Westinghouse Electric Corporation
Energy Systems

Nuclear Services Division

PO Box 855
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December 30, 1996
CAW-96-1057

Document Control Desk
US Nuclear Regulatory Commission
Washington, DC 20555

Attention: Mr. Frank J. Miraglia, Director

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: "Specific Application of Laser Welded Sleeves for Farley Units 1 and 2 Steam Generators" WCAP-14740 (Proprietary)

Dear Mr. Miraglia:

The proprietary information for which withholding is being requested is further identified in Affidavit CAW-96-1057 signed by the owner of the proprietary information, Westinghouse Electric Corporation. The affidavit, which accompanies this letter, 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 10 CFR Section 2.790 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying Affidavit by Southern Nuclear Operating Company.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavit should reference this letter, CAW-96-1057, and should be addressed to the undersigned.

Very truly yours,

N. J. Liparulo, Manager
Regulatory & Engineering Networks

/jas
Enclosures

cc: Kevin Bohrer/NRC (12H7)

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CAW-96-1057

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

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COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared Henry A. Sepp, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Corporation ("Westinghouse") and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

Henry A. Sepp, Manager
Regulatory and Licensing Initiatives

Sworn to and subscribed
before me this 2nd day
of January, 1997

Notary Public

Notarial Seal
Janet A. Schwab, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires May 22, 2000
Member, Pennsylvania Association of Notaries

1569a.wpf:jas:1:December 30, 1996

(1) I am Manager, Regulatory and Licensing Initiatives, in the Nuclear Services Division, of the Westinghouse Electric Corporation and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rulemaking proceedings, and am authorized to apply for its withholding on behalf of the Westinghouse Energy Systems Business Unit.

(2) I am making this Affidavit in conformance with the provisions of 10CFR Section 2.790 of the Commission's regulations and in conjunction with the Westinghouse application for withholding accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by the Westinghouse Energy Systems Business Unit in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.790 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of

Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information which is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10CFR Section 2.790, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in "Specific Application of Laser Welded Sleeves for Farley Units 1 and 2 Steam Generators" WCAP-14740 (Proprietary), December, 1996 for Farley Units 1 and 2, being transmitted by Southern Nuclear Operating Company letter and Application for Withholding Proprietary Information from Public Disclosure, to Document Control Desk, Attention Frank J. Miraglia. The proprietary information as submitted for use by Southern Nuclear Operating Company for Farley Units 1 and 2 is expected to be applicable in other licensee submittals in response to certain NRC requirements for justification of steam generator laser welded sleeves.

This information is part of that which will enable Westinghouse to:

(a) Provide documentation of the results of an analysis to evaluate the applicability of the generic steam generator laser welded sleeving analysis (WCAP-13088, Rev. 4) to the Farley Units 1 and 2 Steam Generators.

(b) Provide mechanical test results for sleeves.

(c) Provide analytical verification for the use of sleeves.

(d) Define the minimum wall thickness requirement for the sleeves.

(e) Assist the customer in obtaining NRC approval.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of similar information to its customers for purposes of meeting requirements for licensing documentation.

(b) Westinghouse can sell support and defense of the technology to its customers in the licensing process.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar methodologies and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort,

having the requisite talent and experience, would have to be expended for developing testing and analytical methods and performing testing.

Further the deponent sayeth not.

Proprietary Information Notice

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.790 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) contained within parentheses located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuance to 10 CFR 2.790(b)(1).

Enclosure 3

Significant Hazards Evaluation

Laser Welded Sleeving

Laser Welded Sleeving
Farley Nuclear Plant Units 1 And 2
Significant Hazards Evaluation

1.0 INTRODUCTION

The installation of steam generator tubesheet and tube support plate elevation tube laser welded sleeves per WCAP-12672 is currently licensed at the Farley Nuclear Plant. However, as continual improvements in the sleeve installation process and sleeve configuration have occurred, the tube/sleeve assembly as described in Westinghouse Report WCAP-12672 is no longer entirely representative of the latest installation process and configuration, which are described and evaluated in WCAP-13088, Revision 4 and in the accompanying plant specific report, WCAP-14740. WCAP-13088, Revision 4 is a generic analysis of a laser welded sleeve tube assembly which uses bounding inputs applicable to all plants with Westinghouse Model 44 and 51 steam generators. The accompanying plant specific WCAP-14740, "Specific Application of Laser Welded Sleeves for the Farley Units 1 and 2 Steam Generators," shows that the sleeve design evaluated in WCAP-13088, Revision 4 is acceptable for installation into the Farley Units 1 and 2 steam generators at uprated conditions. WCAP-14740 also describes specific installation parameters for the full length tubesheet and elevated tubesheet sleeves developed for Farley Nuclear Plant. These documents support the installation of laser welded sleeves at Farley Units 1 and 2, and supersede WCAP-12672.

A license amendment is proposed to support the installation of Alloy 690 laser welded sleeves within the steam generators at Farley Units 1 and 2 as described in WCAP-13088, Revision 4 and WCAP-14740. The installation of laser welded sleeves in accordance with these technical support documents requires a change to the tube repair definitions included within Specification 4.4.6.4.a.9 in the Farley Nuclear Plant Technical Specifications. WCAP-13088, Revision 4, updates the sleeve installation process to include recent improvements in the sleeve installation procedure that ultimately result in a higher quality repair process.

In addition for Unit 2, references to a one cycle limited implementation of L* are being removed. The approval for the limited implementation of L* expired at the last Unit 2 outage in the Fall of 1996.

2.0 DESCRIPTION OF THE AMENDMENT REQUEST

As required by 10 CFR 50.91 (a)(1), this analysis is provided to demonstrate that a proposed license amendment to implement repair of tubes using laser welded tube sleeves for the steam generators at Farley Units 1 and 2 as described in WCAP-13088, Revision 4, and WCAP-14740 represents no significant hazards consideration. In accordance with 10 CFR 50.92(c), implementation of the proposed license amendment was analyzed using the following standards and found not to: 1) involve a significant increase in the probability or consequences for an accident previously evaluated; 2) create the possibility of a new or different kind of accident from any accident previously evaluated; or 3) involve a significant reduction in a margin of safety.

The original analysis criteria for the licensed laser welded sleeving configuration at Farley Nuclear Plant continues to apply to the installation of laser welded sleeves at Farley Nuclear Plant per WCAP-13088, Revision 4 and WCAP-14740. These criteria are that the structural attachment between the tube and sleeve for each individual joint meets the limiting loading conditions defined in draft Regulatory Guide 1.121, and that the sleeve will not significantly contribute to offsite doses following a main steam line break outside of the containment building, but upstream of the main steam line isolation valves.

The proposed amendment would modify portions of Technical Specification 3/4.4.6, "Steam Generators," and the associated bases to update the installation process for laser welded tube sleeves and to provide the sleeve/tube inspection requirements and acceptance criteria to determine the level of degradation which would require the sleeve to be removed from service.

The changes in the existing licensing documentation are:

1. WCAP-12672 shows the lower joint of the elevated tubesheet sleeve at Farley Unit 2 is hydraulically expanded into place and a laser weld is produced, using the sleeve and tube. The evaluation of the elevated tubesheet sleeve discussed in WCAP-12672 limited the installation to plants with full depth tube roll expansion only. WCAP-13088, Revision 4, supports elevated tubesheet sleeve installation in plants with full depth roll expanded and full depth hydraulic or explosive tube expansions. The lower joint of the elevated tubesheet sleeve to be installed at Farley Units 1 and 2 will consist of a section that is hydraulically expanded into the original tube and a smaller section within the hydraulically expanded zone which is roll expanded. There will be no laser weld in the lower joint. Currently, WCAP-12672 does not include a roll expansion of the lower joint in the elevated tubesheet sleeve.

2. WCAP-12672 describes the full length tubesheet sleeve configuration as having an optional single pass seal weld between the sleeve and the tube approximately 1 inch above the tubesheet cladding. A letter was written to the NRC staff on April 2, 1992, by Southern Nuclear Operating Company describing the current configuration of tubesheet sleeves installed in Farley Units 1 and 2 where the seal weld was moved from 1 inch above the cladding to in the plane with the tubesheet cladding. The tube/sleeve assembly for the full length tubesheet sleeve is described in WCAP-13088, Revision 4. The lower joint includes a hydraulic expansion with subsequent roll expansion. The lower joint of the full length tubesheet sleeve has been shown to be leaktight at operating conditions. Therefore, the seal weld is not required. The upper hydraulic expansion length in WCAP-12672 is 4" whereas this length is 2.5" in WCAP-13088, Revision 4. Shortening of this distance optimizes post weld heat treatment performance.

3. The initial installation sequence defined in WCAP-12672 called for the free span weld production following lower hard rolling. Testing has shown that particularly for the elevated tubesheet sleeve, far field tube stresses are lowered for a weld first, roll last sequence. The elevated tubesheet sleeve at Farley Nuclear Plant will be installed weld first, roll last. The full length tubesheet sleeve can be installed either roll first or roll last.

4. The sleeve repair limit for allowable tube wall degradation changes from 37 to 24% based on the use of ASME Code minimum material properties for calculating the steam generator tube structural limit and then establishing the necessary repair limit. The Farley sleeve repair limit of 24% by NDE is considered bounding for current and uprated plant operation.

5. The reweld process for the laser welded sleeve joint has changed since issuance of WCAP-12672 and the change is reflected in the WCAP-13088, Rev. 4. The weld process specification for the laser welding process has not changed.

6. For Unit 2, references to a one cycle limited implementation of L* are being removed. The approval for the limited implementation of L* expired at the last Unit 2 outage in the Fall of 1996.

3.0 EVALUATION

3.1 Generic Structural/Leakage Assessment

As discussed in WCAP-12672, during the development of laser welded sleeving, Section III of the 1986 Edition of the ASME Code was used for the bounding stress and fatigue levels for the sleeve and sleeve/tube weld. The sleeve designs identified in WCAP-13088, Revision 4 are designed and analyzed according to the 1986 Edition of the ASME Code. The sleeving subsection of the Code, i.e., IWB-4300, first approved in Section XI, Division 1, 1989 Addenda of the ASME Code, dated March 1990, is also used in the evaluation as guidelines. There are no significant differences between the 1986 and 1989 version of the ASME Code such that the technical justification for the acceptability of the installation of laser welded sleeves at Farley Units 1 and 2 would be changed.

The results of the primary stress intensity evaluation, primary plus secondary stress intensity range evaluation and fatigue evaluation indicate that the limiting values established by the ASME Code are not exceeded. By showing that the sleeve design meets the applicable subsections of Section III of the Code, the sleeve design meets the design requirements of the original tubing, that is, the stresses within the sleeve and weld are bounded by the ASME Code allowable limits, and the sleeve joints are leaktight. The structural analysis utilized a generic set of design and transient loading inputs which are applicable to all plants with Westinghouse Model 44 and 51 steam generators. The temperature and pressure variances used in the generic transients are considered conservative. The weld thickness is based on the weld width which is a result of the laser welding process. The nominal thickness of the field produced welds are approximately twice the minimum required weld thickness used for analysis purposes.

Regulatory Guide 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes," is used to develop the plugging limit of the sleeve determined by NDE, should sleeve wall degradation occur. Potentially degraded sleeves as specified by RG 1.121 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 assumed when performing the minimum wall/burst evaluation. The requirements of

Regulatory Guide 1.83, Revision 1, "Inservice Inspection of PWR Steam Generator Tubes," are implemented, and a baseline eddy current inspection of the installed sleeves is performed prior to operation.

An ultrasonic inspection of the free span weld joints for the tubesheet and tube support plate elevation sleeves is performed prior to operation. The ultrasonic inspection is used to verify that the minimum acceptable fusion zone thickness of the freespan welds is achieved for the entire weld circumference. 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 tube/sleeve assemblies, 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 conservative for an operating plant. The results of the fatigue analysis indicate acceptable usage factors for the entire range of permitted weld thicknesses. Eddy current examination of the sleeves is also performed prior to operation to verify that the welds are properly located, that post weld heat treatment has been performed, and to establish a baseline eddy current signature which inservice inspection can be compared against.

Leakage testing under conditions considered to be more severe than expected during all operating plant conditions has shown that the laser welded sleeve does not introduce additional primary to secondary leakage during a postulated steam line break event. Laser welded sleeved tube joints were subjected to thermal and fatigue cycling and then leak tested at pressure differences of up to 3110 psi, which far exceeds the expected feedline break (FLB)/steamline break (SLB) pressure differential. No leakage was detected in any welded joint.

The two step roll process to be employed for the lower joints of the tubesheet sleeves at Farley Nuclear Plant was leak tested at room temperature conditions. Room temperature leakage testing is conservative since the thermal tightening effects due to the tube/sleeve material combination is not included. Qualification testing completed for the lower joint for the full length tubesheet sleeves and elevated tubesheet sleeves with the two step hardroll resulted in insignificant leakage during all normal operating and SLB conditions. For the full length tubesheet sleeve, the room temperature, average primary-to-secondary leakage experienced during SLB pressure differential of 2650 psi was negligible. Total leakage during a postulated SLB/FLB event from 1000 full length tubesheet sleeve lower joints installed in a single steam generator would be approximately 1.7×10^{-4} gpm. For the elevated tubesheet sleeve, the room temperature average primary-to-secondary leakage experienced during SLB pressure differential was slightly higher, but still negligible. Total leakage during a postulated SLB/FLB from 1000 sleeves installed in a single steam generator would be approximately 8.2×10^{-4} gpm. Based on the test results, no significant primary-to-secondary leakage through the two step roll process non-welded tubesheet sleeve lower joints would be expected during all plant conditions. Because Farley Nuclear Plant has implemented the voltage based plugging criterion for ODSCC at tube support plate intersections (ARC), per Generic Letter 95-05, the combination of ARC permissible leakage and potential leakage from sleeve non-welded joints in a given steam generator at the SLB/FLB condition are considered. The current total allowable primary-to-secondary leakage for a SLB event for Farley Nuclear Plant is 11.4 gpm in the faulted loop. Based on the results of the qualification testing, the leakage contribution from sleeved tubes is a negligible fraction of the 11.4 gpm faulted condition permissible leak

rate. Therefore, essentially all of the 11.4 gpm can be allocated to the support plate ARC. Furthermore, the extremely conservative methodology for calculating SLB leakage from intersections permitted to remain in service through application of the ARC will adequately compensate for any postulated leakage from non-welded sleeve lower joints. Further conservatism is provided in that a pre-existing throughwall penetration in the tube between the upper and lower sleeve joints must be present for any lower joint leakage to migrate to the secondary side of the steam generator.

Tubesheet bow effects were analytically modeled with regard to effect upon leaktightness and structural capacity upon the elevated tubesheet sleeve lower joint. A three dimensional finite element model of the steam generator channel head was used to establish the tubesheet bow effects for various elevations throughout the thickness of the tubesheet. When thermal and pressure tightening effects are combined with tubesheet bow effects at the elevation coincident with the top of the elevated tubesheet sleeve roll expanded region, the net result of the combination of these three factors indicates a positive effect upon contact pressures, even for faulted conditions. Therefore, the elevated tubesheet sleeve lower joint will not experience any operational effects which would act to loosen the joint, either structurally or with regard to leakage integrity.

The two step rolling process was also tested for verification of mechanical integrity. Tensile loading of two step roll lower joints indicates that the breakaway load exceeds the limiting RG 1.121 end cap load by a large margin. Previous testing indicates that the peak load is developed after breakaway. Therefore, additional structural margins above those determined from breakaway load determination will be provided.

Thermally treated Alloy 600 and Alloy 690 sleeved tube assemblies have performed well historically with regard to corrosion. Accelerated corrosion test results show the free span laser welded joint (with post weld heat treatment) is capable of exhibiting a resistance to corrosion of greater than 10 times that of rolled tube transitions. Accelerated corrosion tests also show that non-heat treated laser welded free span joints exhibit resistance to stress corrosion cracking equal to or greater than rolled tube transitions. These factors suggest postulated sleeve degradation, even in a non-heat treated condition, would occur at a relatively slow rate, and be able to be detected by routine eddy current inspection without influencing applicable safety margins. The free span laser welded joint heat treatment process is designed to achieve a tube OD wall temperature adjacent to the weld which results in enhanced corrosion performance of the joint with negligible effect upon post process tube far field residual stresses.

3.2 Specific Structural Assessment

In evaluating the maximum range of stress and fatigue, the number of transients, as well as the temperature and pressure fluctuations are significant. A comparison of the transient cycles considered in the generic analysis to the applicable transients for Farley Units 1 and 2 shows that the generic analysis conditions are bounding and, as such, the stress and fatigue results of WCAP-13088, Revision 4 are enveloping. The primary stress evaluation and the fatigue analysis were performed for the cases where the tube is both free at the tube support plate and dented/locked at the tube support elevation and the parent tube is both separated in the region spanned by the sleeve, and where the tube is intact. For the design conditions, the intact parent

tube case results in the highest stress level in the sleeve/tube assembly while the separated tube results in the limiting case for fatigue.

3.3 Sleeving of Previously Plugged Indications

The sleeve 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. The location of the identified tube degradation indication must be verified to be a minimum distance from the weld joints (same for active tubes), as defined in WCAP-13088, Revision 4. Historically, the areas of the tube which have suffered corrosion degradation indications are the tube support plate intersections, the expansion transition (at the top of the tubesheet), and within the thickness of the tubesheet nearer to the top of the tubesheet. The sleeve free span (structural) weld joints are not located in these areas, and should not be affected by any previously identified degradation mechanism which resulted in the tube's removal from service. The analysis has also supported sleeve installation in a separated tube, therefore, the extent of the originally identified degradation indication should not affect sleeve installation. The ability of the weld to sufficiently penetrate the tube wall has been shown by test in cases where a localized gap of several mils existed between the tube and sleeve. For the installation of full length tubesheet sleeves, the penetrating capabilities of the weld will also help to ensure a leaktight joint in cases where slight surface imperfections due to tube plug removal may be present.

3.4 Rewelding

In the event of an incomplete first cycle weld, or an uninspectable first cycle weld, two rewelds can be performed over the initial weld. Two additional weld passes can be performed at an elevation inboard of the original free span weld. In these cases, the additional weld(s), having the same nominal characteristics as the initial weld will be performed. If the sleeve/tube has not been perforated by an interrupted weld, an additional weld having the same nominal characteristics as the original weld will be made over the initial weld or in the expansion zone near the original weld inboard of this initial weld. If a perforation of the sleeve is suspected in the initial weld area, the repair weld will be made in the expansion zone near the original weld inboard of this initial weld. A perforation of the parent tube will cause the tube/sleeve to be removed from service by plugging. This welding process specification has been qualified according to the ASME Code. Code Case N-395 addresses the laser welded sleeving process and essential variables. Code Case N-395 is listed as an acceptable Code Case in Regulatory Guide 1.84, Revision 28, dated 1992.

4.0 ANALYSIS

Conformance of the proposed amendments to the standards for a determination of no significant hazard as defined in 10 CFR 50.92 (three factor test) is shown in the following:

4.1 Operation of Farley Units 1 and 2 in accordance with the proposed license amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated.

The laser welded sleeve configurations as described within WCAP-13088, Revision 4 and WCAP-14740 have been designed and analyzed in accordance with the requirements of the ASME Code. Fatigue and stress analyses of the sleeved tube assemblies produced acceptable results. Mechanical testing has shown that the structural strength of Alloy 690 sleeves under normal, faulted and upset conditions is within acceptable limits. Leakage testing for 7/8 inch tube sleeves has demonstrated that significant primary-to-secondary leakage is not expected during all plant conditions, including the case where the seal weld is not produced in the lower joint of the tubesheet sleeve.

Initial acceptance of welded joints uses ultrasonic inspection to verify that all weld thicknesses meet the minimum specified conditions over the entire circumference. A plugging limit of 24% allowable depth of penetration of the sleeve tube wall thickness applies for each type of laser welded sleeve that may be installed in the Farley Nuclear Plant steam generators and is determined for uprated conditions with a limiting steam pressure for reduced T_{hot} and 20% steam generator tube plugging conditions. These conditions represent the limiting primary-to-secondary operating pressure differential, which is bounding for the sleeve plugging limit and structural analysis inputs. However, the state-of-the-art in eddy current inspection capability is such that no probes are qualified to size the depth of penetration of stress corrosion cracking. It is generally believed that the detection threshold of these probes is well below 40% throughwall. Southern Nuclear Operating Company will plug on detection any crack-like indications that may occur in the sleeve using the sleeve inspection probe of record until an inspection process is qualified to size depth of penetration of stress corrosion cracking into the tube wall.

The hypothetical consequences of failure of the sleeve would be bounded by the current steam generator tube rupture analysis included in the Farley Nuclear Plant FSAR. Due to the slight reduction in diameter caused by the sleeve wall thickness, it is expected that 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. Combinations of tubesheet sleeves and tube support plate sleeves would reduce the primary fluid flow through the sleeved tube assembly due to the series of diameter reductions the fluid would have to pass on its way to the break area. The overall effect would be reduced steam generator tube rupture release rates.

As addressed previously, the proposed Technical Specification change to support the installation of full length tubesheet, elevated tubesheet, or tube support plate elevation Alloy 690 laser welded sleeves as described in WCAP-13088, Revision 4 and WCAP-14740 does not adversely impact any other previously evaluated design basis accident or the results of LOCA and non-LOCA accident analyses for the current Technical Specification minimum reactor coolant system flow rate. The results of the analyses and testing, as well as plant operating experience, demonstrate that the sleeve assembly is an acceptable means of restoring tube integrity to a condition consistent with its original design basis. Also, per Regulatory Guide 1.83, Revision 1 recommendations, the condition of the sleeved tube can be monitored through periodic inspections with present eddy current techniques.

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 the installation of laser welded tube sleeves will not increase the probability or consequences of an accident previously evaluated. Depending upon the break location for a postulated steam generator tube rupture event, implementation of tube sleeving could act to reduce the radiological consequences to the public due to reduced primary to secondary flow rate through a sleeved tube compared to a non-sleeved tube based on the restriction afforded by the sleeve wall thickness.

Removal of the references to the interim use of an L* repair criteria will not involve a significant increase in the probability or consequences of an accident previously evaluated.

4.2 <u>The proposed license amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated.</u>

Implementation of laser welded sleeving will not introduce significant or adverse changes to the plant design basis. Sleeving also does not represent a potential to affect any other plant component. Stress and fatigue analysis of the repair has shown the ASME Code minimum stress values are not exceeded. Implementation of laser welded sleeving 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 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 hypothetical 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. Since the sleeve design does not affect any other component or location of the tube outside of the immediate area repaired, in addition to the fact that the installation of sleeves and the impact on current plugging level analyses is accounted for, the possibility that laser welded sleeving creates a new or different type of accident is not credible.

Removal of the references to the interim use of an L* repair criteria will not create the possibility of a new or different kind of accident from any accident previously evaluated.

4.3 <u>The proposed license amendment does not involve a significant reduction in margin of safety.</u>

The laser welded sleeving repair of degraded steam generator tubes as identified in WCAP-13088, Revision 4, has been shown by analysis to restore the integrity of the tube bundle consistent with its original design basis condition as the requirements of the ASME Code are satisfied. The safety factors used in the design of sleeves for the repair of degraded tubes are consistent with the safety factors in the ASME Boiler and Pressure Vessel Code used in steam generator design. The design of the tubesheet sleeve lower joints for the 7/8 inch sleeves (for both the full length and elevated tubesheet sleeve) have been verified by testing to preclude realistic leakage during normal and postulated accident conditions.

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 recommendations of Regulatory Guide 1.83, Revision 1 and the surveillance requirements included in Specification 4.4.6.0. The portion of the tube bridged by the sleeve joints 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-13088, Revision 4.

The effect of sleeving on the design transients and accident analyses have been reviewed based on the installation of sleeves up to the level of steam generator tube plugging coincident with the minimum reactor flow rate. The installation of sleeves is to be evaluated as the equivalent of some level of steam generator tube plugging. Evaluation of the installation of sleeves is based on the determination that LOCA evaluations for the licensed minimum reactor coolant flow bound the effect of a combination of tube plugging and sleeving up to an equivalent of the actual steam generator tube plugging limit. Information provided in WCAP-13088, Revision 4, describes the method to determine the flow equivalency for all combinations of tubesheet and tube support plate sleeves in order that the minimum flow requirements are met.

Implementation of laser welded sleeving will reduce the potential for primary-to-secondary leakage during a postulated steam line break while maintaining available primary coolant flow area in the event of a LOCA. By effectively isolating degraded areas of the tube through repair, primary pressure boundary integrity is restored and the potential for primary-to-secondary leakage during all plant conditions is minimized. These degraded tubes are returned to a condition consistent with the design basis. While the installation of a sleeve causes a reduction in primary coolant flow, the reduction is significantly below the reduction incurred by plugging. Therefore, greater primary coolant flow area is maintained through sleeving.

Removal of the references to the interim use of an L* repair criteria will not involve a significant reduction in margin of safety.

5.0 CONCLUSION

Based on the preceding analysis it is concluded that operation of the Farley Units 1 and 2 following the installation of Alloy 690 laser welded sleeves in the steam generators, as described within WCAP-13088, Revision 4 and WCAP-14740 does not increase the probability of an accident previously evaluated, create the possibility of a new or different kind of accident from any accident previously evaluated, nor reduce any margins to plant safety. Therefore, the license amendment does not involve a Significant Hazards Consideration as defined in 10 CFR 50.92.