Westinghouse Electric Corporation
Energy Systems

Box 355
Pittsburgh Pennsylvania 15230-0355

March 1, 1993
CAW-93-427

Document Control Desk
US Nuclear Regulatory Commission
Washington, DC 20555

Attention: Dr. Thomas Murley, Director

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: WCAP-12985, Rev. 2 "Kewaunee Steam Generator Tube Plugging Criteria for ODSCC at Tube Support Plates" (Proprietary)

Dear Dr. Murley:

The proprietary information for which withholding is being requested in the above-referenced letter is further identified in Affidavit CAW-93-427 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 Wisconsin Public Service Corporation.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavit should reference this letter, CAW-93-427, and should be addressed to the undersigned.

Very truly yours,

Mr. Nicholas J. Liparulo, Manager
Nuclear Safety and Regulatory Activities

/cld
Enclosures

cc:Kevin Bohrer/NRC (12H5)

CLD154:TJK/022693

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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 pursuant to 10 CFR 2.790(b)(1).

CLD154:TJK/022693

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CAW-93-427

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
Strategic Licensing Issues

Sworn to and subscribed
before me this 2ND day
of March, 1993

Lorraine M. Piplica
Notary Public

Notarial Seal
Lorraine M. Piplica, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires Dec. 14, 1995
Member, Pennsylvania Association of Notaries

0700C-TJK-1:022693

(1) I am Manager, Strategic Licensing Issues, in the Nuclear and Advanced Technology 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 "Kewaunee Steam Generator Tube Plugging Criteria for ODSCC at Tube Support Plates", WCAP-12985, Rev. 2 (Proprietary), March 1993 for the Kewaunee Nuclear Power Plant, being transmitted by the Wisconsin Public Service Company (WPS) letter and Application for Withholding Proprietary Information from Public Disclosure, to Document Control Desk, Attention Dr. Thomas Murley. The proprietary information as submitted for use by Wisconsin Public Service Company for the Kewaunee Nuclear Power Plant is expected to be

applicable in other licensee submittals in response to certain NRC requirements for justification of steam generator plugging criteria at tube support plates.

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

(a) Provide documentation of the methods for tube plugging criteria for ODSCC at tube support plates.

(b) Establish applicable analytical technologies.

(c) Establish the margins against tube burst.

(d) Assist the customer to obtain 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 NRC 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 analytical methods and performance tests.

Further the deponent sayeth not.

ATTACHMENT 1

to

Proposed Amendment No. 113A

Letter from C. R. Steinhardt (WPSC)

to

Document Control Desk (NRC)

Dated

March 3, 1993

Introduction

Background

Description of Proposed Change

Safety Evaluation

Significant Hazards Determination

Environmental Considerations

INTRODUCTION

In a letter dated December 27, 1991, Wisconsin Public Service Corporation (WPSC) submitted a proposed Technical Specification (TS) amendment requesting an alternate plugging criteria (APC) for the steam generator (SG) tube support plate (TSP) intersections. Subsequent to submitting this request, we learned that the NRC staff was reviewing the tube support plate APC as a generic issue with the Joseph M. Farley Plant Unit 2 submittal serving as the lead proposed amendment request. Since the lead plant review will not be completed prior to our upcoming refueling outage, we are requesting NRC staff approval of an interim plugging criteria (IPC) of 1 volt for flaws confined to within the thickness of the TSP. The IPC is conservatively bounded by the Kewaunee specific APC repair limit of 2.5 volts, and will be applicable for our 1993-1994 operating cycle only. Implementation of the IPC will be supplemented by additional inspection requirements, a reduced operating leakage limit and an analysis to confirm that the leakage subsequent to a postulated end-of-cycle main steam line break (SLB) will not exceed the value of 1 gallon per minute (gpm).

BACKGROUND

Previous inservice inspection results and tubes pulled from the Kewaunee SG tubesheet crevice region in 1990 have identified intergranular stress corrosion cracking on the outside diameter (OD) of the tubes in the crevice region. This form of tube degradation is referred to as outer diameter stress corrosion cracking (ODSCC). This degradation is primarily axial with some intergranular characteristics. Analyses performed on the OD deposits taken from the crevice and crack fracture oxide film showed the presence of an alkaline environment which is known to contribute to stress corrosion cracking. Although direct examination of pulled tubes from the Kewaunee TSP intersections has not been performed, a caustic environment is also expected to exist in this region. This expectation is supported by the existing tube pull data base which has confirmed similar caustic induced ODSCC degradation at TSP intersections at other plants, and by the rotating pancake coil (RPC) probe inspection results for the Kewaunee SG TSP intersections. During the 1992 refueling outage, RPC inspection was performed on a large number of TSP intersections in each SG. The RPC probe inspection results further supported the presence of axial ODSCC at the TSP intersections.

The repair criteria for axially oriented ODSCC degradation confined to within the thickness of the TSPs is developed for Kewaunee in WCAP-12985, Revision 2, "Kewaunee Steam Generator Tube Plugging Criteria for ODSCC at Tube Support Plates." WCAP-12985, Revision 2, incorporates the burst and leak rate data available since the preparation of WCAP-12985, and additional evaluations that have been requested by the NRC staff for IPC submittals from other licensees. Specifically, WCAP-12985, Revision 2, includes:

- incorporation of recent pulled tube data (WCAP-12985, Revision 2 includes the recent Farley 1 data);
- an update of the Kewaunee specific voltage growth rate data;
- a revision to the methodology used to calculate the primary-to-secondary leakage following a postulated steam line break (SLB); and
- the eddy current (EC) inspection and analysis guidelines that will be used for implementation of an IPC or APC.

WCAP-12985, Revision 2, demonstrates that an APC repair limit of 2.5 volts satisfies the criteria of Regulatory Guide (RG) 1.121, "Bases for Plugging Degraded Steam Generator Tubes." The IPC was developed by adding additional conservatism to the APC repair limit. Specifically, the IPC proposal is as follows:

1) A bobbin probe inspection of 100% of the hot and cold leg TSP intersections will be performed for tubes in service.

2) Degradation within the thickness of the TSPs with a bobbin probe voltage less than or equal to 1.0 volt will be allowed to remain in service. This is provided that the projected end-of-cycle (EOC) distribution of indications is verified to result in a primary-to-secondary leakage of < 1 gpm in the faulted loop during a SLB. (The acceptable method for performing the end-of-cycle leak rate calculation is described in WCAP-12985, Revision 2.)

3) Degradation within the thickness of the TSPs with a bobbin probe voltage greater than 1.0 volt and attributable to ODSCC will be repaired or plugged except as noted in 4 below.

4) Indications of potential degradation within the thickness of the TSPs with a bobbin probe voltage greater than 1.0 volt, but less than or equal to 2.5 volts, may remain in-service if a RPC probe inspection does not detect or confirm the degradation as ODSCC.

5) A plant shutdown will be initiated if normal operating primary-to-secondary leakage exceeds 150 gpd in either SG.

In addition to the above items that will affect the Kewaunee Technical Specifications, the following commitments will be implemented in conjunction with staff approval of the IPC:

1) The data acquisition and analysis guidelines, included as Appendix A to WCAP-12985, Revision 2, will be incorporated into the Kewaunee EC analysis guidelines.

2) A sample RPC probe inspection of 100 TSP intersections will be performed. All intersections with a bobbin probe dent voltage exceeding 5 volts will be inspected as a part of the sample. Other intersections in the sample population will be based on inspecting indications throughout the full range of bobbin voltages, including NDD tube intersections. Expansion of the sample plan, if required, will be based on the nature and number of the flaws.

3) RPC probe indications attributable to ODSCC not found by the bobbin probe due to masking effects (denting, artifact indications and noise) will be plugged or repaired.

4) The NRC staff will be informed of any unforeseen RPC probe findings relative to the characteristics of the flaws at the TSPs. This includes any detectable circumferential indications or detectable indications extending outside the thickness of the TSP.

5) The results of the EOC leak rate calculation will be included with the report submitted in accordance with proposed TS 4.6.b.6.d.

Following is a description of the proposed TS changes, a safety evaluation, a 10CFR50.92 significant hazards determination, and an environmental considerations statement. Attachment 2 contains the affected TS pages.

DESCRIPTION OF PROPOSED TS CHANGES

This proposed amendment request modifies Kewaunee TS 3.1.d, "Leakage of Reactor Coolant," and TS 4.2.b, "Steam Generator Tubes," to incorporate the reduced operational leakage requirements, tube inspection requirements and the acceptance criteria based on WCAP-12985, Revision 2. The changes are as follows:

1) In TS 3.1.d.2, the reactor coolant primary-to-secondary leakage through the SG tubes is being reduced from 500 gpd to 150 gpd through either SG if an alternate tube repair limit has been applied.

2) In TS 4.2.b:

- The definition of tube inspection is being expanded to include the inspection of all hot leg and cold leg TSP intersections if an alternate repair limit is applied;

- TS 4.2.b.2.a is being expanded to state that if an alternate repair limit is applied, then a 100% bobbin probe inspection of the hot leg and cold leg TSP intersections will be performed;

- TS 4.2.b.4 is being expanded to make it clear that the depth based plugging limit does not apply for the TSP intersections where the degradation mechanism is ODSCC;

- TS 4.2.b.5 describes the alternate repair limit to be used on an interim basis for the ODSCC within the TSP intersections;

- Footnote (2) has been added to specify that 4.2.b.5 is applicable for the 1993-1994 operating cycle only; and

- TS 4.2.b.6.4 and TS 4.2.b.6.d have been added to include reporting the tubes for which an alternate repair limit has been applied.

In addition to the proposed changes associated with the IPC, the TS changes approved as Amendment No. 93 are being removed. TS Amendment No. 93 was approved by the NRC staff on May 3, 1991, to provide a method to disposition RPC indications in the SG hot leg crevice region during the 1991 refueling outage. The amendment was approved on an interim basis for the 1991-1992 operating cycle, therefore, the provisions of this amendment are no longer applicable.

The following changes are being proposed to remove the conditions approved as TS Amendment No. 93:

- The definitions for distorted indication, tube sheet crevice region and squirrel indication are being removed;

- in TS 4.2.b.4, footnote (2) referring to the hot leg crevice region criteria is being deleted; and

- TS 4.2.b.5, "Hot Leg Tubesheet Crevice Plugging Limit Criteria" and the accompanying footnote are being superseded by the "Tube Support Plate Alternate Plugging Criteria."

Concurrent with these changes, the bases are being revised and submitted for your information.

SAFETY EVALUATION

WCAP-12985, Revision 2, "Kewaunee Steam Generator Tube Plugging Criteria for ODSCC at Tube Support Plates", provides the technical and regulatory basis for a 2.5 volt APC repair limit. The APC was derived from a correlation between the eddy current bobbin coil signal amplitude (voltage), SG tube structural integrity, and potential leakage under normal and postulated accident conditions. The 1.0 volt criteria on an interim basis is more conservative than the 2.5 volt limit. Application of the IPC will not significantly increase the probability of a previously evaluated accident, or result in radiological consequences exceeding a small fraction of the 10CFR100 limit.

The following safety evaluation discusses:

- Tube Structural Issues (RG 1.121)
- Tube Repair Limit Summary
- Leakage Integrity Considerations

Tube Structural Issues (RG 1.121)

In development of the APC repair limit, RG 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes," and RG 1.83, "Inservice Inspection of PWR Steam Generator Tubes," are used as the bases for determining that the tube structural integrity is maintained within acceptable limits. RG 1.121 describes a method acceptable to the NRC staff for meeting General Design Criteria (GDC) 2, 14, 15, 31 and 32 by determining the limiting safe conditions of tube wall degradation beyond which tubes with unacceptable cracking, as established by inservice inspection, should be removed from service. RG 1.121 implements safety factors on loads for tube burst that are consistent with the requirements of Section III of the ASME code. For the TSP degradation occurring in the Kewaunee SGs, tube burst criteria are inherently satisfied during normal operating conditions by the presence of the TSPs.

The presence of the TSP enhances the integrity of the degraded tubes in that region by precluding tube deformation and subsequent tube burst beyond the diameter of the drilled hole during normal operation. It is not certain if the TSP would function to provide a similar function during an accident condition. Therefore, a conservative requirement for tube burst margins assuming free span degradation has been applied to develop the Kewaunee alternate repair limit.

RG 1.83 describes a method acceptable to the NRC staff for implementing GDC 14, 15, 31 and 32 through periodic inservice inspection to detect significant tube wall degradation.

In accordance with paragraph C.3.d(1) of RG 1.121, the applicable limiting structural loading criteria for thinned and unthinned tubes with partial and through-wall cracks can be summarized as:

1. Through-wall cracks in minimum thickness tubes should not propagate and result in tube wall rupture under accident condition loadings.

2. The maximum permissible crack length of the largest single crack should be such that the associated burst pressure is at least 3 times the normal operating pressure differential.

3. The leak rate under normal operation set forth in the plant's Technical Specifications should be less than the leakage limit determined for the longest permissible crack.

With regard to criterion 1 of RG 1.121, the most limiting accident condition relative to accident loadings and tube deformation is the Loss-of-Coolant Accident (LOCA) in combination with a Safe Shutdown Earthquake (SSE). It must be shown that SG tube collapse will not occur under the combined loadings of a postulated LOCA and SSE event. The TSPs may become deformed as a result of radial loads at the wedge supports at the periphery of the TSP due to either the LOCA rarefaction wave or SSE loadings. The pressure differential to the deformed tubes resulting from the deformation of the TSPs may cause some of the tubes to collapse.

There are two issues associated with SG tube collapse. First, collapse of the SG tubing reduces the reactor coolant system (RCS) flow area through the tubes. The reduction in flow area increases the resistance to flow of steam from the core during a LOCA which in turn may potentially increase Peak Clad Temperature (PCT). Second, there is the potential that tubes with partial through-wall cracks could progress to through-wall cracks during tube deformation. This may result in significant secondary-to-primary in-leakage during a LOCA event which may also adversely affect LOCA PCT.

The issue of tube collapse has been addressed for the Kewaunee SGs through the application of leak-before-break (LBB) principles to the primary loop piping. A detailed LBB analysis has been performed for Kewaunee. Based on the results, it is concluded that the LBB methodology (as permitted by GDC 4) is applicable to the Kewaunee reactor coolant system primary loops and, thus, the probability of breaks in the primary loop piping is sufficiently low that they need not be considered in the structural design basis of the plant. Excluding breaks in the RCS primary loops, the LOCA loads from the large branch lines breaks were also assessed and found to be of insufficient magnitude to result in SG tube collapse. Using results from recent tests and analysis programs, it has also been shown that no tubes will undergo permanent deformation, i.e., a change in tubing diameter in excess of 0.025 inch. Although specific leakage data is not

available, it is judged that deformations of this magnitude will not lead to significant tube leakage. No significant tube deformation or leakage is likely to occur during a LOCA plus SSE event. Therefore, no tubes need to be excluded from an alternate repair limit for reasons of deformation resulting from combined LOCA plus SSE loadings.

The limiting RG 1.121 criterion for Kewaunee to satisfy is criterion 2, e.g., a safety factor of 3 against tube burst at normal operating pressure differentials ($3\Delta P_{no}$). For Kewaunee, this translates to a limiting burst pressure criterion of 4620 psia. From the burst pressure versus voltage correlation, the maximum voltage which will satisfy this burst pressure criterion at the lower 95% prediction interval is 3.5 volts. The 2.5 volt APC repair limit is arrived at by including additional allowances of 14% for NDE measurement uncertainty and 30% for crack growth over the operating cycle. These additional allowances will ensure that the tube burst criterion will be satisfied at EOC conditions upon application of an alternate repair limit.

Additional margin can be expressed as a burst pressure margin ratio relative to $3\Delta P_{no}$; e.g., the ratio of beginning-of-cycle (BOC) and EOC burst pressure to $3\Delta P_{no}$. The burst pressure margin ratios were developed by adding a + 90% cumulative probability on growth and NDE uncertainties to the BOC voltage and evaluating the resulting voltages at the lower 95% prediction interval of the burst pressure versus voltage correlation. At the 90% cumulative probability, the projected EOC voltages range from 1.56 volts for a BOC repair limit of 1.0 volts, to 3.27 volts for a BOC repair limit of 2.5 volts. The corresponding burst pressure margin ratios range from 1.16 for BOC repair limit of 1.0 volt, to 1.01 for a BOC repair limit of 2.5 volts. The proposed APC repair limit of 1.0 volt provides a 15%, or 680 psi, higher EOC burst pressure margin when compared to the APC repair limit of 2.5 volts.

Therefore, the proposed 1.0 volt IPC repair limit will provide an extremely conservative margin of safety relative to the Kewaunee burst limit of 4620 psia including consideration for both the NDE measurement uncertainty and expected growth rates. Furthermore, the requirement to repair bobbin probe indications greater than 2.5 volts attributable to ODSCC provides additional assurance that the projected EOC voltages will provide significant margin to the burst pressure versus voltage correlation.

With regard to RG 1.121 criterion 3, an operating leakage rate limit of 150 gpd will be implemented. This limit will provide for leakage detection and plant shutdown in the event of an unexpected single crack resulting in leakage associated with the longest permissible crack length. The acceptance criteria for establishing operating leakage limits are based on LBB considerations such that a plant shutdown is initiated if the leakage associated with the longest permissible crack is exceeded. The longest permissible crack length is the length that provides a safety factor of 3 against bursting at normal operating pressure differentials.

The Westinghouse CRACKFLO leakage model has been developed for single axial cracks and compared with leak rate test results from pulled tubes and laboratory specimens. Fatigue crack and SCC leakage data has been used to compare the predicted and measured leak rates. Good agreement has been obtained between calculated and measured leak rates with the spread of the data being somewhat greater for SCC cracks than for fatigue cracks. The through-wall crack lengths resulting in the tube burst at $3\Delta P_{no}$ and SLB conditions are considered proprietary information and can be found in Section 13.7 of WCAP-12985, Revision 2. The results from the CRACKFLO leakage model demonstrate that the 150 gpd limit provides for plant shutdown prior to reaching critical crack lengths.

In summary, the high level of conservatism inherent in the 1 volt IPC repair limit, coupled with 100% inspection of all the TSP intersections, provides the principal protection against tube rupture. The 150 gpd leakage limit assures further protection against tube rupture. In addition, the 150 gpd limit provides the capability for detecting a rogue crack that might grow at much greater than expected rates and results in additional protection against exceeding the SLB leakage limits.

Tube Repair Limit Summary

As discussed above, an alternate repair limit provides adequate tube structural integrity in accordance with RG 1.121. The most limiting burst pressure criterion of RG 1.121 is that degraded tubes shall retain a margin of three against burst at the normal operating differential pressure across the tube. For Kewaunee, this translates to a limiting burst criterion of 4620 psia. From the burst pressure versus voltage correlation, the maximum voltage which will satisfy this burst pressure criterion at the lower 95% prediction interval is 3.5 volts. Therefore, the burst pressure capability criterion of RG 1.121 are satisfied by a limit of 3.5 volts for the bobbin coil amplitude. To arrive at the tube repair limit, the structural voltage limit is reduced by a conservative allowance of 14% for NDE uncertainties and 30% for crack growth over an operating cycle. This results in a bobbin coil voltage repair limit of 2.5 volts.

Upon implementation of an alternate repair criteria, the data acquisition and analysis guidelines included as Appendix A to WCAP-12985, Revision 2, will be incorporated into the Kewaunee EC analysis guidelines. This will ensure that the field bobbin voltage measurements are obtained in a manner consistent with the development of the alternate repair limit.

Application of the probe wear standard specified in Appendix A leads to probe replacement if the voltage difference between a new probe and subsequent measurements for one or more of the four holes exceeds 15%. The overall standard deviation on voltage measurement made prior to probe replacement is 7%, which corresponds to 9% at 90% cumulative probability. The eddy current analyst variability is 10% at 90% cumulative probability. A square-root-sum-of-the squares combination of the 9% and 10% contributions to the NDE uncertainty leads to a net 14% uncertainty allowance.

Voltage growth rates for Kewaunee SGs are discussed in Section 12 of WCAP-12985, Revision 2. Growth rates are defined in terms of percent voltage growth per cycle and are applied at the voltage requiring tube repair. The average voltage growth rates for the Kewaunee SGs have been essentially constant and small, < 20%, over the last five operating cycles. The average voltage growth has been 0.11 to 0.14 volts with a maximum growth of 1.1 to 1.5 volts. To allow for some variations in future cycles, the allowance for crack growth over an operating cycle has been increased to 30% to establish the APC repair limit.

Based on the above discussion, application of a 1.0 volt IPC will conservatively provide adequate assurance that tubes left in service meet the structural integrity criteria of RG 1.121.

Leakage Integrity Considerations

In addition to satisfying structure integrity, leakage integrity during normal operating, transient and postulated accident conditions must be assured. Leakage integrity refers to limiting the primary-to-secondary leakage to within acceptable limits.

With the application of an alternate repair limit, leakage during normal operating conditions is not expected due to a combination of factors:

- The crack morphology is such that wall penetration is not readily achieved (relatively long cracks are prevented from leakage by a thin ligament on the ID side and, even after penetration, the ID length remains substantially less than the OD length). Also, unbroken ligaments between the crack faces often tend to restrict the leakage path.
- The small opening areas of through-wall cracks can get clogged easily by circulating products, impurities or precipitates.
- The crevice chemistry may block the leak path, either by corrosion product accumulation or by tube denting from corroded TSPs.

Adequate leakage integrity during normal operating conditions is assured by the TS limit restricting primary-to-secondary leakage to 150 gpd per SG. Adequate leakage integrity during transients and postulated accidents is demonstrated by showing that the most limiting accident assumed to occur at the end of the operating cycle will not exceed the leakage rate assumed in the Kewaunee Updated Safety Analysis Report (USAR).

The accidents that are affected by primary-to-secondary leakage are those that include modeling of leakage and secondary side steam release to the environment in the activity release and off-site dose calculation. The affected accidents in the Kewaunee USAR are:

- Loss of Reactor Coolant Flow (Locked Rotor), USAR 14.1.8
- Loss of External Electrical Load, USAR 14.1.9

- Loss of AC Power, USAR 14.1.12
- Steam Generator Tube Rupture, USAR 14.2.4
- Rupture of a Steam Pipe, USAR 14.2.5
- Rupture of a Control Rod Drive Mechanism Housing (RCC Assembly Ejection), USAR 14.2.6

Of these accidents, the SLB (rupture of a steam pipe) is the most limiting. The SLB is limiting because of the assumption that primary leakage to the faulted SG is released directly to the environment; i.e., it is assumed that the faulted SG boils dry--therefore no credit is taken for mixing with the secondary coolant or partitioning of the activity. For other accidents in which there is a secondary side steam release, there is justification for mixing and iodine partitioning in the SG following potential uncovery of the top of the tube bundle. These factors, along with a smaller sustained primary-to-secondary pressure differential, significantly reduces the release of iodine to the environment for accidents other than the SLB.

In support of the 2.5 volt repair limit a Kewaunee specific calculation was performed to determine the maximum permissible SG primary-to-secondary leak rate during a SLB. The calculation considered an accident initiated and a pre-accident iodine spike. The accident initiated iodine spike resulted in the limiting leak rate. Based on a 30 rem thyroid dose at the site boundary, a leak rate of 9.1 gpm was determined to be the upper limit for allowable primary-to-secondary leakage. For the purposes of supporting the interim repair limit, a 1.0 gpm maximum allowable primary-to-secondary limit is being proposed. A 1.0 gpm acceptance criteria is based on the standard review plan and is not currently our licensing basis. A 1.0 gpm limit is being proposed because it has been found acceptable for IPC amendment requests from other Licensees and will conservatively satisfy the acceptance criteria of a small fraction of the 10CFR100 limits.

The method for performing the SLB leak rate analysis is discussed in WCAP-12985, Revision 2, Section 13. Two methods of analysis are described for evaluating potential EOC SLB leakage. If, as expected, the number of indications left in service is less than a thousand in the limiting SG, a deterministic analysis will be applied. If a large number of indications are found, a Monte Carlo analysis will be applied.

As described in Section 9 of WCAP-12985, Revision 2, a leakage threshold of 2.0 volts is applied for Kewaunee. Below 2.0 volts, the probability of leakage is negligible ($\sim$ 2%) and leak rates are also small. All EOC indications above 1.0 volt are included in the leakage analysis. The threshold for significant leakage, $\geq 10^{-3}$ gpm per indication, is approximately 6 volts. The SLB leak rate per indication is obtained as the probability of leakage times the leak rate per leaking indication. Guidelines for the SLB analyses are developed in Section 10 of WCAP-12985, Revision 2. The analyses is performed at a SLB tube pressure differential of 2335 psi.

Using the deterministic analyses with a BOC indication of 1.0 volt, the resulting leak rate per indication at the upper 95% confidence level of the data is 0.00041 gpm per indication left in service. Thus for a 1 gpm leakage limit, approximately 2,440 indications per SG could be left in service when applying the conservative deterministic analysis.

Based on the above discussion, application of a 1.0 volt IPC will ensure that the radiological consequences from tubes remaining in service will not exceed a small fraction of the 10CFR100 limits.

SIGNIFICANT HAZARDS DETERMINATION

The proposed change was reviewed in accordance with the provisions of 10CFR50.92 to show no significant hazards exist. The proposed change will not:

1) Involve a significant increase in the probability or consequences of an accident previously evaluated.

The probability of an accident previously evaluated will not be significantly increased by this proposed change to incorporate an IPC of 1.0 volt for the 1993-1994 operating cycle. The IPC repair limit will be applied to ODSCC occurring within the thickness of the TSPs. A tube integrity assessment performed in accordance with the criteria of RG 1.121 demonstrates that the tubes in the Kewaunee SGs maintain a safety factor of three times normal operating pressure differential for crack indications with voltages up to 3.5 volts, regardless of indicated depth, with no credit taken for potential constraint of the TSP under normal and postulated accident condition loadings. This structural limit is based on the lower 95% confidence level limit of the burst pressure versus voltage correlation. The proposed 1.0 volt repair criteria provides an extremely conservative margin of safety to the structural limit considering the NDE uncertainty and expected growth rates of ODSCC at Kewaunee.

The consequences of an accident previously evaluated will not be significantly increased by application of an IPC. Although tubes are not expected to burst under accident conditions, it cannot be assured that the cracks will not leak during postulated accident condition loadings as discussed in the USAR. Of the accidents that are affected by primary-to-secondary leakage and steam release to the environment, the SLB is most limiting relative to the potential for offsite doses. Upon implementation of the IPC, it will be verified that the distribution of ODSCC indications at the TSP intersections left in service for the 1993-1994 operating cycle are such that primary-to-secondary leakage will not exceed 1.0 gpm in the affected loop during a SLB event. This level of tube leakage will result in radiological consequences that are well within a small fraction of the 10CFR100 limit at the site boundary.

2) Create the possibility of a new of different kind of accident from any previously evaluated.

Implementation of the proposed IPC for ODSCC for the SG TSPs does not reduce the overall safety and functional requirements of the SG tube bundles. The SG tube bundles will continue to sustain, in accordance with the criteria of RG 1.121, the loads during normal operation and the various postulated accident conditions without loss of safety function.

Implementation of the IPC will be supplemented by a reduced operating leakage requirement of 150 gpd per SG. The 150 gpd restriction will provide for leakage detection and plant shutdown in the event of the occurrence of an unexpected single crack resulting in leakage that is associated with the longest permissible crack length. The operating leakage limit is based on leak-before-break considerations, critical crack length and predicted leakage. Therefore, the proposed change does not create the possibility of a new or different kind of accident.

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

Application of the IPC repair limit for the Kewaunee SGs has been demonstrated to maintain tube integrity commensurate with the RG 1.121 criteria. RG 1.121 describes a method acceptable to the NRC staff for meeting GDCs 2, 14, 15, 31 and 32. This is accomplished by determining the limiting condition of degradation of SG tubing, as established by inservice inspection, for which tubes with unacceptable cracking should be removed from service. Upon implementation of the IPC, even under worst case conditions, the occurrence of ODSCC at the TSPs is not expected to lead to a SG tube rupture event during normal or faulted plant conditions. The most limiting event would be a potential increase in leakage during a SLB event. Excessive leakage during a SLB is precluded by verifying that the expected EOC crack distribution of ODSCC indications at TSP intersections would result in primary-to-secondary leakage less than 1.0 gpm. With this level of leakage, the radiological consequences from tubes remaining in service is a small fraction of the 10 CFR 100 limits.

The combined effects of a LOCA plus SSE on the SGs were assessed as required by GDC 2. This issue was addressed for the Kewaunee SGs through the application of leak-before-break (LBB) principles to the primary loop piping. A detailed LBB analysis has been performed for Kewaunee. Based on the results, it is concluded that the LBB (as permitted by GDC 4) is applicable to the Kewaunee RCS primary loops and, thus, the probability of breaks in the primary loop piping is sufficiently low that they need not be considered in the structural design basis of the plant. Excluding breaks in the RCS primary loops, the LOCA loads from the large branch line breaks were also assessed and found to be of insufficient magnitude to result in SG tube collapse. Based on recent analysis results, no tubes are expected to collapse or deform to the degree that secondary-to-primary in-leakage would be increased over current expected levels. On this basis no tubes need to be excluded from the IPC for reasons of deformation resulting from combined LOCA and SSE loadings.

Addressing the RG 1.83 considerations, implementation of the IPC will include a 100% bobbin coil inspection of the TSPs. This will be supplemented by a reduced operating leak rate limit,

eddy current inspection guidelines to provide the methodology for reporting field bobbin voltage measurements consistent with the development of the alternate repair limit, and RPC probe inspection requirements.

Therefore, the proposed change will not result in a significant reduction in the margin of safety.

ENVIRONMENTAL CONSIDERATIONS

This proposed amendment involves a change to an inspection requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. Wisconsin Public Service Corporation has determined that the proposed amendment involves no significant hazards considerations and no significant change in the types of any effluent that may be released off site and that there is no significant increase in individual or cumulative occupational radiation exposure. Accordingly, this proposed amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). This proposed amendment also involves changes in record keeping, reporting or administrative procedures or requirements. Accordingly, with respect to these items, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(10). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with this proposed amendment.