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October 27, 1998

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Washington, D. C. 20555-0001

ULNRC-03910
TAC No. M95204

Gentlemen:

CALLAWAY PLANT
DOCKET NUMBER 50-483
REVISION TO TECHNICAL SPECIFICATION 3/4.4
REACTOR COOLANT SYSTEM

References:
1) K. M. Thomas letter to G. L. Randolph dated December 18, 1998
2) B. C. Westreich letter to G. L. Randolph dated January 9, 1998
3) ULNRC-03741 dated February 24, 1998
4) S. J. Collins letter to G. L. Randolph dated May 20, 1998
5) K. M. Thomas letter dated July 16, 1998

This letter and amendment request supercedes the existing application to use electrosleeves in the Callaway Plant steam generators. This updated request to allow the use of electrosleeves on a 2 cycle basis is hereby submitted. The referenced letters and the information provided with this letter form the basis for this requested amendment.

On July 7, 1998, a meeting was held between Union Eiectric Company, Framatome Technologies, Inc. and the NRC staff to discuss the status of the proposed technical specification amendment to allow installation of electrosleeves in Callaway Plant steam generators. The staff proposed this meeting in a May 20, 1998 letter to UE (Reference 4). This letter provides information to support an amendment application to use electrosleeves for 2 operating cycles. As a follow-up to the July 7 meeting, we are confirming that Callaway Plant will continue to be the lead plant for licensing this repair process. Attached please find a Significant Hazards Evaluation, Technical Specification markups, and topical report BAW-10219P, Revision 3 (non-proprietary Topical to be submitted at a later date). This report has been revised to include information transmitted to the staff over the course of the review process for electrosleeves. Also attached is a risk assessment that supports leaving electrosleeves installed for two cycles of operation and responses to a request for additional information which contains a summary of the QA review performed to address quality issues raised by the staff.

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Framatome Technologies Inc. has determined that information associated with the installation process for electrosleeves is proprietary, and is thereby supported by an affidavit signed by Framatome, the owner of the information. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10CFR2.790. Accordingly, it is respectfully requested that the information that is proprietary to Framatome be withheld from public disclosure in accordance with 10CFR2.790. If you have any questions concerning this information, please contact us.

Sincerely,

Alan C. Passwater
Manager, Corporate Nuclear Services

WEK/plr
Enclosures: 1) Significant Hazards Evaluation
2) Technical Specification Markups
3) Responses to Request for Additional Information
4) Proprietary Information
a) Topical Report BAW-10219P
b) Risk Assessment
5) Non-Proprietary Information
b) Risk Assessment

cc: M. H. Fletcher
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STATE OF MISSOURI)
) S S
COUNTY OF CALLAWAY)

Alan C. Passwater, of lawful age, being first duly sworn upon oath says that he is Manager, Corporate Nuclear Services for Union Electric Company; that he has read the foregoing document and knows the content thereof; that he has executed the same for and on behalf of said company with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By Alan C Passwater
Alan C. Passwater
Manager, Corporate Nuclear Services

SUBSCRIBED and sworn to before me this 27th day of October, 1998.

Patricia A. Reynolds

PATRICIA L. REYNOLDS
NOTARY SEAL
NOTARY PUBLIC
STATE OF MISSOURI

PATRICIA L. REYNOLDS
NOTARY PUBLIC—STATE OF MISSOURI
ST. LOUIS COUNTY
MY COMMISSION EXPIRES DEC. 22, 2000

AFFIDAVIT OF JOSEPH J. KELLY

A. My name is Joseph J. Kelly. I am Manager of B&W Owners Group Services for Framatome Technologies, Inc. (FTI), and as such, I am authorized to execute this Affidavit.

B. I am familiar with the criteria applied by FTI to determine whether certain information of FTI is proprietary and I am familiar with the procedures established within FTI to ensure the proper application of these criteria.

C. In determining whether an FTI document is to be classified as proprietary information, an initial determination is made by the Unit Manager, who is responsible for originating the document, as to whether it falls within the criteria set forth in Paragraph D hereof. If the information falls within any one of these criteria, it is classified as proprietary by the originating Unit Manager. This initial determination is reviewed by the cognizant Section Manager. If the document is designated as proprietary, it is reviewed again by me to assure that the regulatory requirements of 10 CFR Section 2.790 are met.

D. The following information is provided to demonstrate that the provisions of 10 CFR Section 2.790 of the Commission's regulations have been considered:

(i) The information has been held in confidence by FTI. Copies of the document are clearly identified as proprietary. In addition, whenever FTI transmits the information to a customer, customer's agent, potential customer or regulatory agency, the transmittal requests the recipient to hold the information as proprietary. Also, in order to strictly limit any potential or actual customer's use of proprietary information, the substance of the following provision is included in all agreements entered into by FTI, and an equivalent version of the proprietary provision is included in all of FTI's proposals:

"Any proprietary information concerning Company's or its Supplier's products or manufacturing processes which is so designated by Company or its Suppliers and disclosed to Purchaser incident to the performance of such contract shall remain the property of Company or its Suppliers and is disclosed in confidence, and Purchaser shall not publish or otherwise disclose it to others without the written approval of Company, and no rights, implied or otherwise, are granted to produce or have produced any products or to practice or cause to be practiced any manufacturing processes covered thereby.

Notwithstanding the above, Purchaser may provide the NRC or any other regulatory agency with any such proprietary information as the NRC or such other agency may require; provided, however, that Purchaser shall first give Company written notice of such proposed disclosure and Company shall have the right to amend such proprietary information so as to make it non-proprietary. In the event that Company cannot amend such proprietary information, Purchaser shall prior to disclosing such information, use its best efforts to obtain a commitment from NRC or such other agency to have such information withheld from public inspection.

Company shall be given the right to participate in pursuit of such confidential treatment."

(ii) The following criteria are customarily applied by FTI in a rational decision process to determine whether the information should be classified as proprietary. Information may be classified as proprietary if one or more of the following criteria are met:

a. Information reveals cost or price information, commercial strategies, production capabilities, or budget levels of FTI, its customers or suppliers.

b. The information reveals data or material concerning FTI research or development plans or programs of present or potential competitive advantage to FTI.

c. The use of the information by a competitor would decrease his expenditures, in time or resources, in designing, producing or marketing a similar product.

d. The information consists of test data or other similar data concerning a process, method or component, the application of which results in a competitive advantage to FTI.

e. The information reveals special aspects of a process, method, component or the like, the exclusive use of which results in a competitive advantage to FTI.

f. The information contains ideas for which patent protection may be sought.

The document(s) listed on Exhibit "A", which is attached hereto and made a part hereof, has been evaluated in accordance with normal FTI procedures with respect to classification and has been found to contain information which falls within one or more of the criteria enumerated above. Exhibit "B", which is attached hereto and made a part hereof, specifically identifies the criteria applicable to the document(s) listed in Exhibit "A".

(iii) The document(s) listed in Exhibit "A", which has been made available to the United States Nuclear Regulatory Commission was made available in confidence with a request that the document(s) and the information contained therein be withheld from public disclosure.

(iv) The information is not available in the open literature and to the best of our knowledge is not known by ABB CE, EXXON, General Electric, Westinghouse or other current or potential domestic or foreign competitors of FTI.

(v) Specific information with regard to whether public disclosure of the information is likely to cause harm to the competitive position of FTI, taking into account the value of the information to FTI; the amount of effort or money expended by FTI developing the information; and the ease or difficulty with which the information could be properly duplicated by others is given in Exhibit "B".

E. I have personally reviewed the document(s) listed on Exhibit "A" and have found that it is considered proprietary by FTI because it contains information which falls within one or more of the criteria enumerated in Paragraph D, and it is information which is customarily held in confidence and protected as proprietary information by FTI. This report comprises

AFFIDAVIT OF JOSEPH J. KELLY (Cont'd.)

Information utilized by FTI in its business which afford FTI an opportunity to obtain a competitive advantage over those who may wish to know or use the information contained in the document(s).

JOSEPH J. KELLY

State of Virginia)
) SS. Lynchburg
City of Lynchburg)

Joseph J. Kelly, being duly sworn, on his oath deposes and says that he is the person who subscribed his name to the foregoing statement, and that the matters and facts set forth in the statement are true.

JOSEPH J. KELLY

Subscribed and sworn before me
this 22nd day of October 1998.

Brenda C. Cardona
Notary Public in and for the City
of Lynchburg, State of Virginia.

My Commission Expires July 31, 1999

EXHIBITS A & B

EXHIBIT A

1. Framatome Technologies, Inc. Topical Report BAW-10219P, Rev 03, "Electrosleeving Qualification for PWR Recirculating Steam Generator Tube Repair," October 1998.

2. "Risk Assessment for Installation of Electrosleeves at BVPS and Callaway Plant", FTI Document 51-5001925-01, August 28, 1998. (Proprietary and Non-Propriety Copies.)

3. Response to NRC RAI (Question #2, May 20, 1998) on Topical Report BAW-10219P, Rev 01.

EXHIBIT B

The above listed documents contain information which is considered Proprietary in accordance with Criteria b, c, d, and e of the attached affidavit.

EXHIBITS A & B

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1. Topical Report BAW-10219P, Rev 2, "Electrosleeving Qualification for PWR Recirculating Steam Generator Tube Repair," August 1998.

2. "Risk Assessment for Installation of Electrosleeves™ at BVPS and Callaway Plant", FTI Document 51-5001925-01, August 28, 1998. (Proprietary and Non-Propriety Copies.)

3. QA Summary

4. Additional responses.

EXHIBIT B

The above listed documents contain information which is considered Proprietary in accordance with Criteria b, c, and d of the attached affidavit.

SIGNIFICANT HAZARDS EVALUATION

INTRODUCTION

This proposed amendment revises the Surveillance Requirements of Technical Specification (TS) 3/4.4.5 "Steam Generators" and associated to address the installation of electrosleeves in the Callaway Plant steam generators.

This license amendment request revises TS 3/4.4.5 and associated Bases to include Electrosleeving (or sleeving) per Framatome Technical Report BAW-10219P, Revision 3, as an approved tube repair method, and the associated sleeve wall depth-based plugging limit value and inspection requirements.

Currently, tubes with indications of degradation in excess of the plugging criteria are removed from service by plugging. Removal of a tube from service results in a reduction of reactor coolant flow through the steam generator. This small reduction in flow can impact the margin in the reactor coolant flow through the steam generator in LOCA analyses and on the heat transfer efficiency of the steam generator. Repair of a tube via electrochemical deposition of material maintains the tube heat transfer area and results in a much smaller RCS flow reduction. Therefore, the use of sleeving in lieu of plugging helps to assure that minimum flow rates are maintained in excess of that required for operation at full power. Any combination of sleeving and plugging, up to a level such that the effect will not reduce the minimum reactor coolant flow rate to below the current TS limit or below the plugging limits analyzed in the Callaway Safety Analysis Report is acceptable. The sleeve/plug equivalency results are contained in BAW-10219P.

BACKGROUND

Callaway has Westinghouse Model F steam generators which utilize 11/16" OD x 0.040" nominal wall thickness tubes. The first ten rows of tubes at Callaway are thermally treated Alloy 600 (1326 tubes), while the remainder of the tubes (4300 tubes) are mill annealed Alloy 600. The Callaway tubes are hydraulically expanded within the tubesheet region. The pressure utilized for the expansion process is designed to provide a radial preload between the tube and tubesheet such that the tube to tubesheet gap is completely reduced during all conditions.

The current Callaway Technical Specifications require steam generator tubes with eddy current indications of 48% through wall or greater to be removed from service. This amendment proposes to permit the repair of degraded steam generator tubes by the installation of electrosleeves. Electrosleeving is the structural repair of a degraded tube by electrodeposition of ultra-fine-grained high purity nickel on the inner surface of a tube.

EVALUATION

Generic Structural Assessment

Electroformed sleeves have been designed to Section III, Subsection NB-3300 and applicable code cases, of the 1989 Edition of the ASME Code. Fatigue and stress analyses of the sleeved tube assemblies have been completed in accordance with the requirements of Section III, Subsection NB-3200 and applicable code cases, of the 1989 Edition of the ASME Code. The results of the primary stress intensity evaluation, primary plus secondary stress intensity range evaluation and fatigue evaluation indicate that the ASME Code allowable limits are not exceeded. That is, stress intensities are bounded by the minimum limits for the electrosleeve material and cumulative fatigue usage is less than 1.0. Therefore, the design of the sleeve pressure boundary meets the design objectives of the original tubing.

Regulatory Guide 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes" and the ASME Code are used to develop the plugging limit of the sleeve should sleeve wall degradation occur. Potentially degraded sleeves are shown (by test and analysis) to retain burst strength in excess of three times the normal operating pressure differential at end of cycle conditions. No credit for the presence of the parent tube behind the sleeve is assumed when performing the minimum wall/burst evaluation.

The sleeve structural analysis utilizes a generic set of design and transient loading inputs which are intended to bound all Westinghouse Model F steam generators. The temperature and pressure variances used in the assumed operating conditions and generic transients are bounding.

An ultrasonic inspection of the electrosleeve is performed prior to placing the sleeve in service to verify correct electrosleeve position, proper sleeve to tube bonding, that the minimum acceptable sleeve thickness is achieved and to provide a baseline inspection of the new pressure boundary.

The loading cycles that were applied to the electrosleeve analysis and testing were those for a 40 year plant life cycle. Therefore, the fatigue analysis is bounding for an operating plant. The results of the fatigue analysis indicate acceptable usage factors for the entire range of permitted sleeve thickness.

Leakage Assessment

Leakage testing of 5/8", 3/4", 11/16" and 7/8" electrosleeves under conditions considered to be more severe than expected during all operating plant conditions has shown that electrosleeving does not introduce additional primary to secondary leakage during a postulated steam line break event. Electrosleeves were subjected to thermal and fatigue cycling and then leak tested at pressure differentials of greater than 3110 psi, which exceeds the expected maximum feed line break or steam line break pressure differential. Leakage testing has also shown that the electrosleeve is essentially leaktight during all plant conditions.

Corrosion Assessment

Nickel has performed well historically with regard to corrosion. Accelerated corrosion tests also show that fine-grained nickel exhibits resistance to stress corrosion cracking equal to or greater than rolled tube transitions. Any structurally significant sleeve degradation can be detected by nondestructive examination (NDE).

Mechanical Integrity Assessment

Mechanical testing of 5/8", 3/4", 11/16" and 7/8" electrosleeves indicates that the axial load bearing capability exceeds the most limiting pressure end cap loading established by Regulatory Guide 1.121. The sleeve structural integrity requirements include safety factors inherent to the requirements of the ASME Code. Installation of electrosleeves restores the integrity of the primary pressure boundary and the tube is leaktight. The structural analysis and mechanical performance of the sleeves are based on installation in the hot leg of the steam generators.

Sleeving of Previously Plugged Indications

The electrosleeve installation requirements applicable to active tubes which have been identified as containing degradation indications which exceed the repair limit are no different for the sleeving of previously plugged tubes. A

new "baseline" inspection of the entire tube length must be performed prior to sleeve installation in a previously plugged tube. Historically at Callaway, only the top of tubesheet region has experienced stress corrosion cracking. The analysis also supports sleeve installation in a OD circumferentially cracked tube, therefore, the extent of the originally identified degradation indication should not affect electrosleeve installation.

EVALUATION

The proposed changes to the TS do not involve an Unreviewed Safety Question because operation of Callaway Plant with this change would not:

1. Involve a significant increase in the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the Safety Analysis Report.

The electrosleeve configuration has been designed and analyzed in accordance with the requirements of the ASME Code. The applied stresses and fatigue usage for the sleeve are bounded by the limits established in the ASME Code. ASME Code minimum material property values are used for the structural and plugging limit analysis. Mechanical testing has shown that the structural strength of nickel electrosleeves under normal, upset and faulted conditions provides margin to the acceptance limits. These acceptance limits bound the most limiting (3 times normal operating pressure differential) burst margin recommended by RG 1.121. Leakage testing for 5/8", 7/8", 11/16" and 3/4" tube sleeves has demonstrated that no unacceptable levels of primary to secondary leakage are expected during any plant condition.

The sleeve nominal wall thickness (used for developing the depth-based plugging limit for the sleeve) is determined using the guidance of Regulatory Guide 1.121 and the pressure stress equation of Section III of the ASME Code. The limiting requirement of Regulatory Guide 1.121, which applies to part throughwall degradation, is that the minimum acceptable wall must maintain a factor of safety of three against tube failure under normal operating (design) conditions. A bounding set of design and transient loading input conditions was used for the minimum wall thickness evaluation in the generic evaluation. Evaluation of the minimum acceptable wall thickness for normal, upset and postulated accident condition loading per the ASME Code

indicates these conditions are bounded by the design condition requirement minimum wall thickness.

A bounding tube wall degradation growth rate per cycle and an NDE uncertainty has been assumed for determining the sleeve TS plugging limit. The sleeve wall degradation extent is determined by NDE. The degradation which would require plugging sleeved tubes is developed using the guidance of RG 1.121 and is defined in BAW-10219P to be 20% throughwall for any service induced degradation.

The consequences of failure of the sleeve are bounded by the current steam generator tube rupture analysis included in the Callaway FSAR. Due to the slight reduction in diameter caused by the sleeve wall thickness, primary coolant release rates would be slightly less than assumed for the steam generator tube rupture analysis (depending on the break location), and therefore, would result in lower total primary fluid mass release to the secondary system.

A risk assessment for installation of Electrosleeves at Callaway Plant was performed for a two-cycle operating period. The results of this evaluation determined that sufficient margins against postulated tube rupture during bounding accident conditions exist for all types of degradation of the Electrosleeve material. The calculated probability of burst for a hypothetical population of 10,000 axial flaws, 100% throuwall of the parent tube and 0.40" long, is 4.4X10-11 at the end of the second operating cycle. The probability of burst for postulated circumferential flaws and pits is determined to be essentially zero.

The proposed change does not adversely impact any other previously evaluated design basis accident or the results of LOCA and non-LOCA accident analyses for the current TS minimum reactor coolant system flow rate. The results of the analyses and testing demonstrate that the electrosleeve is an acceptable means of maintaining tube integrity. Furthermore, per Regulatory Guide 1.83 recommendations, the sleeved tube can be monitored through periodic inspections with present NDE techniques. These measures demonstrate that installation of sleeves spanning degraded areas of the tube will restore the tube to a condition consistent with its original design basis.

Conformance of the electrosleeve design with the applicable sections of the ASME Code and results of the leakage and mechanical tests, support the conclusion that installation of electrosleeves will not involve a significant increase in the

probability or consequences of an accident previously evaluated.

2. Create the possibility of a new or different kind of accident from any previously evaluated in the Safety Analysis Report.

Electrosleeving does not represent a potential to adversely affect any plant component. Stress and fatigue analysis of the repair has shown that the ASME Code and Regulatory Guide 1.121 criteria are not exceeded. Implementation of electrosleeving maintains overall tube bundle structural and leakage integrity at a level consistent to that of the originally supplied tubing during all plant conditions. Leak and mechanical testing of electrosleeves support the conclusions of the calculations that each sleeve retains both structural and leakage integrity during all conditions. Sleeving of tubes does not provide a mechanism resulting in an accident outside of the area affected by the sleeves. Any accident as a result of potential tube or sleeve degradation in the repaired portion of the tube is bounded by the existing tube rupture accident analysis.

Implementation of sleeving will reduce the potential for primary to secondary leakage during a postulated steam line break while not significantly impacting available primary coolant flow area in the event of a LOCA. By effectively isolating degraded areas of the tube through repair, the potential for steam line break leakage is reduced. These degraded intersections now are returned to a condition consistent with the Design Basis. While the installation of a sleeve reduces primary coolant flow, the reduction is far below that caused by plugging. Therefore, far greater primary coolant flow area is maintained through sleeving versus plugging.

3. Involve a significant reduction in a margin of safety.

The electrosleeve repair of degraded steam generator tubes has been shown by analysis to restore the integrity of the tube bundle consistent with its original design basis condition, i.e., tube/sleeve operational and faulted condition stresses are bounded by the ASME Code requirements and the repaired tubes are leaktight. The safety factors used in the design of sleeves for the repair of degraded tubes are consistent with the safety factors in the ASME Code used in steam generator design. The portions of the installed sleeve assembly which represent the reactor coolant pressure boundary can be monitored for the initiation and

progression of sleeve/tube wall degradation, thus satisfying the requirements of Regulatory Guide 1.83. The portion of the tube bridged by the sleeve is effectively removed from the pressure boundary, and the sleeve then forms the new pressure boundary. The areas of the sleeved tube assembly which require inspection are defined in BAW-10219P.

In addition, since the installed sleeve represents a portion of the pressure boundary, a baseline inspection of these areas is required prior to operation with sleeves installed. The effect of sleeving on the design transients and accident analyses has been reviewed based on the installation of sleeves up to the level of steam generator tube plugging coincident with the minimum reactor flow rate and the Callaway Safety Analysis.

Provisional requirements cited in other NRC Safety Evaluation Reports addressing the implementation of sleeving have required the reduction of the individual steam generator normal operation primary to secondary leakage limit from 500 to 150 gpd. Consistent with these evaluations, Union Electric will reduce the per steam generator leak rate limit of 500 gpd in TS 3.4.6.2.c to 150 gpd. The establishment of this leakage limit at 150 gpd provides additional safety margin.

Finally, Union Electric will reduce the tube plugging limit from 48% through wall to 40% through wall to be consistent with NUREG-1431. The establishment of the plugging limit at 40% through wall provides additional safety margin.

CONCLUSION

Given the above discussions, the proposed change does not adversely affect or endanger the health or safety of the general public or involve a significant hazards consideration.