



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
SUPPORTING AMENDMENT NO. 68 TO FACILITY OPERATING LICENSE NO. DPR-72

FLORIDA POWER CORPORATION, ET AL.

CRYSTAL RIVER UNIT NO. 3 NUCLEAR GENERATING PLANT

DOCKET NO. 50-302

Introduction

By letter dated January 30, 1984, and as supplemented on March 20, 1984, Florida Power Corporation (FPC or the licensee) proposed a change to the Crystal River Unit 3 (CR-3) Technical Specifications (TSs). This change request was to raise the maximum operating steam generator level limit to allow greater operating flexibility and to allow achievement of rated power level when the present level limit becomes restricting due to mechanical conditions such as tube support plate fouling.

Background

The downcomer water level within the Once Through Steam Generators (OTSG) at Crystal River Unit 3 has been increasing at a rate of about 1% per month during full power operation.

The cause of the level increase is attributed to fouling in the broached hole area of the tube support plates. The fouling causes an increased resistance to steam flow within the tube region which causes the water level to rise within the downcomer region.

In order to remain within the TS requirement for downcomer water level, operation of Crystal River Unit 3 is currently limited to 96% power. The licensee requests that the TS limit be increased to permit full power operation.

The current Technical Specification limit for downcomer water level is 360 inches which corresponds to about 87% on the operating range scale. The licensee requests that the limit be raised to 96% on the operating range which corresponds to approximately 382 inches of downcomer level above the lower tube sheet. The aspirator ports within the steam generator shroud which provide for feedwater heating are located at 386 inches. The original limit was based on a conservative calculation of level at the maximum steam generator inventory assumed in the Final Safety Analysis Report (FSAR) of 62,600 lbm. This is the steam generator inventory assumed for the main steam line break calculation of reactor overcooling, environmental doses and containment pressure. The licensee submitted a new calculation of steam generator inventory which concludes the inventory will be less than 57,000 lbm even at the new level limit. This result was confirmed by the staff using the RELAP5 computer code.

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Although no loss of superheat has occurred at Crystal River indicating no tube surface fouling, the licensee's proposed change includes a level penalty which would be applied in the event that tube fouling occurs in future operations.

### Evaluation

The staff concludes that operation at power with up to 96% level on the operating range is acceptable and that the licensee's proposed TS is acceptable as discussed in more detail below.

The licensee also requests that the TSs be revised to remove steam generator level requirements for Mode 4 operation (hot shutdown). Currently the steam generators are allowed to be filled only at cold shutdown. The change would allow filling of the OTSGs at temperatures up to 280°F. The consequences of a main steam line rupture at this temperature would be less than that of the FSAR case at full power. The staff concludes the licensee's proposed change removing level restrictions for Mode 4 operation is acceptable.

The most limiting design-basis accident which would be affected by steam generator operating level, and hence the limit addressed by this amendment, is a steam line failure. This accident is evaluated in Section 14.2.2.1 of the Crystal River FSAR and in the staff's Safety Evaluation Report. The parameter of interest is the mass of water, or inventory, contained in the OTSG due to its role in lowering reactor coolant system temperature and in raising containment pressure during a steam line break accident. A higher inventory causes the effects of the accident to be more severe. The FSAR assumes an inventory of 62,600 lbm for the purpose of analyzing this accident, which was conservatively high and doesn't account for the dynamic complexity of the fluid (i.e. mixture of water and steam) in the OTSG. In order to reevaluate the present OTSG maximum water level limit, the licensee had a more accurate and realistic analysis performed by Babcock & Wilcox which demonstrated that this limit should logically be established by a curve of level vs. superheat rather than a fixed numerical value of level. If the water level should tend to rise above the 96% upper limit, the superheat would rapidly tend to decrease sharply, requiring a reduction in water level. Thus, the superheat vs. level limitation also tends to assure that, in normal operation, water level will remain clear of the aspirator ports. Hence, the licensee has proposed such a curve which will establish the regime of allowed values of level for a given amount of superheat, which is a more accurate prediction of actual water inventory in the OTSG. The curve proposed by the licensee is based upon maintaining inventory less than 57,000 lbm which is 10% less than the inventory used in the FSAR accident analysis and is, therefore, more conservative than the original analysis. Therefore, the proposed limit falls well within the original analysis and would therefore not involve an increase in the consequences of an accident previously evaluated. Since the analysis for the steam line break accident does not assume failure of the OTSG itself, this change does not have any affect on the probability of this accident. The licensee also requested to delete applicability of an upper OTSG limit to Mode 4 of operation. Because the severity of a steam line break accident drops sharply as OTSG temperature and pressure drop, and because temperature is limited to a maximum of 280°F in Mode 4, the staff considers that this change is acceptable.

The TS changes proposed by the licensee and incorporated by this amendment involve only an incremental increase (6%) in maximum OTSG level, and in fact could impose lower level limits with a lower value of steam superheat. Therefore, this change does not create the possibility of a new or different kind of accident from any accident previously evaluated. Rather, it imposes a more accurate and realistic method of limiting maximum OTSG inventory for routine operation and accidents that have been previously evaluated in a great amount of detail.

In the most extreme set of allowed conditions proposed by the licensee (maximum allowable power level, OTSG level and temperature, minimum steam superheat), the OTSG inventory shown by analysis is approximately 10% below that assumed by the FSAR analysis for the steam line break analysis. With the new limit, the allowable OTSG level (and hence inventory) would actually be less than presently allowed for reduced values of steam superheat. Therefore, although the margin of safety may be incrementally reduced in some cases and incrementally increased in others compared to the present limit, in all cases, the margin is at least 10% below the FSAR analysis.

#### Environmental Consideration

We have determined that the amendment does not authorize a change in effluent types or total amounts nor an increase in power level and will not result in any significant environmental impact. Having made this determination, we have further concluded that the amendment involves an action which is insignificant from the standpoint of environmental impact, and pursuant to 10 CFR §51.5(d)(4), that an environmental impact statement or negative declaration and environmental impact appraisal need not be prepared in connection with the issuance of this amendment.

#### Conclusion

We have 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 this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Dated: May 25, 1984

Principal Contributors:

J. Jensen, R. Hernan