



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO AMENDMENT NO. 47 TO FACILITY OPERATING LICENSE NPF-35
AND AMENDMENT NO. 40 TO FACILITY OPERATING LICENSE NPF-52

DUKE POWER COMPANY, ET AL.
CATAWBA NUCLEAR STATION, UNITS 1 AND 2
DOCKET NOS. 50-413 AND 50-414

I. INTRODUCTION

By letter dated October 8, 1987, Duke Power Company, et al., (the licensee) proposed amendments to the operating licenses for Catawba Nuclear Station, Units 1 and 2, which would revise Technical Specification (TS) 3/4.4.5, "Steam Generators" and its Bases. The revisions would allow Catawba Unit 1 steam generator tube defects to be addressed by Westinghouse F* plugging criterion as an alternative to the previous requirements for tube plugging. Although amendments will be issued for both Units 1 and 2, changes are proposed for Unit 1 only. Unit 2 is included only because the TSs are combined in one document for both units.

The licensee's letter dated October 8, 1987, transmitted the technical basis for the application of the F* criterion at Catawba Unit 1 contained in Westinghouse report WCAP-11581 proprietary, "Tubesheet Region Plugging Criterion for the Duke Power Company Catawba 1 Nuclear Station Steam Generators," dated August 1987. The non-proprietary version is WCAP-11582. The licensee's letter dated December 3, 1987, clarified certain aspects of the request. However, the substance of the changes noticed in the Federal Register on October 27, 1987, was not affected by the clarification letter.

II. EVALUATION

Previous steam generator plugging criteria apply throughout the tube length and do not consider the effects of constraints provided by the tubesheet on the embedded length of the tube. However, steam generator tubes are expanded by hardrolling into the tubesheet. The presence of the tubesheet constrains the expanded tube within the tubesheet, and provides resistance to tube rupture and to restrain leakage from through-wall tube flaws in this region.

The F* criterion provides an alternate tube plugging criterion for tube degradation detected within the tubesheet region by accounting for the presence of the tubesheet. It identifies a distance into the tubesheet, measured from either the top of the tubesheet or the bottom of the hardroll expansion transition, whichever is lower in elevation within the steam generator. Below this so-called F* distance, tube degradation of any extent does not necessitate plugging, provided there is no indication of cracking within the F* distance.

The F* distance is estimated as a tube length required to engage the tube to the tubesheet, so as to resist tube pullout forces that could be developed during normal or accident conditions. The F* distance must provide sufficient engagement of the tube hardroll to the tubesheet, such that pullout forces would be successfully resisted by the elastic preload between the tube and tubesheet, even in the event of a circumferential break in the tube below the F* distance. The calculation of the required engagement distance is based on determining the tube length for preload frictional forces to equilibrate the applied operating loads. Safety margins on operating loads are specified in Regulatory Guide (RG) 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes." Furthermore, uncertainties in vertical distance measurements by eddy current testing used in steam generator inspections must be accounted for in the F* distance.

Catawba Unit 1 has four Model D3 steam generators having tubes installed in the tubesheet via a full depth hardroll expansion. The F* distance for Catawba Unit 1 is 1.60 inches, which contains a 0.5 inch eddy current vertical measurement uncertainty allowance. Through analysis and testing, Westinghouse has demonstrated that the roll expansion over the F* distance is sufficient to preclude pullout of tubes from the tubesheet under normal and postulated accident conditions. Below this F* distance, tube degradation of any extent does not necessitate plugging, provided there is no indication of cracking within the F* distance. The existing T₀ leakage rate requirements and accident analysis assumptions remain unchanged.

All F* tubes, i.e., tubes for which the alternate F* plugging criterion is applicable, will be re-inspected in the tubesheet region in addition to the normal tube inspection sample. The results of the inspection of F* tubes will be reported to the Commission before restart of the unit following the inspection.

The licensee's technical basis for the Catawba Unit 1 request is consistent with that accepted previously by the staff. The licensee's proposal provides an acceptable implementation of the F* criterion.

Based on its review, the staff concludes that the F* criterion and the resulting TS changes are acceptable for application at Catawba Unit 1. Thus, steam generator tubes can be left inservice with eddy current indications of pluggable magnitude that are below the F* distance, provided there is no indication of cracking within the F* distance. The F* distance is 1.60 inches from the bottom of the roll expansion transition or the top of the tubesheet if the bottom of the roll expansion is above the top of the tubesheet.

III. ENVIRONMENTAL CONSIDERATION

Pursuant to 10 CFR 51.32 the Commission has determined that the issuance of these amendments will have no significant impact on the environment (53 FR 19355).

IV. CONCLUSION

The Commission issued a Notice of Consideration of Issuance of Amendments to Facility Operating Licenses and Opportunity for Prior Hearing which was published in the Federal Register (53 FR 41374) on October 27, 1987. The Commission consulted with the state of South Carolina. No public comments were received, and the state of South Carolina did not have any comments.

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 these amendments will not be inimical to the common defense and security or to the health and safety of the public.

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