September 13, 2002

Mr. Garry L. Randolph
Vice President and Chief Nuclear Officer
Union Electric Company
Post Office Box 620
Fulton, MO 65251

SUBJECT: CALLAWAY PLANT, UNIT 1 - ISSUANCE OF AMENDMENT RE: STEAM GENERATOR ELECTROSLEEVE™ TUBE SURVEILLANCE PROGRAM (TAC NO. MB1214)

Dear Mr. Randolph:

The Commission has issued the enclosed Amendment No. 153 to Facility Operating License No. NPF-30 for the Callaway Plant, Unit 1. The amendment consists of changes to the Technical Specifications (TSs) in response to your application dated February 15, 2001 (ULNRC-4391), as supplemented by letters dated April 20 and November 7, 2001, and March 1 and August 5, 2002 (ULNRC-4457, -4558, -4617, and -4705, respectively).

The amendment revises paragraph d.1.j) 2) of Technical Specification (TS) 5.5.9, "Steam Generator (SG) Tube Surveillance Program," to (1) delete the requirement that all SG tubes containing an Electrosleeve™, a Framatome proprietary process, be removed from service within two operating cycles following installation of the first Electrosleeve™; (2) add the requirement that Electrosleeves™ will not be installed in the outermost periphery tubes of the SG bundles where potentially locked tubes would cause high axial loads; (3) revise the references describing electrosleeving; and (4) add the requirement that all sleeves with detected inside diameter flaw indications will be removed from service upon detection.

Two meetings were held between your staff and the NRC on June 7 and September 26 and 27, 2001, to discuss the proposed amendment. The NRC issued summaries of the meetings on July 18 and October 16, 2001, respectively.

As addressed in the enclosed safety evaluation and as a condition of this amendment, if the current SGs with Electrosleeved™ tubes remain in service past refueling outage (RO) 14, you have agreed to either plug all the Electrosleeved™ tubes in the SGs in RO14 or implement a time-based Electrosleeve™ tube pull program for the SGs which has been approved by the NRC. In addition, if an Electrosleeve™ tube pull is performed, you have agreed to provide the results of the tube examination to the NRC staff within 60 days of when the final results of the examination become available to Union Electric Company.

In the letters of February 15 and November 7, 2001, you submitted what was stated in the letters to be proprietary information. In response to the affidavits, the NRC issued letters dated September 7, 2001, and May 23, 2002, stating that the proprietary information submitted in the letters will be withheld from the public in accordance with 10 CFR 2.790.

A copy of the related Safety Evaluation (SE) is also enclosed. The Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

Pursuant to 10 CFR 2.790, we have determined that the enclosed SE does not contain proprietary information. However, we will delay placing the SE in the public document room for a period of ten (10) working days from the date of this letter to provide you with the opportunity to comment on the proprietary aspects of the SE.* If you believe that any information in the SE is proprietary, please identify this as soon as reasonably possible by e-mail to me through the internet at jnd@nrc.gov, and follow the e-mail by a letter that identifies such information line by line and defines the basis pursuant to the criteria of 10 CFR 2.790.

Sincerely,

/RA/

Jack Donohew, Senior Project Manager, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-483

Enclosures: 1. Amendment No. 153 to NPF-30
2. Safety Evaluation

cc w/encls: See next page

*The licensee responded to the request in paragraph 7 of this letter by e-mail dated September 17, 2002, stating that Framatome ANP had reviewed the Safety Evaluation and Framatome ANP had determined that the Safety Evaluation contained no proprietary information (ADAMS Accession No. ML022620721).

A copy of the related Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

Pursuant to 10 CFR 2.790, we have determined that the enclosed SE does not contain proprietary information. However, we will delay placing the SE in the public document room for a period of ten (10) working days from the date of this letter to provide you with the opportunity to comment on the proprietary aspects of the SE. If you believe that any information in the SE is proprietary, please identify this as soon as reasonably possible by e-mail to me through the internet at jnd@nrc.gov, and follow the e-mail by a letter that identifies such information line by line and defines the basis pursuant to the criteria of 10 CFR 2.790.

Sincerely,

/RA/

Jack Donohew, Senior Project Manager, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-483

Enclosures: 1. Amendment No. 153 to NPF-30
2. Safety Evaluation

cc w/encls: See next page

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* See previous concurrence PKG: ML022680755
ACCESSION NO.: ML022140230 TS: ML022680629 NRR-058

OFFICE	PDIV-2/PM	PDIV-2/LA	EMCB/SC	OGC	PDIV-2/SC
NAME	JDonohew:sp	EPeyton	LLund*	RWeisman*	SDembek
DATE	9/11/2002	9/12/02	08/21/2002	09/11/2002	9/12/02

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cc:
Professional Nuclear
Consulting, Inc.
19041 Raines Drive
Derwood, MD 20855

John O'Neill, Esq.
Shaw, Pittman, Potts & Trowbridge
2300 N. Street, N.W.
Washington, D.C. 20037

Mr. Mark A. Reidmeyer, Regional
Regulatory Affairs Supervisor
Regulatory Affairs
AmerenUE
Post Office Box 620
Fulton, MO 65251

U.S. Nuclear Regulatory Commission
Resident Inspector Office
8201 NRC Road
Steedman, MO 65077-1302

Mr. J. V. Laux, Manager
Quality Assurance
AmerenUE
Post Office Box 620
Fulton, MO 65251

Manager - Electric Department
Missouri Public Service Commission
301 W. High
Post Office Box 360
Jefferson City, MO 65102

Regional Administrator, Region IV
U.S. Nuclear Regulatory Commission
Harris Tower & Pavilion
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-8064

Mr. Ronald A. Kucera, Deputy Director
for Public Policy
Department of Natural Resources
205 Jefferson Street
Jefferson City, MO 65101

Mr. Otto L. Maynard
President and Chief Executive Officer
Wolf Creek Nuclear Operating Corporation
Post Office Box 411
Burlington, KA 66839

Mr. Dan I. Bolef, President
Kay Drey, Representative
Board of Directors Coalition
for the Environment
6267 Delmar Boulevard
University City, MO 63130

Mr. Lee Fritz
Presiding Commissioner
Callaway County Court House
10 East Fifth Street
Fulton, MO 65151

Mr. David E. Shafer
Superintendent Licensing
Regulatory Affairs
AmerenUE
Post Office Box 66149, MC 470
St. Louis, MO 63166-6149

Mr. John D. Blosser, Manager
Regulatory Affairs
AmerenUE
P.O. Box 620
Fulton, MO 65251

Mr. Gary McNutt, Director
Section for Environmental Public Health
P. O. Box 570
Jefferson City, Missouri 65102-0570

UNION ELECTRIC COMPANY

CALLAWAY PLANT, UNIT 1

DOCKET NO. 50-483

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No.153
License No. NPF-30

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Union Electric Company (UE, the licensee) dated February 15, 2001, as supplemented by letters dated April 20 and November 7, 2001, and March 1 and August 5, 2002, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and paragraph 2.C.(2) of Facility Operating License No. NPF-30 is hereby amended to read as follows:

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 153 and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. As stated in the licensee's letter of August 5, 2002, upon implementation of this amendment, if for any reason the current steam generators are not replaced in Refuel 14, the licensee will plug all of the Electrosleeved™ tubes or implement a time-based tube pull program which has been approved by NRC by license amendment.

4. This amendment is effective as of its date of issuance and shall be implemented within 60 days of the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA by Robert A. Gramm for/
Stephen Dembek, Chief, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: September 13, 2002

ATTACHMENT TO LICENSE AMENDMENT NO. 153

FACILITY OPERATING LICENSE NO. NPF-30

DOCKET NO. 50-483

Replace the following page of the Appendix A Technical Specifications with the attached revised page. The revised page is identified by amendment number and contains vertical lines indicating the areas of change.

REMOVE	INSERT
5.0-15	5.0-15

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 153 TO FACILITY OPERATING LICENSE NO. NPF-30

UNION ELECTRIC COMPANY

CALLAWAY PLANT, UNIT 1

DOCKET NO. 50-483

1.0 INTRODUCTION

By application dated February 15, 2001, as supplemented by letters dated April 20 and November 7, 2001, and March 1 and August 5, 2002, Union Electric Company (the licensee) requested changes to the Technical Specifications (TSs, Appendix A to Facility Operating License No. NPF-30) for the Callaway Plant, Unit 1 (Callaway). The proposed amendment would revise TS 5.5.9, "Steam Generator (SG) Tube Surveillance Program," to remove the 2-cycle operating limit on the use of the Electrosleeve™ process to repair degraded SG tubes. The licensee's request is to allow continued operation of the plant with the installed Electrosleeve™ tubes.

The request is supported by a topical report prepared by Framatome Technologies, Inc. (FTI), submitted by the licensee, "Electrosleeving™ Qualification for PWR Recirculating Steam Generator Tube Repair," BAW-10219P, Revision 4. The supplemental letters dated November 7, 2001, and March 1, 2002, provided responses to requests for additional information (RAIs) from the NRC staff. To expedite the review, the RAIs were given to the licensee in two e-mails (documented in ADAMS Accession Nos. ML012050096 and ML012390331) and in a conference call on February 19, 2002.

Two meetings between the licensee and the NRC were held on June 7, and September 26 and 27, 2001, to discuss the proposed amendment. The NRC issued summaries of the meetings on July 18 and October 16, 2001, respectively.

The supplemental letter of August 5, 2002, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the NRC staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on May 14, 2002 (67 FR 34494).

2.0 BACKGROUND

The NRC approved changes to the Callaway TSs in License Amendment No. 132, dated May 21, 1999, to allow the use of the new Electrosleeve™ technology for the repair of degraded SG tubes for two operating cycles. The safety evaluation for Amendment No. 132 addressed

and accepted the following issues: Electrosleeve™ description, process description and installation procedures, material properties, corrosion evaluation, structural evaluation, non-destructive evaluation (NDE), flaw growth, plugging limits, leakage integrity, and quality assurance. However, Amendment No. 132 contained a requirement that all Electrosleeve™ tubes will be removed from service within two operating cycles following the installation of the first Electrosleeve™ tube. The proposed amendment is to remove this requirement.

The licensee first installed 57 Electrosleeve™ tubes in two of its steam generators in Refueling Outage No. 10 (RF10), which was conducted in the Fall of 1999. Therefore, the two-cycle operating limit in TS 5.5.6 began with that refueling outage. The first inspection of these tubes was conducted by the licensee in RF11, in the Spring of 2001. No new Electrosleeve™ tubes were installed in RF11.

The Electrosleeve™ tube repair process is a structural nickel plating applied to the inside of a degraded SG tube to form a tube sleeve. Electrosleeve™ is the trademark name for the proprietary nickel plating technique for tube sleeving developed by Ontario Hydro Technologies (OHT). It is marketed for commercial use in the United States by FTI. The intent of the repair is to install sleeves that would remain in service for the remaining life of the SGs. For Amendment No. 132, the technical basis and qualification for the Electrosleeve™ repair process were provided by the licensee in the Topical Report BAW-10219P, Revision 3.

Amendment No. 132 specified in TS 5.5.9 that all Electrosleeve™ tubes shall be removed from the SGs two cycles after the outage in which these tubes were first installed at Callaway. The remaining open issues that needed to be resolved were discussed in the safety evaluation for Amendment No. 132. These issues are addressed in the following section.

3.0 EVALUATION

In the evaluation of the licensee's proposed amendment, the open issues that need to be resolved to remove the 2-cycle operating limit for Electrosleeve™ tubes are addressed in Section 3.1 and the proposed changes to the TSs are addressed in Section 3.2.

3.1 Electrosleeve™ Tubes Open Issues

In the safety evaluation for Amendment No. 132, there was a section entitled "Future Considerations." In this section, the NRC staff discussed the issues that needed to be addressed by the licensee to remove the 2-cycle limitation on the Electrosleeve™ tubes. The issues, and the sections they are addressed in, are the following:

- Detecting and Depth-Sizing Stress Corrosion Cracks (SCCs) (Section 3.1.1)
- Ultrasonic Testing (UT) Inspections From One Direction (Section 3.1.2)
- Tube Pull Program (Section 3.1.3)
- Inspection of Dented Intersections (Section 3.1.4)
- Additional UT Data on Pits and Disbonds (Section 3.1.5)
- Effect of Honing on the Electrosleeve™ (Section 3.1.6)
- UT Procedures and Peer Review Report (Section 3.1.7)
- Tube Exclusion Criteria for Electrosleeving™ (Section 3.1.8)

The NRC staff had concerns regarding the UT technique's ability to reliably depth size stress corrosion cracks. Despite the relatively reasonable UT uncertainty for the SCC data set, a review of the data supporting the UT uncertainty for the previous safety evaluation revealed significant under-call errors when assessing the deepest flaws in the data set. Therefore, in Amendment No. 132, the NRC staff could not conclude that the UT technique could reliably depth size SCCs to ensure that SG structural limits were maintained.

The licensee's resolutions of the outstanding issues are presented below.

3.1.1 Detecting and Depth-Sizing Stress Corrosion Cracks

As stated in BAW-10219P, Revision 4, the inspection technique used to evaluate the performance of the Electrosleeve™ tube must provide a means to determine the sleeve thickness, the position of the sleeve relative to the intended repair location, the presence of the sleeve-to-tube bond, quality of the sleeve installation, and the depth/extent of flaws in the parent tube. Based on an earlier program to develop and evaluate techniques for examination of the Electrosleeve™ tube, UT was chosen by the licensee to perform these functions. Based on the NRC staff's previous review of the Electrosleeve™ qualification data sets for Amendment No. 132, additional information was still needed to address questions by the NRC staff that arose about the qualification of the UT for detecting and sizing stress corrosion cracks, both in the parent tube and the Electrosleeve™ tube.

In the information submitted for the Electrosleeve™ process in Amendment No. 132, the licensee had attempted to qualify UT to depth size all tube/sleeve flaw types (i.e., pitting, thinning and stress corrosion cracks), but had not proven to the NRC staff that the UT inspection technique was qualified to reliably depth size SCCs. Specifically, for Amendment No. 132, the licensee had not proven that a safety significant flaw would not be undersized by UT.

For the proposed amendment, the licensee has provided new SCC qualification data sets in Revision 4 to BAW-10219P. The new data sets in Section 11.0 were used for qualification as specified in Appendix J of the Electric Power Research Institute's (EPRI's) Pressurized Water Reactor Steam Generator Examination Guidelines, Revision 5. In the February 15, 2001, submittal, the licensee stated that neither the seven undersized flaws, nor the Salem pulled tube data that were used for the initial qualification were subsequently used for the EPRI Appendix J qualification. The early samples were used to develop understanding of the problems experienced during early UT technique testing in order to aid the development of improved methods, but were destructively examined prior to the EPRI Appendix J qualification. These improved methods were then used for the subsequent EPRI Appendix J qualification.

The goal of the EPRI Appendix J qualification was to demonstrate that the combination of three depth sizing techniques used in the procedures could accurately determine the crack depth of penetration with an accuracy that would support the sleeve degradation repair limit. Multiple analysts evaluated the data sets, which was a more rigorous test of the analysis procedures than the single analyst approach used in a typical EPRI Appendix J qualification. This approach incorporated the analyst variability in the statistical determination of the error and confidence

level. Because all error determinations were computed using destructive evaluation results, this

was a true test of the analyst variability from the actual crack measurement. Therefore, the non-destructive uncertainty determined from the qualifications reflected the system (i.e., technique and analyst) variability.

Various longitudinal wave UT procedures were qualified by peer reviews. Procedures were qualified for sleeve positioning, sleeve-to-tube bonding, sleeve thickness, sleeve inside diameter (ID) pitting, sleeve outside diameter (OD) pitting, parent tube cracking, and parent tube volumetric wall reduction. The EPRI Appendix J reviews evaluated the data set, analysis of the data, destructive examination documentation, and the procedures and found the sample sets to be an adequate basis for the qualification. The licensee evaluated the flaw extents observed at Callaway, and concluded that the flaws in the Electrosleeve™ parent tubes were at the smaller end of the range of extent of the axial and circumferential flaws in the qualification data sets. The licensee believes that the qualification samples provide ample margin to envelope the potential flaw growth in the parent SG tubes at Callaway.

The Electrosleeve™ tubes installed at Callaway have been at the top of the tube sheet. Structurally significant flaw lengths and depths were selected for the qualification sample sets to span the expected structural limits. Top-of-the-tube sheet expansion transition samples and dented samples were used as a method of including axial and circumferential outside diameter stress corrosion cracking (ODSCC) in the data sets. The axial cracks had extents and depths of sufficient length and mix to meet the standards of the EPRI Appendix J qualification. Results from the qualification produced acceptably low average errors and standard deviations for the pre-sleeve data and the post-sleeve data.

However, the NRC staff had raised concerns before Amendment No. 132 was approved that the licensee had not proven that UT had been qualified to depth size all tube/sleeve flaw types (i.e., pitting, thinning, and SCC). These concerns continued through the current NRC staff review, and were the focus of many of the RAI questions. Although the data sets contained pits in the sleeves, the data sets only contained cracks that would be initiated in the parent tube and not in the sleeves. The licensee's rationale for putting together the data sets was that it had concluded that primary water stress corrosion cracking (PWSCC) or ODSCC in the Electrosleeve™ tube would be very unlikely, based on foreign operating experience with material similar to the Electrosleeve™ material and laboratory corrosion studies with the Electrosleeve™ material. Thus, the licensee's NDE program, according to the licensee, did not need to contain procedures to evaluate SCC in the Electrosleeve™ tube. In addition, the licensee had encountered difficulty in cracking the Electrosleeve™ material in the laboratory, and had not been able to easily simulate cracking by growing fatigue cracks in the material because the material was resistant to fatigue cracking unless an electrode discharge machining (EDM) notch was used to begin the crack. Because EDM notches provide such an easy target for detection, having EDM notches in the samples obscured the technique's capability of detecting the presence of the much tighter fatigue cracks.

Nonetheless, the NRC staff believed that the licensee's NDE program should be capable of detecting flaws in Electrosleeve™ tubes, and requested additional information from the licensee to support this capability. In the letter dated November 7, 2001, the licensee presented three supporting arguments. The first argument was based on the sensitivity of the system to the inner diameter EDM notches in a calibration standard. The second argument was based on the

sensitivity of the UT signals to shallow ODSCC, and an inference that the PWSCC amplitude would be present in the UT reflection (i.e., skips) and therefore detected. The final argument was based on the capability of the system to detect PWSCC and ODSCC in the parent tube material.

The NRC staff requested that the licensee provide additional data to support its ability to detect flaws on the ID of the Electrosleeve™ tube particularly with respect to the licensee's second argument that if an ODSCC signal were to produce sufficient reflective energy for detection at 1 ½ skips, a PWSCC crack of equivalent depth would be expected to produce sufficient reflective energy for detection at the full skip. This information was provided by the licensee's letter dated March 1, 2002. Without having any experience with degradation of the Electrosleeve™ material, the arguments presented by the licensee provide logical and reasonable support as to the effectiveness of the licensee's inspection process to detect flaws initiating from the ID of the Electrosleeve™ tube.

The licensee also stated that they only need to detect, not size, ID flaws in the Electrosleeve™ tube, because the tubes would be plugged upon detection of ID flaws in the Electrosleeve™ tube. The licensee expects that there would be a high probability that any ID flaw detected in the Electrosleeve™ tube would probably be a pit, and for plugging purposes the depth of the ID pit is assumed to be 100% of the sleeve wall by definition. The licensee stated that the current wording in the TSs was intended to require that all sleeve ID flaws at Callaway be plugged, but have revised the wording in the TSs as part of the proposed amendment to clarify that all Electrosleeve™ tubes with ID indications will be plugged.

The licensee provided details of their UT examination of the installed Electrosleeve™ tubes after one cycle of service. The UT inspections of the tubes were done in RO11. The licensee stated that there were no detectable changes in sleeve thickness, no changes in extent or depth of parent tube indications identified in the previous refueling outage, and no new indications identified in the current outage in either the parent tube or Electrosleeve™ tube.

The NRC staff finds the licensee's approach for detecting and depth sizing SCC reasonable given the licensee's commitments to pull a tube based upon finding degradation in the Electrosleeve™ tubes and plug all Electrosleeve™ tubes found with ID degradation as discussed above, and to replace the SGs during RO14 as discussed in Section 3.1.3 below.

3.1.2 UT Inspections From One Direction

The NRC staff was concerned that UT examinations were only performed from one direction instead of both directions. The NRC staff had requested additional information to support the licensee's contention that UT inspection results would not improve if UT examinations were performed from two directions. FTI supported this contention by examining a sample set containing 20 axial and 19 circumferential cracks before and after the application of a structural Electrosleeve™ repair on Alloy 600 tubes with expansion transitions. The samples were examined in both scan directions for each process step, and no statistical difference resulted from the use of different scan directions. Therefore, the EPRI Appendix J qualification presented the forward scan data only.

The NRC staff finds this acceptable based on the results of the tests performed to evaluate the effects of UT inspections from one direction as discussed above.

3.1.3 Tube Pull Program

The NRC staff had requested in Amendment No. 132 that the licensee propose a tube pull program that is both condition-based and time-based. The condition-based aspect would require a tube pull if NDE provides an indication that Electrosleeve™ degradation is occurring in the SGs. The time-based aspect establishes periodic tube pulls performed over the life of the plant SGs with Electrosleeve™ tubes for assurance that sleeve degradation that is not being detected or correctly sized by NDE is not occurring. The time-based program would continue until experience indicated that this assurance was no longer needed.

For Amendment No. 132, the licensee proposed a time-based program that required one tube to be pulled at any U.S. plant having Electrosleeve™ tubes at the end of five effective full power years (EFPYs) of operation and, if an Electrosleeve™ tube was pulled based on tube degradation at any plant in the five EFPYs, then that tube fulfilled the tube pull requirement for the time-based program at Callaway. The NRC staff concluded in Amendment No. 132 that one tube pulled was an inadequate number of tube pulls to assure the integrity of the remaining sleeves; however, tubes pulled for Electrosleeve™ degradation would count for those needed for the time-based program.

The NRC staff's concerns, which prompted the request for a tube pull program, were the following: some weaknesses in the UT qualification data, and lack of experience with nanocrystalline nickel material in the SGs, especially as it remains in-service over a long period of time. The licensee's time-based program for Amendment No. 132 did not address the NRC staff's concerns. The staff believes that five EFPYs is a reasonable time for the first time-based tube pull, but pulling only one tube is not a sufficient number to assure that Electrosleeve™ degradation is being detected and correctly sized by NDE. The NRC staff stated in Amendment No. 132 that the licensee's proposal for a time-based program should be revised and submitted as part of the submittal to remove the 2-cycle limitation in the amendment.

In its February 15, 2001 submittal, the licensee stated that its intention to replace its current SGs in 2005 addressed the time-based tube pull issue. The SG replacement will occur during RO14, which is the first outage following the 5 EFPYs and there is no need for a time-based tube pull program. The licensee does plan to have a condition-based tube pull program. The program would be based on detecting service-related degradation in the installed Electrosleeve™ base material and then removing a tube for destructive examination.

Based on the anticipated short length of time in service (just over 5 years) of the Electrosleeve™ tubes in the current SGs being replaced in RO14, the degradation-resistant qualities exhibited by the nanocrystalline Electrosleeve™ material, and the licensee's plans to implement a condition-based tube pull program, the NRC staff concludes that it is acceptable to not require a time-based tube pull program for the Callaway SGs. Based on this, the NRC staff requested and the licensee accepted, in its letter of August 5, 2002, a condition on the proposed amendment to address the lack of a time-based tube pull program. If the current SGs with Electrosleeve™ tubes remain in service past RO14, the licensee has agreed that it will

either plug all the Electrosleeve™ tubes in the SGs in RO14 or implement a time-based tube pull program for the SGs which has been approved by the NRC. With this agreement, the NRC staff concludes that the issue of a time-based tube pull program is resolved for the current SGs. In addition, if an Electrosleeve™ tube pull is performed by the licensee, the licensee has agreed to provide the results of the tube examination to the NRC staff within 60 days of when the final results of the examination are made available to the licensee.

3.1.4 Inspection of Dented Intersections

During its review of Amendment No. 132, the NRC staff requested that the licensee provide a discussion of the UT technique's ability to inspect dented intersections, of the limits on the size of dents that can be reliably inspected, and on the size of the dented samples used in the qualification.

For Amendment No. 132, the licensee stated that the sample set for crack depth sizing contained Alloy 600 tube expansion transitions with laboratory induced corrosion cracking and installed sleeves, which is consistent with the top-of-the tubesheet installation of the Electrosleeve™ tubes at Callaway. However, the licensee used Alloy 600 tubes with both dented tube support plate regions as well as Alloy 600 tube expansion transitions for ODSCC detection and extent sizing. In its November 7, 2001 submittal, the licensee reported an evaluation of the effects of denting on a data set used for peer review during the EPRI Appendix J qualification.

In this evaluation, the licensee compared the results of using the dented samples with results from non-dented samples, and concluded that the use of dented samples did not change the root mean square error values that were reported for the depth sizing of the cracks in these samples. Also, the licensee provided data in BAW-10219P, Revision 4, and in its November 7, 2001, submittal that summarized the capability of the technique to detect and size axial and circumferential cracks in the presence of a range of dent sizes. The results of the qualification in the topical report support the licensee's argument that the dents do not affect the ability of the technique to inspect dented intersections. In addition, the licensee stated that no denting has been observed at Callaway, and is not expected due to the use of stainless steel quatrefoil support plates, periodic chemical cleaning, and controls for secondary side chemistry.

The NRC staff finds the licensee's position that the UT technique will be able to reliably inspect dented intersections acceptable, based on the results of tests performed by the licensee to evaluate the differences in using dented samples and non-dented samples within a certain range of dent sizes. In addition, the NRC staff concludes that service-induced denting would not be likely for plants with stainless steel quatrefoil support plates, such as those used in the SGs at Callaway, based on field experience reported from plants that use these type of tube support plates in their SGs.

3.1.5 Additional UT Data on Pits and Disbonds

At a meeting on December 9, 1997, for Amendment No. 132, the licensee indicated that a peer review of the UT process and qualification identified, in part, that additional pit and disbond samples were necessary for EPRI Appendix J qualification statistical requirements. The NRC

staff requested in Amendment No. 132 that the licensee submit the UT and destructive examination results from the additional samples. This information was intended to provide additional assurances to the NRC staff that the UT errors previously assumed for sizing of pits and areas of disbond are still accurate.

The licensee stated that the UT EPRI Appendix J qualification work for the current NRC review, discussed previously in Section 3.1.1, required a demonstration that the techniques were applicable and accurate for the flaws represented in the EPRI database, which included pits. In addition, the pitting and disbond data sets used for qualification met the criteria of the EPRI Appendix J program. UT techniques to detect parent tube OD pits, sleeve OD pits, sleeve ID pits, and disbond between the parent tube and sleeve were EPRI Appendix J qualified.

The NRC staff finds the licensee's techniques for detecting pits and disbonds acceptable, based on the satisfactory results from the qualification work performed for the EPRI Appendix J qualification.

3.1.6 Effect of Honing on Electrosleeve™ Tubes

In the safety evaluation for Amendment No. 132, the NRC staff indicated that the licensee needed to address the effect of honing on the Electrosleeve™ tube. The licensee had indicated for Amendment No. 132 that contingency plans existed to permit the use of honing to improve the surface finish of the Electrosleeve™ tube. The NRC staff asked the licensee to provide a detailed process description, description of any inspection of the honing results, and applicable field checks for quality assurance and quality control (QA/QC).

During the review for Amendment No. 132, the NRC staff also asked the licensee to provide details of metallurgical tests that were conducted on honed samples to determine the effect of the honing on the nickel layer and the effect, if any, upon the corrosion resisting performance of the nickel layer. Specifically, the NRC staff asked the licensee to address the questions of whether or not the honing results in a cold worked or otherwise altered surface layer and whether this layer affects the corrosion resistance of the nickel.

For the proposed amendment, the licensee provided information on the process, inspection, quality checks, and effects of honing on the Electrosleeve™ surface in Sections 10 and 11 of BAW-10219P, Rev. 4. The licensee stated that if the tube surface prior to Electrosleeving™ was unacceptable, a honing process had been qualified using a flexible honing tool. The objective of the honing process was to improve the surface finish in order to reduce the attenuation in the UT signal to acceptable levels, with acceptable values cited. The average material removed from the surface is less than 0.0001 inch of wall thickness, with a final signal loss of less than 1 dB. Thus, the hone "deburs" the peaked finish very rapidly without significant metal removal.

The licensee stated that because the material exposed by the process is metallurgically the same as the material considered in corrosion testing performed on the Electrosleeve™ material, and the surface finish is smoother comparable to the coupon samples that were machined for the corrosion testing, the honed surface is expected to have a similar corrosion performance to the coupons used in the corrosion testing. The cold-working that would be expected from the

honing process on the tubes would be similar in magnitude to that expected from surface preparation of corrosion test specimens.

The NRC staff finds the use of the honing process for Electrosleeve™ tubes acceptable based on the correlation of the effects of the honing to the surface used in the corrosion testing performed for the Electrosleeve™ material.

3.1.7 UT Procedures and Peer Review Report

As described in BAW-10219P, Revision 4, the licensee presented the updated UT analysis procedures that had been qualified using samples for combined wall thickness, tube OD pits, sleeve OD pits, sleeve ID pits, sleeve bond/disbond areas, and ODSCC cracks. Seven EPRI Appendix J peer reviews have been completed for detection and sizing the various pre- and post-installation defect mechanisms. The licensee provided a few of the examination test specification sheets (ETSS) for NRC staff review, which contained the UT process parameters used or the UT qualification. The NRC staff concludes that the procedures are acceptable based on the ETSS sheets examined, the satisfactory performance for the EPRI Appendix J qualification, and the successful peer review of the qualification.

3.1.8 Locked Tube Exclusion Criteria for Electrosleeving™

The licensee has stated that "Union Electric will commit to not install an Electrosleeve™ in these periphery tubes near wedge supports" and that approximately 100 tubes would be excluded from the "candidate list to be Electrosleeved™." Although the statements clarified the licensee's position on the issue of tube locking, the response failed to identify which tubes would be excluded per the above noted commitment and did not provide the technical basis defining the locked tube exclusion zone. In Amendment No. 132, the NRC staff requested that the licensee provide these additional details on the exclusion of tubes due to locked tube effects, and propose specific text to incorporate exclusion requirements into the TSs for Callaway.

In its supplemental letter dated November 7, 2001, the licensee stated that no sleeves were installed within 7 tube rows/pitches of the wedge supports at Callaway. The licensee proposed to add a statement to TS 5.5.9 to prohibit the installation of Electrosleeve™ tubes in any outermost periphery tube. The NRC staff concludes that this statement clarifies the intent of the tube exclusion criteria and is acceptable.

3.2 Proposed Technical Specification Changes

In order to incorporate the proposed changes to remove the 2-cycle operating limit on the use of the Electrosleeve™ process to repair degraded steam generator tubes and for continued operation with the installed Electrosleeve™ tubes, the licensee has proposed the following changes to TS 5.5.9.j).2):

- Change the revision number of Technical Report BAW - 10219P from "Revision 3 (10/98)" to "Revision 4 (12/00)" and add the phrase to the list of documents describing electrosleeving: ", and as supplemented by the information provided by ULNRC-04558, dated November 7, 2001."

The licensee has proposed to reference the latest revision of the FTI topical report and the RAI responses submitted November 7, 2001, in the TSs to describe the Electrosleeve™ tubes installed in the SGs. Because Revision 4 of the topical report and the November 7, 2001, submittal describe the Electrosleeve™ tubes and provide additional evaluations and justifications for allowing the Electrosleeve™ tubes to remain in service, the NRC staff concludes that the proposed change is acceptable.

- Adding the sentence "... however all sleeves with detected ID flaw indications will be removed from service upon detection."

The licensee has proposed to add the requirement that Electrosleeve™ tubes showing degradation will be removed from service to clarify the intent of the 20% plugging or repair limit with regards to ID flaws in the Electrosleeve™ tubes. This requirement is discussed in Section 3.1.1 of this safety evaluation. Based on Section 3.1.1, the NRC staff concludes that the proposed change is acceptable.

- Add the following statement: Electrosleeves will not be installed in the outermost periphery tubes of the steam generator bundles where potentially locked tubes would cause high axial loads.

The basis for this change is discussed in Section 3.1.8 of this safety evaluation. Because this TS change clarifies the intent of the tube exclusion criteria for Electrosleeve™ tubes discussed in Section 3.1.8, the NRC staff concludes that the proposed change is acceptable.

- Remove the following statement that limits the use of Electrosleeve™ tubes to 2 operating cycles: "All steam generator tubes containing an Electrosleeve will be removed from service within 2 cycles following installation of the first Electrosleeve."

Based on the staff's conclusions in Sections 3.1.1 through 3.1.8 of this safety evaluation, the NRC staff concludes that the proposed change to remove the two-cycle limitation on the use of Electrosleeve™ tubes is acceptable. This conclusion is based, in part, on the replacement of the SGs in RO14 to address the lack of a time-based tube pull program for the Electrosleeve™ tubes. As stated in Section 3.1.3, if the current SGs with Electrosleeved™ tubes remain in service past RO 14, the licensee has agreed that it will either plug all the Electrosleeve™ tubes in the SGs in RO14 or implement a time-based tube pull program for the SGs which has been approved by the NRC. Because the NRC staff is relying on this statement by the licensee to address its concerns about there being no time-based tube pull program proposed by the licensee for the Electrosleeve™ tubes, the NRC staff requested and the licensee accepted, in its letter of August 5, 2002, the following condition to the amendment of the license: "Upon implementation of this amendment, if for any reason the current steam generators are not replaced in Refuel 14, the licensee will plug all of the Electrosleeve™ tubes or implement a time-based tube pull program for the Electrosleeve™ tubes which has been approved by NRC."

Therefore, if the current SGs with Electrosleeve™ tubes remain in service past RO14, the licensee has agreed that it will either plug all the Electrosleeve™ tubes in the SGs in RO14 or implement a time-based tube pull program for the SGs which has been approved by the NRC. With this condition on the Callaway operating license, the Callaway SGs will be replaced in RO14, a NRC-approved time-based tube pull program will be in effect for the Electrosleeve™ tubes in RO14, or the Electrosleeve™ tubes will be removed from service in RO14. Any of these three cases resolves the staff concerns about an appropriate time-based tube pull program for the Electrosleeve™ tubes in the current SGs. In addition, if an Electrosleeve™ tube pull is performed by the licensee, the licensee has agreed to provide the results of the tube examination to the NRC staff within 60 days of when the final results of the examination are made available to the licensee.

Therefore, based on the above, the NRC staff concludes that the proposed amendment is acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Missouri State official was notified of the proposed issuance of the amendment. The State official did not offer any comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration and there has been no public comment on such finding (67 FR 34494). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

The Commission has 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, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: Louise Lund

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