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AUTH. NAME AUTHOR AFFILIATION
 TUCKER, H. B. Duke Power Co.
 RECIP. NAME RECIPIENT AFFILIATION
 DENTON, H. R. Office of Nuclear Reactor Regulation, Director (post 851125
 STOLZ, J. F. PWR Project Directorate 6

SUBJECT: Forwards results of review of FSAR safety analyses re potential impact on plant safety of sleeving up to 5,000 tubes per steam generator. Review supps 860116 proposed amend to Tech Specs re sleeving method.

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DUKE POWER COMPANY

P.O. BOX 33189
CHARLOTTE, N.C. 28242

HAL B. TUCKER
VICE PRESIDENT
NUCLEAR PRODUCTION

TELEPHONE
(704) 373-4531

April 18, 1986

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. John F. Stolz, Project Director
PWR Project Directorate No. 6

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287

Dear Sir:

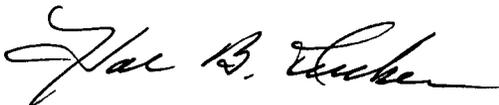
By letter dated January 16, 1986, Duke Power Company (Duke) submitted a proposed amendment to the Oconee Facility Operating License and proposed technical specifications to allow the use of sleeving method for repair of the defective steam generator tubes.

Attachment C to Duke's submittal of January 16, 1986 (BAW-1823P, Rev. 1) described the sleeving repair process and the supporting analyses. Section 3.5 of the BAW-1823P described analyses showing that the thermal and hydraulic effects of sleeving up to 5,000 80-inch long sleeves per generator will have minimal effect on plant operation.

Duke has performed a review of the FSAR safety analyses supporting the operation of the Oconee Units to address the potential impact on plant safety of sleeving up to 5,000 tubes per steam generator. The review addressed the changes to heat transfer and primary flow rate resulting from the insertion of sleeves in the tubes.

Please find attached the results of this review which are intended as a supplement to Duke's letter dated January 16, 1986. The review indicates that the existing FSAR safety analyses bound the expected plant conditions with respect to steam generator heat transfer and primary system flow rate with up to 5,000 sleeved tubes per generator.

Very truly yours,



Hal B. Tucker

MAH:slb

Attachment

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Mr: Harold R. Denton, Director

April 18, 1986

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xc: Dr. J. Nelson Grace, Regional Administrator
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

Ms. Helen Pastis
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Mr. Heyward Shealy, Chief
Bureau of Radiological Health
South Carolina Department of Health &
Environmental Control
2600 Bull Street
Columbia, South Carolina 29201

Mr. J. C. Bryant
NRC Resident Inspector
Oconee Nuclear Station

ATTACHMENT

Safety Review of Steam Generator Tube Sleeving for Oconee Nuclear Station

This report summarizes a review of the Oconee Nuclear Station accident analysis to document the impact on plant safety of sleeving five thousand (5,000) tubes per steam generator.

Steam generator sleeving has been shown to be an effective means of repairing degraded steam generator tubes. By sleeving the tube rather than plugging, the tube remains in service and continues to be used to transfer energy from the primary to secondary system. The sleeved tube performs as well mechanically as an unsleeved tube and does not significantly increase the probability or consequences of accidents previously analyzed and does not create the chance for a new event that is not already bounded by the licensing analysis. However, the sleeved tube will not transfer energy as efficiently as an unsleeved tube. Thus, the sleeving will result in a slight reduction in heat transfer in the steam generator and a small increase in the primary side pressure drop through the steam generator due to the smaller tube diameters in the sleeved tubes.

As discussed in Reference 1, the effect of sleeving 5,000 tubes in one generator is a reduction in primary flow of less than one percent and a decrease in steam superheat of approximately 7.7 F at full power. The reduction in superheat results in the need for an additional 1% full feedwater flow to remove the same amount of primary energy.

The FSAR analysis of overcooling events assumed that the feedwater flow increased during the event to increase the heat removal by the steam generator. Thus, the small increase in nominal feed/steam flow does not impact the safety analysis of the Oconee units since the heat removal rates calculated for these events are conservative.

For overheating events, the heat transfer in the steam generator is either left at the nominal value, which will not change due to tube sleeving, or is reduced dramatically for events such as a loss of main feedwater. The slight reduction in heat transfer coefficient along the sleeve will not impact these assumptions since the plant is in a steady-state heat transfer condition prior to the event.

Other events analyzed in the FSAR which do not fall into one of the above categories are not affected at all since the assumption on steam generator heat removal does not change.

The effectiveness of AFW cooling will be decreased somewhat due to the insertion of sleeves. The effect will be that the heat removal will occur at a lower elevation in the steam generator, thus slightly lowering the thermal center of the generator. This will not significantly affect the ability of the generator to operate in natural circulation or boiler condenser modes of cooling.

A decrease in primary system flow has been evaluated previously for TMI-1 under a task to evaluate plugging up to a total of 3,000 steam generator tubes. The evaluation summarized in Reference 2, concluded that the primary system flow would be reduced by approximately 2.5%. This reduction is larger than that for the tube sleeving under review in this instance. The conclusions of the TMI-1 review indicated sufficient design margins exist to allow full power operation with the large number of tubes plugged. However, to assure that the plant safety analysis remains bounding, it is required to measure primary system flow at the beginning of each fuel cycle and demonstrate that the actual flow is in excess of the flow rate assumed in the analysis. As long as the minimum flow rate is met, the plant safety analysis remains valid. Duke Power will measure primary flow each fuel cycle to ensure the minimum flow used in design calculations exists. This verification will ensure that the safety analysis calculations for the Oconee units remains bounding.

In conclusion, since the plant safety analysis calculations bound the expected plant conditions with respect to steam generator heat transfer and primary system flow rate, up to 5,000 tubes per steam generator may be sleeved at the Oconee units without invalidating the existing analysis basis of the units.

References:

- (1) BAW-1832P Rev. 1 "Once-through Steam Generator Mechanical Sleeve Qualification", Babcock & Wilcox, Lynchburg, Virginia, November, 1985.
- (2) B&W Document Number 86-1130560-00 "Effect of Plugging OTSG Tubes", Babcock & Wilcox, Lynchburg, Virginia, January, 1982.