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August 29, 1996
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File No.: G20.02.01
10 CFR 50.90,
10 CFR 50.92,
10 CFR 51

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

South Texas Project
Units 1 & 2
Docket Nos.: STN 50-498, STN 50-499
Proposed Amendment to Incorporate Steam Generator Tube
Repair by Electrosleeving in Technical Specifications 3/4.4.5 and 3.4.6.2

Reference: Letter (Topical Report BAW-10219P, Rev. 1, "Electrosleeving Qualification for PWR Recirculating Steam Generator Tube Repair," March 1996) from J. H. Taylor, Framatome Technologies, Inc. to K. R. Wichman, Nuclear Regulatory Commission, dated March 26, 1996

The South Texas Project proposes to amend Facility Operating Licenses NPF-76, Unit 1, and NPF-80, Unit 2, by incorporating the attached proposed amendment to Technical Specifications 3/4.4.5 and 3.4.6.2, Steam Generators. The purpose of the amendment is to allow electrosleeving as an approved steam generator tube repair method in lieu of plugging tubes. South Texas Project steam generator electrosleeving will be performed in accordance with Framatome Technical Report BAW-10219P, Revision 1, March, 1996, "Electrosleeving Qualification For PWR Recirculating Steam Generator Tube Repair". This amendment will require a separate plugging limit for tubes that have been repaired by electrosleeving. Required Special Reports will include number and extent of Electrosleeves inspected and identification of tubes repaired. The allowable primary-to-secondary leakage through any one steam generator is revised.

Framatome Technologies, Inc. has determined that information associated with the installation process for Electrosleeves is proprietary. The installation process for the South Texas Project is described in Technical Report BAW-10219P, Revision 1, which was transmitted to the Nuclear Regulatory Commission by the referenced letter. That letter references the original proprietary affidavit provided by Framatome for this process.

The ASME Code does not address the use of electrochemical material deposition for steam generator tube repair. However, a special ASME task group was formed to develop a Code Case for this process. This Code Case has recently been approved by the ASME.

South Texas Project has reviewed the attached proposed amendment pursuant to 10 CFR 50.92 and determined that it does not involve a significant hazards consideration. In addition, South Texas Project has determined that the proposed amendment satisfies the criteria of 10 CFR51.22(c)(9) for categorical exclusion from the requirement for an environmental assessment. The South Texas Project Nuclear Safety Review Board has reviewed and approved the proposed changes.

The required affidavit, a Safety Evaluation and No Significant Hazards Consideration Determination associated with the proposed changes, and the marked-up affected pages of the Technical Specifications are included as attachments to this letter.

In accordance with 10 CFR 50.91(b), South Texas Project is providing the State of Texas with a copy of this proposed amendment.

If you should have any questions concerning this matter, please call Mr. H. R. Pate at (512) 972-7787 or myself at (512) 972-8787.

T. H. Cloninger
Vice President,
Nuclear Engineering

HRP/lf

Attachments:
1. Affidavit
2. Safety Evaluation and No Significant Hazards Consideration Determination
3. Proposed Change to Technical Specifications 3/4.4.5 and 3.4.6.2

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ATTACHMENT 1

AFFIDAVIT

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)		
	)		
Houston Lighting & Power	)	Docket Nos.	50-498
Company, et al.,	)		50-499
	)		
South Texas Project	)		
Units 1 and 2	)		

AFFIDAVIT

I, T. H. Cloninger, being duly sworn, hereby depose and say that I am Vice President, Nuclear Engineering, of Houston Lighting & Power Company; that I am duly authorized to sign and file with the Nuclear Regulatory Commission the attached revision to proposed changes to Technical Specification 3/4.4.5 and 3.4.6.2; that I am familiar with the content thereof; and that the matters set forth therein are true and correct to the best of my knowledge and belief.

T.H. Cloninger
Vice President,
Nuclear Engineering

STATE OF TEXAS)
)
COUNTY OF MATAGORDA)

Subscribed and sworn to before me, a Notary Public in and for the State of Texas, this 29th day of August, 1996.

LINDA RITTENBERRY
Notary Public, State of Texas
My Commission Expires 10/9/97

Linda Rittenberry
Notary Public in and for the
State of Texas

ATTACHMENT 2

SAFETY EVALUATION
AND
NO SIGNIFICANT HAZARDS
CONSIDERATION DETERMINATION

DESCRIPTION OF AMENDMENT REQUEST

The proposed amendment would revise Technical Specifications 3/4.4.5 and 3.4.6.2 and Bases 3/4.4.5, 3/4.4.6.2 and 3/4.4.8 to allow repairs of steam generator tubes by Electrosleeving. The allowed Unit 2 primary-to-secondary operational leakage from any one steam generator will be reduced from 500 gallons per day (gpd) to 150 gpd. The allowed Unit 1 primary-to-secondary operational leakage from any one steam generator was previously reduced to 150 gpd by Amendment 83 (Unit 1) to the South Texas Project Technical Specifications.

This license amendment requests changing Technical Specifications 3/4.4.5 and 3.4.6.2 to include:

a. Electrosleeving (or sleeving) per a Framatome technical report approved by the NRC as an approved tube repair method;

b. The associated Electrosleeve wall depth based plugging limit value and inspection requirements; and

c. The reduction of the primary-to-secondary operational tube leak limit from 500 to 150 gpd per steam generator for Unit 2.

Controls will be in place to ensure that the combination of tube sleeving and plugging will not exceed the plugging limit assumed in Chapter 15 of the South Texas Project Safety Analysis Report.

The South Texas Project will follow industry progress regarding sleeving technology and will incorporate enhancements as they develop.

BACKGROUND

The South Texas Project has Westinghouse Model E steam generators which utilize mill annealed Alloy 600 3/4" OD x 0.043" nominal wall thickness tubes. The Unit 1 tubes are mechanically hard rolled into the tube sheet. The Unit 1 tube support plates have drilled holes and are made from SA 285 Grade C material. The Unit 2 tubes are hydraulically expanded into the tube sheet. The Unit 2 tube support plates have drilled holes and are made from SA 240 Type 405 stainless steel.

Pressurized water reactor steam generators throughout the industry have experienced tube degradation related to corrosion phenomena, such as wastage, pitting, intergranular attack, stress corrosion cracking and crevice corrosion, along with other denting and vibration wear.

Tubes that experience excessive degradation reduce the integrity of the primary-to-secondary pressure boundary. Eddy current examination is used to measure the extent of tube degradation. When the reduction in tube wall thickness reaches a calculated value commonly known as the plugging criteria, the tube is considered defective and corrective action is taken.

BASES

Currently, degraded tubes with identified defects exceeding the Technical Specification Limits 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 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 (Electrosleeving) maintains the tube heat transfer area and results in a much smaller Reactor Coolant System flow reduction. Steam generator Electrosleeves do not greatly affect the heat transfer capability or the primary coolant flow rate through the section of the tube being repaired; therefore, a large number of Electrosleeves can be installed without significantly affecting the Reactor Coolant System. The Electrosleeve spans the degraded section of the tube and maintains the structural integrity of the steam generator tubes under normal and accident conditions, and prevents primary-to-secondary leakage through the Electrosleeved section of the tube should the degradation of the parent tube continue to deteriorate into a through-wall crack.

SAFETY EVALUATION

1) Generic Structural Assessment

Electrosleeves 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 Electrosleeved 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 range 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 Electrosleeve 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 Electrosleeve should Electrosleeve end-of-cycle wall degradation occur. Potentially degraded Electrosleeves 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 Electrosleeve is conservatively assumed when performing the minimum wall/burst evaluation.

Electrosleeve structural analysis utilizes a generic set of design and transient loading inputs that are intended to bound all Westinghouse Model E 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 Electrosleeve in service to verify correct Electrosleeve position, proper Electrosleeve to tube bonding, minimum acceptable Electrosleeve thickness is achieved and to provide a baseline inspection of the pressure boundary. The loading cycles that are applied to the Electrosleeve analysis and testing are those for a 40 year plant life cycle. The results of the fatigue analysis indicate acceptable usage factors for the entire range of permitted Electrosleeve thickness.

Any combination of Electrosleeving and plugging is acceptable up to a level such that the effect will not reduce the minimum reactor coolant flow rate below the current Technical Specification limit or below the plugging limits analyzed in the South Texas Project Updated Final Safety Analysis Report. The Electrosleeve/plug equivalency results are contained in Framatome Technical Report BAW-10219P, Revision 1.

2) Leakage Assessment

Leakage testing of 3/4" Electrosleeve assemblies 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, with 30% through-wall axial Electrode Discharge Machining (EDM) notches 1" long, were subjected to internal pressure cycles at differentials up to 3,429 psi which far exceeds the expected maximum feed line break or steam line break pressure differential. Burst testing 7/8" Electrosleeve assemblies with 50% through-wall axial EDM notches 3/4" long resulted in burst pressures of 6.6 ksi. Leakage testing has also shown that the Electrosleeve is essentially leaktight during all plant conditions.

3) Steam Generator Leakage Monitoring

Steam generator leakage monitoring at the South Texas Project employs a sampling program in conjunction with radiation monitors permanently installed on the Condenser Air Removal System, the Unit Vent Monitor, the Steam Generator Blowdown (SGBD) Flash Tank, and N-16 Primary-to-Secondary Leak Monitors permanently installed on each of the four main steam lines. The South Texas Project program for detection and mitigation of steam generator tube leak events was upgraded earlier in response to industry lessons learned, such as Nuclear Regulatory Commission Inspection & Enforcement Information Notice 91-043. The South Texas Project program for early leak detection provides for prompt detection and response, minimizing the likelihood of a steam generator tube rupture event. (Note: In addition to the monitors described below, additional monitors less sensitive to small leaks have been provided on each of the four main steam lines and on the four Steam Generator Blowdown lines. These are provided primarily for detection of a Steam Generator Tube Rupture event.)

- Sampling:

  Each steam generator is routinely sampled for various purposes, including the detection of tube leaks and determination of secondary specific radioactivity once every 72 hours during operation in modes 1, 2, 3, and 4.

- Steam Generator Blowdown (SGBD) Radiation Monitor:

  The SGBD Radiation Monitor continuously checks the steam generator blowdown flash tank effluent. This monitor provides indication and alarms locally and in the Control Room. The SGBD Radiation Monitor detects water activation products as well as corrosion activation products and fission products. It is sensitive to leakage as low as five gallons per day. An alert or high alarm would be an indication of a primary-to-secondary leak.

- Condenser Air Removal System Radiation Monitor:

  The Condenser Air Removal System is provided with a radiation monitor which continuously monitors the effluent line from the Condenser Vacuum Pump. This monitor is designed to detect low levels of noble gas radioactivity and is sensitive to leaks as low as five gallons per day. An alarm from this detector indicates a primary-to-secondary system leak.

- Unit Vent Monitor:

The Unit Vent Monitor is provided with a radiation monitor which samples the plant vent stack prior to discharge to the environment and monitors for particulates, iodine, and noble gases. The Unit Vent Monitor provides sampling capability of plant effluents in compliance with NUREG-0737, Item II.F.1.

- N-16 Radiation Monitor:

The N-16 gamma detectors provide continuous indication of individual steam generator primary-to-secondary leakage. The N-16 gamma detectors provide real time indication in the Control Room of steam generator leak rate in gallons per day and are used when reactor power is greater than or equal to 25 percent. The South Texas Project N-16 gamma detectors are reactor power compensated for accurate leakage trending during power level reductions and increases. A recorder monitors the N-16 detector readings and provides a trend recording of steam generator leak rate. The N-16 gamma detectors alarm in the Cold Chemistry Lab, from which they are controlled, while monitor readings are continuously available in the Control Room via the plant computer.

- Station Response to a Steam Generator Tube Leak:

Abnormal radiation in a steam generator indicates primary-to-secondary leakage. This can be shown by trends or alarms on main steam line N-16 monitors, the Condenser Air Removal System Radiation Monitor, the Steam Generator Blowdown Radiation Monitor, or from chemistry samples. A large leak would be indicated by feedwater flow being less than steam flow, decreasing feed flow, a mismatch in charging and letdown flow, or decreasing feed regulating valve position in conjunction with a stable steam generator level. These symptoms, however, would more likely be noticed with a tube rupture event. Procedures provide actions to mitigate the entire spectrum of steam generator tube leaks from the threshold of detectability up to a steam generator tube rupture event.

Upon any confirmed indication of leakage, the frequency of monitoring and sampling is increased in a manner proportionate to the severity of the leak. Additional confirmatory/diagnostic samples would be taken from the steam generator blowdown and from the Condenser Air Removal System effluent and the N-16 indication in the Control Room would be closely monitored.

- Training:

  The operator training program has been upgraded to include training on the revised station steam generator tube leak procedures and simulator scenarios based on predicted South Texas Project plant response to steam generator tube events. Plant operators and chemical analysis technicians have been trained in the use of N-16 gamma detectors and in the upgraded station procedures for response to steam generator leaks.

- Steam Generator Leak Detection Program Adequacy:

  The plant leak rate monitors and procedures provide the required indications and alarms to ensure Reactor Coolant System leakage is detected early while the leakage rate is relatively low. In addition, leakage verification is provided by South Texas Project chemistry procedures which provide alternate means of calculating and confirming Reactor Coolant System leakage. These measures maximize assurance that leak evaluation and mitigation can occur before small leaks propagate to steam generator tube rupture events.

4) Corrosion Assessment

EPRI Report TR-105960 "PWR Steam Generator Sleeving Assessment Document" identifies the following degraded sleeving experiences due to corrosion:

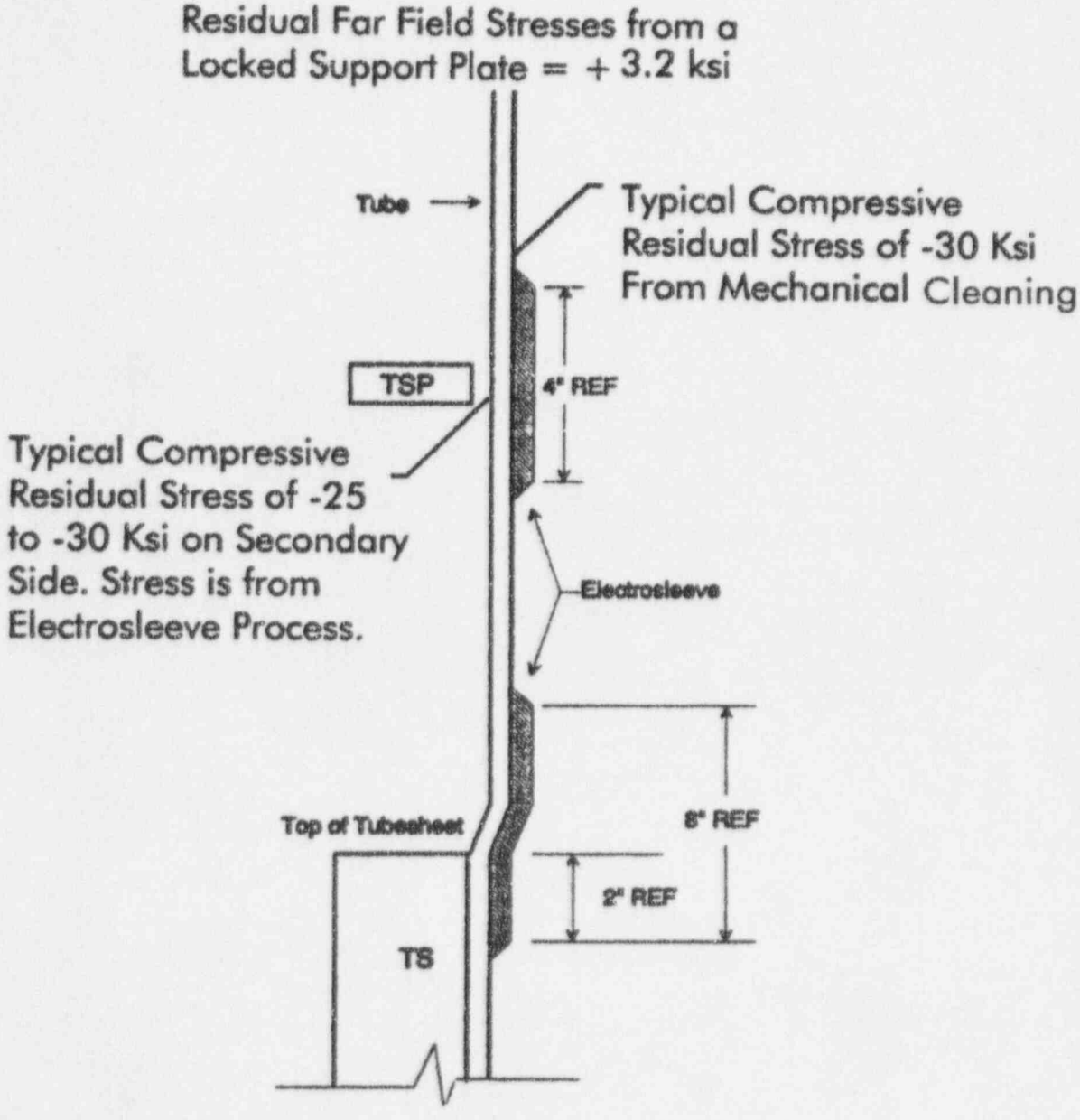
- Stress Corrosion Cracking in the parent tube material due to high residual stress attributed to the sleeving installation process.

- Wastage of both the Electrosleeve (Alloy 690) and the parent tube (Alloy 600 LTMA) in a trapped crevice region.

The above mentioned EPRI report states that tensile residual stresses above 40 ksi may cause Alloy 600 tubing to be susceptible to Pressurized Water Stress Corrosion Cracking. For the secondary side in which a crevice or sludge pile exists, the threshold for Stress Corrosion Cracking may only be 25 ksi. The Electrosleeving installation process has the following beneficial advantages concerning residual stress:

- Residual stresses in the parent Alloy 600 material are mostly compressive in nature. With a locked support plate, the far field stresses are approximately 3.2 Ksi.

- The pure Nickel Strike Layer extends 3/4" beyond the deposited Electrosleeve which helps to protect the parent material from stress corrosion cracking at the Electrosleeve-to-base metal transition.


Residual Far Field Stresses from a Locked Support Plate = + 3.2 ksi
Tube
Typical Compressive Residual Stress of -30 Ksi From Mechanical Cleaning
TSP
4" REF
Typical Compressive Residual Stress of -25 to -30 Ksi on Secondary Side. Stress is from Electrosleeve Process.
Electrosleeve
8" REF
Top of Tubesheet
2" REF
TS

The Electrosleeving process effectively eliminates crevices associated with conventional sleeving processes, with the exception of a through wall defect in the parent tubing material. When the tubing material is properly cleaned to remove oxides, the nickel strike layer and Electrosleeve deposition form a metallurgical bond with the tube material. This metallurgical bond eliminates the crevices between the Electrosleeve and tube material.

In the Electrosleeve Qualification Program, corrosion tests in both primary and secondary environment indicated that general corrosion, crevice corrosion, pitting, Stress Corrosion Cracking or Intergranular Attack (IGA) of the Electrosleeve material is not a concern in PWR environments. Electrosleeve degradation can be detected by nondestructive examination (NDE).

5) Mechanical Integrity Assessment

Mechanical testing of 3/4" Electrosleeves indicates that the axial load bearing capability exceeds the most limiting pressure end cap loading established by Regulatory Guide 1.121. The Electrosleeve 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.

6) Sleeving of Previously Plugged Indications

The Electrosleeve installation requirements applicable to active tubes, which have been identified as containing degradation indications exceeding the repair limit are no different for the Electrosleeving of previously plugged tubes. A new "baseline" inspection of the entire tube length must be performed prior to Electrosleeve installation in a previously plugged tube.

NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

Pursuant to 10 CFR 50.91, this analysis provides a determination that the proposed change to the Technical Specifications does not involve any significant hazards consideration as defined in 10 CFR 50.92 as described below:

1. Does the change involve a significant increase in the probability or consequences of an accident previously evaluated?

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 Electrosleeve are bounded by the limits established in the 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 Regulatory Guide 1.121. Leakage testing has shown that the Electrosleeve is essentially leaktight during all plant conditions.

The Electrosleeve nominal wall thickness (used for developing the depth-based plugging limit for the Electrosleeve) 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 through wall degradation, is the minimum acceptable wall must maintain a safety factor of three against tube failure under design normal operating 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.

Bounding tube wall degradation growth rate per cycle and nondestructive examination uncertainty has been assumed for determining the Electrosleeve Technical Specification plugging limit. Electrosleeve wall degradation extent determined by nondestructive examination, which would require plugging Electrosleeved tubes, is developed using the guidance of Regulatory Guide 1.121 and is defined in Framatome Technical Report BAW-10219P, Revision 1, to be 20% throughwall.

The effect of Electrosleeving and plugging will remain below the plugging limit assumed in Chapter 15 accident analysis of the South Texas Project Updated Final Safety Analysis Report. The proposed change will not increase the consequences of these accidents.

The results of the analyses and testing demonstrate that the Electrosleeve is an acceptable means of maintaining tube integrity. Further, per Regulatory Guide 1.83 recommendations, the Electrosleeved tube can be monitored through periodic inspections with present NDE techniques. These measures demonstrate that installation of Electrosleeves spanning degraded areas of the tube will restore the tube to a condition consistent with its original design basis.

Since the main steam line break post-accident primary-to-secondary leakage is not increased by the presence of Electrosleeves, the consequences of an accident previously evaluated in the Updated Final Safety Analysis Report are not increased. 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 does not increase the probability or consequences of an accident previously evaluated.

2. **Does the change create the possibility of a new or different kind of accident from any accident previously evaluated?**

Electrosleeving will not 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 with that of the original tubing during all plant conditions. Leak and mechanical testing of Electrosleeves support the conclusions of the calculations that each Electrosleeve retains both structural and leakage integrity during all conditions. Electrosleeving of tubes does not provide a mechanism resulting in an accident outside of the area affected by the Electrosleeves. Any accident resulting from potential tube or Electrosleeve degradation in the repaired portion of the tube is bounded by the existing tube rupture accident analysis.

Implementation of Electrosleeving will reduce the potential for primary-to-secondary leakage 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 an Electrosleeve reduces primary coolant flow, the reduction is far below that caused by plugging. Greater primary coolant flow area is maintained through Electrosleeving versus plugging. Therefore, the possibility of a new or different kind of accident from any accident previously evaluated is not created.

3. Does the change 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. The tube/Electrosleeve operational and faulted condition stresses are bounded by the ASME Code requirements and the Electrosleeved tubes are leaktight. The safety factors used in the design of Electrosleeves 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 Electrosleeve assembly which represent the reactor coolant pressure boundary can be monitored for the initiation and progression of Electrosleeve/tube wall degradation, thus satisfying the requirements of Regulatory Guide 1.83. The portion of the tube bridged by the Electrosleeve is effectively removed from the pressure boundary, and the Electrosleeve then forms the new pressure boundary. The areas of the Electrosleeved tube assembly which require inspection are defined in Framatome Technologies Technical Report BAW-10219P, Revision 1.

In addition, since the installed Electrosleeve represents a portion of the pressure boundary, a baseline inspection of these areas is required prior to operation with Electrosleeves installed. The effect of sleeving on the design transients and accident analyses has been reviewed based on the installation of Electrosleeves up to the level of steam generator tube plugging coincident with the minimum reactor flow rate and the South Texas Project Updated Final Safety Analysis Report and has been found acceptable.

Provisional requirements cited in other NRC Safety Evaluation Reports addressing the implementation of Electrosleeving 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, the South Texas Project will reduce the steam generator leak rate limit of 500 gpd in Technical Specification 3.4.6.2.c to 150 gpd. The establishment of this leakage limit at 150 gpd provides additional safety margin. Since post-accident primary-to-secondary leakage is not increased by the presence of Electrosleeves, the consequences of a main steam line break are not increased. Therefore, the change does not involve a reduction in the margin of safety as applied to radiological consequences.

It is concluded that the proposed license amendment request does not result in a significant reduction in the margin of safety as defined in the South Texas Project Updated Final Safety Analysis Repor or Technical Specifications.

Conclusion

The Framatome Technologies Electrosleeve has been structurally qualified by testing and analysis for application in Westinghouse Model E steam generators. Based on the Regulatory Guide 1.121 guidelines for tube degradation limits, appropriate Electrosleeved tube repair criteria have been established. Non-destructive examination techniques are available to perform necessary Electrosleeve and tube inspections for defects and to verify proper installation of the Electrosleeve. As discussed in the Safety Evaluation and in the No Significant Hazards Consideration Determination, the proposed change does not adversely affect or endanger the health or safety of the public or involve an unreviewed safety question.

IMPLEMENTATION PLAN

The South Texas Project desires to have Electrosleeving as an option to repair defective steam generator tubes during refueling outages. Therefore, the South Texas Project requests that the Nuclear Regulatory Commission review and approve this proposed amendment on or before July 1997. The South Texas Project requests 14 days for implementation after approval.