

FLORIDA POWER CORPORATION  
CRYSTAL RIVER UNIT 3  
DOCKET NO. 50-302/LICENSE NO. DPR-72  
REQUEST NO. 152, SUPPLEMENT  
EXTENDED LIFE CONTROL RODS

LICENSE DOCUMENT INVOLVED: Technical Specifications

PORTION: 5.3.2. Control Rods

DESCRIPTION OF REQUEST:

This change adds the design description for new extended life control rods to Technical Specification 5.3.2. The current specification only describes the standard Mark-B Control Rod. The new control rods use a smaller diameter silver-indium-cadmium (AG-IN-Cd) neutron poison. The diameter reduction is offset by extending the active poison length by five (5) inches from 134 inches to 139 inches. Additionally, the new control rods use Inconel clad material in lieu of stainless steel clad. FPC will be using eight (8) extended Life Control Rods in the Cycle Seven Core. The new control rods are designed for a 22 effective full power year (EFPY) lifetime. Mark-B Control Rods are designed for a five EFPY lifetime.

REASON FOR REQUEST:

Use of control rods designed for a longer lifetime are needed due to longer fuel cycles. The smaller diameter absorber material allows more room within the control rod clad for swelling as neutrons are absorbed. Inconel clad improves the irradiated ductility and creep behavior of the control rod.

EVALUATION OF REQUEST:

The control rod assemblies are described in Section 3.2.4.2.2 of the FSAR. Critical aspects addressed include consideration of clearances to permit freedom of movement, water tight design, strength under expected hydraulic and thermal conditions, operating experience with new designs and absorber swelling. Additionally, the new control rod reactivity worth must be within limits assumed in core response analyses of the FSAR and Reload Report. Finally, control rod weight must not exceed control rod drive mechanism allowable loads, nor cause a longer trip response time than assumed in safety analyses.

The extended life control rods are not significantly different from the Standard Mark-B Control Rods currently in use in that the new rods do not change operating and safety analyses. The external dimensions of the Extended Life Control Rod are the same as those for control rods currently in use. The new control rods meet the most limiting mechanical criteria and thermal hydraulic limits used for the Mark-B Control Rod analyses. The new rods have been used at Arkansas Nuclear One, Cycle Seven (1984) where no significant anomalies were noted. The reactivity differences are small and are conservative or within design allowances, such as poison depletion allowance. The new control rods weigh the same as standard design, 130 pounds, so trip times and control rod mechanism loads are maintained. The extended life control rods are designed to meet requirements for position indication and rod drop times.

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The design differences between the current control rod design and extended life control rod have a negligible effect on reactivity control and shutdown capability. While the design differences change FSAR and Technical Specification Design Descriptions, the safety analyses are not affected. Due to the similarity in design, a new type of accident is not likely and the consequences or probability of accidents assumed in the FSAR are not increased. Additionally, poison depletion over the extended life is within the poison depletion allowance assumed for the current design, so there are no significant changes in the margin of safety.

The reload report and supporting analyses reflect the use of extended life control rods.

## SHOLLY EVALUATION OF REQUEST:

Florida Power Corporation has determined that this amendment does not involve a significant hazards consideration. The proposed amendments and planned modifications are consistent with guidelines published by the staff for making this determination (48 FR 14870).

This reload involves the reinsertion of fuel assemblies of a type previously used by Crystal River Unit 3 and the insertion of 81 new fuel assemblies of the Mark BZ type. The Mark BZ fuel assemblies are similar to previously approved assemblies and differ only slightly in the use of Zircaloy Spacer Grids rather than Inconel Grids, annealed guide tubes and a modified holddown spring. The use of Mark BZ fuel assemblies has been previously reviewed and approved by the staff.

The Cycle Seven control rods are slightly different from those of previous cycles. The new control rods have a larger clad-to-absorber gap, thicker clad, and new clad material (inconel) in order to increase its lifetime. The overall dimensions are the same with a longer length absorber within the rod to compensate for the reduced absorber diameter. The use of this type of control rod has been previously approved by NRC Staff.

The revised power imbalance detector correlation is a new application of an analytical error calculation method for Crystal River Unit 3. This revision involves statistically combining assumed errors and tightening the allowable detector error to provide additional operating margin within the imbalance curves. This application has been previously accepted for use at another B2W facility.

The addition of the shutdown margin curve to the rod insertion limits is an additional limitation to clarify the Technical Specifications. Additionally, the proposed curve is consistent with NRC Guidelines contained in NUREG-0103, Standard Technical Specifications.

Based on the above, Florida Power has determined this change will not:

- (1) Involve a significant increase in the probability or consequences of an accident previously evaluated. Each FSAR accident analysis was examined to determine the effects of the Cycle Seven Reload. A discussion of this effort and the results are provided in the attached Reload Report. The accident doses resulting from the reload would not be significantly different than current accident doses. Additionally, the moderator dilution accident was reevaluated with minor changes to makeup tank reactivity. The results were not significantly different from current accident analysis results and were within FSAR acceptance criteria.
- (2) Create the possibility of a new or different kind of accident from any accident previously evaluated because the reload modifications are not significant changes and have been previously reviewed by the NRC Staff.
- (3) Involve a significant reduction in a margin of safety because design analyses and proposed Technical Specifications assure an equivalent margin of safety. The fuel and control rod modifications and the revised power imbalance detector correlation are within established acceptance criteria as shown by the referenced analysis.

Thus Florida Power Corporation has determined the Cycle Seven Reload and resultant Technical Specifications meet NRC Guidelines for an amendment which does not involve a significant hazards consideration.

## DESIGN FEATURES

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### DESIGN PRESSURE AND TEMPERATURE

5.2.2 The Reactor Containment building is designed and shall be maintained for a maximum internal pressure of 55 psig and a temperature of 281°F.

### 5.3 REACTOR CORE

#### FUEL ASSEMBLIES

5.3.1 The reactor core shall contain 177 fuel assemblies with each fuel assembly containing 208 fuel rods clad with Zircaloy - 4. Each fuel rod shall have a nominal active fuel length of 144 inches and contain a maximum total weight of 2253 grams uranium. The initial core loading shall have a maximum enrichment of 2.83 weight percent U-235. Reload fuel shall be similar in physical design to the initial core loading and shall have a maximum enrichment of 4.0 (nominal) weight percent U-235.

#### CONTROL RODS

5.3.2 The reactor core shall contain 60 safety and regulating (including extended life control rods) and 8 axial power shaping (APSR) control rods. Except for the extended life control rods, the safety and regulating control rods shall contain a nominal 134 inches of absorber material. The extended life control rods shall contain a nominal 139 inches of absorber material. The nominal values of absorber material shall be 80 percent silver, 15 percent indium, and 5 percent cadmium. Except for the extended life control rods, all control rods shall be clad with stainless steel tubing. The extended life control rods shall be clad with Inconel. The APSRs shall contain a nominal 63 inches of absorber material at their lower ends. The absorber material for the APSRs shall be 100% Inconel.