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SUBJECT: Application for exigent amend to license DPR-58,revising TS 4.4.5, "SGs" to incorporate acceptance criterion for SG tube degradation in tubesheet region known as F*.Westinghuse repts WCAP-13970 & WCAP-13971 encl.WCAP-13970 withheld.

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AEP:NRC:1166K

Donald C. Cook Nuclear Plant Unit 1
Docket No. 50-315
License No. DPR-58
TECHNICAL SPECIFICATION CHANGES TO
INCORPORATE F* STEAM GENERATOR TUBE
PLUGGING CRITERION

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, D. C. 20555

Attn: T. E. Murley

February 15, 1994

Dear Dr. Murley:

This letter and its attachments constitute an application for an exigent amendment to the Technical Specifications (T/Ss) for Donald C. Cook Nuclear Plant Unit 1. Specifically, we are requesting a change to T/S 4.4.5 (Steam Generators) to incorporate an acceptance criterion for steam generator tube degradation in the tubesheet region known as F*. This criterion has been licensed and successfully implemented at a number of operating plants. As discussed with your staff on February 9, 1994, the reason for requesting this on an exigent basis is that the change is associated with steam generator repairs during the current Unit 1 refueling outage. The repairs are currently scheduled to begin March 6, 1994. Therefore, we request approval of this amendment request by March 4, in order to avoid outage delays.

Attachment 1 contains a description of the proposed T/S changes as well as the 10 CFR 50.92 no significant hazards evaluation. Attachment 2 contains the existing T/S pages marked to reflect the changes. Attachment 3 contains the proposed revised T/S pages. Attachment 4 contains Westinghouse Electric Corporation's report WCAP-13970, entitled "F* Tube Plugging Criterion for Tubes with Degradation in the Tubesheet Roll Expansion Region of Cook Nuclear Plant Unit 1 Steam Generators." This report supports the 10 CFR 50.92 evaluation contained in Attachment 1. The report is considered proprietary to Westinghouse Electric Corporation. As such, an affidavit for withholding from public disclosure is provided in Attachment 4. A non-proprietary version of the WCAP (WCAP-13971) is provided in Attachment 5.

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We believe the proposed changes will not result in (1) a significant change in the types of any effluent that may be released offsite, or (2) a significant increase in individual or cumulative occupational radiation exposure.

These proposed changes have been reviewed by the Plant Nuclear Safety Review Committee and by the Nuclear Safety and Design Review Committee.

In compliance with the requirements of 10 CFR 50.91(b)(1), copies of this letter and its attachments have been transmitted to the Michigan Public Service Commission and to the Michigan Department of Public Health.

This letter is submitted pursuant to 10 CFR 50.30(b), and, as such, an oath statement is attached.

Sincerely,

E. E. Fitzpatrick
Vice President

dr

Attachments

cc: A. A. Blind
G. Charnoff
J. B. Martin - Region III
NFEM Section Chief
NRC Resident Inspector - Bridgman
J. R. Padgett

STATE OF OHIO)
COUNTY OF FRANKLIN)

E. E. Fitzpatrick, being duly sworn, deposes and says that he is the Vice President of licensee Indiana Michigan Power Company, that he has read the forgoing TECHNICAL SPECIFICATION CHANGES TO INCORPORATE F* STEAM GENERATOR TUBE PLUGGING CRITERION and knows the contents thereof; and that said contents are true to the best of his knowledge and belief.

E E Fitzpatrick

Subscribed and sworn to before me this 15th

day of February, 19 94.

Rita D. Hill
NOTARY PUBLIC

RITA D. HILL
NOTARY PUBLIC, STATE OF OHIO
MY COMMISSION EXPIRES 6-28-94

ATTACHMENT 1 TO AEP:NRC:1166K

DESCRIPTION AND JUSTIFICATION OF CHANGES

10 CFR 50.92 ANALYSIS FOR CHANGES TO THE DONALD C. COOK NUCLEAR PLANT UNIT 1 TECHNICAL SPECIFICATIONS

I. INTRODUCTION

This amendment request proposes a change to Technical Specification (TS) 4.4.5 (Steam Generators) to incorporate a revised acceptance criterion for steam generator tubes with degradation in the tubesheet roll expansion region. This criterion for steam generator tube acceptance was developed by Westinghouse Electric Corporation and is known as F* ("F-Star"). This criterion was developed to avoid unnecessary plugging of steam generator tubes. The existing T/S tube repairing and plugging criteria apply throughout the tube length, but do not take into account the reinforcing effect of the tubesheet on the external surface of the tube in the roll expansion region. The presence of the tubesheet will constrain the tube and will complement its integrity in that region by essentially precluding tube deformation beyond its expanded outside diameter. The resistance to both tube rupture and tube collapse is significantly strengthened by the tubesheet. In addition, the proximity of the tubesheet significantly affects the leak behavior of through wall tube cracks in this region, i.e., no significant leakage relative to plant T/S limits is to be expected.

The F* methodology and determination of the F* distance are included in WCAP 13970, entitled "F* Tube Plugging Criterion for Tubes With Degradation in the Tubesheet Roll Expansion Region of the Donald C. Cook Unit 1 Steam Generators." This report, prepared by Westinghouse Electric Corporation, is contained in Attachment 4. A non-proprietary version of the report is included in Attachment 5.

II. DESCRIPTION OF THE CHANGES

The proposed changes are those necessary to incorporate the F* tubesheet region plugging criterion into the T/Ss. The specific changes are as follows:

1. T/S 4.4.5.2

   A requirement is added to inspect (in the roll expanded region) all tubes which have had the F* criteria applied. The roll expanded region of these tubes may be excluded from the requirements of T/S 4.4.5.2.b.1.

2. T/S 4.4.5.4.a

   Definitions for F* distance and an F* tube are added. F* distance is the distance from the bottom of the hardroll transition toward the bottom of the tubesheet that has been conservatively determined to be 1.11 inches (not including eddy current uncertainty). An F* tube is a tube with degradation, below the F* distance, equal to or greater than 40%, and not degraded (i.e., no indications of cracking) within the F* distance.

   The definition of "Repair/Plugging Limit" (T/S 4.4.5.4.a.6) is modified to note that the 40% repair/plugging limit does not apply to the portion of the tube in the tubesheet below the F* distance for F* tubes.

3. T/S 4.4.5.5

A requirement is added to report to the NRC the results of inspections performed under T/S 4.4.5.2 for all tubes that have defects below the F* distance and were not plugged.

III. 10 CFR 50.92 EVALUATION

The amendment has been proposed to address eddy current indications of tube degradation which can occur in the roll expanded portion of the tubes within the tubesheet in the steam generators at the Cook Nuclear Plant Unit 1. These steam generators were fabricated with a 2.75 inch partial depth roll expansion in the tubesheet. Interpretation of eddy current data from the Cook Nuclear Plant Unit 1 and similar plants has shown a potential for primary water stress corrosion cracking (PWSCC) within the roll expanded portion of the tube in the tubesheet. It can be shown that tube plugging or sleeving is not required in many such cases to maintain steam generator tube integrity. Using existing T/S tube plugging criteria for the length of tube within the tubesheet, many of the tubes with potential indications would have to be repaired or removed from service. The proposed amendment would preclude occupational radiation exposure that would otherwise be incurred by plant workers involved in tube plugging or sleeving operations.

The proposed amendment would also avoid loss of margin in reactor coolant system flow and therefore assist in assuring that minimum flow rates are maintained in excess of that required for operation at full power. Reduction in the amount of tube plugging or sleeving required can reduce the length of plant outages and reduce the time that the steam generator is open to the containment environment during an outage.

The possibility of tube repair by sleeving should not be considered a reason to exclude use of this proposed tubesheet plugging criterion, but should be considered one of the options used to address degradation in the expanded region of the tube. The disadvantages of tube plugs noted above also apply to some extent to sleeves.

The proposed amendment addresses the action required when degradation has been detected in the mechanically expanded portion of steam generator tubes within the steam generator tubesheet. Existing tube repair or plugging criteria do not take into account the effect of the tubesheet on the external surface of the tube. The presence of the tubesheet will enhance the integrity of potentially degraded tubes in that region by precluding tube deformation beyond the expanded outside diameter. Structural (burst) integrity of tubes with significant throughwall axial penetration length is provided in the roll expanded area. An axial length of roll expansion equal to the F* length at the top of the roll expansion of the tube into the tubesheet provides sufficient structural integrity to preclude pull out of the tube due to pressure effects, even after

assuming that the tube has experienced a complete circumferential separation at or below the bottom of the F* distance. This same axial length of roll expansion of the tube into the tubesheet provides a barrier to leakage during all plant conditions for through wall cracking of the tube in the expanded region below F*.

The proposed change designates a portion of the tube for which tube degradation of a defined type does not necessitate remedial action except as dictated for compliance with tube leakage limits as set forth in the T/Ss. As noted above, the area subject to this change is in the expanded portion of the tube within the tubesheet of the steam generators. The F* length has been determined to be 1.11 inches. Sound roll expansion of 1.11 inches will satisfy all applicable recommendations of Regulatory Guide 1.121, with regard to tube burst capability.

Conformance of the proposed amendments to the standards for a determination of no significant hazard as defined in 10 CFR 50.92 (three factor test) is shown in the following:

1) Operation of Donald C. Cook Nuclear Plant Unit 1 in accordance with the proposed license amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated.

   The supporting technical and safety evaluations of the subject criterion demonstrate that the presence of the tubesheet will enhance the tube integrity in the region of the hardroll by precluding tube deformation beyond its initial expanded outside diameter. The resistance to both tube rupture and tube collapse is strengthened by the presence of the tubesheet in that region. The result of hardrolling of the tube into the tubesheet is an interference fit between the tube and the tubesheet. Tube rupture can not occur because the contact between the tube and tubesheet does not permit sufficient movement of tube material. The radial preload developed by the rolling process will secure a postulated separated tube end within the tubesheet during all plant conditions. In a similar manner, the tubesheet does not permit sufficient movement of tube material to permit buckling collapse of the tube during postulated LOCA loadings.

   The type of degradation for which the F* criterion has been developed (cracking with a circumferential orientation) can theoretically lead to a postulated tube rupture event provided that the postulated through-wall circumferential crack exists near the top of the tubesheet. An evaluation including analysis and testing has been done to determine the resistive strength of roll expanded tubes within the tubesheet. This evaluation provides the basis for the acceptance criteria for tube degradation subject to the F* criterion.

The F* length of roll expansion is sufficient to preclude tube pullout from tube degradation located below the F* distance, regardless of the extent of the tube degradation. The existing T/S leakage rate requirements and accident analysis assumptions remain unchanged in the unlikely event that significant leakage from this region does occur. As noted above, tube rupture and pullout is not expected for tubes using the F* criterion. Any leakage out of the tube from within the tubesheet at any elevation in the tubesheet is fully bounded by the existing steam generator tube rupture analysis included in the Cook Nuclear Plant FSAR. For plants with partial depth roll expansion like Cook Nuclear Plant Unit 1, a postulated tube separation within the tube near the top of the roll expansion (with subsequent limited tube axial displacement) would not be expected to result in coolant release rates equal to those assumed in the FSAR for a steam generator tube rupture event due to the limited gap between the tube and tubesheet (approximately 0.013 inch diametral gap). The proposed plugging criterion does not adversely impact any other previously evaluated design basis accident.

Leakage testing of roll expanded tubes indicates that for roll lengths approximately equal to the F* distance, any postulated faulted condition primary to secondary leakage from F* tubes would be insignificant.

2) The proposed license amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated.

Implementation of the proposed F* criterion does not introduce any significant changes to the plant design basis. Use of the criterion does not provide a mechanism to initiate an accident outside of the region of the expanded portion of the tube. Any hypothetical accident as a result of any tube degradation in the expanded portion of the tube would be bounded by the existing tube rupture accident analysis. Tube bundle structural integrity will be maintained. Tube bundle leaktightness will be maintained such that any postulated accident leakage from F* tubes will be negligible with regard to offsite doses.

3) The proposed license amendment does not involve a significant reduction in a margin of safety.

The use of the F* criterion has been demonstrated to maintain the integrity of the tube bundle commensurate with the requirements of Reg Guide 1.121 (intended for indications in the free span of tubes) and the primary to secondary pressure boundary under normal and postulated accident conditions. Acceptable tube degradation for the F* criterion is any degradation indication in the tubesheet region, more than the F* distance below the bottom of the transition between the roll expansion and the unexpanded tube. The safety factors used in the verification of the strength of the degraded tube are consistent with the safety factors in the ASME Boiler and Pressure Vessel Code used in steam generator design. The F* distance has been verified by testing to be greater than the length of roll expansion required to preclude both tube pullout and

significant leakage during normal and postulated accident conditions. Resistance to tube pullout is based upon the primary to secondary pressure differential as it acts on the surface area of the tube, which includes the tube wall cross-section, in addition to the inner diameter based area of the tube. The leak testing acceptance criteria are based on the primary to secondary leakage limit in the T/Ss and the leakage assumptions used in the FSAR accident analyses.

Implementation of the tubesheet plugging criterion will decrease the number of tubes which must be taken out of service with tube plugs or repaired with sleeves. Both plugs and sleeves reduce the RCS flow margin; thus, implementation of the F* criterion will maintain the margin of flow that would otherwise be reduced in the event of increased plugging or sleeving. Based on the above, it is concluded that the proposed change does not result in a significant reduction in margin with respect to plant safety as defined in the FSAR or the T/S Bases.