnup fuel GE8x8EB. The fuel designations are BD317A and BD232A. This fuel type has been approved in the

NRC Safety Evaluation Report for Amendment 10 to GESTAR II. The specific descriptions of this fuel have been submitted in Amendment 18 to GESTAR II. However, since this amendment has not as yet been accepted, the fuel description has also been presented for Brunswick 2, Cycle 8, in a letter from S. R. Zimmerman (CP&L) to NRC dated October 2, 1987. This fuel description is acceptable.

The proposed Linear Heat Generation Rate (LHGR) for the GE8x8EB fuel is 14.4 kilowatts per foot (kw/ft) as compared to 13.4 kw/ft for the other GE fuel. This LHGR has been reviewed and accepted for this fuel in the GE extended burnup fuel review. This LHGR is, therefore, acceptable as the new fuel in Cycle 8.

2.3 Nuclear Design

The nuclear design analyses for Cycle 8 have been performed by GE with the approved methodology described in GESTAR II. The results of these analyses are given in the GE reload report in standard GESTAR II format. The results are within the range of those usually encountered for BWR reloads. In particular, the shutdown margin is 1.2% delta k at both beginning of cycle (BOC) and at the exposure of minimum shutdown margin, thus fully meeting the required 0.38% delta k. Since these and other Cycle 8 nuclear design parameters have been obtained using previously approved methods, and fall within expected ranges, the nuclear design is acceptable.

2.4 Thermal-Hydraulic Design

The thermal-hydraulic design analyses for Cycle 8 have been performed by GE with the approved methodology described in GESTAR II and the results are given in the GE reload report. The parameters used for the analyses are those approved for the Brunswick class BWR 4. The GEMINI system of methods was used for relevant transient analyses. The revised constants mu and sigma, which are a part of the TS changes for Cycle 8 (Specification 3.2.3.2), are used to calculate the ODYN Option B scram time limit, conforming to the approved GEMINI/ODYN analysis methods. These revised constants are appropriate for 20% scram insertion time requirements where control rod notch position 36 corresponds to the 20% scram time position.

The Operating Limit MCPR (OLMCPR) values are determined by the limiting transients, which are usually Rod Withdrawal Error (RWE), Feedwater Controller Failure (FWCF), and Load Rejection Without Bypass (LRWBP). The analyses of these events for Cycle 8, using the standard, approved ODYN Option A and B approach for pressurization transients, provide new Cycle 8 Technical Specification values of OLMCPR in the standard operating region.

For Cycle 8, the licensee follows standard practice by having exposure dependent OLMCPR values. Two exposure regions from BOC to EOC were analyzed: (1) BOC to EOC - 2 GWD/ST, and (2) EOC - 2 GWD/ST to EOC. For all standard operating conditions, LRWBP is controlling at both Option A and B limits. These OLMCPR results are reflected in TS changes, which also include an adder of 0.02 to support extended periods of operation during operational conditions, such as a main steam line isolation valve out-of-service event or a feedwater heater out-of-service event.

The licensee has performed analyses which show that an adder of 0.02 to the proposed MCPR limits conservatively bounds these abnormal modes of operation. Approved methods were used to analyze these events, as well as others which could be limiting, and the analyses and results are acceptable and fall within expected ranges.

The BSEP-2 TS contain requirements approved by NRC staff for the detection and suppression of core thermal-hydraulic instability for two or one recirculation loop operation. These specifications reflect the conclusions of the NRC Generic Letters 86-02 and 86-09, which were based on extensive stability reviews and the recommendations of the GE report SIL-380. Thus, cycle specific stability calculations are not required for Cycle 8 operation.

2.5 Transient and Accident Analyses

The transient and accident analysis methodologies used for Cycle 8 are described, and NRC approval indicated, in GESTAR II. The GEMINI system of methods option was used for transient analyses. The limiting MCPR events for BSEP-2, Cycle 8, are indicated in Section 2.4. The core wide transient analysis methodologies and results are acceptable and fall within expected ranges.

The RWE was analyzed on a plant and cycle specific basis (as opposed to the statistical approach) and a rod block setpoint of 107 was selected to provide an OLMCPR of 1.25 for all fuel types. The fuel misorientation event was analyzed with standard methods for the D lattice fuel, giving a nonlimiting MCPR of 1.20. The results of the cycle specific control rod drop accident from both cold conditions and hot standby conditions meet the NRC acceptance criterion (220 calories per gram peak enthalpy) for this event. The local transient event analyses have been analyzed with approved methods and acceptable input assumptions and result in acceptable consequences for Cycle 8.

The limiting pressurization event, the main steam isolation valve closure with flux scram, analyzed with standard GESTAR II methods, gave results for peak steam dome and vessel pressures well below required limits. These are acceptable methodologies and results.

Loss-of-coolant-accident analyses, using approved methodologies (SAFE/REFLOOD) and parameters, were performed to provide MAPLHGR values for the new reload fuel assemblies (GE8x8EB). The results are within the limits of 10 CFR 50.46 and are, therefore, acceptable.

The staff has reviewed the reports submitted for the Cycle 8 operation of BSEP-2. Based on this review, the staff concludes that appropriate material was submitted and that the fuel design, nuclear design, thermal-hydraulic design, and transient and accident analyses are acceptable. There are also minor administrative changes to the index, pagination, the definitions of CRITICAL POWER RATIO and PHYSICAL TESTS, associated Bases, and references. These are all acceptable. The Technical Specification changes submitted for this reload suitably reflect the necessary modifications for operation in this cycle.

3.0 ENVIRONMENTAL CONSIDERATIONS

This amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The staff has 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 should be 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 §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 the amendment.

4.0 CONCLUSION

The Commission made a proposed determination that this amendment involves no significant hazards consideration which was published in the FEDERAL REGISTER (53 FR 2310) on January 27, 1988, and consulted with the State of North Carolina. No public comments or requests for hearing were received, and the State of North Carolina did not have any comments.

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, and (2) such activities will be conducted in compliance with the Commission's regulations, and the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

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AMENDMENT NO. 149 TO FACILITY OPERATING LICENSE NO. DPR-62 - BRUNSWICK, UNIT 2

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