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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 144 TO FACILITY OPERATING LICENSE NO. DPR-72

FLORIDA POWER CORPORATION, ET. AL.

CRYSTAL RIVER UNIT NO. 3 NUCLEAR GENERATING PLANT

DOCKET NO. 50-302

1.0 INTRODUCTION

By letter dated February 27, 1992 (Ref. 1), Florida Power Corporation (FPC or the licensee) requested an amendment to the Technical Specifications (TSs) appended to Facility Operating License No. DPR-72 for the Crystal River Unit No. 3 Nuclear Generating Plant (CR-3). The proposed amendment would revise the operability requirements for the control rod reed switch or absolute position indicator (API) channels. This request also supports modifications made to the control rod position indication from a single channel to a dual channel which is more reliable but less accurate. The licensee has completed a statistical analysis to justify the reduced accuracy and to demonstrate that all safety analysis assumptions and related TS limits are preserved.

2.0 BACKGROUND

The control rod drive control system (CRDCS) has two different types of position indication: absolute position indication (API) and relative position indication (RPI). Both position indications are available in the main control room. The licensee proposes to modify the API system during Refuel 8, which is scheduled for completion in June 1992.

3.0 EVALUATION

The Type "A" API system presently installed at CR-3 is comprised of: (1) a permanent magnet internally mounted on the lead screw's upper end. As the control rod moves the magnet moves up or down following the control rod motion; (2) an external position indicator assembly with equally spaced reed switches that are normally open; (3) a buffer amplifier located in the API system control; and (4) a position indication meter located at the control console in the main control room.

The reed switches close when exposed to a magnetic field, produced by the magnet which is mounted on the control rod lead screw. The closure of the reed switch shorts out resistors in the voltage divider circuit. An analog voltage, proportional to the control rod position (5 volts for full out position and zero volts for full in position of the control rod), is produced. The Type "A" API has 48 reed switches and 48 resisters in a single voltage divider network. Full in and full out position indication switches and one reference (0%, 25%, 50%, 75% and 100%) switch are also available.

Accuracy of the Type "A" API is a function of the number of reed switches closed and the distance between reed switches. The Type "A" API system is designed to have either one or two reed switches closed in the vicinity of the magnet. Individual control rod position indication is lost in the event of a failure of any reed switch, resistor, or power supply, which requires the unit to go to shutdown to change out the API assembly.

TS 3.1.3.3 requires that all safety, regulating, and axial power shaping control rod reed switch position indicator channels and pulse stepping position indicator channels be operable and capable of determining the control rod position within $\pm$ 2% in Modes 1 and 2. When a channel is not operable, operator action is required to reduce power level, and increase surveillance.

The licensee proposes to change the Type "A" API to Type "A-R4C" API, which consists of two parallel sets (A and B) of voltage divider circuits (channels) each made up of 36 reed switches and 36 resistors. The reed switches of each channel are staggered in position from each other. The Type "A-R4C" API system is designed to have either two or three reed switches closed in the vicinity of the magnet, which reduces accuracy. Since there are 36 reed switches in the Type "A-R4C" API system instead of 48 reed switches in the Type "A" API system in the same overall distance, accuracy is further reduced.

In addition, full in and full out zone reference (0%, 25%, 50%, 75% and 100%) switches are also available, as in the existing design. The Type "A-R4C" API voltage output to the indicators is proportional to 5 volts for full out position and zero volts for full in position of the control rod.

The major differences between the Type "A" and the Type "A-R4C" API are redundancy and accuracy. In the Type "A-R4C" API, either channel A or B may be isolated when there is a failure of that channel, thus eliminating the need to enter the limiting condition for operation (LCO) in the event of a single channel failure. However, in this event, accuracy would be reduced further.

During preparation for the modification from Type "A" to Type "A-R4C" API, the licensee could not identify a specific reference for the basis of the $\pm$ 2% allowable error on the control rod position between the API and the RPI indication systems. A similar situation existed for the surveillance requirements acceptance criteria. The 2% value appeared in the Babcock & Wilcox (B&W) Standard Technical Specification (STS) and is reflected in Crystal River Unit 3 (CR-3) TS.

The licensee proposed to change TS LCO 3.1.3.3 by removing the phrase "and capable of determining the rod positions within + or - 2%," and requiring operability only. It is also proposed to further define the word "channels" to mean "At least one reed switch string OPERABLE along with all other necessary functions needed to indicate rod position."

TS 4.1.3.3 presently requires that at least once per 12 hours the determination of operable be made by "verifying that the pulse stepping position indicator channels [relative position indication (RPI)] and the reed switch position indicator channels [absolute position indication (API)] agree within 2%.." This value of 2% is proposed to be changed to the following:

"Indicator Channel Agreement Criteria

a) 2.7% when comparison is performed using the plant computer, or

b) 3.5% when comparison is performed using panel meters on the main control board."

Because the licensee could not determine the basis for the 2% deviation between the API and the RPI system rod position, it requested B&W Nuclear Services (B&WNS) to undertake an extensive review effort to determine the correct values for the TS. This effort considered the use and application of control rod position indication both within the TS and the safety analysis. The results of this evaluation are contained in B&WNS document 51-1178835-02 (Ref. 2) and are reflected in the proposed TS changes.

The core reload analysis is used to ensure that the safety analysis assumptions reflected by the cycle-specific control rod position limit curves are preserved. The methodology for the reload analysis is documented in B&W 10122A Revision 1 (Ref. 3) and has been approved by the NRC (Ref. 4). B&W has always applied a 1.5% uncertainty to the rod group average position as part of this reload analysis. The 1.5% uncertainty accounts for the deviation of the indicated group average position from the true average position. This value forms the basis for the proposed operability requirements due to its use in the safety analysis.

The regulating, safety, and axial power shaping rod positions must be known in order to verify that the core is operating within the group sequence, overlap and design peaking limits and with minimum shutdown capability (insertion limits). The rod position must be known in order to verify that alignment limits are preserved.

B&W has provided a statistical analysis to justify the reduced accuracy of the proposed API system and demonstrated that all safety analysis assumptions and safety-related TS limits are preserved (Ref. 5).

4.0 SUMMARY

The proposed change to the LCO is consistent with the latest proposed B&W STS. B&WNS has evaluated the errors and uncertainties of both the API and RPI systems and determined the indicator channel agreement criteria which defines the surveillance requirements operable condition. The indicator channel agreement criteria bounds the 1.5% uncertainty in the rod group average position which is part of the core reload analysis. The staff has reviewed this analysis and concludes that the safety analysis assumptions and safety-related TS limits are preserved (Ref. 5). Based on its review, the staff finds the requested changes acceptable.

5.0 STATE CONSULTATION

Based upon the written notice of the proposed amendment, the Florida State official had no comments.

6.0 ENVIRONMENTAL CONSIDERATION

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 and changes surveillance requirements. The NRC 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 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 (57 FR 13129). 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 this amendment.

7.0 CONCLUSION

The Commission 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 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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8.0 REFERENCES

1. Letter from P.M. Beard, FPC to NRC, "Technical Specification Change Request No. 195 Control Rod Position Indication" dated February 27, 1992.

2. B&W Nuclear Technologies Document Identifier 51-1178835-02 "CRD Type A-R4C Position Indication (PI) Evaluation" dated October 4, 1991.

3. Letter from James H. Taylor, Manager Licensing, B&W, to NRC dated August 4, 1978, with enclosure "Topical Report BAW-10122A, Rev. 1 Normal Operating Controls" dated May 1984.

4. Letter from NRC to James H. Taylor, Manager Licensing, B&W, "Review of Topical Report BAW-101222 Request for Additional Information," dated November 22, 1978.

   Letter from James H. Taylor, Manager Licensing, B&W to NRC, "Response to Questions on Topical Report BAW-10122", dated January 31, 1979.

   Letter from NRC to James H. Taylor, Manager Licensing, B&W, "Evaluation of BAW-10122," dated September 14, 1979.

   Letter from NRC to James H. Taylor, Manager Licensing, B&W, "Acceptance for Referencing of Licensing Topical Report BAW-10122, Revision 1, Normal Operating Control," dated April 20, 1984

   Letter from James H. Taylor, Manager L ing, B&W, to NRC, "Acceptance Version of Topical Report BAW 0122, Revision 1, Normal Operating Controls," dated May 22, 1984.

5. BWNS Document 86-1179868-01 "Summary-Position Indication CRDM", four calculations pertaining to position indication to evaluate what effect the Type A-R4C position indicator (API) would have on the licensing basis of the plant (Technical Specification).

   BWNS Document 51-1173263 "Type A-R4C Absolute Position Indicator Error" (BWNS Proprietary).