The Light company
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May 17, 1996
ST-HL-AE-5362
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 Sleeving in Technical Specification 3/4.4.5 and 3.4.6.2

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, and associated Bases. The purpose of the amendment is to allow the installation of tube sleeves as an alternative to plugging to repair defective steam generator tubes.

Currently, the South Texas Project Technical Specifications only allow defective tubes to be plugged and removed from service. The installation of steam generator tube plugs removes the heat transfer surface of the plugged tubes from service, and leads to a reduction in the primary coolant flow available for core cooling. The proposed amendment will revise the appropriate Technical Specifications and their Bases to permit tube sleeving repair techniques developed by Westinghouse Electric Corporation to be used at the South Texas Project. Sleeving is a steam generator tube repair method where a length of tubing (sleeve), having an outer diameter slightly smaller than the inside of the steam generator tube, is installed spanning the degraded region of the parent tube. Installation of steam generator sleeves do not greatly affect the heat transfer capability or the primary coolant flow rate through the tube being sleeved; therefore, a large number of sleeves can be installed without significantly affecting the operation of the Reactor Coolant System. The sleeve spans the degraded section of the tube and maintains the structural integrity of the steam generator tube under normal and accident conditions.

Ltr Encl.
Change: NRC PDR 1 INP

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This amendment will require a separate plugging limit or repair limit for tubes that have been repaired by sleeving. Required Special Reports will include identification of tubes repaired. The allowable primary-to-secondary leakage through any one steam generator will also be revised.

The detailed report on the specific qualifications of the Westinghouse sleeves for the South Texas Project steam generators are documented in Attachments 5, 6 and 8. Attachments 5 and 8 contain information proprietary to Westinghouse. Accompanying Attachment 5 is an affidavit (Attachment 4) signed by Westinghouse, 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 10 CFR 2.790(b)(4). Accordingly, it is requested that the information which is proprietary to Westinghouse be withheld from public disclosure. Attachment 7 is a letter, signed by Westinghouse, stating that the information in Attachment 8 is proprietary to Westinghouse. The proprietary report (Attachment 8) will be resubmitted, accompanied by affidavit setting forth the basis on which the information may be withheld from public disclosure, along with the non-proprietary report from Westinghouse of the specific application of sleeving for the South Texas Project steam generators under a separate letter to the Nuclear Regulatory Commission within 30 days.

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 CFR 51.22(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, along with 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. A. W. Harrison at (512) 972-7298 or myself at (512) 972-8787.

T. H. Cloninger
Vice President,
Nuclear Engineering

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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
4. Westinghouse Authorization Letter, CAW-96-967, Accompanying Affidavit, Proprietary Information Notice, and Copyright Notice
5. Proprietary Westinghouse Report WCAP-13698 Revision 2; "Laser Welded Sleeves for 3/4 Inch Diameter Tube Feedring-Type and Westinghouse Preheater Steam Generators, Generic Sleeving Report," April 1995
6. Non-proprietary Westinghouse Report WCAP-13699 Revision 2; "Laser Welded Sleeves for 3/4 Inch Diameter Tube Feedring-Type and Westinghouse Preheater Steam Generators, Generic Sleeving Report," April 1995
7. Letter from N. J. Liparulo, Westinghouse, to the NRC Document Control Desk dated May 16, 1996 (NSD-NRC-96-4726)
8. Proprietary Westinghouse Letter Report, NSD-JLH-6146, SG-96-05-013, "Specific Application of Laser Welded Sleeves for the South Texas Power Plant Steam Generators," May 1996

c: *

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* Above copies distributed with Attachments 1-3 only

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 Specifications 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 16th day of May, 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 including associated Bases 3/4.4.5 and 3/4.4.6.2 to allow repairs of steam generator tubes by sleeving. The allowed primary-to-secondary operational leakage from any one steam generator will be reduced from 500 gallons per day (gpd) to 150 gpd.

This license amendment requests changing Technical Specifications 3/4.4.5 and 3.4.6.2 and associated Bases to include;

a. Laser welded sleeving as addressed in Westinghouse Report WCAP-13698 Revision 2; "Laser Welded Sleeves for 3/4 Inch Diameter Tube Feedring-Type and Westinghouse Preheater Steam Generators, Generic Sleeving Report," April 1995; and Westinghouse Letter Report NSD-JLH-6146, "Specific Application of Laser Welded Sleeves for the South Texas Power Plant Steam Generators" May 1996, as an approved tube repair method,

b. The associated sleeve wall depth based plugging limit value and inspection requirements,

c. The reduction of the primary-to-secondary normal operation tube leak limit from 500 to 150 gpd per steam generator.

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 wording used in the Technical Specification markup is similar to the wording used by previous applicants, such as Baltimore Gas and Electric Company which submitted an application for its Calvert Cliffs Nuclear Power Plant on November 30, 1995. The South Texas Project will follow industry progress regarding sleeving technology and will incorporate enhancements as they develop.

BACKGROUND

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 (PWR) steam generators (SGs) 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 a corrective action is taken.

JUSTIFICATION

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 by sleeving maintains the tube heat transfer area and results in a much smaller Reactor Coolant System flow reduction. Sleeving is a steam generator tube repair method where a length of tubing (sleeving) having an outer diameter slightly smaller than the inside of the steam generator tube is installed inside the parent tube spanning the degraded region. Installation of steam generator sleeves do not greatly affect the heat transfer capability or the primary coolant flow rate through the section of the tube being sleeved; therefore, a large number of sleeves can be installed without significantly affecting the Reactor Coolant System. The sleeve spans the degraded section of the tube and maintains the structural integrity of the steam generator tubes under normal and accident conditions, and limits or prevents primary-to-secondary leakage through the sleeved 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

   The laser welded sleeves described in WCAP-13698, Revision 2 and Westinghouse Letter Report NSD-JLH-6146 have been designed to Section III, Subsection NB-3300 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 of the 1989 Edition of the ASME Code. Both the sleeve and weld are evaluated. The structural evaluation considers the effects of operation on the assembly by considering cases of free and fixed tube support conditions on applied stresses. 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. Stress intensities are bounded by the Code minimum limits for SB-163 (Alloy 690) 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 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 conservatively assumed when performing the minimum wall/burst evaluation.

The sleeve and weld structural analysis utilizes a generic set of design and transient loading inputs which are intended to bound all plants with Westinghouse Model E steam generators. The temperature and pressure variances used in the assumed operating conditions and generic transients have been evaluated to establish the applicability to the South Texas steam generators in Westinghouse Letter Report NSD-JLH-6146.

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. An ultrasonic inspection of the free span welds is performed prior to placing the sleeve in service to verify that the minimum acceptable fusion zone thickness of the weld is achieved. This minimum weld fusion zone thickness has been shown by analysis to satisfy the requirements of the ASME Code with regard to acceptable stress levels during operating and accident conditions. In addition, a fatigue analysis was performed for the assembly with the critical location being the free span laser weld. The loading cycles that were applied to the sleeve assembly analysis 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 indicates acceptable usage factors for the entire range of permitted weld thickness.

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 Technical Specification limit or below the plugging limits analyzed in the South Texas Project Safety Analysis Report is acceptable. The sleeve/plug equivalency results are contained in Westinghouse Letter Report NSD-JLH-6146.

2) Leakage Assessment

The laser welded sleeve joint is an autogenous tube-to-sleeve weld. Leakage testing of 3/4" and 7/8" laser welded sleeve assemblies under conditions considered to be more severe than expected during all temperatures during operating plant conditions has shown that the laser welded joint does not introduce additional primary-to-secondary leakage during a postulated steam line break event. Laser welded tube assemblies were subjected to thermal and fatigue cycling and then leak tested at expected maximum feed line break or steam line break pressure differential. Leakage testing has also shown that the non-welded elevated tubesheet sleeve (ETS) lower joint is essentially leaktight during all plant conditions. By analysis, leakage from the non-welded lower joint has been shown to be acceptable for the South Texas Project. Non-welded lower joint tubesheet sleeve/tube leakage test specimens were subjected to both fatigue and thermal cycling tests prior to final leak rate evaluation testing. Essentially no leakage was detected in any non-welded tubesheet sleeve lower joint at 600°F in hard rolled tubes similar to Unit 1 after both thermal and fatigue loading.

The lower joint of the South Texas Unit 1 ETS is qualified and has recently been used during laser welded sleeving programs at Byron Unit 1. The Unit 2 tubes have the same dimensions as Unit 1; however, Unit 2 tubes are hydraulic expanded into the tubesheet holes. The lower joint of the Unit 2 ETS will be very similar to an existing ETS joints made in non-roll expanded (nonrolled) 3/4" diameter tubes. The Unit 2 joint will be verified by a minor program of confirmatory testing at the appropriate point in the preparations for the field sleeving operation.

Primary-to-secondary leakage through non-welded tubesheet sleeve lower joints would be expected to be negligible for a steam line break event, normal operating, and at 0% power conditions, and therefore will not significantly contribute to offsite doses in the event of postulated steam line break event.

3) Steam Generator Leakage Monitoring

Steam generator leakage monitoring at 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 employing 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 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 which are 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 and are not discussed in detail.)

- 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, and prior to entering Mode 4 per South Texas Project Technical Specification 3.7.1.4.

- 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 Vacuum Pump Effluent 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. Operations begins to closely monitor the N-16 monitors in the Control Room.

- Training:
  The operator training program has been upgraded previously 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 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

Thermally treated Alloy 600 and Alloy 690 sleeve tube assemblies have performed well historically with regard to corrosion. There are no reported instances of sleeve degradation for greater than 35,000 hybrid expansion joint (HEJ) sleeves or approximately 12,000 laser welded sleeves that Westinghouse has installed in United States and European plants. Previous corrosion testing has been correlated to South Texas Project site specific environment for the following three conditions:

a) The tubes are completely free to expand axially.
b) The tubes are rigidly fixed at the first tube support plate (TSP).
c) Outer Diameter Surface Condition

Tubes Free to Expand

Following thermal stress relief of the laser weld region, the primary stresses acting on the tube-sleeve assemblies are the remaining residual weld stress and the operating pressure stress. Doped steam accelerated corrosion tests on mockups prepared under the condition of no axial fixity have run for periods exceeding 432 hours (for five mockups, there were no failures in test observed). Based on comparison with roll transition mockups, prepared of the same Alloy 600 material and tested at the same time, the sleeved tubes are projected to exhibit resistance to pressurized water stress corrosion cracking (PWSCC) for periods greater than 30 times those required to crack the roll transitions in primary water.

Tubes Fixed at the First Support Plate

In the South Texas Project Model E steam generator, the first TSP is at an elevation approximately 37 inches above the top of the tube sheet. For fixed conditions at this elevation, the far-field stresses after thermal stress relief of the weld will be in the range of 10-12 ksi. Corrosion testing of mockups under this condition of stress, again from comparison with roll transition mockups exposed at the same time, indicates degradation-free sleeve performance for periods approximately twenty times those required to initiate PWSCC in roll transitions. For South Texas, the assumed earliest inservice degradation occurred after approximately 3 effective full power years of operation. Based on the accelerated corrosion results it is believed that the sleeved joints will provide adequate corrosion protection.

Outer Diameter Surface Condition

Because the sleeving involves operations only on the primary side, the sleeve installation does not substantially affect the tube outside diameter surface. In operating steam generators however, the outside diameter surfaces undergo surface corrosion and may collect deposits. These are typically oxides or related minerals in the thermodynamically stable form of the constituent elements; in PWR secondary water, magnetite is the most prominent oxide that forms. At the temperatures experienced during sleeve welding and thermal stress relief, these compounds are stable and do not thermally decompose. All such compounds have crystal structures that are too large to permit diffusion into the lattice of the Alloy 600. Reactions between these stable oxides and minerals and the alloying elements of Alloy 600 are thermodynamically unfavorable. Consequently, their presence during sleeving installation is not expected to produce harmful tube-sludge/scale interactions.

This judgment has been evaluated by installing laser welded sleeves into tubes removed from operating plants. Following the sleeving operations, microanalytical examinations were performed to verify the lack of interactions. Prior to welding, the tubes had oxide deposits which contained Cu, Ti, Al, Zn, P, and Ca as measured by EDAX analysis on an SEM. Following welding and stress relief, the maximum penetrations of the outside diameter surfaces were on the order of 7 to 8 μm (less than a grain depth).

Additional evaluations were performed on three areas of an Alloy 600 U-bend section which was coated with sludge and heat treated in air for 10 minutes at 1350°F. The sludge was a simulant of steam generator secondary side sludge (Fe_3O_4, Cu, CuO, ZnO, $CaSO_4$ and $MgCl_2$) and was applied to the U-bend using acrylic paint as a binder. Post-thermal exposure evaluations indicated no general or intergranular corrosion had occurred.

5) Mechanical Integrity Assessment

Mechanical testing of 3/4" and 7/8" laser weld and HEJ sleeves indicates that the axial load bearing capability of these joints individually exceeds the most limiting theoretical pressure end cap loading established by Regulatory Guide 1.121. Both the lower joints (hydraulic expansion plus roll expansion, commonly known as HEJ joint) and the free span laser weld joint (LWJ) separately have load bearing characteristics which exceed the most limiting Regulatory Guide 1.121 loading scenario. Therefore, it can be postulated that a loss of structural integrity in one of the sleeve joints will not result in a loss of structural integrity for the sleeve. The structural integrity requirements include safety factors inherent to the requirements of the ASME Code. Installation of sleeves restores the integrity of the primary pressure boundary and the tube is leak tight. All welds must be produced at a minimum distance from any detected tube degradation as described in WCAP-13698 Revision 2. The structural analysis and mechanical performance of the sleeves are based on installation in the hot leg of the steam generators.

6) Sleeving of Previously Plugged Indications

The sleeve installation requirements applicable to active tubes, which have been identified as containing degradation indications exceeding 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 per Westinghouse Report WCAP-13698 Revision 2; "Laser Welded Sleeves for 3/4 Inch Diameter Tube Feedring-Type and Westinghouse Preheater Steam Generators, Generic Sleeving Report," April 1995.

NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

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

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

The laser welded sleeve 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. Ultrasonic inspection is used to verify that minimum weld fusion zone thicknesses are produced. Mechanical testing has shown that the structural strength of Alloy 690 laser welded sleeves, under normal, upset, and faulted conditions provides margin to the acceptance limits. Leakage testing for 3/4" and 7/8" tube sleeves has demonstrated no unacceptable levels of primary-to-secondary leakage are expected during any plant condition, including the case where the seal weld is not produced in the lower joint of the tubesheet.

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 through wall degradation, is the minimum acceptable wall to 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 required minimum wall thickness.

A bounding tube wall degradation growth rate per cycle and an eddy current uncertainty has been assumed for determining the sleeve Technical Specification plugging limit. The sleeve wall degradation extent determined by eddy current, which would require plugging sleeved tubes, is developed using the guidance of Regulatory Guide 1.121 and is defined in Westinghouse Letter Report NSD-JLH-6146 to be 42% throughwall. Conservatively, South Texas will plug 40% sleeve wall degradation as determined by eddy current.

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

The results of the analyses and testing demonstrate the laser welded sleeve is an acceptable means of maintaining tube integrity. Further, per Regulatory Guide 1.83 recommendations, the sleeved tube can be monitored through periodic inspections with present non-destructive examination techniques. These measures demonstrate 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 sleeve design with the applicable sections of the ASME Code and results of the leakage and mechanical tests, support the conclusion that installation of laser welded sleeves 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?

Sleeving will not adversely affect any plant component. Stress and fatigue analysis of the repair has shown the ASME Code and Regulatory Guide 1.121 criteria are not exceeded. Implementation of laser welded sleeving 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 sleeves support the conclusions of the calculations that each sleeve joint 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 laser welded 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 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.

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 laser welded sleeve repair of degraded steam generator tubes has 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 essentially 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 WCAP-13698, Revision 2 and Westinghouse Letter Report NSD-JLH-6146.

The effect of sleeving and plugging will remain below the plugging limit assumed in Chapter 15 accident analysis of the South Texas Project Safety Analysis. The change will not reduce the margin of safety for these accidents.

Provisional requirements cited in other Nuclear Regulatory Commission 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, the South Texas Project will reduce the per 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.

Therefore, 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 Final Safety Analysis Report or Technical Specifications.

Conclusion

The Westinghouse laser welded sleeve meets or exceeds all applicable ASME Code requirements. Based on the Regulatory Guide 1.121 guidelines for tube degradation limits, appropriate sleeved tube repair criteria have been established. Non-destructive examination techniques are available to perform necessary sleeve and tube inspections for defects and to verify proper installation of the sleeve. The discussion in the Safety Evaluation and in the No Significant Hazards Consideration Determination present that the proposed change does not adversely affect or endanger the health or safety of the public or does not involve an unreviewed safety question.

IMPLEMENTATION PLAN

South Texas Project desires to have sleeving as an option to repair defective steam generator tubes during refueling outages. Therefore, South Texas Project requests that the Nuclear Regulatory Commission review and approve this proposed amendment on or before 30 October, 1996 or on a more rapid schedule if adverse conditions occur before 30 October 1996 arising out of ongoing steam generator inspections. South Texas Project requests 14 days for implementation after approval.