

August 3, 1999

FOR: The Commissioners

FROM: William D. Travers /s/  
Executive Director for Operations

SUBJECT: ELECTROSLEEVE AMENDMENT ISSUED TO UNION ELECTRIC COMPANY FOR CALLAWAY PLANT, UNIT 1

**PURPOSE:**

To inform the Commission regarding the status of issues related to risk informed decision making that were raised during the staff's review of a license amendment approving the Electrosleeve steam generator tube repair method for the Union Electric Company (UE) Callaway Plant, Unit 1.

**BACKGROUND:**

The Electrosleeve is a nano-crystalline nickel sleeve that is electrochemically deposited on the inner surface of a steam generator tube. The Electrosleeve is a proprietary process designed to span a known flaw in the steam generator tube and to function as the pressure boundary. Framatome Technologies, Incorporated (FTI), obtained under license and further developed the Electrosleeving process and characterized the material properties by analysis and testing. The results are documented in a proprietary FTI topical report. On April 12, 1996, UE submitted an amendment application, with the subject topical report, and requested that the staff approve the Electrosleeve steam generator tube repair method for Callaway Plant, Unit 1. UE is the first licensee to request approval of the Electrosleeve repair method. UE plans to use ultrasonic testing (UT) to periodically verify that degradation is detected and structural integrity is maintained for all types of service-induced degradation. The staff approved the amendment for Callaway Plant with a two-cycle limitation while UE develops an acceptable method to monitor the continued integrity of the Electrosleeves during operation.

During the review of the amendment application, the staff identified a concern with the Electrosleeve performance during beyond-design-basis severe accident conditions. This issue raised a number of policy, process, and technical questions associated with risk-informed regulatory approaches. For Callaway Plant, the staff determined that the severe accident concern did not warrant additional restrictions on the amendment application. Therefore, the staff approved and issued this amendment on May 24, 1999, with a two-cycle limit associated with UT qualification. However, the staff was not unified in reaching this conclusion. The staff expects, during the next two operating cycles, UE and FTI to complete qualification of the UT technique and submit an amendment application requesting that the staff remove the two-cycle limitation.

**DISCUSSION:**

Except for the UT qualification issue, the staff determined that the Electrosleeve steam generator repair method meets the Callaway Plant design and licensing basis. However, late in the review, the staff identified a concern regarding the performance of Electrosleeves during certain beyond-design-basis severe accident conditions. Specifically, the staff identified that the Electrosleeve material would weaken during high-temperature severe accident scenarios as a result of grain growth in the Electrosleeve material. The severe accident scenarios in question are characterized by high primary side pressure and a depressurized and dry secondary side.

UE's amendment request to use Electrosleeves for steam generator tube repair was not a risk-informed submittal (per Regulatory Guide 1.174), and hence did not address the risk issues raised by the staff. Moreover, the licensee reaffirmed that its submittal was not risk informed, and requested the staff reach its conclusions solely on the plant's ability to meet the current design basis.

To assess the risk issue, the staff investigated the expected frequency of these severe accidents for Callaway Plant. The staff reviewed the Callaway Plant Probabilistic Safety Assessment developed in response to [Generic Letter 88-20](#) and other risk information provided by UE in response to the staff's concern. The staff determined that the frequency of high-dry severe accident scenarios that would challenge Callaway Plant Electrosleeved steam generator tubes was in the low- to mid-10E-6-per-year range.

RES sponsored modeling and testing of Electrosleeved repaired tubes with flaws under severe accident time-temperature profiles to determine their expected behavior. The time-temperature profiles were based on a RES evaluation of the appropriate boundary conditions based on detailed severe accident thermal hydraulic analysis. The results indicated that for some flaws under certain severe accident conditions, the Electrosleeved repaired and degraded Inconel tubes may fail before other reactor coolant system (RCS) components located in the containment, resulting in containment bypass. However, the staff recognized that a better understanding of uncertainties would benefit the characterization of severe accident thermal-hydraulic modeling and the expected time-to-failure of Electrosleeved tubes as compared to other RCS components inside containment.

In issuing the amendment, the staff considered both the Callaway plant-specific frequency of severe accidents that would challenge Electrosleeves and the Electrosleeve modeling and test results. As stated above, the Callaway plant-specific frequency of high-dry severe accident scenarios that could challenge Callaway Plant Electrosleeved steam generator tubes was determined to be in the low- to mid-10E-6-per-year range. Although the licensee's submittal was not risk-informed, using the guidance in Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," the delta-LERF (large early release frequency) estimated by the staff was such that the amendment received increased senior management attention.

With regard to the Electrosleeve modeling and test results, although there was some information that suggested concerns with respect to the

comparative time-to-failure of Electrosleeved tubes under severe accident conditions, the staff concluded that this information was not sufficiently developed at this time to support imposition of limitations on the amendment arising from a risk-informed perspective. In considering the need to further develop this information, the staff determined the Callaway plant-specific frequency of high-dry severe accident scenarios that could challenge Electrosleeved steam generator tubes to be sufficiently low such that the amendment should be issued.

The staff was not unified in reaching this conclusion. Some managers and staff hold the view that from a risk-informed perspective, Electrosleeve installation should be limited to flaws of a certain length in the freespan of steam generator tubes in order to reduce the likelihood of steam generator tube failure prior to other RCS components. Others concluded that a sufficient basis existed to approve the amendment without any restrictions. The varying technical perspectives resulted from different interpretations of the uncertainty associated with available information on the severe accident conditions of interest and response of various RCS components.

From a broader perspective, the technical issues that arose highlighted the need for clear policy and process guidance on how to deal with proposed license amendments that are not risk-informed, satisfy existing design and licensing bases, but introduce new potential risks. In issuing the amendment, the staff informed UE that the staff's review of this amendment highlighted the need to further evaluate and develop staff guidance for risk-informed regulatory decisionmaking. The need for this guidance was previously transmitted to the Commission in [SECY-98-300](#). The staff plans to submit a paper to the Commission by September 30, 1999, consistent with the schedule contained in the [SRM for SECY 98-300](#), that provides additional guidance to clarify the staff authority for applying risk-informed processes in regulatory activities beyond risk-informed licensing actions. The paper will propose an interim position as to how the staff intends to proceed with similar reviews until these policy and process issues are resolved. Also, the staff is continuing dialogue with FTI to address, on a generic basis, the issues associated with electrosleeving, and the staff is pursuing further technical refinement of severe accident phenomena modeling to support future risk informed decisions.

COORDINATION:

This paper was coordinated with RES and OGC. OGC has no legal objection to this paper.

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