



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

ENCLOSURE

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

ACTIONS PERTAINING TO STEAM GENERATOR TUBES AND PLUGS

VIRGINIA ELECTRIC AND POWER COMPANY

NORTH ANNA UNIT 1

DOCKET NO. 50-338

1.0 INTRODUCTION

Letters dated May 5, May 19, and May 28, 1989 from Virginia Electric and Power Company (the licensee) described actions taken during the current refueling outage to resolve problems experienced with the North Anna Unit 1 steam generators. The May 19, 1989 letter reported that the results of steam generator (S/G) tube inspections performed during the current refueling outage were Category C-3 as defined in the plant Technical Specifications (TS). In accordance with Table 4.4-1 of the TS, the licensee has requested NRC approval to return to power operation based on information provided in the May 5 and May 19, 1989 letters.

The May 5 and May 28, 1989 letters described corrective actions taken to resolve problems experienced with Westinghouse mechanical S/G tube plugs. These actions follow the plug failure event at North Anna Unit 1 which occurred on February 25, 1989 during a feedwater isolation transient. The May 28, 1989 letter includes the licensee's formal response to NRC Bulletin 89-01, "Failure of Westinghouse Mechanical Steam Generator Tube Plugs." The NRC bulletin requests specific actions by licensees to ensure that Westinghouse mechanical plugs will continue to provide adequate assurance of reactor coolant system boundary integrity.

2.0 DISCUSSION

2.1 Steam Generator Tube Inspections

Eddy current test (ECT) inspection of the S/G tubes revealed that greater than 1% of the tubes in each of the three S/Gs contained pluggable indications. Thus, the inspection results for each S/G were Category C-3 as defined in the TS. The scope of the inspection included a 100% sample inspection in all S/Gs with a standard bobbin coil over the full tube length. As a screening inspection for circumferential cracks which have been previously observed at the tube expansion transition regions, the bobbin coil inspections were supplemented by 8 x 1 coil inspections in all tubes on the hot leg side through the first support plate in S/Gs A and B and through the seventh support plate for S/G C. The bobbin coil and 8 x 1 coil inspections were further supplemented by rotating pancake coil (RPC) inspections. The RPC offers improved sensitivity to axial and circumferential cracks compared to the bobbin coil and 8 x 1 coil, particularly in the

presence of discontinuities such as dents, expansion transitions, and U-bends. The RPC probe was used to better characterize distorted and possible indications found with the bobbin and 8 x 1 coil inspections. All row 2 U-bends were also inspected with the RPC probe.

The number and type of indications found were generally consistent with what was found during previous inspections. The bulk of these indications involved stress corrosion cracking at the support plates (107 tubes) and circumferential cracking at the tube expansion transitions (28 tubes). A total of 145 tubes were plugged.

The staff believes that the scope and type of inspections performed provide reasonable assurance that all tubes remaining in service currently have adequate integrity to sustain the full range of normal operating and postulated accident loadings. Thus, the staff concludes there is an adequate basis to support plant restart. However, the staff is continuing to review the tube integrity implications of stress corrosion cracks which may develop before the end of the upcoming fuel cycle. This review is being performed to ensure there is adequate justification to operate until the next refueling outage before performing the next steam generator inspection.

2.2 Steam Generator Mechanical Plug Issue

The licensee's May 28, 1989 submittal provides a comprehensive summary of S/G mechanical plug actions taken at each of its facilities including North Anna Unit 1. Since 1979 and prior to the current outage, 1251 mechanical plugs have been installed at North Anna Unit 1. All of these plugs were supplied by Westinghouse with the exception of about 28 plugs which were supplied by Babcock & Wilcox (B&W).

In response to requested Action No. 1 in Bulletin 89-01, the licensee has verified and corrected information in WCAP-12244, Revision 1, concerning plugs fabricated from heats NX3279, NX3513, NX3962, and NX4523 which are installed at North Anna Unit 1.

During the current outage, the licensee fully implemented the actions requested by Items 2 and 4 of the bulletin (Item 3 does not apply to North Anna Unit 1). Plug lifetime estimates have been performed for all plugs fabricated from the subject heats. Based on these lifetime estimates, remedial actions in the form of plug replacement or plug repair (using the plug-in-plug technique described in WCAP-12244, Revision 1) have been performed for all hot leg plugs fabricated from the subject heats, with the exception of "sentinel-related" plugs as defined in the bulletin. Item 4 of the bulletin states that remedial actions for sentinel-related plugs may be deferred until the next refueling outage. Cold leg plugs from the subject heats are estimated to have sufficient remaining lifetime to cover the next 5 fuel cycles.

The licensee also implemented remedial actions for 6 Westinghouse plugs installed in 1979 as a conservative measure since the heat number and microstructure of these plugs is unknown. In all, remedial actions were implemented for a total of 437 plugs during the current outage. The 28 B&W plugs are fabricated from a heat of material which B&W has determined does not exhibit a susceptible microstructure, and thus these plugs remain in service.

The actions requested in Items 2 and 4 of the bulletin are applicable to future as well as the current refueling outage. The licensee stated in its May 28, 1989 letter that a long-term plan will be developed before the next refueling outage to deal with plugs that will at some future time experience degradation. The licensee further stated that its long-term plan will deal with the sentinel plugs at the next refueling outage. As point of clarification and consistent with the Reporting Requirements as stated in the bulletin, it is the staff's understanding that the licensee's long-term plan will be performed consistent with the actions requested by the bulletin, Items 2 and 4, unless the licensee submits proposed alternative actions with supporting justification.

3.0 CONCLUSIONS

The steam generator tube inspection program conducted during the current outage provides an adequate basis to support plant restart. As discussed in Section 2.1, however, the staff is still evaluating whether there is adequate justification to operate until the next refueling outage before performing the next steam generator inspection.

Actions taken with respect to Westinghouse mechanical plugs are concluded by the staff to be acceptable and consistent with the actions requested by Bulletin 89-01 subject to the following clarification. It is the staff's interpretation of the licensee's May 28, 1989 letter that its long-term program with respect to Westinghouse mechanical plugs will be consistent with Items 2 and 4 of the actions requested by the bulletin unless proposed alternative actions are submitted with supporting justification.

Dated: June 28, 1989

Principal Contributor:

E. Murphy