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10 CFR 50.90

Serial: RNP-RA/13-0030

APR 0 9 2013

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

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/RENEWED LICENSE NO. DPR-23

REVISION TO LICENSE AMENDMENT REQUEST FOR REVISION TO STEAM GENERATOR PROGRAM INSPECTION FREQUENCIES AND TUBE SAMPLE SELECTION AND APPLICATION OF PERMANENT ALTERNATE REPAIR CRITERIA

Dear Sir or Madam:

By letter to the U. S. Nuclear Regulatory Commission (NRC) dated August 29, 2012, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12251A363), Carolina Power and Light Company, now doing business as Progress Energy, submitted a license amendment request (LAR) which combined two proposed changes that affect the same Technical Specification (TS) sections. The first part proposes to implement revisions consistent with TS Task Force-510 (TSTF-510), Revision 2, "Revision to Steam Generator Inspection Frequencies and Tube Sample Selection." The second part proposes to exclude portions of the steam generator tube below the top of the steam generator tubesheet from periodic inspections by implementing the permanent alternate repair criteria "H*."

By letter dated February 4, 2013, (ADAMS Accession No. ML13017A288) the NRC staff requested additional information (RAI) needed to continue its review of the proposed license amendment.

The license amendment request dated August 29, 2012, utilized nominal values of T_{avg} for the structural and leakage evaluations needed to support application of the alternate repair criteria (H*). The RAI requested H. B. Robinson determine the low T_{avg} and high T_{avg} hot leg temperatures, the differential pressure across the tubesheet and verification that the bounding value of H* submitted continues to apply when the low T_{avg} hot leg temperature is used in the HBRSEP H* analysis. Progress Energy provided the response to the RAI by letter dated March 6, 2013.

The RAI response provided verification that the H* value provided in the license change request was bounding for the H. B. Robinson structural analysis when the low T_{avg} hot leg temperature is

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applied; however, application of the high T_{avg} to the leakage evaluation yielded a higher leakage factor than was limiting under nominal conditions.

The revised leakage factor does not affect the conclusions of the argument presented supporting the license amendment request.

Additionally, the words "or repaired" are deleted from TS 5.6.8.f on page 10 of Enclosure 1 to correct a minor error.

Enclosure 1 to this letter provides a corrected version of the Enclosure to the original submittal. Note that Attachment 6, LTR-SGMP-12-30, has been replaced by LTR-SGMP-12-30, Revision 1.

Enclosure 2 to this letter presents a markup of the pages affected by the correction.

Approval of the proposed amendment is requested by August 30, 2013. Once approved, the amendment shall be implemented within 30 days.

This letter contains no new Regulatory Commitments.

In accordance with 10 CFR 50.91(b), a copy of this application is being provided to the State of South Carolina. If you should have any questions regarding this submittal, please contact Mr. Richard Hightower, Supervisor – Licensing/Regulatory Programs at (843) 857-1329.

I declare under penalty of perjury that the foregoing is true and correct. Executed On:

APR 0 9 2013

Sincerely,

Sharon A. Wheeler - Peavyhouse

Sharon A. Wheeler - Peavyhouse
Manager – Support Services

SAW - P/jk

Enclosures

cc: Ms. S. E. Jenkins, Manager, Infectious and Radioactive Waste Management Section (SC)
Mr. V. M. McCree, NRC Region II
Ms. A. T. Billoch-Colon, NRC Project Manager, NRR
NRC Resident Inspectors, HBRSEP Unit No. 2
Mr. A. Wilson, Attorney General (SC)

ENCLOSURE 1

Evaluation of the Proposed Change

Request for Technical Specifications Changes to Revise Steam Generator Program Inspection Frequencies and Tube Sample Selection and to Apply Permanent Alternate Repair Criteria (H*)

ATTACHMENTS:

1.0 SUMMARY DESCRIPTION

Pursuant to 10 CFR 50.90, Carolina Power and Light Company, now doing business as Progress Energy, is requesting an amendment to the H. B. Robinson Steam Electric Plant, (HBRSEP) Unit No. 2 renewed facility operating license DPR-23, Appendix A, Technical Specifications (TS) Sections 5.5.9, 5.6.8, and 3.4.18.

The proposed schedule supports implementation of the requested changes to steam generator inspection prior to entering the refueling outage following the current operating cycle, Cycle 28.

The proposed amendment would:

- Revise TS Sections 3.4.18 "Steam Generator Tube (SG) Integrity", 5.5.9 "Steam Generator (SG) Program", and 5.6.8 "Steam Generator Tube Inspection Report" to address issues associated with the inspection periods, and address other administrative changes and clarifications consistent with TSTF-510, Revision 2, "Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection" (Reference 1).

- Revise TS Section 5.5.9 "Steam Generator (SG) Program" to permanently exclude portions of the steam generator tubes below the top of the steam generator tubesheet from periodic inspections, by deleting conditions requiring application of the alternate repair criteria (H*) only until the end of Cycle 27, revising the value of H* and making editorial changes to the identification of the steam generator tube length subject to inspection. Consistent with this proposed change, the value of H* in TS Section 5.6.8 "Steam Generator Tube Inspection Report" is also revised.

1.1 Revision to SG Program Inspection Frequencies and Tube Sample Selection

The amendment proposes to revise the requirements in the HBRSEP Unit No. 2 TS related to steam generator (SG) program inspection frequencies and tube sample selection. These changes are consistent with NRC approved Technical Specification Task Force (TSTF) Standard Technical Specification Change Traveler, TSTF-510, Revision 2, "Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection" (Reference 1).

A Notice of Availability, published in the Federal Register (76 FR 66763) identified that the NRC had accepted the model license amendment change application included in TSTF-510, Revision 2 and that a model safety evaluation for plant specific adoption of TSTF-510 was available as part of the Consolidated Line Item Improvement Process (CLIIP). The notice also stated that instead of the model application licensees desiring additional changes should submit a license amendment request that does not claim to adopt TSTF–510.

Notwithstanding the proposed changes associated with application of the alternate repair criteria on a permanent basis (modification of the value of H* and deletion of wording associated with expiration of the applicability of the alternate repair criteria) the requested amendment is consistent with adoption of TSTF-510, Revision 2. Minor variations from TSTF-510 numbering

and wording, as discussed in section 2.2, are administrative and consistent with application of the intent of TSTF-510.

The proposed schedule supports revision of steam generator inspection frequencies and tube sample selection consistent with industry documents which address implementation issues associated with inspection periods and other administrative changes and clarifications prior to entering the refueling outage following the current operating cycle.

1.2 Revision of Alternate Repair Criteria H* Value

The proposed amendment will revise Technical Specification (TS) 5.5.9, "Steam Generator (SG) Program," to permanently exclude portions of the steam generator tubes below the top of the steam generator tubesheet from periodic tube inspections. Application of the supporting structural analysis and leakage evaluation results to exclude portions of the tubes from inspection and repair of tube indications is interpreted to constitute a redefinition of the primary to secondary pressure boundary.

Exclusion of portions of the steam generator tubes from inspection and repair below the top of the steam generator tubesheet was initially approved on a temporary basis with Amendment 214 until the end of operating Cycle 25. Amendment 224 was subsequently approved and required the application of the alternate repair criteria until the end of Cycle 27. Analyses completed since the implementation of these amendments have addressed issues associated with the application of the H* methodology and criteria on a permanent basis.

Amendments that would implement the alternate repair criteria on a permanent basis have been submitted by other licensees. Early requests were not approved pending resolution of NRC staff questions including, most notably, the effect of bore eccentricity on the H* analysis assumptions. Recently, license amendments for the Catawba and Surry Plants have been issued which allow the permanent application of the alternate repair criteria.

The nomenclature alternate "repair" criteria is retained in later discussions describing the licensing activities and technical evaluations completed to adequately demonstrate the appropriateness of applying the criteria on a permanent basis and in describing applications and approvals of the use of the criteria at HBRSEP Unit No. 2, e.g. Amendments 214 and 224. The term, "plugging criteria" is used in the proposed TS consistent with TSTF-510 and that a repair method is not available for HBRSEP Unit No. 2.

The proposed amendment would delete wording associated with the expiration of the applicability of the alternate repair criteria and revise the value of H*, the distance from the top of the tubesheet below which inspections and repair are not required in specifications 5.5.9 and 5.6.8. The revised value of H* is based on the supporting structural analysis and leakage evaluations completed by Westinghouse Electric Company LLC (Reference 2). Editorial changes to that revise the description of the portion of the steam generator tube length subject to inspection in the first paragraph of specification 5.5.9.d are also made.

The value of H* proposed for permanent application of the alternate repair criteria at HBRSEP Unit No. 2 is the 95/95 whole plant H* value of 18.11 inches from Table 5-1 of Westinghouse WCAP-17345-P, Revision 2 (Reference 2). The value of the leak rate factor of 1.87 evaluated in LTR-SGMP-12-30, revision 1 (Reference 33) is applicable to the use of the alternate repair criteria at HBRSEP Unit No. 2.

HBRSEP Unit No. 2 does not have an approved steam generator tube repair method and tubes meeting tube repair criteria must be plugged. Tube plugging impacts plant thermal efficiency and performance during both routine and transient operation. Implementation of the proposed changes associated with application of the alternate repair criteria on a permanent basis will require inspection for those portions of the tube within the tubesheet required to maintain the primary to secondary pressure boundary and tube plugging upon flaw detection irrespective of the depth of the indication.

Approval of the proposed amendment is requested prior to entering the refueling outage in the fall of 2013 as the current temporary application of the alternate repair criteria approved with Amendment 224 expired at the end of the previous cycle, Cycle 27.

2.0 DETAILED DESCRIPTION

2.1 Description of the Proposed Revisions

The HBRSEP Unit No. 2, Technical Specifications Section 5.5.9 "Steam Generator (SG) Program", will be revised to delete the word "provisions" at the end of the first paragraph as it is duplicative as noted in TSTF-510 Revision 2:

> "A Steam Generator Program shall be established and implemented to ensure that SG tube integrity is maintained. In addition, the Steam Generator Program shall include the following ~~provisions~~"

Subsection 5.5.9.b.1, currently states:

> "Structural integrity performance criterion: All in-service SG tubes shall retain structural integrity over the full range of normal operating conditions (including startup, operation in the power range, hot standby, and cool down and all anticipated transients included in the design specification) and design basis accidents"

This specification will be revised as follows to correct the misplaced closing parenthesis as noted in TSTF-510.

> "Structural integrity performance criterion: All in-service SG tubes shall retain structural integrity over the full range of normal operating conditions (including startup, operation in the power range, hot standby, and cool down), all

anticipated transients included in the design specification, and design basis accidents."

Technical Specifications Section 5.5.9 "Steam Generator (SG) Program", specification 5.5.9.c currently states:

c. Provisions for SG tube repair criteria. Tubes found by inservice inspection to contain flaws with a depth equal to or exceeding the following criteria shall be plugged: 47% of the nominal tube wall thickness if the next inspection interval of that tube is 12 months, and a 2% reduction in the repair criteria for each 12 month period until the next inspection of the tube.

The following alternate tube repair criteria shall be applied as an alternative to the preceding criteria, until the end of Operating Cycle 27:

Tubes with service-induced flaws located greater than 17.28 inches below the top of the tubesheet do not require plugging. Tubes with service-induced flaws located in the portion of the tube from the top of the tubesheet to 17.28 inches below the top of the tubesheet shall be plugged upon detection.

This specification is to be revised, consistent with TSTF-510, to change "tube repair criteria" to "tube plugging [or repair] criteria." As HBRSEP Unit No. 2 does not have an approved SG repair technique the bracketed references to repair are deleted. Also, the expiration of the applicability of the alternate repair criteria at the end of operating Cycle 27 is deleted and the value of H* is revised consistent with application of the H* methodology to HBRSEP Unit No. 2 on a permanent basis.

c. Provisions for SG tube plugging ~~repair~~ criteria. Tubes found by inservice inspection to contain flaws with a depth equal to or exceeding the following criteria shall be plugged: 47% of the nominal tube wall thickness if the next inspection interval of that tube is 12 months, and a 2% reduction in the plugging ~~repair~~ criteria for each 12 month period until the next inspection of the tube.

The following alternate tube plugging ~~repair~~ criteria shall be applied as an alternative to the preceding criteria~~, until the end of Operating Cycle 27~~:

Tubes with service-induced flaws located greater than 18.11 ~~17.28~~ inches below the top of the tubesheet do not require plugging. Tubes with service-induced flaws located in the portion of the tube from the top of the tubesheet to 18.11 ~~17.28~~ inches below the top of the tubesheet shall be plugged upon detection.

The first paragraph of HBRSEP Unit No. 2 specification 5.5.9.d currently states:

d. Provisions for SG tube inspections. Periodic SG tube inspections shall be performed. The number and portions of the tubes inspected and methods of inspection shall be performed with the objective of detecting flaws of any type (e.g., volumetric flaws, axial and circumferential cracks) that may be present along the length of the tube, from the tube-to-tubesheet weld at the tube inlet to the tube-to-tubesheet weld at the tube

outlet (until the end of Operating Cycle 27 the required inspection length extends 17.28 inches below the top of the tubesheet on the tube hot leg side to 17.28 inches below the top of the tubesheet on the tube cold leg side), and that may satisfy the applicable tube repair criteria. The tube-to-tubesheet weld is not part of the tube. In addition to meeting the requirements of d.1, d.2, and d.3 below, the inspection scope, inspection methods, and inspection intervals shall be such as to ensure that SG tube integrity is maintained until the next SG inspection. An assessment of degradation shall be performed to determine the type and location of flaws to which the tubes may be susceptible and, based on this assessment, to determine which inspection methods need to be employed and at what locations.

This paragraph will be revised consistent with TSTF-510 to replace "repair criteria" with "plugging criteria" and "assessment of degradation" with "degradation assessment." With implementation of the alternate repair criteria on a permanent basis the portion of the tube from the tube-to-tubesheet weld to a distance H* below the top of the tubesheet does not satisfy the alternate repair/plugging criteria (see specification 5.5.9.c above) and is not included in the required inspection. Therefore the prescription of the length of the steam generator tube subject to inspection in the third sentence is revised accordingly.

With the proposed changes the first paragraph of specification 5.5.9.d reads as follows:

d. Provisions for SG tube inspections. Periodic SG tube inspections shall be performed. The number and portions of the tubes inspected and methods of inspection shall be performed with the objective of detecting flaws of any type (e.g., volumetric flaws, axial and circumferential cracks) that may be present along the length of the tube, from ~~the tube-to-tubesheet weld at the tube inlet to the tube-to-tubesheet weld at the tube outlet (until the end of Operating Cycle 27 the required inspection length extends~~ 18.11 ~~17.28~~ inches below the top of the tubesheet on the ~~tube~~ hot leg ~~side~~ to 18.11 ~~17.28~~ inches below the top of the tubesheet on the ~~tube~~ cold leg ~~side)~~, and that may satisfy the applicable tube plugging ~~repair~~ criteria. The tube-to-tubesheet weld is not part of the tube. In addition to meeting the requirements of d.1, d.2, and d.3 below, the inspection scope, inspection methods, and inspection intervals shall be such as to ensure that SG tube integrity is maintained until the next SG inspection. A ~~An assessment of~~ degradation assessment shall be performed to determine the type and location of flaws to which the tubes may be susceptible and, based on this assessment, to determine which inspection methods need to be employed and at what locations.

HBRSEP Unit No. 2 specification 5.5.9.d.1 currently states:

1. Inspect 100% of the tubes in each SG during the first refueling outage following SG replacement.

This specification will be revised as follows to replace "replacement with "installation"

consistent with TSTF-510.

1. Inspect 100% of the tubes in each SG during the first refueling outage following SG ~~replacement~~ installation.

HBRSEP Unit No. 2 specification 5.5.9.d.2 currently states:

2. Inspect 100% of the tubes at sequential periods of 120, 90, and, thereafter, 60 effective full power months. The first sequential period shall be considered to begin after the first inservice inspection of the SGs. In addition, inspect 50% of the tubes by the refueling outage nearest the midpoint of the period and the remaining 50% by the refueling outage nearest the end of the period. No SG shall operate for more than 48 effective full power months or two refueling outages (whichever is less) without being inspected.

Consistent with TSTF-510, specification 5.5.9.d.2 is replaced with content applicable to SGs with Alloy 600 thermally treated tubing except the TSTF-510 content is modified slightly consistent with the administrative error noted in Technical Specifications Task Force letter dated March 28, 2012 (Reference 4). The correction in this letter notes that the phrase "tube repair criteria" should have read "tube plugging [or repair] criteria" consistent with other changes to specification 5.5.9.d of TSTF-510. The corrected phrase is modified to "tube plugging criteria" to reflect that HBRSEP Unit No. 2 does not have an approved SG tube repair method.

2. After the first refueling outage following SG installation, inspect each SG at least every 48 effective full power months or at least every other refueling outage (whichever results in more frequent inspections). In addition, the minimum number of tubes inspected at each scheduled inspection shall be the number of tubes in all SGs divided by the number of SG inspection outages scheduled in each inspection period as defined in a, b, and c below. If a degradation assessment indicates the potential for a type of degradation to occur at a location not previously inspected with a technique capable of detecting this type of degradation at this location and that may satisfy the applicable tube plugging criteria, the minimum number of locations inspected with such a capable inspection technique during the remainder of the inspection period may be prorated. The fraction of locations to be inspected for type of this potential degradation at this location at the end of the inspection period shall be no less than the ratio of the number of times the SG is scheduled to be inspected in the inspection period after the determination that a new form of degradation could potentially be occurring at this location divided by the total number of times the SG is scheduled to be inspected in the inspection period. Each inspection period defined below may be extended up to 3 effective full power months to include a SG inspection outage in an inspection period and the

subsequent inspection period begins at the conclusion of the included SG inspection outage.

a) After the first refueling outage following SG installation, inspect 100% of the tubes during the next 120 effective full power months. This constitutes the first inspection period.

b) During the next 96 effective full power months, inspect 100% of the tubes. This constitutes the second inspection period.

c) During the remaining life of the SGs, inspect 100% of the tubes every 72 effective full power months. This constitutes the third and subsequent inspection periods.

HBRSEP Unit No. 2 specification 5.5.9.d.3 currently states:

3. If crack indications are found in any portion of a SG tube not excluded above, then the next inspection for each SG for the degradation mechanism that caused the crack indication shall not exceed 24 effective full power months or one refueling outage (whichever is less). If definitive information, such as from examination of a pulled tube, diagnostic non-destructive testing, or engineering evaluation indicates that a crack-like indication is not associated with a crack(s), then the indication need not be treated as a crack.

Consistent with TSTF-510, specification 5.5.9.d.3 is revised to clarify the term "each SG" and to make an editorial change to the parenthetical statement.

The application of the permanent alternate plugging criteria of specification 5.5.9.c excludes from required inspection, those portions of each SG tube which is greater than the distance below the top of the tubesheet calculated using the H* methodology. Adjustment of the inspection interval based on crack indications in locations that would not otherwise meet inspection and plugging criteria is not appropriate. Therefore, the phrase "in any portion of a SG not excluded above" is retained to emphasize which crack indications are of interest in determining an adjustment of the inspection interval.

With incorporation of the above clarification and editorial change consistent with TSTF-510, proposed specification 5.5.9.d.3 reads as follows:

3. If crack indications are found in any portion of a SG tube not excluded above, then the next inspection for each affected and potentially affected SG for the degradation mechanism that caused the crack indication shall not exceed 24 effective full power months or one refueling outage (whichever results in more frequent inspections ~~is less~~). If definitive information, such as from examination of a pulled tube, diagnostic non-destructive testing, or engineering evaluation indicates

> that a crack-like indication is not associated with a crack(s), then the indication need not be treated as a crack.

The HBRSEP Unit No. 2 Technical Specification Section 5.6.8 "Steam Generator Tube Inspection report" currently states:

> A report shall be submitted within 180 days after the initial entry into MODE 4 following completion of an inspection performed in accordance with the Specification 5.5.9, Steam Generator (SG) Program. The report shall include:
>
> a. The scope of inspections performed on each SG.
>
> b. Active degradation mechanisms found.
>
> c. Nondestructive examination techniques utilized for each degradation mechanism.
>
> d. Location, orientation (if linear), and measured sizes (if available) of service induced indications.
>
> e. Number of tubes plugged during the inspection outage for each active degradation mechanism.
>
> f. Total number and percentage of tubes plugged to date.
>
> g. The results of condition monitoring, including the results of tube pulls and in-situ testing.
>
> h. The primary to secondary leakage rate observed in each SG (if it is not practical to assign the leakage to an individual SG, the entire primary to secondary leakage should be conservatively assumed to be from one SG) during the cycle preceding the inspection that is the subject of the report.
>
> i. The calculated accident induced leakage rate from the portion of the tubes below 17.28 inches from the top of the tubesheet for the most limiting accident in the most limiting SG. In addition, if the calculated accident induced leakage rate from the most limiting accident is less than 1.82 times the maximum operational primary to secondary leakage rate, the report should describe how it was determined, and
>
> j. The results of monitoring for tube axial displacement (slippage). If slippage is discovered, the implications of the discovery and corrective action shall be provided.

Consistent with TSTF-510, the word "active" is removed from specifications 5.6.8.b and e and specification 5.6.8.f is revised to require reporting the effective plugging percentage.

The value of H* in specification 5.6.8.i is revised consistent with application of the H*

methodology to HBRSEP Unit No. 2 on a permanent basis. The value of the leak rate factor evaluated in WCAP-17091-P, Revision 0 (Reference 3) applicable to the use of the alternate repair criteria at HBRSEP Unit No. 2 remains unchanged.

Proposed TS 5.6.8 would read as follows:

> A report shall be submitted within 180 days after the initial entry into MODE 4 following completion of an inspection performed in accordance with the Specification 5.5.9, Steam Generator (SG) Program. The report shall include:
>
> a. The scope of inspections performed on each SG.
>
> b. ~~Active d~~ Degradation mechanisms found.
>
> c. Nondestructive examination techniques utilized for each degradation mechanism.
>
> d. Location, orientation (if linear), and measured sizes (if available) of service induced indications.
>
> e. Number of tubes plugged during the inspection outage for each ~~active~~ degradation mechanism.
>
> f. The number and percentage of tubes plugged ~~or repaired~~ to date, and the effective plugging in each steam generator. ~~Total number and percentage of tubes plugged to date.~~
>
> g. The results of condition monitoring, including the results of tube pulls and in-situ testing.
>
> h. The primary to secondary leakage rate observed in each SG (if it is not practical to assign the leakage to an individual SG, the entire primary to secondary leakage should be conservatively assumed to be from one SG) during the cycle preceding the inspection that is the subject of the report,
>
> i. The calculated accident induced leakage rate from the portion of the tubes below 18.11 ~~17.28~~ inches from the top of the tubesheet for the most limiting accident in the most limiting SG. In addition, if the calculated accident induced leakage rate from the most limiting accident is less than 1.87 times the maximum operational primary to secondary leakage rate, the report should describe how it was determined, and
>
> j. The results of monitoring for tube axial displacement (slippage). If slippage is discovered, the implications of the discovery and corrective action shall be provided.

The HBRSEP Unit No. 2 Technical Specifications 3.4.18 "Steam Generator (SG) Tube Integrity", currently states:

LCO 3.4.18 SG tube integrity shall be maintained,

AND

All SG tubes satisfying the tube repair criteria shall be plugged in accordance with the Steam Generator Program.

CONDITION A

A. One or more SG tubes satisfying the tube repair criteria and not plugged in accordance with the Steam Generator Program.

SURVEILLANCE

SR 3.4.18.2 Verify that each inspected SG tube that satisfies the tube repair criteria is plugged in accordance with the Steam Generator Program.

The current references to "tube repair criteria" in the LCO, Condition A and SR 3.4.18.2 are revised to "tube plugging criteria" consistent with the changes to Specifications 5.5.9 based on the TSTF-510 change from "tube repair criteria" to "tube plugging [or repair] criteria" and recognition that HBRSEP Unit No. 2 does not have an approved tube repair technique as follows:

LCO 3.4.18 SG tube integrity shall be maintained,

AND

All SG tubes satisfying the tube plugging criteria shall be plugged in accordance with the Steam Generator Program.

CONDITION A

A. One or more SG tubes satisfying the tube plugging criteria and not plugged in accordance with the Steam Generator Program.

SURVEILLANCE

SR 3.4.18.2 Verify that each inspected SG tube that satisfies the tube plugging criteria is plugged in accordance with the Steam Generator Program.

2.2 Variations from TSTF-510

Progress Energy has reviewed TSTF-510, Revision 2, "Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection," (Reference 4) and the model safety

evaluation dated October 19, 2011 (Reference 5) included as part of the Federal Register Notice of Availability dated October 27, 2011 (76 FR 66763).

Progress Energy has concluded that proposed variations from the TS changes described below including revision of the value of H* and deletion of expiration of the applicability of the alternate plugging/repair criteria are administrative in nature with respect to the applicability of the justifications presented in TSTF-510 and the model safety evaluation prepared by the NRC staff to HBRSEP Unit No. 2. The variations and the bases for the conclusion that the differences are administrative in nature are presented below.

HBRSEP Unit No. 2 Technical Specifications utilize different numbering than NUREG-1431, Revision 3.1, Standard Technical Specifications Westinghouse Plants" on which the content of TSTF-510 applicable to HBRSEP Unit No. 2 was based. The specific numbering differences are:

TSTF-510 Rev. 2	HBRSEP Unit No. 2 TS
3.4.20, "Steam Generator Tube Integrity"	3.4.18
5.6.7, "Steam Generator Tube Inspection Report"	5.6.8

TS Task Force letter dated March 28, 2012 (Reference 4) identified that the proposed wording for specification 5.5.9.d.2 contained an administrative error in the following statement:

> If a degradation assessment indicates the potential for a type of degradation to occur at a location not previously inspected with a technique capable of detecting this type of degradation at this location and that may satisfy the applicable tube repair criteria, the minimum number of locations inspected with such a capable inspection technique during the remainder of the inspection period may be prorated. (Emphasis added)

The underlined phrase should state "tube plugging [or repair] criteria," consistent with the other changes made in TSTF-510. Progress Energy is changing the phrase to "tube plugging criteria" consistent with the March 28 letter and to reflect that HBRSEP Unit No. 2 does not have an approved SG tube repair method. This change is administrative and does not alter the applicability of the TSTF-510 model safety evaluation.

HBRSEP Unit No. 2 Specification 5.6.8 does not contain a reporting requirement consistent with Standard Technical Specification optional specification 5.6.7.h. In TSTF-510 this reporting requirement is included in the modification to specification 5.6.7.f and optional specification 5.6.7.h is deleted. The proposed change to current HBRSEP Unit No. 2 specification 5.6.8.f is consistent with the specification 5.6.7.f as revised in TSTF-510. This is an administrative difference and does not affect the applicability of the TSTF-510 model safety evaluation.

Progress Energy has combined its request for changes consistent with TSTF-510 with changes which would make the application of the alternate repair criteria permanent as both requests involve steam generator inspection and reporting and involve the same TS Sections. While

these changes involve both TS 5.5.9 and 5.6.8 only specification 5.5.9.c and the first paragraph of specification of 5.5.9.d are modified by both.

The proposed changes consistent with TSTF-510 directly impact only the first paragraph of specification 5.5.9.c while changes associated with application of alternate repair criteria on a permanent basis impact the second and third paragraphs. The Reviewer's Note following the first paragraph of 5.5.9.c in TSTF-510 addresses the content of the second paragraph with guidance that the description of alternate tube plugging or repair criteria should be equivalent to the descriptions in current technical specifications. This Reviewer's Note also indicates that any allowed accident induced leakage rates for specific types of degradation at specific locations associated with tube plugging or repair criteria should be included. Current specification 5.5.9.c does not include any allowed accident induced leakage rates for specific types of degradation at specific locations associated with tube plugging or repair criteria.

Consistent with the guidance in the Reviewer's Note following the first paragraph of TS 5.5.9.c from TSTF-510 that the alternate tube plugging [or repair] criteria should be equivalent to the descriptions in current technical specifications, the phrase "shall be applied as an alternative to the preceding criteria" in the second paragraph of 5.5.9.c is retained instead of the optional phrase "may be applied as an alternative to the 40% depth criteria" listed in TSTF-510.

The phrase "until the end of Operating Cycle 27" does not strictly describe the criteria but instead identifies the applicability of the criteria. Modification of the value of H* in the third paragraph does not strictly follow the guidance in the Reviewer's Note following TS 5.5.9.c but is appropriate based on the intention stated in this amendment request to combine changes which affect the same TS sections into one amendment for efficiency and to minimize redundant reviews.

The proposed changes to the first paragraph of specification 5.5.9.d consistent with TSTF-510 are editorial and replace "repair criteria" with "plugging criteria" and "assessment of degradation" with "degradation assessment." The third sentence is revised to appropriately identify the length of the steam generators tubes that are required to be inspected consistent with implementation of the alternate repair criteria on a permanent basis. The changes to the third sentence for implementation of the alternate repair criteria on a permanent basis are editorial with respect to the changes consistent with TSTF-510.

The above variations and the proposed changes related to making the alternate repair criteria permanent are administrative differences from the changes described in TSTF-510 and do not alter the applicability of the TSTF-510 model safety evaluation.

3.0 BACKGROUND

H. B. Robinson Steam Electric Plant, Unit No. 2, is a three loop Westinghouse designed plant. It has three replacement Model 44F SGs that were installed in 1984. Each SG has 3214 thermally treated Alloy 600 tubes, full depth hydraulically expanded tubesheet joints, and stainless steel tube support plates with broached-hole quatrefoils in each of the steam generators. A total of 44 tubes have been plugged.

The SG tubes in pressurized water reactors have a number of important safety functions. Steam generator tubes are an integral part of the reactor coolant pressure boundary (RCPB) and, as such, are relied on to maintain the primary system's pressure and inventory. As part of the RCPB, the SG tubes are unique in that they act as a heat transfer surface between the primary and secondary systems to remove heat from the primary system. In addition, the SG tubes isolate the radioactive fission products in the primary coolant from the secondary system.

Steam generator tube integrity is necessary in order to satisfy the tubing's safety functions. Maintaining tube integrity ensures that the tubes are capable of performing their intended safety functions consistent with the plant licensing basis, including applicable regulatory requirements. Concerns relating to the integrity of the tubing stem from the fact that the SG tubing is subject to a variety of degradation mechanisms. Steam generator tubes have experienced tube degradation related to corrosion phenomena, such as wastage, pitting, intergranular attack, and stress corrosion cracking, along with other mechanically induced phenomena such as wear. These degradation mechanisms can impair tube integrity if they are not managed effectively.

The industry, through the Electric Power Research Institute (EPRI) Steam Generator Management Program (SGMP) and developed a series of EPRI Guidelines. These guidelines include

- "Pressurized Water Reactor Steam Generator Examination Guideline" (Reference 6),
- "Steam Generator Integrity Assessment Guideline" (Reference 7)

These EPRI Guidelines, along with NEI 97-06 (Reference 8), tie the entire Steam Generator Program together, while defining a comprehensive, performance based approach to managing SG performance.

In parallel with the industry efforts, the NRC pursued resolution of SG performance issues. In December of 1998, the NRC staff determined that the Steam Generator Program described by NEI 97-06 (Reference 8) and its referenced EPRI Guidelines provide an acceptable starting point to use in the resolution of differences between it and the staff's proposed Generic Letter and draft Regulatory Guide (DG-1074). Since then the industry and the NRC have participated in a series of meetings to resolve differences and develop the regulatory framework necessary to implement a comprehensive Steam Generator Program.

As a result of these interactions, the Technical Specifications Task Force (TSTF) prepared TSTF-449, Revision 4, "Steam Generator Tube Integrity" (Reference 9). The NRC staff approved TSTF-449, Revision 4 and it was posted for adoption by licensees in the NRC Federal Register Notice of Availability published on May 6, 2005 (70 FR 24126). This approach was adopted by HBRSEP Unit No. 2 after issuance of Amendment 212 (Reference 10) on March 12, 2007.

Additional initiatives resulted in the development of justification for excluding portions of each steam generator tube below the top of the steam generator tubesheet from periodic inspections. A structural analysis and leakage evaluation based on contact pressure between the tube and

tubesheet was performed specifically for HBRSEP Unit No. 2 as reported in WCAP-16627-P, "Steam Generator Alternate Repair Criteria for Tube Portion Within the Tubesheet at H. B. Robinson Unit 2" (Reference 11).

The WCAP-16627-P report concluded that the structural integrity of the primary to secondary pressure boundary is unaffected by tube degradation of any magnitude below a tube location-specific depth designated as the H* depth. It was also determined that accident condition leak rate integrity could be bounded by twice the normal operational leak rate including degradation of the tube end welds. Alternate steam generator tube repair criteria were implemented at HBRSEP Unit No. 2 with issuance of Amendment 214 on a temporary basis through the end of Cycle 25 (Reference 12).

Industry initiatives continued and resulted in development of the technical justifications reported in WCAP-17091-P, "H*: Alternate Repair Criteria for the Tubesheet Expansion Region in Steam Generators with Hydraulically Expanded Tubes (Model 44F)" (Reference 3). As a result of the availability of the evaluations included in WCAP-17091-P changes to the portions of HBRSEP Unit No. 2 Technical Specifications implementing the alternate repair criteria were proposed and approved on May 7, 2010 with issuance of Amendment 224 (Reference 13) including the modification of the expiration of the applicability of the alternate repair criteria until the end of Cycle 27.

The alternate repair criteria require that tubes with service induced flaws located in the portion of the tube from the top of the tubesheet to a distance of H* below the top of the tubesheet be plugged upon detection. Tubes with service-induced flaws located greater than a distance of H* below the top of the tubesheet are not required to be plugged. When applicable, the alternate repair criteria exclude that portion of each SG tube from a distance of H* below the top of the tubesheet to the tube-to-tubesheet weld at the bottom of the tubesheet from inspections required by specification 5.5.9.d of TS 5.5.9 "Steam Generator Program."

Analyses such as WCAP-16627-P and WCAP-17091 demonstrate that the integrity of steam generator tubes as part of the RCPB is not dependent upon the portion of the tube near the tube end welds at the bottom of the tubesheet. Application of the alternate repair criteria reduces the number of SG tubes that are required to be plugged while maintaining established margins of safety for normal and accident conditions.

The TSTF prepared TSTF-510 to address implementation issues associated with the inspection periods of specification 5.5.9.d that were included in TSTF-449 and to make a number of editorial corrections, changes, and clarifications intended to improve the internal consistency, consistency with implementing industry documents, and usability without changing the intent of the requirements.

Steam generator inspection scope is governed by TS 5.5.9 "Steam Generator (SG) Program"; Nuclear Energy Institute (NEI) 97-06, "Steam Generator Program Guidelines" (Reference 8); EPRI 1013706, "Pressurized Water Reactor Steam Generator Examination Guidelines"

(Reference 6); EPRI 1019038, "Steam Generator Integrity Assessment Guidelines" (Reference 7); the Progress Energy Steam Generator Integrity Program and the results of the degradation assessments required by the SG Program. Criterion IX, "Control of Special Processes" of 10 CFR Part 50, Appendix B, requires in part that nondestructive testing be accomplished by qualified personnel using qualified procedures in accordance with the applicable criteria. The inspection techniques and equipment are capable of reliably detecting the known and potential specific degradation mechanisms applicable to HBRSEP Unit No. 2. The inspection techniques, essential variables and equipment are qualified to Appendices H and I, "Performance Demonstration for Eddy Current Examination" of the EPRI PWR Steam Generator Examination Guidelines (Reference 6). The Steam Generator Integrity Program requires the use of applicable industry operating experience.

Catawba Nuclear Station, Unit 2 (Catawba), reported indications of cracking following nondestructive eddy current examination of the SG tubes during their fall 2004 outage.

In April 2005, NRC Information Notice (IN) 2005-09, "Indications in Thermally Treated Alloy 600 Steam Generator Tubes and Tube-to-Tubesheet Welds" (Reference 14) was issued and noted that Catawba reported crack like indications in the tubes approximately seven inches below the top of the hot leg tubesheet in one tube, and just above the tube-to-tubesheet welds in a region of the tube known as the tack expansion in several other tubes. Indications were also reported adjacent to and possibly extending into the tube-to-tubesheet welds where the tubes are joined to the tubesheet.

The experience at Catawba (as noted in IN 2005-09) shows the importance of monitoring all tube locations (such as bulges, dents, dings, and other anomalies from the manufacture of the SGs) with techniques capable of finding potential forms of degradation that may be occurring at these locations such as those discussed in NRC Generic Letter 2004-01, "Requirements for Steam Generator Tube Inspections" (Reference 15). Since the HBRSEP Unit No. 2 Westinghouse Model 44F SGs were fabricated with Alloy 600 thermally treated tubes, similar to the Catawba Unit 2 Westinghouse Model D5 SGs, a potential exists for HBRSEP Unit No. 2 to identify tube indications similar to those reported at Catawba within the hot leg tubesheet region.

Prior to issuance of IN 2005-09, potential inspection plans for the tubes and tube welds underwent intensive industry discussions in March 2005. The findings in the Catawba SG tubes present three distinct issues with regard to the SG tubes at HBRSEP Unit No. 2:

1) Indications in internal bulges and over-expansions within the hot leg tubesheet,
2) Indications at the elevation of the tack expansion transition, and,
3) Indications in the tube-to-tubesheet welds and propagation of these indications into adjacent tube material.

Tubes with bulges and over-expansions in the HBRSEP Unit No. 2 steam generators were determined by evaluation of bobbin inspection data from refueling outages prior to Refueling Outage 24.

In Refueling Outage 24, the inspection scope included a sample of approximately 50% of the hot leg tubes inspected from 4 inches above the top of tube sheet to 2 inches below the top of tubesheet. Those tubes which were identified with bulges or over-expansions were inspected for degradation with a rotating +Point coil to a depth of 17.00 inches below the top of the tubesheet consistent with the then current alternate repair criteria (Amendment 214).

The Refueling Outage 26 inspection scope included +Point inspection of 50% of the hot leg tubes from 4 inches above the top of tubesheet to 2 inches below the top of tubesheet which were not inspected during Refueling Outage 24. Tubes with bulges or over-expansions above the H* depth were inspected from 4 inches above the top of tube sheet to 17.28 inches below the top of the tubesheet consistent with the then current alternate repair criteria (Amendment 224). No degradation was identified in any of the tube segments where bulges or over-expansions were located.

Progress Energy has not performed systematic inspections with qualified techniques to identify indications at the tube-to-tubesheet weld or at tack expansion transitions. However, consistent with the Steam Generator Program the following activities and observations relevant to potential tube sever due to propagation of indications into adjacent material have been conducted:

- Tubes that were not fully expanded to at least 0.5 inches from the top of the tubesheet were inspected from the tube ends to at least 0.5 inches from the top of the tubesheet. No degradation or slippage was identified in any of these tube ends.
- All inservice tubes were inspected for tube end slippage. No slippage was identified.
- Based on these inspections, no indications of a 360 degree tube sever have been detected in any steam generator at HBRSEP Unit No. 2. Consequently, the level of degradation in the HBRSEP Unit No. 2 steam generators is very limited compared to the assumption of "all tubes severed" that was utilized in the development of the permanent H* value. Thus, structural integrity will be assured for these permanent alternate repair criteria as required by the Steam Generator (SG) Program.

As a result of these potential issues and the possibility of unnecessarily plugging steam generator tubes, Progress Energy is proposing changes to TS 5.5.9 to delete the limitation of the applicability of the alternate plugging/repair criteria only until the end of Cycle 27. The proposed changes also include modification of the value of H* consistent with the resolution of previously outstanding questions regarding application of the H* methodology on a permanent basis. The proposed TS changes will continue to require the reporting requirements established with adoption of Amendments 214 and 224 in TS 5.6.8 "Steam Generator Tube Inspection Report" while limiting steam generator tube inspection and plugging to the safety significant portion of the tubes.

4.0 SUMMARY OF LICENSING BASIS ANALYSIS (H* ANALYSIS)

Amendments that would implement the alternate repair criteria on a permanent basis have been submitted by several licensees. Early requests were not approved pending resolution of NRC

staff questions, including most notably, the effect of bore eccentricity on the H* analysis assumptions. However, application of the alternate repair criteria was approved on a limited temporary basis for several plants including HBRSEP Unit No. 2. Recently, license amendments for the Catawba and Surry Plants have been issued which allow the permanent application of the alternate repair criteria.

License Amendment 214 was issued to HBRSEP Unit No. 2 on April 9, 2007 and limited requirements for inspection to a depth to 17 inches below the top of the hot leg tube sheet for inspections conducted prior to the end of Operating Cycle 25 (Reference 12). The inspection depth limit was based on plant specific evaluations contained within WCAP-16627-P, "Steam Generator Alternate Repair Criteria for Tube Portion within the Tubesheet at H. B. Robinson Unit 2" (Reference 11).

HBRSEP Unit No. 2 subsequently requested a license amendment (Reference 16) that would apply alternate repair criteria based on application of the H* methodology described in Westinghouse WCAP-17091-P, "H*: Alternate Repair Criteria for the Tubesheet Expansion Region in Steam Generators with Hydraulically Expanded Tubes (Model 44F)" (Reference 3). The request proposed changes to TS 5.5.9 "Steam Generator (SG) Program" to limit the SG tube inspection and repair (plugging) to the portion of tubing from the top of the tube sheet to 17.28 inches below the top of the tube sheet. Changes to TS 5.6.8, "Steam Generator Tube Inspection Report," were also requested to revise reporting requirements applicable to the alternate repair criteria. On May 7, 2010, the NRC issued HBRSEP Unit No. 2 Amendment 224 (Reference 13) which limited the required inspection to a depth to 17.28 inches until the end of Operating Cycle 27.

In response to amendment requests for application of the alternate repair criteria on a permanent basis for the Turkey Point and Surry plants, the NRC issued Requests for Additional Information in late 2009 and early 2010 (References 17 and 18 respectively). These requests documented the then currently identified and unresolved issues relating to tubesheet bore eccentricity which required resolution before the NRC could complete its review of a permanent amendment request.

The NRC staff documented the summary of a February 16, 2011 public meeting regarding steam generator tube inspection permanent alternate repair criteria in a letter dated March 28, 2011 to Southern Nuclear Operating Company (Reference 26). Enclosure 3 of the NRC letter provided technical NRC staff questions developed at the meeting. Responses to these questions have been incorporated into WCAP-17345- P, Revision 2 (Reference 2).

In addition, Section 1.3 of WCAP-17345- P, Revision 2 (Reference 2) was revised to address recommendations from the independent review of the H* analysis performed by MPR Associates. Related to the independent review, a May 26, 2011 letter from the NRC to Southern Nuclear Operating Company (Reference 27) included a pre-submittal review request for additional information. The response to the NRC pre-submittal review request is provided in Southern Nuclear Operating Company letter NL-11-1178, dated June 20, 2011 (Reference 28).

On July 28, 2011, Virginia Electric and Power Company (Dominion) submitted a license amendment request (Reference 29) for permanent application of the alternate repair criteria, H*, for Surry Power Station Units 1 and 2. On January 18, 2012, the NRC issued a request to Surry Power Station for additional information (Reference 30) consisting of 15 questions. These 15 questions included several of the same questions the NRC staff had transmitted to Catawba in response to a June 30, 2011 letter to the NRC that had submitted a request to revise Technical Specifications for permanent alternative repair criteria (Reference 37).

In a letter dated February 14, 2012 Surry Power Station submitted responses (References 31) to the NRC's Request for Additional Information (Reference 30) related to WCAP-17345-P. As noted in Reference 30, questions 2, 6, 10, 11, and 13 were not applicable to the Model 51F steam generators installed at Surry or were not applicable to the Surry plant. HBRSEP Unit No. 2 has reviewed these questions and determined that they are also not applicable to the Model 44F steam generators installed at HBRSEP Unit No. 2 or are not applicable to HBRSEP Unit No. 2. Questions 1, 3, 4, 5, 7, 8, 9, and 14 were addressed in the Attachments 1 and 2 (Proprietary/Non-Proprietary) responses prepared by Westinghouse included with Reference 31. Plant specific responses to questions 12 and 15 were provided in Attachment 4 of Reference 31 for the Surry Plant.

The responses provided in Attachments 1 and 2 of Reference 31 are also applicable to the Model 44F replacement steam generators installed at HBRSEP Unit No. 2. HBRSEP Unit No. 2 responses to plant specific questions 12 and 15 are presented in Attachment 4 of this enclosure.

Documents describing evaluations and analyses most directly applicable to application of the H* methodology and alternate repair criteria on a permanent basis to HBRSEP Unit No. 2 are presented in Table 1.

Table 1

Document Number	Revision Number	Title	Reference Number
LTR-SGMP-12-30	1	Applicability of H* to H. B. Robinson Unit 2 and Recommended Leakage Factor	33
WCAP-17345-P	2	H*: Resolution of NRC Technical Issue Regarding Tubesheet Bore Eccentricity (3-Loop Model 44F/Model 51F)	2
WCAP-17091-P	0	H*: Alternate Repair Criteria for the Tubesheet Expansion Region in Steam Generators with Hydraulically Expanded Tubes (Model 44F)	3
LTR-SGMP-09-108-P Attachment	0	Response to NRC Request for Additional Information on H*; Model 44F and Model51 F Steam Generators	19
LTR-SGMP-09-108-Errata	0	Errata: Responses to NRC Request for Additional Information on H*; Model 44F and Model 51F Steam Generators Model 51F Steam Generators	20
LTR-SGMP-10-95-P-Attachment	1	H*: Alternate Leakage Calculation Methods for H* for Situations When Contact Pressure at Normal Operating Conditions Exceeds Contact Pressure at Accident Conditions	21
LTR-SGMP-10-78-P-Attachment	0	Effects of Tubesheet Bore Eccentricity and Dilation on Tube-to Tubesheet Contact Pressure and Their Relative Importance to H*	22
LTR-SGMP-10-33-P-Attachment	0	H* Response to NRC Questions Regarding Tubesheet Bore Eccentricity	23
LTR-SGMP-09-111 P-Attachment	1	Acceptable Value of the Location of the Bottom of the Expansion Transition (BET) for Improvement of H*	24
LTR-SGMP-11-29	1	Responses to USNRC Request for Additional Information Regarding the Surry License Amendment Request for Permanent Application of the Alternate Repair Criterion, H*	25

5.0 TECHNICAL EVALUATION

The proposed changes include changes consistent with TSTF-510, Revision 2 which revise TS 3.4.18, TS 5.5.9.d.2 within the Steam Generator (SG) Program to modify the frequency of verification of SG tube integrity and SG tube sample selection and TS 5.6.8 to clarify steam generator reporting requirements. These proposed changes are consistent with the guidance for the industry initiative on NEI 97-06, "Steam Generator Program Guidelines." The changes consistent with TSTF-510 also implement a number of editorial corrections, changes, and clarifications intended to improve internal consistency, consistency with the implementing industry documents, and usability without changing the intent of the requirements. The proposed changes are more effective in managing the frequency of verification of tube integrity and sample selection than those required by current TSs.

Progress Energy has reviewed TSTF-510, and the model safety evaluation dated October 19, 2011 (Reference 5) as part of the Federal Register Notice of Availability dated October 27, 2011 (76 FR 66763). The purpose of this model is to provide a common template for licensees to use in order to permit the NRC to efficiently process amendments that propose to revise TS for SG tube integrity. As described in Section 2.2, Progress Energy has concluded that the justifications presented in TSTF-510 and the model safety evaluation prepared by the NRC staff are applicable to HBRSEP Unit No. 2 for those changes consistent with TSTF-510. Changes associated with application of the H* methodology on a permanent basis are administrative with respect to the intent of TSTF-510.

The proposed Amendment also includes changes which would make application of the alternate repair criteria permanent. Specifically, these changes delete wording associated with expiration of the application of the alternate repair criteria and revise the value of H*.

To preclude unnecessarily plugging tubes in the HBRSEP Unit No. 2 SGs, an evaluation was performed to identify the safety significant portion of the tube within the tubesheet necessary to maintain structural and leakage integrity in both normal and accident conditions. Tube inspections will be limited to identifying and plugging degradation in the safety significant portion of the tubes. The technical evaluation for the inspection and repair methodology is provided in References 2, 3 and 19. This evaluation is based on the use of finite element model structural analysis and a bounding leak rate evaluation based on contact pressure between the tube and the tube sheet during normal and postulated accident conditions. The limited tubesheet inspection criteria were developed for the tubesheet region of the HBRSEP Unit No. 2 Model 44F SGs considering the most stringent loads associated with plant operation, including transients and postulated accident conditions. The limited tube sheet inspection criteria were selected to prevent tube burst and axial separation due to axial pullout forces acting on the tube and to ensure that the accident induced leakage limits are not exceeded. Table 1 of this enclosure provides the list of documents that provide the technical justification for limiting the inspection in the tubesheet expansion region to less than the full depth of the tubesheet.

The basis for determining the safety significant portion of the tube within the tubesheet is based upon evaluation and testing programs that quantified the tube-to-tubesheet radial contact pressure for bounding plant conditions as described in the H* Analysis. The tube-to-tubesheet radial contact pressure provides resistance to tube pull out and resistance to leakage during plant operation and transients.

The constraint that is provided by the tubesheet precludes tube burst for cracks within the tubesheet. The criteria for tube burst described in NEI 97-06 (Reference 8) and NRC Regulatory Guide 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes," (Reference 32) are satisfied by the constraint provided by the tubesheet. Through application of the limited tubesheet inspection scope as described below, the existing operational leakage limit provides assurance that excessive leakage (i.e., greater than accident analysis assumptions) will not occur.

Primary to secondary leakage from tube degradation is assumed to occur in several design basis accidents: main steam line break (MSLB), locked rotor, and control rod ejection. The radiological dose consequences associated with this assumed leakage are evaluated to ensure that they remain within regulatory limits (e.g. 10 CFR Part 100, 10 CFR 50.67, GDC 19). The accident induced leakage performance criteria are intended to ensure the primary to secondary leak rate during any accident does not exceed the primary to secondary leak rate assumed in the accident analysis. Radiological dose consequences define the limiting accident condition for the H* value. The accident analyses use a primary to secondary accident leak rate value of 0.11 gallons per minute (gpm) through the faulted SG and a total of 0.19 gpm through the two intact SGs for the MSLB. When the TS operational leak rate limit of 75 gpd or about 0.052 gpm, through any one SG is multiplied by the MSLB leak rate factor applicable to HBRSEP Unit No. 2 of 1.87 (page 5 in LTR-SGMP-12-30, revision 1, Reference 33) the maximum primary to secondary accident induced leak rate is less than 0.098 gpm and is bounded by the value of 0.11 gpm through the faulted SG used in the MSLB accident analyses.

The other design basis accidents, such as the postulated locked rotor event and the control rod ejection event, are conservatively modeled using the design specification transients that result in increased temperatures in the SG hot and cold legs for a period of time. Dynamic viscosity decreases with increasing temperature such that leakage would be expected to increase due to decreasing viscosity and increasing differential pressure for the duration of time that there is a rise in RCS temperature. The length of time that a plant with Model 44F SGs will exceed the normal operating differential pressure across the tubesheet is less than 30 seconds for the locked rotor event, and less than 10 seconds for the control rod ejection event. As the accident induced leakage performance criteria is defined in gallons per minute, the leak rate for a locked rotor and a control rod ejection event can be integrated over a minute for comparison to the limit. Time integration permits an increase in acceptable leakage during the time of peak pressure differential by approximately a factor of two for the locked rotor event because of the short duration (less than 30 seconds) of the elevated pressure differential, and by a factor of six for the control rod ejection event (less than 10 seconds). This translates into an effective reduction in the leakage factor by the same factor for each event. The values for leakage rate factors for a postulated locked rotor event are 0.08 and 0.38 for a postulated control rod ejection event (page 4, reference 33). Due to the short duration of the transients above normal operating pressure differential, no leakage factor is required for the locked rotor and control rod ejection events (i.e., the leakage factor is under 1.0 for both transients). Thus, MSLB is the limiting accident and 1.87 is the limiting leak rate factor for HBRSEP Unit No. 2 (page 5, reference 33).

It should be noted that some of the discussion in WCAP-17091-P (Reference 3) refers to feedline break (FLB) accident analyses. References to FLB analyses, however, are specific to the initial analyses for other SG models and are not intended to imply that the FLB accident is applicable to HBRSEP Unit No. 2. These FLB accident analyses are not considered to be part of the design basis for HBRSEP Unit No. 2.

Plant-specific operating conditions are used to generate the overall leakage factor ratios that are used in the condition monitoring and operational assessments. The plant-specific data provide the initial conditions for application of the transient input data. The results of the analysis of the plant-specific inputs to determine the bounding plant for each model of SG and to assure that the design basis accident contact pressures are greater than the normal operating contact pressure are contained in section 6 of WCAP-17091-P (Reference 3).

As discussed in References 2 and 3, the leak rate ratio (accident induced leak rate to operational leak rate) is a product of the pressure differential subfactor and the viscosity subfactor using the Darcy flow equation. For the postulated MSLB event, a plant cool down event would occur and the subsequent temperature in the reactor coolant system (RCS) would not be expected to exceed the temperatures at plant no load conditions. An increase in leakage would not be expected to occur as a result of the temperature change and the viscosity subfactor can be conservatively set equal to 1.0. Therefore, the increase in leakage would only be a function of the increase in primary to secondary pressure differential. The resulting leak rate ratio for the MSLB event is 1.87 for HBRSEP Unit No. 2 (page 5, reference 33).

The leak rate factor of 1.87 for HBRSEP Unit No. 2 for a postulated MSLB has been calculated as shown in page 5 of reference 33. HBRSEP Unit No. 2 will apply a factor of 1.87 to the normal operating leakage associated with the tubesheet expansion region in the condition monitoring and operational assessment. The leak rate factor of 1.87 in page 5 of reference 33 applies to both hot and cold legs. Specifically, for the condition monitoring assessment, the component of leakage from the prior cycle from below the H* distance will be multiplied by a factor of 1.87 and added to the total leakage from any other source and compared to the assumed accident leak rate. For the operational assessment, the difference between the allowable leakage and the accident induced leakage from sources other than the tubesheet expansion region will be divided by 1.87 and compared to the observed operational leakage. An administrative operational leakage limit will be established to not exceed the calculated value as necessary.

References 2 and 3 redefine the primary pressure boundary. The tube-to-tubesheet weld no longer functions as a portion of this boundary. The hydraulically expanded portion of the tube into the tubesheet over the H* distance now functions as the primary pressure boundary in the area of the tube and tube sheet, maintaining the structural and leakage integrity over the full range of SG operating conditions, including the most limiting accident conditions. The evaluations in References 2 and 3 determined that degradation in tubing below this safety significant portion of the tube does not require inspection or repair (plugging). The inspection of the safety significant portion of the tubes provides a high level of confidence that the structural and leakage performance criteria are maintained during normal operating and accident conditions.

WCAP-17091-P (Reference 3), section 9.8, provides a review of leak rate susceptibility to tube slippage and concluded that the tubes are fully restrained against motion under very conservative design and analysis assumptions such that tube slippage is not a credible event for any tube in the

bundle. Monitoring for steam generator tube slippage is part of the HBRSEP Unit No. 2 steam generator tube inspection program and the results of slippage monitoring are included in the reporting requirements of TS 5.6.8, "Steam Generator Tube Inspection Report." To date no evidence of steam generator tube slippage has been identified.

To determine if there were any significant deviations in the location of the bottom of the expansion transition relative to the top of tube sheet compared to the assumptions in WCAP-17091-P (Reference 3) a profile analysis of the tubes within the tubesheets for HBRSEP Unit No. 2 was performed. The analysis included data from several different outages to include 100% of the inservice tubes. During refueling outage RO-24, approximately 60% of the tubes identified by the analysis with indications of bulges or over expansions were inspected for degradation to a depth of the then current H* value of 17.00 inches. During RO-26, the beginning of a new sequential period for these steam generators, the planned 50% sample of the tubes identified by the analysis was supplemented with 34 tubes inspected during RO-24 that had indication of bulges or over expansions at or around the 17 inch mark for inspection to 17.28 inches, the then current H* value. No degradation was found in any of the tubes examined.

6.0 REGULATORY EVALUATION

6.1 Applicable Regulatory Requirements/Criteria

The General Design Criteria (GDC) applicable to HBRSEP Unit No. 2 at the time the operating license was issued (July, 1970) were those contained in Proposed Appendix A to lOCFR50, General Design Criteria for Nuclear Power Plants, published in the Federal Register on July 11, 1967. These criteria are described in HBRSEP Unit No. 2 UFSAR Sections 3.1.1.1 and 3.1.2, The Appendix A GDC, effective in 1971 with subsequent amendments are somewhat different from the proposed 1967 criteria. HBRSEP Unit No. 2 was evaluated with respect to the proposed 1967 GDC and the original FSAR contained a discussion of the criteria as well as a summary of the criteria by groups.

The following provides discussion of the affects of the proposed change on the capability of HBRSEP Unit No. 2 for continued compliance with the 1967 GDCs.

The regulatory requirements applicable to SG tube integrity are the following:

1967 GDC-9 Reactor Coolant Pressure Boundary - The reactor coolant pressure boundary shall be designed, fabricated, erected, and tested so as to have an extremely low probability of gross rupture or significant uncontrolled leakage throughout its design lifetime.

The proposed change does not alter the SG design, fabrication, erection or testing.

1967 GDC-16 Monitoring Reactor Coolant Leakage - Means shall be provided to detect significant uncontrolled leakage from the reactor coolant pressure boundary.

The proposed change does not alter the means of detecting leakage from the reactor coolant pressure boundary.

1967 GDC-33 Reactor Coolant Pressure Boundary Capability -The RCPB shall be capable of accommodating without rupture the static and dynamic load imposed on any boundary component as a result of an inadvertent and sudden release of energy to the coolant. As a design reference, this sudden release shall be taken as that which would result from a sudden reactivity insertion such as rod ejection (unless prevented by positive mechanical means), rod dropout, or cold water addition.

The proposed change excludes from inspection those portions of the steam generator tubes that are not safety significant with respect to maintaining the reactor coolant pressure boundary. Structural analyses demonstrate that the safety significant portion of the steam generator tube within the tubesheet maintains the capability to accommodate, without rupture, the sudden release of energy into the coolant.

1967 GDC-34 RCPB Rapid Propagation Failure Prevention - The RCPB shall be designed and operated to reduce to an acceptable level the probability of rapidly propagating type failure.

The proposed change does not alter the SG design or operation.

1967 GDC-36 RCPB Surveillance - RCPB components shall have provisions for inspection, testing, and surveillance of criteria areas by appropriate means to assess the structural and leaktight integrity of the boundary components during their service lifetime.

The proposed change does not alter provisions for inspection, testing, or surveillance of criteria applicable to the safety significant portions of steam generator tubes credited as part of the reactor coolant pressure boundary.

10 CFR 50.55a, Codes and Standards - Section (b), ASME Code - c) *Reactor coolant pressure boundary*. (1) Components which are part of the reactor coolant pressure boundary must meet the requirements for Class 1 components in Section III of the ASME Boiler and Pressure Vessel Code, except as provided in paragraphs (c)(2), (c)(3), and (c)(4) of this section.

The proposed change and the Steam Generator Program requirements which underlie it are in full compliance with the ASME Code. The proposed technical specifications are more effective at ensuring tube integrity and, therefore, compliance with the ASME Code, than the current technical specifications as described in Section 5.0 (Technical Evaluation).

10 CFR 50.65 Maintenance Rule – Each holder of a license to operate a nuclear power plant under 50.21(b) or 50.22 shall monitor the performance or condition of structures, systems, or components, against licensee-established goals, in a manner sufficient to provide reasonable assurance that such structures, systems, and components, as defined in paragraph (b), are capable of fulfilling their intended functions. Such goals shall be established commensurate with safety and, where practical, take into account industry-wide operating experience. When the performance or condition of a structure, system, or component does not meet established goals, appropriate corrective action shall be taken. For a nuclear power plant for which the licensee has submitted the certifications specified in 50.82(a)(1), this section only shall apply to the extent

that the licensee shall monitor the performance or condition of all structures, systems, or components associated with the storage, control, and maintenance of spent fuel in a safe condition, in a manner sufficient to provide reasonable assurance that such structures, systems, and components are capable of fulfilling their intended functions.

Under 10 CFR 50.65, the Maintenance Rule, licensees classify SGs as risk significant components because they are relied upon to remain functional during and after design basis events. SGs are to be monitored under 10 CFR 50.65(a) (2) against industry established performance criteria. Meeting the performance criteria of NEI 97-06, Revision 3, and TS 5.5.9 provides reasonable assurance that the SG tubing remains capable of fulfilling its specific safety function of maintaining the reactor coolant pressure boundary.

The SG tube performance criteria in NEI 97-06, Revision 3, and TS 5.5.9 include:

- Structural integrity performance criterion: All in-service SG tubes shall retain structural integrity over the full range of normal operating conditions (including startup, operation in the power range, hot standby, and cooldown and all anticipated transients included in the design specification) and design basis accidents.
- The primary-to-secondary accident induced leakage rate for any design basis accident, other than SG tube rupture, shall not exceed the leakage rate assumed in the accident analysis in terms of total leakage rate for all SGs and leakage rate for an individual SG.
- The RCS operational primary to secondary leakage through any one SG shall be limited to 75 gallons per day.

Section 5.0 (Technical Evaluation) describes the supporting structural analysis and leakage evaluation results that establish the safety significant portion of the tube within the tubesheet based upon evaluation and testing programs that quantified the tube-to-tubesheet radial contact pressure which provides resistance to tube pull out and resistance to leakage during plant operation and transients. For HBRSEP Unit No. 2 it was determined that degradation in tubing below 18.11 inches from the top of the tubesheet does not require plugging. As such, the HBRSEP Unit No. 2 inspection program provides a high level of confidence that the structural and leakage criteria are maintained during normal operating and accident conditions.

6.2 Precedents

This request proposes to combine two changes that affect the same Technical Specification (TS) sections into one License Amendment. Specifically, the first part proposes to implement revisions consistent with TSTF-510 Revision 2, "Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection" and the second part proposes to permanently revise TS 5.5.9 to exclude portions of the Steam Generator (SG) tube below the top of the SG tubesheet from periodic inspections by implementing the permanent alternate repair criteria H*.

A Notice of Availability, published in the Federal Register (76 FR 66763) identified that a model safety evaluation for plant specific adoption of TSTF-510 was available as part of the Consolidated Line Item Improvement Process (CLIIP). The notice also stated that instead of the model application licensees desiring additional changes should submit a license amendment request that does not claim to adopt TSTF–510.

The proposed changes consistent with TSTF-510 are similar to the proposed changes submitted in the following license amendment requests to adopt TSTF-510:

> Exelon Generation Company letter, Braidwood Units 1 and 2, Byron Units 1 and 2, "Application to Revise Technical Specifications to Adopt TSTF-510, Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection" dated March 22, 2012 (Reference 34)
>
> Wolf Creek Nuclear Operating Company letter, "Docket No. 50-482: Application to Revise Technical Specifications to Adopt TSTF-510, Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection," Using the Consolidated Line Item Improvement Process", dated April 26, 2012 (Reference 35)

The proposed changes to permanently revise TS 5.5.9 to exclude portions of the Steam Generator (SG) tube below the top of the SG tubesheet from periodic inspections by implementing the permanent alternate repair criteria H* are similar to the following license amendment requests approved by the NRC staff as noted:

> Virginia Electric and Power Company (Dominion) Surry Power Station Units 1 and 2 License Amendment Request Permanent Alternate Repair Criteria For Steam Generator Tube Inspection and Repair, dated July 28, 2011, (Reference 29) as approved by NRC letter, Surry Power Station Unit Nos. 1 and 2, Issuance of Amendments Regarding Virginia Electric and Power Company License Amendment Request for Permanent Alternate Repair Criteria for Steam Generator Tube Inspection and Repair (TAC Nos. ME6803 and ME6804), dated April 17, 2012 (Reference 36)
>
> Catawba Nuclear Station, Units 1 and 2 - Proposed Technical Specifications (TS) Amendment - TS 3.4.13, "RCS Operational LEAKAGE," TS 5.5.9, "Steam Generator (SG) Program" and TS 5.6.8, "Steam Generator Tube Inspection Report" - License Amendment Request to Revise TS for Permanent Alternate Repair Criteria, dated June 30, 2011, (Reference 37) as approved by NRC letter, Catawba Nuclear Station, Units 1 and 2, Issuance of Amendments Regarding Technical Specification Amendments for Permanent Alternate Repair Criteria for Steam Generator Tubes (TAC Nos. ME6670 and ME6671), dated March 12, 2012 (Reference 38)

6.3 No Significant Hazards Consideration Determination

This request proposes to combine two changes that affect the same Technical Specification (TS) sections into one License Amendment. Specifically, the first part proposes to implement revisions consistent with TSTF-510 Revision 2, "Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection" and the second part proposes to permanently revise TS 5.5.9 to exclude portions of the Steam Generator (SG) tube below the top of the SG tubesheet from periodic inspections by implementing the permanent alternate repair criteria H*.

The request proposes to revise TS Sections 3.4.18 "Steam Generator Tube (SG) Integrity", 5.5.9 "Steam Generator (SG) Program", and 5.6.8 "Steam Generator Tube Inspection Report" to address issues associated with the inspection periods, and address other administrative changes and clarifications consistent with TSTF-510, Revision 2, "Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection" (Reference 1)

The request also proposes to revise TS Section 5.5.9 "Steam Generator (SG) Program", to permanently exclude portions of the steam generator tubes below the top of the steam generator tubesheet from periodic inspections, by deleting conditions requiring application of the alternate repair criteria (H*) on a temporary basis and to revise the value of H*. Consistent with this proposed change, TS Section 5.6.8 "Steam Generator Tube Inspection Report", is revised. In addition, editorial changes are made to identify the steam generator tube length subject to required inspection.

Application of the structural analysis and leak rate evaluation results, to exclude portions of the tubes from inspection and repair, is interpreted to constitute a redefinition of the primary to secondary pressure boundary and defines the safety significant portion of the tube that must be inspected and repaired. A justification has been developed by Westinghouse Electric Company LLC in WCAP-17091-P Revision 0 (Reference 3) and WCAP-17345-P Revision 2 (Reference 2) to identify the specific inspection depth below which any type of axial or circumferential primary water stress corrosion cracking can be shown to have no impact on the performance criteria in Nuclear Energy Institute (NEI) 97-06 (Reference 8), "Steam Generator Program Guidelines," and TS 5.5.9, "Steam Generator (SG) Program."

Progress Energy has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

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

   Response: No

   The previously analyzed accidents are initiated by the failure of plant structures, systems, or components. The proposed change modifies steam generator tube inspection frequencies and tube selection consistent with TSTF-510 and excludes the lower portion of steam generator tubes from inspection by implementing the alternate repair criteria

(H*) on a permanent basis and does not have a detrimental impact on the integrity of any plant structure, system, or component that initiates an analyzed event. The proposed change will not alter the operation of, or otherwise increase the failure probability of any plant equipment that initiates an analyzed accident.

Of the applicable accidents previously evaluated, the limiting transients with consideration to the proposed change to the SG tube inspection and repair criteria are the SG tube rupture (SGTR) event and the main steam line break (MSLB) postulated accident.

The proposed SG tube inspection frequency and sample selection criteria will continue to ensure that the SG tubes are inspected such that the probability of a SGTR is not increased. The consequences of a SGTR are bounded by the conservative assumptions in the design basis accident analysis. The proposed SG tube inspection frequency and sample selection criteria will not cause the consequences of a SGTR to exceed those assumptions.

With respect to the SGTR event, the required structural integrity margins of the SG tubes and the tube-to-tubesheet joint over the H* distance will be maintained. Tube rupture in tubes with cracks within the tubesheet is precluded by the constraint provided by the presence of the tubesheet and the tube-to-tubesheet joint. Tube burst cannot occur within the thickness of the tubesheet. The tube-to-tubesheet joint constraint results from the hydraulic expansion process, thermal expansion mismatch between the tube and tube sheet, and from the differential pressure between the primary and secondary side, and tube sheet rotation. The structural margins against burst, as discussed in Regulatory Guide 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes" (Reference 32) and NEI 97-06, "Steam Generator Program Guidelines", (Reference 8) are maintained for both normal and postulated accident conditions.

For the portion of the tube outside of the tubesheet, the proposed change also has no impact on the structural or leakage integrity. Therefore, the proposed change does not result in a significant increase in the probability of the occurrence of a SGTR accident.

At normal operating pressures, leakage from degradations below the proposed limited inspection depth is limited by the tube-to-tubesheet crevice. Consequently, negligible normal operating leakage is expected from degradation below the inspected depth within the tubesheet region. The consequences of an SGTR event are affected by the primary to secondary leakage flow during the event. However, primary to secondary leakage flow through a postulated tube that has been pulled out of the tubesheet is not affected by the proposed changes since the tubesheet enhances the tube integrity in the region of the hydraulic expansion by precluding tube deformation beyond its initial hydraulically expanded outside diameter. Therefore, the proposed change does not result in a significant increase in the consequences of an SGTR. In addition, the selected H* value envelopes the depth within the tubesheet required to prevent a tube pullout.

The probability of a MSLB event is unaffected by the potential failure of a SG tube as the failure of a tube is not an initiator for a MSLB event. Therefore the proposed SG tube inspection frequency and sample selection criteria and the structural integrity margins of the SG tubes and the tube-to-tubesheet joint over the H* distance do not increase the probability of a MSLB event.

The leak rate factor of 1.87 for HBRSEP Unit No. 2, for a postulated MSLB, has been calculated as shown in References 2, 3, 23 and 33. HBRSEP Unit No. 2 will apply the factor of 1.87 to the normal operating leakage associated with the tubesheet expansion region in the condition monitoring and operational assessment. Through application of the limited tube sheet inspection scope, the existing operating leakage limit provides assurance that excessive leakage (i.e., greater than accident analysis assumptions) will not occur.

When the TS operational leak rate limit of 75 gpd or about 0.052 gallons per minute (gpm) through any one SG is multiplied by the MSLB leak rate factor applicable to HBRSEP Unit No. 2 of 1.87 (page 5 of reference 33) the maximum primary to secondary accident induced leak rate is less than 0.098 gpm and is bounded by the value of 0.11 gpm through the faulted SG used in the MSLB accident analyses. Since the existing limit on operational leakage continues to ensure that the MSLB assumed accident induced leakage will not be exceeded, the consequences of a MSLB accident are not increased.

For the condition monitoring assessment, the component of leakage from the prior cycle from below the H* distance will be multiplied by a factor of 1.87 and added to the total leakage from any other source and compared to the allowable accident induced leak rate. For the operational assessment, the difference in the leakage between the allowable leakage and the calculated accident induced leakage from sources other than the tubesheet expansion region will be divided by 1.87 and compared to the observed operational leakage.

Based on the above, the proposed change does not involve a significant increase in 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?*

Response: No

The proposed change modifies steam generator tube inspection frequencies and tube selection consistent with TSTF-510 and excludes the lower portion of steam generator tubes from inspection by implementing the alternate repair criteria (H*) on a permanent basis. The proposed change does not introduce any new equipment, create new failure modes for existing equipment, or create any new limiting single failures resulting from tube degradation. The proposed change does not affect the design of the SGs or their method of operation. In addition, the proposed change does not impact any other plant

system or component. Plant operation will not be altered, and all safety functions will continue to perform as previously assumed in accident analyses. Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. *Does the change involve a significant reduction in a margin of safety?*

Response: No

The SG tubes in pressurized water reactors are an integral part of the reactor coolant pressure boundary and, as such, are relied upon to maintain the primary system's pressure and inventory. As part of the reactor coolant pressure boundary, the SG tubes are unique in that they are also relied upon as a heat transfer surface between the primary and secondary systems such that residual heat can be removed from the primary system. In addition, the SG tubes also isolate the radioactive fission products in the primary coolant from the secondary system. In summary, the safety function of a SG is maintained by ensuring the integrity of its tubes. Steam generator tube integrity is a function of the design, environment, and the physical condition of the tube. The proposed change does not affect tube design or operating environment. The proposed change will continue to require monitoring of the physical condition of the SG tubes but will limit inspection within the tubesheet to the portion of the tube from the top of the tubesheet to a distance H* below the top of the tubesheet.

The proposed change modifies steam generator tube inspection frequencies and tube selection consistent with TSTF-510 and limits required inspection to the safety significant portion of the steam generator tubes. WCAP-17345, Rev. 2 (Reference 2) identifies the specific inspection depth (H*) below which any type of tube degradation is shown to have no impact on the performance criteria in NEI 97-06 Rev. 3, "Steam Generator Program Guidelines" (Reference 8) and TS 5.5.9, "Steam Generator (SG) Program." Changes associated with inspection frequency and tube selection criteria are consistent with TSTF-510 and are based on recent industry experience and are more effective in managing the frequency of verification of tube integrity and sample selection than those required by current TSs.

The proposed change maintains the required structural margins of the SG tubes for both normal and accident conditions. Nuclear Energy Institute 97-06, "Steam Generator Program Guidelines" (Reference 8), and NRC Regulatory Guide 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes" (Reference 32), are used as the bases in the development of the limited tubesheet inspection depth methodology for determining that SG tube integrity considerations are maintained within acceptable limits. Regulatory Guide 1.121 describes a method acceptable to the NRC for meeting General Design Criteria (GDC) 14, "Reactor Coolant Pressure Boundary," GDC 15, "Reactor Coolant System Design," GDC 31, "Fracture Prevention of Reactor Coolant Pressure Boundary," and GDC 32, "Inspection of Reactor Coolant Pressure Boundary,"

by reducing the probability and consequences of a SGTR. Regulatory Guide 1.121 concludes that by determining the limiting safe conditions for tube wall degradation, the probability and consequences of a SGTR are reduced. This Regulatory Guide uses safety factors on loads for tube burst that are consistent with the requirements of Section III of the American Society of Mechanical Engineers (ASME) Code.

For axially oriented cracking located within the tubesheet, tube burst is precluded due to the presence of the tubesheet. For circumferentially oriented cracking, Westinghouse WCAP-17091-P, Rev. 0 (Reference 3) and WCAP- 17345, Rev. 2 (Reference 2) define a length of degradation-free expanded tubing that provides the necessary resistance to tube pullout due to the pressure induced forces, with applicable safety factors applied. Application of the limited hot and cold leg tubesheet inspection criteria will preclude unacceptable primary to secondary leakage during all plant conditions. When the TS operational leak rate limit of 75 gpd or about 0.052 gpm through any one SG is multiplied by the MSLB leak rate factor applicable to HBRSEP Unit No. 2 of 1.87 (page 5 of LTR-SGMP-12-30, revision 1, Reference 33) the maximum primary to secondary accident induced leak rate is less than 0.98 gpm and is bounded by the value of 0.11 gpm through the faulted SG used in the MSLB accident analyses.

Therefore, the proposed change does not involve a significant reduction in any margin of safety.

6.4 Conclusions

The proposed changes to the frequency, tube selection, and portion of steam generator tube subject to required inspection for degradation maintain structural and leakage integrity over the full range of steam generating operating conditions, including the most limiting accident conditions. The safety significant portion of the tube is the length of tube that is engaged from the top of the tubesheet to a distance H* below the top of the tubesheet. Tubing degradation below a distance H* from the top of the tubesheet does not impact the safety significant portion of the tube within the tubesheet and does not require plugging. The H* analysis serves as the basis for the limited tubesheet inspection criteria, which are intended to ensure the primary to secondary leak rate values used in accident analyses. Based on the considerations above, 1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, 2) such activities will be conducted in compliance with the Commission's regulations, and, 3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

7.0 ENVIRONMENTAL CONSIDERATION

HBRSEP Unit No. 2 has evaluated the proposed amendment for environmental considerations. The review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, and would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or

significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendments meet the eligibility criterion for categorical exclusion set for in 10 CFR 51.22(c) (9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment needs to be prepared in connection with the proposed amendment.

8.0 REFERENCES

1. Technical Specification Task Force (TSTF) Letter to NRC, TSTF-11-02, "Correction to TSTF-510, Revision 2, Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection" March 1, 2011 (ADAMS Accession No. ML110610350)
2. Westinghouse Electric Company WCAP-17345-P, Revision 2, "H*: Resolution of NRC Technical Issue Regarding Tubesheet Bore Eccentricity (3-Loop Model 44F/Model 51F)" June 2011 (Submitted to NRC as Attachment 4 of Reference 29)
3. Westinghouse Electric Company WCAP-17091-P, Revision 0, "H*: Alternate Repair Criteria for the Tubesheet Expansion Region in Steam Generators with Hydraulically Expanded Tubes (Model 44F)" June, 2009 (Submitted to NRC as Attachment VI of Reference 16)
4. Technical Specification Task Force (TSTF) Letter to NRC, TSTF-12-09, "Correction to TSTF-510-A, Revision 2, Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection" March 28, 2012 (ADAMS Accession No. ML12088A82)
5. NOA Model SE of TSTF-510, Rev 2, "Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection", Using the CLIIP, October 19, 2011 (ADAMS Accession No. ML112101513)
6. EPRI 1013706 "Pressurized Water Reactor Steam Generator Examination Guidelines" Rev. 7, October 2007
7. EPRI 1019038 "Steam Generator Integrity Assessment Guidelines" November 2009
8. NEI 97-06 "Steam Generator - Program Guidelines" Revision 3, January 2011 (ADAMS Accession No. ML111310708)
9. Technical Specification Task Force (TSTF) Letter to NRC, TSTF-05-05 "TSTF-449, Revision 4, "Steam Generator Tube Integrity" April 14, 2005 (ADAMS Accession No. ML051090200)
10. NRC letter, "H. B. Robinson Steam Electric Plant, Unit No. 2 – Issuance of an Amendment – Steam Generator Tube Integrity (TAC NO. MD2136)" March 12, 2007 (ADAMS Accession No. ML070430307)
11. Westinghouse Electric Company WCAP-16627-P, "Steam Generator Alternate Repair Criteria for Tube Portion within the Tubesheet at H. B. Robinson Unit 2" provided as Attachment VI to H. B. Robinson Steam Electric Plant, Unit No. 2, letter to NRC, "Resubmission of Request for Technical Specifications Change Regarding Steam

Generator Alternate Repair Criteria", January 19, 2007 (ADAMS Accession No. ML070240483)

12. NRC letter, "H. B. Robinson Steam Electric Plant, Unit No. 2 – Issuance of an Amendment On Steam Generator Tube Repair in the Tubesheet (TAC NO. MD4046)" April 9, 2007 (ADAMS Accession No. ML070920008)

13. NRC letter, "H. B. Robinson Steam Electric Plant, Unit No. 2 - Issuance of Amendment Regarding Technical Specifications Changes Related to the Steam Generator Alternate Repair Criteria (TAC NO. ME2952)" May 7, 2010 (ADAMS Accession No. ML100990405)

14. NRC Information Notice 2005-09 "Indications in Thermally Treated Alloy 600 Steam Generator Tubes and Tube-to-Tubesheet Welds" April 7, 2005

15. NRC Generic Letter 2004-01 "Requirements for Steam Generator Tube Inspections," August 30, 2004

16. H. B. Robinson Steam Electric Plant, Unit No. 2, letter to NRC, "H. B. Robinson Steam Electric Plant, Unit No. 2 - Request for Technical Specifications Change Regarding Steam Generator Alternate Repair Criteria" December 16, 2009 (ADAMS Accession No. ML093631212)

17. NRC Letter, "Turkey Point Nuclear Plant, Units 3 and 4 – Request for Additional Information Regarding the Permanent Alternate Repair Criteria License Amendment Request (TAC Nos. ME1754 and ME 1755)" December 29, 2009 (ADAMS Accession No. ML093561371)

18. NRC Letter, "Surry Power Station, Unit Nos. 1 and 2 (Surry Units 1 and 2) Request for Additional Information (RAI) Regarding the Permanent Alternate Repair Criteria License Amendment Request (TAC NOS. ME1783 AND ME1784)" January 6, 2010 (ADAMS Accession No. ML093441173)

19. Westinghouse Letter LTR-SGMP-09-108-P - Attachment "Response to NRC Request for Additional Information on H*; Model 44 F and Model 51 F Steam Generators" August 27, 2009 [Submitted as Attachment 2 to Surry Power Station Units 1 and 2 Response to Request for Additional Information Proposed License Amendment Request Permanent Alternate Repair Criteria (PARC) for Steam Generator Tube Repair Units 1 and 2, September 16, 2009 (ADAMS Accession #ML092660615)]

20. Westinghouse Letter LTR-SGMP-09-108 Errata, "Errata: Responses to NRC Request for Additional Information on H*; Model 44F and Model 51F Steam Generators" September 8, 2009 [This letter identifies that on page 49 of both attachments to LTR-SGMP-09-108 P-Attachment (Reference 19) and LTR-SGMP-09-108 NP-Attachment the header that reads "RAI#20 References" should be corrected to read "RAI#18 References"]

21. Westinghouse letter LTR-NRC-10-60, Submittal of LTR-SGMP-10-95-P-Attachment, Rev. 1 and LTR-SGMP-10-95 NP-Attachment, Rev. 1, "H*: Alternate Leakage

Calculation Methods for H* for Situations When Contact Pressure at Normal Operating Conditions Exceeds Contact Pressure at Accident Conditions (Proprietary/Non-Proprietary) for Review and Approval" September 3, 2010 [Submitted directly to NRC]

22. Westinghouse letter LTR-NRC-10-68, "Submittal of LTR-SGMP-10-78-P Attachment and LTR-SGMP-10-78 NP-Attachment, "Effects of Tubesheet Bore Eccentricity and Dilation on Tube-to- Tubesheet Contact Pressure and Their Relative Importance to H*", (Proprietary/Non-Proprietary) for Review and Approval", November 9, 2010

23. Westinghouse letter LTR-NRC-10-70, "Submittal of LTR-SGMP-10-33-P Attachment and LTR-SGMP-I0-33 NP-Attachment, "H*: Response to NRC Questions Regarding Tubesheet Bore Eccentricity," (Proprietary/Non-Proprietary) for Review and Approval" November 11, 2010

24. Westinghouse letter LTR-NRC-10-69, "Submittal of LTR-SGMP-09-111-P Attachment, Rev. 1 and LTR-SGMP-09-111 NP-Attachment, Rev. 1, "Acceptable Value of the Location of the Bottom of the Expansion Transition (BET) for Implementation of H*," (Proprietary/Non-Proprietary) for Review and Approval", November 10, 2010 (ADAMS Accession No. ML103400083).

25. Westinghouse Letter LTR-SGMP-11-29, Rev. 1 "Responses to USNRC RAI on Surry Units 1& 2 Permanent H* Submittal" January 22, 2012 provided as Attachment 1 to Surry Power Station Units 1 and 2 "Response to Request for Additional Information Proposed License Amendment Request Permanent Alternate Repair Criteria for Steam Generator Tube Inspection and Repair", February 14, 2012 (ADAM Accession #ML12048A676)

26. NRC Letter to Southern Nuclear Operating Company, Inc., " Summary of February 16, 2011 Meeting with Southern Nuclear Operating Company, Inc. and Westinghouse on Technical Issues Regarding Steam Generator Tube Inspection Permanent Alternate Repair Criteria (TAC Nos. ME5417 and ME5418)" March 28, 2011 (ADAMS Accession No. ML110660648)

27. NRC Letter to Southern Nuclear Operating Company, Inc., "Vogtle Electric Generating Plant Units 1 and 2 - Pre submittal Consideration of Steam Generator Alternative Repair Criteria Requirements Request for Additional Information (TAC Nos. ME5417 and ME5418)" May 26, 2011 (ADAMS Accession No. ML11140A099)

28. Southern Nuclear Operating Company, Inc. letter to NRC, NL-11-1178, "Vogtle Electric Generating Plant - Response to Presubmittal Consideration of Steam Generator Alternative Repair Criteria Requirements Request for Additional Information" June 20, 2011 (ADAMS Accession No. ML111721903)

29. Virginia Electric and Power Company (Dominion) letter to NRC, "Surry Power Station Units 1 and 2 License Amendment Request Permanent Alternate Repair Criteria for Steam Generator Tube Inspection and Repair" July 28, 2011 (ADAMS Accession No. ML11215A058)

30. NRC letter to Surry Power Station, "Surry Power Station, Units Nos. 1 and 2-Request for Additional Information Regarding the Steam Generator License Amendment Request to Revise Technical Specification for Permanent Alternate Repair Criteria (TAC Nos. ME6803 and ME6804)" January 18, 2012 (ADAMS Accession No. ML12006A001)

31. Surry Power Station letter to NRC, "Response to Request for Additional Information Related to License Amendment Request for Permanent Alternate Repair Criteria for Steam Generator Tube Inspection and Repair" February 14, 2012 (ADAMS Accession No. ML12048A676)

32. NRC Regulatory Guide 1.121 "Bases for Plugging Degraded PWR Steam Generator Tubes," August 1976

33. Westinghouse letter LTR-SGMP-12-30, Revision 1 "Applicability of H* to H. B. Robinson Unit 2 and Recommended Leakage Factor" March 4, 2013

34. Exelon Generation Company letter, Braidwood Units 1 and 2, Byron Units 1 and 2, "Application to Revise Technical Specifications to Adopt TSTF-510, Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection" March 22, 2012 (ADAMS Accession No. ML12082A135)

35. Wolf Creek Nuclear Operating Company letter, "Docket No. 50-482: Application to Revise Technical Specifications to Adopt TSTF-510, Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection," Using the Consolidated Line Item Improvement Process" April 26, 2012 (ADAMS Accession No. ML12124A339)

36. NRC letter to Surry Power Station, "Surry Power Station, Unit Nos. 1 and 2, Issuance of Amendments Regarding Virginia Electric and Power Company License Amendment Request for Permanent Alternate Repair Criteria for Steam Generator Tube Inspection and Repair (TAC Nos. ME6803 AND ME6804)" April 17, 2012 (ADAMS Accession No. ML12109A270)

37. Catawba Nuclear Station letter to NRC, "Proposed Technical Specifications (TS) Amendment - TS 3.4.13, "RCS Operational LEAKAGE," TS 5.5.9, "Steam Generator (SG) Program" and TS 5.6.8, "Steam Generator Tube Inspection Report" License Amendment Request to Revise TS for Permanent Alternate Repair Criteria, June 30, 2011 (ADAMS Accession No. ML11188A107)

38. NRC Letter to Catawba Nuclear Station, "Catawba Nuclear Station, Units 1 and 2, Issuance of Amendments Regarding Technical Specification Amendments for Permanent Alternate Repair Criteria for Steam Generator Tubes (TAC Nos. ME6670 and ME6671)" March 12, 2012 (ADAMS Accession No. ML12054A692)

Attachment 1 Serial: RNP-RA/13-0030
9 Pages (including cover page)

ATTACHMENT 1

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

PROPOSED TECHNICAL SPECIFICATIONS CHANGES (MARK-UP)

5.5 Programs and Manuals (continued)

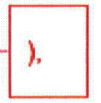
5.5.9 Steam Generator (SG) Program

A Steam Generator Program shall be established and implemented to ensure that SG tube integrity is maintained. In addition, the Steam Generator Program shall include the following ~~provisions~~:

a. Provisions for condition monitoring assessments. Condition monitoring assessment means an evaluation of the "as found" condition of the tubing with respect to the performance criteria for structural integrity and accident induced leakage. The "as found" condition refers to the condition of the tubing during an SG inspection outage, as determined from the inservice inspection results or by other means, prior to the plugging of tubes. Condition monitoring assessments shall be conducted during each outage during which the SG tubes are inspected or plugged to confirm that the performance criteria are being met.

b. Performance criteria for SG tube integrity. SG tube integrity shall be maintained by meeting the performance criteria for tube structural integrity, accident induced leakage, and operational LEAKAGE.

1. Structural integrity performance criterion: All in-service steam generator tubes shall retain structural integrity over the full range of normal operating conditions (including startup, operation in the power range, hot standby, and cool down ~~and~~ all anticipated transients included in the design specification) and design basis accidents. This includes retaining a safety factor of 3.0 against burst under normal steady state full power operation primary-to-secondary pressure differential and a safety factor of 1.4 against burst applied to the design basis accident primary-to-secondary pressure differentials. Apart from the above requirements, additional loading conditions associated with the design basis accidents, or combination of accidents in accordance with the design and licensing basis, shall also be evaluated to determine if the associated loads contribute significantly to burst or collapse. In the assessment of tube integrity, those loads that do significantly affect burst or collapse shall be determined and assessed in combination with the loads due to pressure with a safety factor of 1.2 on the combined primary loads and 1.0 on axial secondary loads.



(continued)

5.5.9 Steam Generator (SG) Program
(continued)

2. Accident induced leakage performance criterion: The primary to secondary accident induced leakage rate for any design basis accident, other than a SG tube rupture, shall not exceed the leakage rate assumed in the accident analysis in terms of total leakage rate for all SGs and leakage rate for an individual SG. Leakage is not to exceed 75 gallons per day per SG.

3. The operational LEAKAGE performance criterion is specified in LCO 3.4.13, "RCS Operational LEAKAGE."

c. Provisions for SG tube ~~repair~~ criteria. Tubes found by inservice inspection to contain flaws with a depth equal to or exceeding the following criteria shall be plugged: 47% of the nominal tube wall thickness if the next inspection interval of that tube is 12 months, and a 2% reduction in the ~~repair~~ criteria for each 12 month period until the next inspection of the tube.

The following alternate tube ~~repair~~ criteria shall be applied as an alternative to the preceding criteria~~, until the end of Operating Cycle 27~~:

Tubes with service-induced flaws located greater than ~~17.28~~ inches below the top of the tubesheet do not require plugging. Tubes with service-induced flaws located in the portion of the tube from the top of the tubesheet to ~~17.28~~ inches below the top of the tubesheet shall be plugged upon detection.

d. Provisions for SG tube inspections. Periodic SG tube inspections shall be performed. The number and portions of the tubes inspected and methods of inspection shall be performed with the objective of detecting flaws of any type (e.g., volumetric flaws, axial and circumferential cracks) that may be present along the length of the tube, from ~~the tube-to-tubesheet weld at the tube inlet to the tube-to-tubesheet weld at the tube outlet (until the end of Operating Cycle 27 the required inspection length extends 17.28~~ inches below the top of the tubesheet on the ~~tube~~ hot leg ~~side~~ to ~~17.28~~ inches below the top of the tubesheet on the ~~tube~~ cold leg ~~side)~~, and that may satisfy the applicable tube ~~repair~~ criteria. The tube-to-tubesheet weld is not part of the tube. In addition to meeting the requirements of d.1, d.2, and d.3 below, the inspection scope, inspection methods, and inspection intervals shall be such as to ensure that SG tube

plugging
plugging
plugging
18.11
18.11
18.11
18.11
plugging

(continued)

assessment

5.5 Programs and Manuals

5.5.9 Steam Generator (SG) Program
(continued)

integrity is maintained until the next SG inspection. An ~~assessment of~~ degradation shall be performed to determine the type and location of flaws to which the tubes may be susceptible and, based on this assessment, to determine which inspection methods need to be employed and at what locations.

1. Inspect 100% of the tubes in each SG during the first refueling outage following SG ~~replacement~~.

installation

Insert text on following page

2. ~~Inspect 100% of the tubes at sequential periods of 120, 90, and, thereafter, 60 effective full power months. The first sequential period shall be considered to begin after the first inservice inspection of the SGs. In addition, inspect 50% of the tubes by the refueling outage nearest the midpoint of the period and the remaining 50% by the refueling outage nearest the end of the period. No SG shall operate for more than 48 effective full power months or two refueling outages (whichever is less) without being inspected.~~

affected and potentially affected

3. If crack indications are found in any portion of a SG tube not excluded above, then the next inspection for each SG for the degradation mechanism that caused the crack indication shall not exceed 24 effective full power months or one refueling outage (whichever ~~is less~~). If definitive information, such as from examination of a pulled tube, diagnostic non-destructive testing, or engineering evaluation indicates that a crack-like indication is not associated with a crack(s), then the indication need not be treated as a crack.

results in more frequent inspections

e. Provisions for monitoring operational primary to secondary LEAKAGE.

5.5.10 Secondary Water Chemistry Program

This program provides controls for monitoring secondary water chemistry to inhibit SG tube degradation. The program shall include:

a. Identification of critical parameters, their sampling frequency, sampling points, and control band limits;

(continued)

Text to be inserted as specification 5.5.9.d.2

plugging

After the first refueling outage following SG installation, inspect each SG at least every 48 effective full power months or at least every other refueling outage (whichever results in more frequent inspections). In addition, the minimum number of tubes inspected at each scheduled inspection shall be the number of tubes in all SGs divided by the number of SG inspection outages scheduled in each inspection period as defined in a, b, and c below. If a degradation assessment indicates the potential for a type of degradation to occur at a location not previously inspected with a technique capable of detecting this type of degradation at this location and that may satisfy the applicable tube ~~repair~~ criteria, the minimum number of locations inspected with such a capable inspection technique during the remainder of the inspection period may be prorated. The fraction of locations to be inspected for this potential type of degradation at this location at the end of the inspection period shall be no less than the ratio of the number of times the SG is scheduled to be inspected in the inspection period after the determination that a new form of degradation could potentially be occurring at this location divided by the total number of times the SG is scheduled to be inspected in the inspection period. Each inspection period defined below may be extended up to 3 effective full power months to include a SG inspection outage in an inspection period and the subsequent inspection period begins at the conclusion of the included SG inspection outage.

a) After the first refueling outage following SG installation, inspect 100% of the tubes during the next 120 effective full power months. This constitutes the first inspection period;

b) During the next 96 effective full power months, inspect 100% of the tubes. This constitutes the second inspection period; and

c) During the remaining life of the SGs, inspect 100% of the tubes every 72 effective full power months. This constitutes the third and subsequent inspection periods.

5.6 Reporting Requirements (continued)

5.6.7 Tendon Surveillance Report

a. Notification of a pending sample tendon test, along with detailed acceptance criteria, shall be submitted to the NRC at least two months prior to the actual test.

b. A report containing the sample tendon test evaluation shall be submitted to the NRC within six months of conducting the test.

5.6.8 Steam Generator Tube Inspection Report

A report shall be submitted within 180 days after the initial entry into MODE 4 following completion of an inspection performed in accordance with the Specification 5.5.9, Steam Generator (SG) Program. The report shall include:

D

a. The scope of inspections performed on each SG.

b. ~~Active~~ degradation mechanisms found.

c. Nondestructive examination techniques utilized for each degradation mechanism.

The number and percentage of tubes plugged to date, and the effective plugging in each steam generator.

d. Location, orientation (if linear), and measured sizes (if available) of service induced indications.

e. Number of tubes plugged during the inspection outage for each ~~active~~ degradation mechanism.

f. ~~Total number and percentage of tubes plugged to date.~~

g. The results of condition monitoring, including the results of tube pulls and in-situ testing.

h. The primary to secondary leakage rate observed in each SG (if it is not practical to assign the leakage to an individual SG, the entire primary to secondary leakage should be conservatively assumed to be from one SG) during the cycle preceding the inspection that is the subject of the report.

18.11

i. The calculated accident induced leakage rate from the portion of the tubes below ~~17.28~~ inches from the top of the tubesheet for the most limiting accident in the most limiting SG. In addition, if the calculated accident induced leakage rate from the most limiting accident is less than ~~1.00~~ times the maximum operational primary to secondary leakage rate, the report should describe how it was determined, and

1.87

NO CHANGES TO THIS PAGE

5.6 Reporting Requirements (continued)

5.6.8 Steam Generator Tube Inspection Report (continued)

j. The results of monitoring for tube axial displacement (slippage). If slippage is discovered, the implications of the discovery and corrective action shall be provided.

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.18 Steam Generator (SG) Tube Integrity

LCO 3.4.18 SG tube integrity shall be maintained.

AND

All SG tubes satisfying the tube ~~repair~~ criteria shall be plugged in accordance with the Steam Generator Program.

plugging

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

NOTE

Separate Condition entry is allowed for each SG tube.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or more SG tubes satisfying the tube ~~repair~~ criteria and not plugged in accordance with the Steam Generator Program.	A.1	Verify tube integrity of the affected tube(s) is maintained until the next refueling outage or SG tube inspection.	7 days
	AND		
	A.2	Plug the affected tube(s) in accordance with the Steam Generator Program.	Prior to entering MODE 4 following the next refueling outage or SG tube inspection.
B. Required Action and associated Completion Time of Condition A not met. OR SG tube integrity not maintained.	B.1	Be in MODE 3.	6 hours
	AND		
	B.2	Be in MODE 5.	36 hours

plugging

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.18.1	Verify SG tube integrity in accordance with the Steam Generator Program.	In accordance with the Steam Generator Program
SR 3.4.18.2	Verify that each inspected SG tube that satisfies the tube ~~repair~~ criteria is plugged in accordance with the Steam Generator Program.	Prior to entering MODE 4 following a SG tube inspection

plugging

Attachment 2 Serial: RNP-RA/13-0030
7 Pages (including cover page)

ATTACHMENT 2

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

REVISED AND RETYPED TECHNICAL SPECIFICATIONS PAGES

5.5 Programs and Manuals (continued)

5.5.9 Steam Generator (SG) Program

A Steam Generator Program shall be established and implemented to ensure that SG tube integrity is maintained. In addition, the Steam Generator Program shall include the following:

a. *Provisions for condition monitoring assessments.* Condition monitoring assessment means an evaluation of the "as found" condition of the tubing with respect to the performance criteria for structural integrity and accident induced leakage. The "as found" condition refers to the condition of the tubing during an SG inspection outage, as determined from the inservice inspection results or by other means, prior to the plugging of tubes. Condition monitoring assessments shall be conducted during each outage during which the SG tubes are inspected or plugged to confirm that the performance criteria are being met.

b. Performance criteria for SG tube integrity. SG tube integrity shall be maintained by meeting the performance criteria for tube structural integrity, accident induced leakage, and operational LEAKAGE.

1. Structural integrity performance criterion: All in-service steam generator tubes shall retain structural integrity over the full range of normal operating conditions (including startup, operation in the power range, hot standby, and cool down), all anticipated transients included in the design specification, and design basis accidents. This includes retaining a safety factor of 3.0 against burst under normal steady state full power operation primary-to-secondary pressure differential and a safety factor of 1.4 against burst applied to the design basis accident primary-to-secondary pressure differentials. Apart from the above requirements, additional loading conditions associated with the design basis accidents, or combination of accidents in accordance with the design and licensing basis, shall also be evaluated to determine if the associated loads contribute significantly to burst or collapse. In the assessment of tube integrity, those loads that do significantly affect burst or collapse shall be determined and assessed in combination with the loads due to pressure with a safety factor of 1.2 on the combined primary loads and 1.0 on axial secondary loads.

2. Accident induced leakage performance criterion: The primary to secondary accident induced leakage rate for any design basis accident, other than a SG tube rupture, shall not exceed the leakage rate assumed in the accident analysis in terms of total leakage rate for all SGs and leakage rate for an individual SG. Leakage is not to exceed 75 gallons per day per SG.

3. The operational LEAKAGE performance criterion is specified in LCO 3.4.13, "RCS Operational LEAKAGE."

(continued)

5.5.9 Steam Generator (SG) Program
(continued)

c. Provisions for SG tube plugging criteria. Tubes found by inservice inspection to contain flaws with a depth equal to or exceeding the following criteria shall be plugged: 47% of the nominal tube wall thickness if the next inspection interval of that tube is 12 months, and a 2% reduction in the plugging criteria for each 12 month period until the next inspection of the tube.

The following alternate tube plugging criteria shall be applied as an alternative to the preceding criteria:

Tubes with service-induced flaws located greater than 18.11 inches below the top of the tubesheet do not require plugging. Tubes with service-induced flaws located in the portion of the tube from the top of the tubesheet to 18.11 inches below the top of the tubesheet shall be plugged upon detection.

d. Provisions for SG tube inspections. Periodic SG tube inspections shall be performed. The number and portions of the tubes inspected and methods of inspection shall be performed with the objective of detecting flaws of any type (e.g., volumetric flaws, axial and circumferential cracks) that may be present along the length of the tube, from 18.11 inches below the top of the tubesheet on the hot leg to 18.11 inches below the top of the tubesheet on the cold leg and that may satisfy the applicable tube plugging criteria. The tube-to-tubesheet weld is not part of the tube. In addition to meeting the requirements of d.1, d.2, and d.3 below, the inspection scope, inspection methods, and inspection intervals shall be such as to ensure that SG tube integrity is maintained until the next SG inspection. A degradation assessment shall be performed to determine the type and location of flaws to which the tubes may be susceptible and, based on this assessment, to determine which inspection methods need to be employed and at what locations.

1. Inspect 100% of the tubes in each SG during the first refueling outage following SG installation.

2. After the first refueling outage following SG installation, inspect each SG at least every 48 effective full power months or at least every other refueling outage (whichever results in more frequent inspections). In addition, the minimum number of tubes inspected at each scheduled inspection shall be the number of tubes in all SGs divided by the number of SG inspection outages scheduled in each inspection period as defined in a, b, and c below. If a degradation assessment indicates the potential for a type of degradation to occur at a location not previously inspected with a technique capable of detecting this type of degradation at this location and that may satisfy

(continued)

5.5.9 Steam Generator (SG) Program
(continued)

the applicable tube plugging criteria, the minimum number of locations inspected with such a capable inspection technique during the remainder of the inspection period may be prorated. The fraction of locations to be inspected for this potential type of degradation at this location at the end of the inspection period shall be no less than the ratio of the number of times the SG is scheduled to be inspected in the inspection period after the determination that a new form of degradation could potentially be occurring at this location divided by the total number of times the SG is scheduled to be inspected in the inspection period. Each inspection period defined below may be extended up to 3 effective full power months to include a SG inspection outage in an inspection period and the subsequent inspection period begins at the conclusion of the included SG inspection outage.

a) After the first refueling outage following SG installation, inspect 100% of the tubes during the next 120 effective full power months. This constitutes the first inspection period;

b) During the next 96 effective full power months, inspect 100% of the tubes. This constitutes the second inspection period; and

c) During the remaining life of the SGs, inspect 100% of the tubes every 72 effective full power months. This constitutes the third and subsequent inspection periods.

3. If crack indications are found in any portion a SG tube not excluded above, then the next inspection for each affected and potentially affected SG for the degradation mechanism that caused the crack indication shall not exceed 24 effective full power months or one refueling outage (whichever results in more frequent inspections). If definitive information, such as from examination of a pulled tube, diagnostic non-destructive testing, or engineering evaluation indicates that a crack-like indication is not associated with a crack(s), then the indication need not be treated as a crack.

e. Provisions for monitoring operational primary to secondary LEAKAGE.

5.5.10 Secondary Water Chemistry Program

This program provides controls for monitoring secondary water chemistry to inhibit SG tube degradation. The program shall include:

a. Identification of critical parameters, their sampling frequency, sampling points, and control band limits;

(continued)

5.6 Reporting Requirements (continued)

5.6.7 Tendon Surveillance Report

a. Notification of a pending sample tendon test, along with detailed acceptance criteria, shall be submitted to the NRC at least two months prior to the actual test.

b. A report containing the sample tendon test evaluation shall be submitted to the NRC within six months of conducting the test.

5.6.8 Steam Generator Tube Inspection Report

A report shall be submitted within 180 days after the initial entry into MODE 4 following completion of an inspection performed in accordance with the Specification 5.5.9, Steam Generator (SG) Program. The report shall include:

a. The scope of inspections performed on each SG.

b. Degradation mechanisms found.

c. Nondestructive examination techniques utilized for each degradation mechanism.

d. Location, orientation (if linear), and measured sizes (if available) of service induced indications.

e. Number of tubes plugged during the inspection outage for each active degradation mechanism.

f. The number and percentage of tubes plugged to date, and the effective plugging in each steam generator.

g. The results of condition monitoring, including the results of tube pulls and in-situ testing.

h. The primary to secondary leakage rate observed in each SG (if it is not practical to assign the leakage to an individual SG, the entire primary to secondary leakage should be conservatively assumed to be from one SG) during the cycle preceding the inspection that is the subject of the report,

i. The calculated accident induced leakage rate from the portion of the tubes below 18.11 inches from the top of the tubesheet for the most limiting accident in the most limiting SG. In addition, if the calculated accident induced leakage rate from the most limiting accident is less than 1.87 times the maximum operational primary to secondary leakage rate, the report should describe how it was determined, and

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.18 Steam Generator (SG) Tube Integrity

LCO 3.4.18 SG tube integrity shall be maintained.

AND

All SG tubes satisfying the tube plugging criteria shall be plugged in accordance with the Steam Generator Program.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

NOTE
Separate Condition entry is allowed for each SG tube.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or more SG tubes satisfying the tube plugging criteria and not plugged in accordance with the Steam Generator Program.	A.1	Verify tube integrity of the affected tube(s) is maintained until the next refueling outage or SG tube inspection.	7 days
	AND		
	A.2	Plug the affected tube(s) in accordance with the Steam Generator Program.	Prior to entering MODE 4 following the next refueling outage or SG tube inspection.
B. Required Action and associated Completion Time of Condition A not met.	B.1	Be in MODE 3.	6 hours
	AND		
	B.2	Be in MODE 5.	36 hours
OR			
SG tube integrity not maintained.			

SURVEILLANCE REQUIERMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.18.1	Verify SG tube integrity in accordance with the Steam Generator Program.	In accordance with the Steam Generator Program
SR 3.4.18.2	Verify that each inspected SG tube that satisfies the tube plugging criteria is plugged in accordance with the Steam Generator Program.	Prior to entering MODE 4 following a SG tube inspection

Attachment 3 to Serial: RNP-RA/13-0030
5 Pages (including cover page)

ATTACHMENT 3

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

PROPOSED CHANGES TO TECHNICAL SPECIFICATIONS BASES PAGES

plugging

plugging

plugging

BASES (Continued)

LCO

the safety significant portion of an SG tube from 18.11 inches below the top of the tubesheet on the hot leg to 18.11 inches below the top of the tubesheet on the hot leg is subject to inspection.

The LCO requires that SG tube integrity be maintained. The LCO also requires that all SG tubes that satisfy the ~~repair~~ criteria be plugged in accordance with the Steam Generator Program.

During an SG inspection, any inspected tube that satisfies the Steam Generator Program ~~repair~~ criteria is removed from service by plugging. If a tube was determined to satisfy the ~~repair~~ criteria but was not plugged, the tube may still have tube integrity.

In the context of this Specification, ~~an SG tube is defined as the entire length of the tube, including the tube wall, between the tube to tubesheet weld at the tube inlet and the tube to tubesheet weld at the tube outlet.~~ The tube-to-tubesheet weld is not considered part of the tube.

A SG tube has tube integrity when it satisfies the SG performance criteria. The SG performance criteria are defined in Specification 5.5.9, "Steam Generator Program," and describe acceptable SG tube performance. The Steam Generator Program also provides the evaluation process for determining conformance with the SG performance criteria.

There are three SG performance criteria: structural integrity, accident induced leakage, and operational LEAKAGE. Failure to meet any one of these criteria is considered failure to meet the LCO.

The structural integrity performance criterion provides a margin of safety against tube burst or collapse under normal and accident conditions, and ensures structural integrity of the SG tubes under all anticipated transients included in the design specification. Tube burst is defined as, "The gross structural failure of the tube wall. The condition typically corresponds to an unstable opening displacement (e.g., opening area increased in response to constant pressure) accompanied by ductile (plastic) tearing of the tube material at the ends of the degradation." Tube collapse is defined as, "For the load displacement curve for a given structure, collapse occurs at the top of the load versus displacement curve where the slope of the curve becomes zero." The structural integrity performance criterion provides guidance on assessing loads that have a

(continued)

BASES (Continued)

APPLICABILITY

Steam generator tube integrity is challenged when the pressure differential across the tubes is large. Large differential pressures across SG tubes can only be experienced in MODE 1, 2, 3, or 4.

RCS conditions are far less challenging in MODES 5 and 6 than during MODES 1, 2, 3, and 4. In MODES 5 and 6, primary to secondary differential pressure is low, resulting in lower stresses and reduced potential for LEAKAGE.

ACTIONS

The ACTIONS are modified by a Note clarifying that the Conditions may be entered independently for each SG tube. This is acceptable because the Required Actions provide appropriate compensatory actions for each affected SG tube. Complying with the Required Actions may allow for continued operation, and subsequently affected SG tubes are governed by subsequent Condition entry and application of associated Required Actions.

plugging

A.1 and A.2

Condition A applies if it is discovered that one or more SG tubes examined in an inservice inspection satisfy the tube ~~repair~~ criteria but were not plugged in accordance with the Steam Generator Program as required by SR 3.4.18.2. An evaluation of SG tube integrity of the affected tube(s) must be made. Condition A does not apply to the occurrence of primary to secondary LEAKAGE, which is monitored and maintained in accordance with LCO 3.4.13. Steam generator tube integrity is based on meeting the SG performance criteria described in the Steam Generator Program. The SG ~~repair~~ criteria define limits on SG tube degradation that allow for flaw growth between inspections while still providing assurance that the SG performance criteria will continue to be met. In order to determine if a SG tube that should have been plugged has tube integrity, an evaluation must be completed that demonstrates that the SG performance criteria will continue to be met until the next refueling outage or SG tube inspection. The tube integrity determination is based on the estimated condition of the tube at the time the situation is discovered and the estimated growth of the degradation prior to the next SG tube inspection. If it is determined that tube integrity is not being maintained, Condition B applies.

plugging

(continued)

BASES (Continued)

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.18.1 (continued)

assessment determines the "as found" condition of the SG tubes. The purpose of the condition monitoring assessment is to ensure that the SG performance criteria have been met for the previous operating period.

The Steam Generator Program determines the scope of the inspection and the methods used to determine whether the tubes contain flaws satisfying the tube ~~repair~~ criteria. Inspection scope (i.e., which tubes or areas of tubing within the SG are to be inspected) is a function of existing and potential degradation locations. The Steam Generator Program also specifies the inspection methods to be used to find potential degradation. Inspection methods are a function of degradation morphology, nondestructive examination (NDE) technique capabilities, and inspection locations.

The Steam Generator Program defines the Frequency of SR 3.4.18.1. The Frequency is determined by the operational assessment and other limits in the SG examination guidelines (Ref. 6). The Steam Generator Program uses information on existing degradations and growth rates to determine an inspection Frequency that provides reasonable assurance that the tubing will meet the SG performance criteria at the next scheduled inspection. In addition, Specification 5.5.9 contains prescriptive requirements concerning inspection intervals to provide added assurance that the SG performance criteria will be met between scheduled inspections.

SR 3.4.18.2

During an SG inspection, any inspected tube that satisfies the Steam Generator Program ~~repair~~ criteria is removed from service by plugging. The tube ~~repair~~ criteria delineated in Specification 5.5.9 are intended to ensure that tubes accepted for continued service satisfy the SG performance criteria with allowance for error in the flaw size measurement and for future flaw growth. In addition, the tube ~~repair~~ criteria, in conjunction with other elements of the Steam Generator Program, ensure that the SG performance criteria will continue to be met until the next inspection of the subject tube(s). Reference 1 provides guidance for performing operational assessments to verify that the tubes remaining in service will continue to meet the SG performance criteria.

(continued)

plugging

If crack indications are found in any SG tube, the maximum inspection interval for each affected and potentially affected SG is restricted by Specification 5.5.9 until subsequent inspections support extending the inspection interval.

plugging

plugging

plugging

plugging

BASES (Continued)

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.18.2 (continued)

The Frequency of prior to entering MODE 4 following a SG inspection ensures that the Surveillance has been completed and all tubes meeting the ~~repair~~ criteria are plugged prior to subjecting the SG tubes to significant primary to secondary pressure differential.

REFERENCES

1. NEI 97-06, "Steam Generator Program Guidelines."
2. 10 CFR 50 Appendix A, GDC 19.
3. 10 CFR 50.67.
4. ASME Boiler and Pressure Vessel Code, Section III, Subsection NB.
5. Draft Regulatory Guide 1.121, "Basis for Plugging Degraded Steam Generator Tubes," August 1976.
6. EPRI, "Pressurized Water Reactor Steam Generator Examination Guidelines."

ATTACHMENT 4

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

RESPONSE TO LICENSEE SPECIFIC RAI

In a letter dated February 14, 2012 Surry Power Station submitted responses [Reference 1] to the NRC's Request for Additional Information [Reference 2] related to WCAP-17345-P. As noted in Reference 2, questions 2, 6, 10, 11, and 13 were not applicable to the Model 51F steam generators installed at the Surry plant or were not applicable to the Surry Plant. HBRSEP Unit No. 2 has reviewed these questions and determined that they are also not applicable to the Model 44F steam generators installed at HBRSEP Unit No. 2 or are not applicable to HBRSEP Unit No. 2.

Questions 1, 3, 4, 5, 7, 8, 9, and 14 were addressed in the Attachments 1 and 2 (Proprietary/Non-Proprietary) responses prepared by Westinghouse included with Reference 1. The responses provided in Attachments 1 and 2 of Reference 1 are also applicable to the Model 44F replacement steam generators installed at HBRSEP Unit No. 2.

Plant specific responses for HBRSEP Unit No. 2 are provided below to RAI questions 12 and 15 of Reference 2.

RAI No.12:

BET measurements for Surry 2, documented in Westinghouse letter LTR-SGMP-09-111 P-Attachment, Revision 1, range to a maximum of 0.91 inches. BET measurements for Surry 1 led to the plugging of 6 tubes (Dominion letter 11-289 dated May 24, 2011) with BETs exceeding 1-inch. Apart from tubes with this reported range of BETs, Dominion letter 10-715, Attachment 1, page 10 of 23, states that a total of 20 tubes in the Unit 1 and 2 SGs were identified as not being expanded within the tubesheet and were plugged. Explain how the inspections and analyses performed were sufficiently systematic to ensure that all inservice tubes at Units 1 and 2 have been expanded against the tubesheet to within 1-inch of the top of the tubesheet.

Response:

The results of an inspection of the Bottom Expansion Transition (BET) were reported in the Steam Generator Tube Inspection Report submitted on January 13, 2011 [Reference 3] (ADAMS Accession No. ML110190222). By letter dated August 5, 2011 [Reference 4] (ADAMS Accession No. ML11203A814) the NRC staff requested additional information (RAI) about two tubes that were identified with BET greater than 1 inch below the top of the tubesheet. Two additional tubes were also identified as not being fully expanded within the tubesheet and as stated in the criteria in the HBRSEP Unit No. 2 Steam Generator Tube Inspection Report [Reference 3] these two tubes are not candidates for application of the alternate repair criteria.

In its response dated October 26, 2011, HBRSEP Unit No. 2 [Reference 5] (ADAMS Accession No. ML11305A077) reported that all tubes with BETs greater than 0.5 inches had been inspected by rotating pancake coil (RPC) to the tube end and that no degradations had been found. As discussed in the response to Questions 4, 5 & 6, HBRSEP Unit No. 2 indicated that there was no plan to plug these tubes and that when the alternate repair criteria technology was accepted for permanent application, additional assessment of the need to plug these tubes would be performed. In its subsequent review of the HBRSEP Unit No. 2 Steam Generator Tube Inspection Report [Reference 6] (ADAMS Accession No. ML12039A194) the NRC staff concluded that there were no technical issues that warrant followup action since the inspections appear to be consistent with the objective of detecting potential tube degradation and the inspection results appear to be consistent with industry operating experience at similarly designed and operated units.

RAI No.15:

Verify that regulatory commitments pertaining to monitoring for tube slippage and for primary to secondary leakage, as described in Dominion letter dated December 16, 2010 (NRC ADAMS Accession No. ML103550206), Attachment 1, page 10 of 23, remain in place. In addition, revise the proposed amendment to include a revision to technical specification limit on primary to secondary leakage from 150 gallons per day (gpd) to 83 gpd (150 divided by the proposed 1.8 leakage factor), or provide a regulatory basis for not making this change.

Response:

Two commitments were listed in Dominion letter dated December 16, 2010. These commitments correspond to the first and fourth commitments submitted by HBRSEP Unit No. 2 in Reference 3 in support of the license amendment [Reference 7] request issued as Amendment 224. These two commitments are as follows:

- Monitoring for tube slippage as part of the steam generator tube inspection program will be conducted.
- For the condition monitoring assessment, the component of operational leakage from the prior cycle from below the H* distance will be multiplied by a factor of 1.87 and added to the total accident leakage from any other source and compared to the allowable accident induced leakage limit. For the operational assessment, the difference between the allowable accident induced leakage and the accident induced leakage from sources other than the tubesheet expansion region will be divided by 1.87 and compared to the observed operational leakage. If necessary, an administrative operational leakage limit will be established to not exceed the calculated value.

The second and third commitments of Reference 7 were associated with one time inspections of the steam generator tube expansion transition locations. These inspections have been completed with appropriate entries into the plant corrective program made and a report transmitted to the NRC in Reference 3.

Monitoring for tube slippage has been incorporated into the Steam Generator Program and the results are required to be reported per specification 5.6.8.j in the Steam Generator Tube Inspection Report. All inservice SG tubes were inspected for tube end slippage during Refueling Outage 26 as reported in the Generator Tube Inspection Report (ADAMS Accession No. ML110190222).

Specification 5.5.9.a requires condition monitoring of the performance criteria for accident induced leakage. Specification 5.5.9.b.2 requires the accident induced leakage to be less than the leakage rate assumed in the accident analysis. The accident leakage is the sum of the leakage from below H* from the top of the tubesheet times the leakage rate factor for the most limiting event and accident leakage from any other source. The leakage rate factor for the most limiting event is 1.87. Therefore comparison of the sum of the operational leakage below H* multiplied by 1.87 and total accident leakage from any other source to the leakage rate assumed in the accident analysis is required by specifications 5.5.9.a and 5.5.9.b.

Evaluation of potential accident induced leakage from sources other than the tubesheet expansion region is included in the operational assessment required by the Steam Generator Program. The most recent Condition Monitoring/Operational Assessment determined that the result of dividing the difference between the accident induced leakage and the accident leakage from sources other than the tubesheet expansion region by 1.87 was about 80 gallons per day (gpd). This value is greater than the operational leakage limit of 75 gpd specified in TS 3.14 and therefore no administrative limit is necessary.

The limiting accident for evaluation of steam generator leakage for the H* methodology is the Main Steam Line Break (MSLB). The MSLB accident analyses use a primary to secondary accident leak rate value of 0.11 gallons per minute (gpm) through the faulted SG and a total value of 0.19 gpm for the two unaffected SGs. When the TS operational leak rate limit of 75 gpd or about 0.052 gpm through any one SG is multiplied by the MSLB leak rate factor applicable to HBRSEP Unit No. 2 of 1.87 from page 5 of reference 9 the maximum primary to secondary accident induced leak rate is less than 0.098 gpm and is bounded by the value of 0.11 gpm assumed for the accident leakage through the faulted SG.

Therefore, because the maximum accident induced leakage rate (considering the H* leak rate factor) is bounded by the assumed primary to secondary accident induced leak rate of the MSLB accident analyses, the technical specification operational leak rate limit of 75 gpd is not required to the revised.

References:

1. Surry Power Station letter to NRC, "Virginia Electric and Power Company (Dominion) Surry Power Stations 1 and 2 Response to Request for Additional Information Related to License Amendment Request for Permanent Alternate Repair Criteria for Steam Generator Tube Inspection and Repair" February 14, 2012 (ADAMS Accession No. MLI2048A676)

2. NRC letter to Surry Power Station, "Surry Power Station, Units Nos. 1 and 2- Request for Additional Information Regarding the Steam Generator License Amendment Request to Revise Technical Specification for Permanent Alternate Repair Criteria (TAC Nos. ME6803 and ME6804)" January 18, 2012 (ADAMS Accession No. ML12006A001)

3. H. B. Robinson Steam Electric Plant, Unit No. 2, letter to NRC, "Steam Generator Tube Inspection Report" January 13, 2011 (ADAMS Accession No. ML110190222)

4. NRC letter to H. B. Robinson Steam Electric Plant, Unit 2 "Request for Additional Information Regarding the Steam Generator Tube Inservice Inspection Report (TAC NO. ME5411)" August 5, 2011 (ADAMS Accession No. ML11203A814)

5. H. B. Robinson Steam Electric Plant, Unit No. 2, letter to NRC, "Response to NRC Request for Additional Information Regarding the Steam Generator Tube Inservice Inspection Report Dated January 13, 2011" October 26, 2011 (ADAMS Accession No. ML11305A077)

6. NRC letter to H. B. Robinson Steam Electric Plant, Unit 2 "Review of the Steam Generator Tube Inservice Inspection Report for Refueling Outage 26 (TAC NO. ME5411)" August 5, 2011 (ADAMS Accession No. ML12039A194)

7. H. B. Robinson Steam Electric Plant, Unit No. 2, letter to NRC, "H. B. Robinson Steam Electric Plant, Unit No. 2 -Request for Technical Specifications Change Regarding Steam Generator Alternate Repair Criteria" December 16, 2009 (ADAMS Accession No. ML093631212)

8. Westinghouse Electric Company WCAP-17091-P, Revision 0, "H*: Alternate Repair Criteria for the Tubesheet Expansion Region in Steam Generators with Hydraulically Expanded Tubes (Model 44F)" June 2009 (Submitted to NRC as Attachment VI of Reference 7)

9. Westinghouse letter LTR-SGMP-12-30, Revision 1, "Applicability of H* to H. B. Robinson Unit 2 and Recommended Leakage Factor," March 4, 2013

Attachment 5 Serial: RNP-RA/13-0030
2 Pages (including cover page)

ATTACHMENT 5

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

WESTINGHOUSE LETTER LTR-SGMP-09-98 ERRATA

Westinghouse

To: G. M. Turley, D. H. Warren, D. C. Beddingfield, D.L. Rogosky
cc: D. A. Testa, B. W. Woodman, C. D. Cassino, J. T. Kandra

Date: September 8, 2009

From: Steam Generator Management
Ext: 724-722-5082
Fax: 724-722-5889

Your ref:
Our ref: LTR-SGMP-09-108 Errata

Subject: Errata: Responses to NRC Request for Additional Information on H*; Model 44F and Model 51F Steam Generators

Reference:
1. LTR-SGMP-09-108, "Responses to NRC Request for Additional Information on H*; Model 44F and Model 51F Steam Generators," Westinghouse Electric Company LLC, August 28, 2009

Reference 1 provided responses to NRC RAIs on the LAR submittals for the alternate repair criterion, H*, for the plants with Model 44F and Model 51F steam generators. On page 49 of both attachments to Reference 1, LTR-SGMP-09-108 P-Attachment (proprietary) and LTR-SGMP-09-108 NP-Attachment (non-proprietary), the following correction should be made:

The header "RAI#20 References" should be "RAI#18 References"

Please transmit this information to the affected H* program participants.

Author:

*HOL**
Hermann Lagally
Fellow Engineer
Steam Generator Management Programs

Verified:

*GWW**
G.W. Whiteman
Principal Engineer
Regulatory Compliance and Plant Licensing

*Electronically approved records are authenticated in the Electronic Document Management System

Attachment 6 to Serial: RNP-RA/13-0030
6 Pages (including cover page)

ATTACHMENT 6

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

WESTINGHOUSE LETTER LTR-SGMP-12-30, Revision 1

Westinghouse

To: D. Beddingfield
cc: W.J. Bedont

Date: March 4, 2013

From: G.W. Whiteman
Ext: 724-722-5584
Fax: 724-722-5889

Your ref:
Our ref: LTR-SGMP-12-30, Rev. 1

Subject: **Applicability of H* to H.B. Robinson Unit 2 and Recommended Leakage Factor**

References:

1. WCAP-17345-P, Rev. 2, "H*: Resolution of NRC Technical Issue Regarding Tubesheet Bore Eccentricity (3-Loop Model 44F/Model 51F," June 2011.
2. LTR-SGMP-09-100 P-Attachment, Revision 1, "Responses to NRC Request for Additional Information on H*; Model F and Model D5 Steam Generators," September 2010.
3. LTR-SGMP-12-30, Rev. 0, "Applicability of H* to H.B. Robinson Unit 2 and Recommended Leakage Factor," May 7, 2012.
4. WCAP-17091-P, "H*: Alternate Repair Criteria for the Tubesheet Expansion Region in Steam Generators with Hydraulically Expanded Tubes (Model 44F), "June 2009.
5. Email from Progress Energy (Jim.Hendrickson@pgnmail.com) to Westinghouse (Gary W. Whiteman) dated February 25, 2013, Subject: RE: RNP RAI.

Introduction

This document has been revised to address a request for additional information by the Nuclear Regulatory Commission (NRC) staff relating to the steam generator (SG) tube alternate repair criteria H* applicable to H.B. Robinson Steam Electric Plant (HBRSEP) Unit 2. All revisions to this document are identified by a vertical line in the right-hand margin of the page.

Because the population of H* candidate plants contains multiple Model 44F steam generators, Westinghouse determined the bounding plant for all Model 44F steam generators. The limiting H* distance (18.11") and leakage rate factor (1.82) identified in References 1 and 2 are based on the limiting normal operating parameters (NOP) for Turkey Point Units 3 and 4. A comparison of the nominal normal operating parameters for the HBRSEP Unit 2 to those of the bounding plant was made in Reference 3. Only one set of operating parameters was provided to Westinghouse for HBRSEP Unit 2 by Progress Energy for this comparison and, therefore, the same parameters were used to establish both the required H* distance and leak rate factors. Typically, normal operating parameters for a range from low T_{avg} and High T_{avg} are utilized for direct comparison with the bounding plant. In reviewing the HBRSEP Unit 2 submittal, the NRC staff noted that there was no listed hot leg temperature for the low T_{avg} condition in Reference 4. Additionally, the NRC staff has noted that the low T_{avg} condition appears to have a significant effect on secondary side pressure (a large secondary side pressure change occurs between low T_{avg} to high T_{avg} at Turkey Point Units 3 and 4). In order to address these and similar requests for information by the NRC staff and to provide a one-to-one

comparison with the bounding plant for HBRSEP Unit 2, both a low T_{avg} and high T_{avg} set of bounding normal operating conditions at 6% steam generator tube plugging level have been developed by Progress Energy (Reference 5).

The values provided below represent conditions at high/low T_{avg}, full power and 6% tube plugging. The columns labeled "SG Tubesheet Conditions" are the best estimate conditions at the top of tubesheet. These values contain no conservatism beyond the ±4°F variation in RCS T_{avg}.

RCS (psia)	RCS Conditions			SG Tubesheet Conditions	
	T_{avg}	T_{cold}	T_{hot}	P_{steam}	RCS-SG
2250	(°F)	(°F)	(°F)	(psia)	psi
Low T_{avg}	571.9	543.1	600.7	773.6	1476.4
High T_{avg}	579.9	551.5	608.3	833.9	1416.1

Operating Condition Assessment

The analysis for H* is based on a bounding concept among the affected models of SGs. The H* candidate population includes all SGs with hydraulically expanded Alloy 600 thermally treated tubes. Among this population are SGs of different designs, specifically Model F, Model D5, Model 44F (2 and 3 Loop) and Model 51 SGs. For each model of SG, a plant is identified that provides bounding conditions for all others with that model SG with respect to calculating H* (e.g., as discussed in WCAP-17091-P, Reference 4).

The 3-loop plants with Model 44F SGs are identified in Reference 4. As identified in Reference 1, Turkey Point Units 3 and 4 have been determined to be the bounding plants for the Model 44F steam generators because the operating conditions in these plants result in the most conservative value of H*.

Different bounding parameters apply for the structural evaluation (tube pull-out) and for the leakage evaluation. For the structural evaluation, the low T_{avg} normal operating (NOP) condition has been determined to be the limiting condition. Thus, for HBRSEP Unit 2, it is necessary to determine that the respective measurement uncertainty recapture (MUR) uprate conditions are bounded by those that apply to the limiting Model 44F plants, Turkey Points Units 3 and 4.

Table 5-1 of WCAP-17091-P (Reference 4) summarizes the operating conditions for all of the two- and three-loop Model 44F plants that are candidates for application of H*. A condensed version of this table is reproduced below, showing the limiting 3-loop plants, Turkey Points Units 3 and 4, and data provided for HBRSEP Unit 2 in Reference 5 in support of completing the structural assessment.

Parameter and Units		Turkey Point Units 3 and 4 10% Tube Plugging (Low T_{avg})	HBRSEP Unit 2 6% Tube Plugging MUR Uprate Conditions (Low T_{avg})
Power - NSSS	MWt	2652	2339
Primary Pressure	psia	2250	2250
Secondary Pressure	psia	701[1]	773.6
SG Hot Leg Temperature	°F	604.5	600.7
SG Primary-to-Secondary Pressure Differential (psid) Across the Tubesheet	Psid	1549[1]	1476.4
[1] 20 psi internal pressure drop incorporated. The full power, normal operating pressure differential across the tubesheet is 1529 psid (P_{steam} = 721 psia).			

Structural Assessment

The critical parameter for the structural analysis is the NOP condition low T_{avg} secondary pressure because this pressure dictates the largest tube end-cap (pull-out) load on the tubes. As can be seen from the table above, Turkey Point Units 3 and 4 exhibits a lower secondary pressure for the low T_{avg} NOP condition (701 psia); therefore, it bounds the secondary pressure under the same condition for HBRSEP Unit 2 (773.6 psia).

Based on the bounding plant approach, the recommended H* inspection distance for HBRSEP Unit 2 is 18.11 inches from the top of the tubesheet as documented in Reference 1. This H* depth is the 95% probability value at 95% confidence. The details of the technical basis of this number are contained in References 1, 2 and 4.

Leakage Factor Assessment

The leakage factors developed in References 1 and 2 are calculated using the high T_{avg} normal operating condition in the technical justification of H* and are based on the occurrence of a postulated feed line break FLB) event, which is a heat-up event. However, the 3-loop Model 44F plants do not include a postulated FLB event as part of their licensing basis. Therefore, the limiting accident condition for the leakage calculation for H* for the Model 44F steam generator is a postulated steam line break event (SLB) event, which is considered to be a cooldown event.

As discussed in References 1, 2 and 4, the Darcy formulation for flow through a porous medium is used to develop the ratio of leak rates between postulated accident-induced conditions and normal operating conditions (NOP). The resulting Darcy flow equation ratio can be separated into four "subfactors" as follows:

$$\frac{Q_{DBA}}{Q_{NOP}} = \frac{\Delta p_{DBA}}{\Delta p_{NOP}} \frac{\mu_{NOP}}{\mu_{DBA}} \frac{K_{NOP}}{K_{DBA}} \frac{l_{NOP}}{l_{DBA}}$$

Comparing the limiting plant and HBRSEP Unit 2 MUR uprate conditions, it was determined that:

1. The driving head (Δp) subfactor is calculated to be greater for HBRSEP Unit 2 (1.87) than for Turkey Point Units 3 and 4 (1.82).

2. The viscosity subfactor (μ_{NOP}/μ_{DBA}) is the same for HBRSEP Unit 2 and Turkey Points Units 3 and 4, because the SLB transient originates from a hot standby condition. As SLB is a plant cooldown event, the postulated SLB event does not result in a temperature increase above normal operating conditions. Therefore, the viscosity subfactor can conservatively be considered to be 1.0.

3. The results of the square cell analysis show that for the limiting plant operating parameters, the contact pressures during a postulated SLB event between the elevations of 0 and 21.81 inches at all radii in the tube bundle meets or exceeds the contact pressure during normal operating conditions, therefore, the loss coefficient subfactor, (K_{NOP}/K_{DBA}), can conservatively be considered to be 1.0.

4. The effective crevice length during a postulated SLB event is shown to meet or exceed the crevice length for normal operating conditions. Therefore, the effective crevice length subfactor, (l_{NOP}/l_{DBA}), can be conservatively considered to be 1.0.

   As noted above, the final leakage rate factor is a product of the four subfactors. Therefore, it is conservative to apply the leakage factor of 1.87 for a postulated steam line break for the HBRSEP Unit 2 steam generators.

   The values for leakage rate factors for the other accidents that model primary-to-secondary leakage are 0.80 for a postulated locked rotor event and 0.38 for a postulated control rod ejection event. As discussed in Section 9.5 of Reference 4, because of the short duration of the elevated pressure differential across the tubesheet for these transients, the leakage factors are less than 1.0 and, therefore, are not used.

   For the HBRSEP Unit 2 steam generators, the limiting leakage factor, 1.87 for a postulated SLB event, would be used as follows:

   - For the condition monitoring (CM) assessment, the component of leakage from the prior cycle below the H* distance would be multiplied by a factor of 1.87 and added to the leakage from any other source and compared to the allowable accident-induced leakage limit. (Condition Monitoring is the United States (US) NRC required process of evaluating the current condition of the SG tubing, based on current inspection results, to assure that all structural and safety requirements have been met.)
   - For the operational assessment (OA), the difference in the leakage between the allowable leakage limit and the accident leakage limit from sources other than the tubesheet expansion

region (below the H* distance) will be divided by 1.87 and compared to the observed operational leakage. If necessary, an administrative limit for operational leakage can be established to ensure that the allowable accident leakage limit is not exceeded. (Operational Assessment is the US NRC required process of estimating the condition of the SG tubing, based on current inspection results and estimated degradation growth rates, to determine if all structural and safety requirements will be met at the time of the next inspection.

Summary and Conclusion

1. Based on a review of operating conditions provided by Progress Energy, Westinghouse concludes that the current H* technical justification adequately bounds the conditions of HBRSEP Unit 2.
2. For structural analysis, i.e., tube pull-out evaluation, Conclusion 1 is valid provided that the actual HBRSEP Unit 2 operating conditions do not result in a condition in which the secondary side pressure is less than 701 psia under full power normal operating conditions.
3. The recommended H* inspection depth is 18.11 inches from the top of the tubesheet.
4. The applicable SLB leak rate factor for HBRSEP Unit 2 is 1.87.

***Electronically Approved** **

Prepared by: G.W. Whiteman
Principal Engineer,
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***Electronically Approved** **

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SG Management Programs

***Electronically Approved** **

Approved by: W.J. Bedont, Manager
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*Electronically approved records are authenticated in the Electronic Document Managemment System

Enclosure to Serial: RNP-RA/12-0057
13 Pages (including the cover page)

ENCLOSURE 2

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

MARK UP SHOWING CHANGES FROM RNP-RA/12-0057

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9	Enclosure page 36 of 36
10	Attachment 1 page 5.0-28
11	Attachment 4 page 2 of 4
12	Attachment 4 page 3 of 4
13	Attachment 4 page 4 of 4

The value of H* proposed for permanent application of the alternate repair criteria at HBRSEP Unit No. 2 is the 95/95 whole plant H* value of 18.11 inches from Table 5-1 of Westinghouse WCAP-17345-P, Revision 2 (Reference 2). The value of the leak rate factor of 1.87 evaluated in LTR- SGMP-12-30, revision 1 (Reference 33) is~~WCAP-17091-P, Revision 0 (Reference 3) will continue to be~~ applicable to the use of the alternate repair criteria at HBRSEP Unit No. 2. HBRSEP Unit No. 2 does not have an approved steam generator tube repair method and tubes meeting tube repair criteria must be plugged. Tube plugging impacts plant thermal efficiency and performance during both routine and transient operation. Implementation of the proposed changes associated with application of the alternate repair criteria on a permanent basis will require inspection for those portions of the tube within the tubesheet required to maintain the primary to secondary pressure boundary and tube plugging upon flaw detection irrespective of the depth of the indication.

Approval of the proposed amendment is requested prior to entering the refueling outage in the fall of 2013 as the current temporary application of the alternate repair criteria approved with Amendment 224 expired at the end of the previous cycle, Cycle 27.

2.0 DETAILED DESCRIPTION

2.1 Description of the Proposed Revisions

The HBRSEP Unit No. 2, Technical Specifications Section 5.5.9 "Steam Generator (SG) Program", will be revised to delete the word "provisions" at the end of the first paragraph as it is duplicative as noted in TSTF-510 Revision 2:

> "A Steam Generator Program shall be established and implemented to ensure that SG tube integrity is maintained. In addition, the Steam Generator Program shall include the following ~~provisions~~"

Subsection 5.5.9.b.1, currently states:

> "Structural integrity performance criterion: All in-service SG tubes shall retain structural integrity over the full range of normal operating conditions (including startup, operation in the power range, hot standby, and cool down and all anticipated transients included in the design specification) and design basis accidents"

This specification will be revised as follows to correct the misplaced closing parenthesis as noted in TSTF-510.

> "Structural integrity performance criterion: All in-service SG tubes shall retain structural integrity over the full range of normal operating conditions (including startup, operation in the power range, hot standby, and cool down), all

methodology to HBRSEP Unit No. 2 on a permanent basis. The value of the leak rate factor evaluated in WCAP-17091-P, Revision 0 (Reference 3) applicable to the use of the alternate repair criteria at HBRSEP Unit No. 2 remains unchanged.

Proposed TS 5.6.8 would read as follows:

> A report shall be submitted within 180 days after the initial entry into MODE 4 following completion of an inspection performed in accordance with the Specification 5.5.9, Steam Generator (SG) Program. The report shall include:
>
> a. The scope of inspections performed on each SG.
>
> b. ~~Active d~~ Degradation mechanisms found.
>
> c. Nondestructive examination techniques utilized for each degradation mechanism.
>
> d. Location, orientation (if linear), and measured sizes (if available) of service induced indications.
>
> e. Number of tubes plugged during the inspection outage for each ~~active~~ degradation mechanism.
>
> f. The number and percentage of tubes plugged or repaired to date, and the effective plugging in each generator. ~~Total number and percentage of tubes plugged to date.~~
>
> g. The results of condition monitoring, including the results of tube pulls and in-situ testing.
>
> h. The primary to secondary leakage rate observed in each SG (if it is not practical to assign the leakage to an individual SG, the entire primary to secondary leakage should be conservatively assumed to be from one SG) during the cycle preceding the inspection that is the subject of the report,
>
> i. The calculated accident induced leakage rate from the portion of the tubes below 18.11 ~~17.28~~ inches from the top of the tubesheet for the most limiting accident in the most limiting SG. In addition, if the calculated accident induced leakage rate from the most limiting accident is less than ~~1.82~~ 1.87 times the maximum operational primary to secondary leakage rate, the report should describe how it was determined, and
>
> j. The results of monitoring for tube axial displacement (slippage). If slippage is discovered, the implications of the discovery and corrective action shall be provided.

The HBRSEP Unit No. 2 Technical Specifications 3.4.18 "Steam Generator (SG) Tube Integrity", currently states:

Table 1

Document Number	Revision Number	Title	Reference Number
LTR-SGMP-12-30	~~0~~-1	Applicability of H* to H. B. Robinson Unit 2 and Recommended Leakage Factor	33
WCAP-17345-P	2	H*: Resolution of NRC Technical Issue Regarding Tubesheet Bore Eccentricity (3-Loop Model 44F/Model 51F)	2
WCAP-17091-P	0	H*: Alternate Repair Criteria for the Tubesheet Expansion Region in Steam Generators with Hydraulically Expanded Tubes (Model 44F)	3
LTR-SGMP-09-108-P Attachment	0	Response to NRC Request for Additional Information on H*; Model 44F and Model51 F Steam Generators	19
LTR-SGMP-09-108-Errata	0	Errata: Responses to NRC Request for Additional Information on H*; Model 44F and Model 51F Steam Generators Model 51F Steam Generators	20
LTR-SGMP-10-95-P-Attachment	1	H*: Alternate Leakage Calculation Methods for H* for Situations When Contact Pressure at Normal Operating Conditions Exceeds Contact Pressure at Accident Conditions	21
LTR-SGMP-10-78-P-Attachment	0	Effects of Tubesheet Bore Eccentricity and Dilation on Tube-to Tubesheet Contact Pressure and Their Relative Importance to H*	22
LTR-SGMP-10-33-P-Attachment	0	H* Response to NRC Questions Regarding Tubesheet Bore Eccentricity	23
LTR-SGMP-09-111 P-Attachment	1	Acceptable Value of the Location of the Bottom of the Expansion Transition (BET) for Improvement of H*	24
LTR-SGMP-11-29	1	Responses to USNRC Request for Additional Information Regarding the Surry License Amendment Request for Permanent Application of the Alternate Repair Criterion, H*	25

5.0 TECHNICAL EVALUATION

The proposed changes include changes consistent with TSTF-510, Revision 2 which revise TS 3.4.18, TS 5.5.9.d.2 within the Steam Generator (SG) Program to modify the frequency of verification of SG tube integrity and SG tube sample selection and TS 5.6.8 to clarify steam generator reporting requirements. These proposed changes are consistent with the guidance for the industry initiative on NEI 97-06, "Steam Generator Program Guidelines." The changes consistent with TSTF-510 also implement a number of editorial corrections, changes, and clarifications intended to improve internal consistency, consistency with the implementing industry documents, and usability without changing the intent of the requirements. The proposed changes are more effective in managing the frequency of verification of tube integrity and sample selection than those required by current TSs.

Primary to secondary leakage from tube degradation is assumed to occur in several design basis accidents: main steam line break (MSLB), locked rotor, and control rod ejection. The radiological dose consequences associated with this assumed leakage are evaluated to ensure that they remain within regulatory limits (e.g. 10 CFR Part 100, 10 CFR 50.67, GDC 19). The accident induced leakage performance criteria are intended to ensure the primary to secondary leak rate during any accident does not exceed the primary to secondary leak rate assumed in the accident analysis. Radiological dose consequences define the limiting accident condition for the H* value. The accident analyses use a primary to secondary accident leak rate value of 0.11 gallons per minute (gpm) through the faulted SG and a total of 0.19 gpm through the two intact SGs for the MSLB. When the TS operational leak rate limit of 75 gpd or about 0.052 gpm, through any one SG is multiplied by the MSLB leak rate factor applicable to HBRSEP Unit No. 2 of ~~1.82 (Table 9-7 in WCAP-17091-P, Reference 3)~~ 1.87 (page 5 in LTR-SGMP-12-30 revision 1, Reference 33) the maximum primary to secondary accident induced leak rate is less than ~~0.095~~ 0.098 gpm and is bounded by the value of 0.11 gpm through the faulted SG used in the MSLB accident analyses.

The other design basis accidents, such as the postulated locked rotor event and the control rod ejection event, are conservatively modeled using the design specification transients that result in increased temperatures in the SG hot and cold legs for a period of time. Dynamic viscosity decreases with increasing temperature such that leakage would be expected to increase due to decreasing viscosity and increasing differential pressure for the duration of time that there is a rise in RCS temperature. The length of time that a plant with Model 44F SGs will exceed the normal operating differential pressure across the tubesheet is less than 30 seconds for the locked rotor event, and less than 10 seconds for the control rod ejection event. As the accident induced leakage performance criteria is defined in gallons per minute, the leak rate for a locked rotor and a control rod ejection event can be integrated over a minute for comparison to the limit. Time integration permits an increase in acceptable leakage during the time of peak pressure differential by approximately a factor of two for the locked rotor event because of the short duration (less than 30 seconds) of the elevated pressure differential, and by a factor of six for the control rod ejection event (less than 10 seconds). This translates into an effective reduction in the leakage factor by the same factor for each event. ~~Therefore, the locked rotor event leak rate factor of 1.56 for HBRSEP Unit No. 2 is adjusted downward to a factor of 0.78 (Table 9-7, Reference 3). Similarly, the control rod ejection event leak rate factor is reduced by a factor of six, from 2.21 to 0.37 (Table 9-7, Reference 3).~~ The value for leakage rate factors for a postulated locked rotor event are 0.80 and 0.38for a postulated control rod ejection event (page 4 of Reference 33). Due to the short duration of the transients above normal operating pressure differential, no leakage factor is required for the locked rotor and control rod ejection events (i.e., the leakage factor is under 1.0 for both transients). Thus, MSLB is the limiting accident and ~~1.82~~ 1.87 is ~~remains~~ the limiting leak rate factor for HBRSEP Unit No. 2 (Table 9-7 in Reference 3).

It should be noted that some of the discussion in WCAP-17091-P (Reference 3) refers to feedline break (FLB) accident analyses. References to FLB analyses, however, are specific to the initial analyses for other SG models and are not intended to imply that the FLB accident is

applicable to HBRSEP Unit No. 2. These FLB accident analyses are not considered to be part of the design basis for HBRSEP Unit No. 2.

Plant-specific operating conditions are used to generate the overall leakage factor ratios that are used in the condition monitoring and operational assessments. The plant-specific data provide the initial conditions for application of the transient input data. The results of the analysis of the plant-specific inputs to determine the bounding plant for each model of SG and to assure that the design basis accident contact pressures are greater than the normal operating contact pressure are contained in section 6 of WCAP-17091-P (Reference 3).

As discussed in References 2 and 3, the leak rate ratio (accident induced leak rate to operational leak rate) is a product of the pressure differential subfactor and the viscosity subfactor using the Darcy flow equation. For the postulated MSLB event, a plant cool down event would occur and the subsequent temperature in the reactor coolant system (RCS) would not be expected to exceed the temperatures at plant no load conditions. An increase in leakage would not be expected to occur as a result of the temperature change and the viscosity subfactor can be conservatively set equal to 1.0. Therefore, the increase in leakage would only be a function of the increase in primary to secondary pressure differential. The resulting leak rate ratio for the MSLB event is ~~1.82~~ 1.87 for HBRSEP Unit No. 2 ~~(Table 9-7 of WCAP-17091-P)~~.(page 5 of Reference 33).

The leak rate factor of ~~1.82~~ 1.87 for HBRSEP Unit No. 2 for a postulated MSLB has been calculated as shown in ~~Table 9-7 of Reference 3~~.page 5 of Reference 33. HBRSEP Unit No. 2 will apply a factor of ~~1.82~~ 1.87 to the normal operating leakage associated with the tubesheet expansion region in the condition monitoring and operational assessment. The leak rate factor of ~~1.82 in Table 9-7 of Reference 3~~ 1.87 in page 5 of Reference 33 applies to both hot and cold legs. Specifically, for the condition monitoring assessment, the component of leakage from the prior cycle from below the H* distance will be multiplied by a factor of ~~1.82~~ 1.87 and added to the total leakage from any other source and compared to the assumed accident leak rate. For the operational assessment, the difference between the allowable leakage and the accident induced leakage from sources other than the tubesheet expansion region will be divided by ~~1.82~~ 1.87 and compared to the observed operational leakage. An administrative operational leakage limit will be established to not exceed the calculated value as necessary.

References 2 and 3 redefine the primary pressure boundary. The tube-to-tubesheet weld no longer functions as a portion of this boundary. The hydraulically expanded portion of the tube into the tubesheet over the H* distance now functions as the primary pressure boundary in the area of the tube and tube sheet, maintaining the structural and leakage integrity over the full range of SG operating conditions, including the most limiting accident conditions. The evaluations in References 2 and 3 determined that degradation in tubing below this safety significant portion of the tube does not require inspection or repair (plugging). The inspection of the safety significant portion of the tubes provides a high level of confidence that the structural and leakage performance criteria are maintained during normal operating and accident conditions.

hydraulic expansion by precluding tube deformation beyond its initial hydraulically expanded outside diameter. Therefore, the proposed change does not result in a significant increase in the consequences of an SGTR. In addition, the selected H* value envelopes the depth within the tubesheet required to prevent a tube pullout.

The probability of a MSLB event is unaffected by the potential failure of a SG tube as the failure of a tube is not an initiator for a MSLB event. Therefore the proposed SG tube inspection frequency and sample selection criteria and the structural integrity margins of the SG tubes and the tube-to-tubesheet joint over the H* distance do not increase the probability of a MSLB event.

The leak rate factor of ~~1.82~~ 1.87 for HBRSEP Unit No. 2, for a postulated MSLB, has been calculated as shown in References 2, 3, ~~and~~ 23 and 33. HBRSEP Unit No. 2 will apply the factor of ~~1.82~~ 1.87 to the normal operating leakage associated with the tubesheet expansion region in the condition monitoring and operational assessment. Through application of the limited tube sheet inspection scope, the existing operating leakage limit provides assurance that excessive leakage (i.e., greater than accident analysis assumptions) will not occur.

When the TS operational leak rate limit of 75 gpd or about 0.052 gallons per minute (gpm) through any one SG is multiplied by the MSLB leak rate factor applicable to HBRSEP Unit No. 2 of ~~1.82 (Table 9-7 in WCAP-17091-P, Reference 3)~~ 1.87 (page 5 of Reference 33) the maximum primary to secondary accident induced leak rate is less than ~~0.095~~ 0.098 gpm and is bounded by the value of 0.11 gpm through the faulted SG used in the MSLB accident analyses. Since the existing limit on operational leakage continues to ensure that the MSLB assumed accident induced leakage will not be exceeded, the consequences of a MSLB accident are not increased.

For the condition monitoring assessment, the component of leakage from the prior cycle from below the H* distance will be multiplied by a factor of ~~1.82~~ 1.87 and added to the total leakage from any other source and compared to the allowable accident induced leak rate. For the operational assessment, the difference in the leakage between the allowable leakage and the calculated accident induced leakage from sources other than the tubesheet expansion region will be divided by ~~1.82~~ 1.87 and compared to the observed operational leakage.

Based on the above, the proposed change does not involve a significant increase in 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?*

Response: No

The proposed change modifies steam generator tube inspection frequencies and tube selection consistent with TSTF-510 and excludes the lower portion of steam generator tubes from inspection by implementing the alternate repair criteria (H*) on a permanent

General Design Criteria (GDC) 14, "Reactor Coolant Pressure Boundary," GDC 15, "Reactor Coolant System Design," GDC 31, "Fracture Prevention of Reactor Coolant Pressure Boundary," and GDC 32, "Inspection of Reactor Coolant Pressure Boundary," by reducing the probability and consequences of a SGTR. Regulatory Guide 1.121 concludes that by determining the limiting safe conditions for tube wall degradation, the probability and consequences of a SGTR are reduced. This Regulatory Guide uses safety factors on loads for tube burst that are consistent with the requirements of Section III of the American Society of Mechanical Engineers (ASME) Code.

For axially oriented cracking located within the tubesheet, tube burst is precluded due to the presence of the tubesheet. For circumferentially oriented cracking, Westinghouse WCAP-17091-P, Rev. 0 (Reference 3) and WCAP- 17345, Rev. 2 (Reference 2) define a length of degradation-free expanded tubing that provides the necessary resistance to tube pullout due to the pressure induced forces, with applicable safety factors applied.

Application of the limited hot and cold leg tubesheet inspection criteria will preclude unacceptable primary to secondary leakage during all plant conditions. When the TS operational leak rate limit of 75 gpd or about 0.052 gpm through any one SG is multiplied by the MSLB leak rate factor applicable to HBRSEP Unit No. 2 of ~~1.82 (Table 9-7 in WCAP-17091-P (Reference 3))~~ 1.87 (page 5 in LTR-SGMP-12-30-Revision 1, Reference 33) the maximum primary to secondary accident induced leak rate is less than ~~0.095~~ 0.098 gpm and is bounded by the value of 0.11 gpm through the faulted SG used in the MSLB accident analyses.

Therefore, the proposed change does not involve a significant reduction in any margin of safety.

6.4 Conclusions

The proposed changes to the frequency, tube selection, and portion of steam generator tube subject to required inspection for degradation maintain structural and leakage integrity over the full range of steam generating operating conditions, including the most limiting accident conditions. The safety significant portion of the tube is the length of tube that is engaged from the top of the tubesheet to a distance H* below the top of the tubesheet. Tubing degradation below a distance H* from the top of the tubesheet does not impact the safety significant portion of the tube within the tubesheet and does not require plugging. The H* analysis serves as the basis for the limited tubesheet inspection criteria, which are intended to ensure the primary to secondary leak rate values used in accident analyses. Based on the considerations above, 1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, 2) such activities will be conducted in compliance with the Commission's regulations, and, 3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

7.0 ENVIRONMENTAL CONSIDERATION

HBRSEP Unit No. 2 has evaluated the proposed amendment for environmental considerations. The review has determined that the proposed amendment would change a requirement with respect to

29. Virginia Electric and Power Company (Dominion) letter to NRC, "Surry Power Station Units 1 and 2 License Amendment Request Permanent Alternate Repair Criteria for Steam Generator Tube Inspection and Repair" July 28, 2011 (ADAMS Accession No. ML11215A058)
30. NRC letter to Surry Power Station, "Surry Power Station, Units Nos. 1 and 2-Request for Additional Information Regarding the Steam Generator License Amendment Request to Revise Technical Specification for Permanent Alternate Repair Criteria (TAC Nos. ME6803 and ME6804)" January 18, 2012 (ADAMS Accession No. ML12006A001)
31. Surry Power Station letter to NRC, "Response to Request for Additional Information Related to License Amendment Request for Permanent Alternate Repair Criteria for Steam Generator Tube Inspection and Repair" February 14, 2012 (ADAMS Accession No. ML12048A676)
32. NRC Regulatory Guide 1.121 "Bases for Plugging Degraded PWR Steam Generator Tubes," August 1976
33. Westinghouse letter LTR-SGMP-12-30, Revision 1 "Applicability of H* to H. B. Robinson Unit 2 and Recommended Leakage Factor" ~~May 7, 2012~~ March 4, 2013
34. Exelon Generation Company letter, Braidwood Units 1 and 2, Byron Units 1 and 2, "Application to Revise Technical Specifications to Adopt TSTF-510, Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection" March 22, 2012 (ADAMS Accession No. ML12082A135)
35. Wolf Creek Nuclear Operating Company letter, "Docket No. 50-482: Application to Revise Technical Specifications to Adopt TSTF-510, Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection," Using the Consolidated Line Item Improvement Process" April 26, 2012 (ADAMS Accession No. ML12124A339)
36. NRC letter to Surry Power Station, "Surry Power Station, Unit Nos. 1 and 2, Issuance of Amendments Regarding Virginia Electric and Power Company License Amendment Request for Permanent Alternate Repair Criteria for Steam Generator Tube Inspection and Repair (TAC Nos. ME6803 AND ME6804)" April 17, 2012 (ADAMS Accession No. ML12109A270)
37. Catawba Nuclear Station letter to NRC, "Proposed Technical Specifications (TS) Amendment - TS 3.4.13, "RCS Operational LEAKAGE," TS 5.5.9, "Steam Generator (SG) Program" and TS 5.6.8, "Steam Generator Tube Inspection Report" License Amendment Request to Revise TS for Permanent Alternate Repair Criteria, June 30, 2011 (ADAMS Accession No. ML11188A107)
38. NRC Letter to Catawba Nuclear Station, "Catawba Nuclear Station, Units 1 and 2, Issuance of Amendments Regarding Technical Specification Amendments for Permanent Alternate Repair Criteria for Steam Generator Tubes (TAC Nos. ME6670 and ME6671)" March 12, 2012 (ADAMS Accession No. ML12054A692

5.6 Reporting Requirements .(continued)

5.6.7 Tendon Surveillance Report

a. Notification of a pending sample tendon test, along with detailed acceptance criteria, shall be submitted to the NRC at least two months prior to the actual test.

b. A report containing the sample tendon test evaluation shall be submitted to the NRC within six months of conducting the test.

5.6.8 Steam Generator Tube Inspection Report

A report shall be submitted within 180 days after the initial entry into MODE 4 following completion of an inspection performed in accordance with the Specification 5.5.9, Steam Generator (SG) Program. The report shall include:

a. The scope of inspections performed on each SG.

b. Degradation mechanisms found.

c. Nondestructive examination techniques utilized for each degradation mechanism.

d. Location, orientation (if linear), and measured sizes (if available) of service induced indications.

e. Number of tubes plugged during the inspection outage for each active degradation mechanism.

f. The number and percentage of tubes plugged to date, and the effective plugging in each steam generator.

g. The results of condition monitoring, including the results of tube pulls and in-situ testing.

h. The primary to secondary leakage rate observed in each SG (if it is not practical to assign the leakage to an individual SG, the entire primary to secondary leakage should be conservatively assumed to be from one SG) during the cycle preceding the inspection that is the subject of the report,

i. The calculated accident induced leakage rate from the portion of the tubes below 18.11 inches from the top of the tubesheet for the most limiting accident in the most limiting SG. In addition, if the calculated accident induced leakage rate from the most limiting accident is less than ~~1.82~~ 1.87 times the maximum operational primary to secondary leakage rate, the report should describe how it was determined, and

In its response dated October 26, 2011, HBRSEP Unit No. 2 [Reference 5] (ADAMS Accession No. ML11305A077) reported that all tubes with BETs greater than 0.5 inches had been inspected by rotating pancake coil (RPC) to the tube end and that no degradations had been found. As discussed in the response to Questions 4, 5 & 6, HBRSEP Unit No. 2 indicated that there was no plan to plug these tubes and that when the alternate repair criteria technology was accepted for permanent application, additional assessment of the need to plug these tubes would be performed. In its subsequent review of the HBRSEP Unit No. 2 Steam Generator Tube Inspection Report [Reference 6] (ADAMS Accession No. ML12039A194) the NRC staff concluded that there were no technical issues that warrant followup action since the inspections appear to be consistent with the objective of detecting potential tube degradation and the inspection results appear to be consistent with industry operating experience at similarly designed and operated units.

RAI No.15:

Verify that regulatory commitments pertaining to monitoring for tube slippage and for primary to secondary leakage, as described in Dominion letter dated December 16, 2010 (NRC ADAMS Accession No. MLI03550206), Attachment 1, page 10 of 23, remain in place. In addition, revise the proposed amendment to include a revision to technical specification limit on primary to secondary leakage from 150 gallons per day (gpd) to 83 gpd (150 divided by the proposed 1.8 leakage factor), or provide a regulatory basis for not making this change.

Response:

Two commitments were listed in Dominion letter dated December 16, 2010. These commitments correspond to the first and fourth commitments submitted by HBRSEP Unit No. 2 in Reference 3 in support of the license amendment [Reference 7] request issued as Amendment 224. These two commitments are as follows:

- Monitoring for tube slippage as part of the steam generator tube inspection program will be conducted.
- For the condition monitoring assessment, the component of operational leakage from the prior cycle from below the H* distance will be multiplied by a factor of ~~1.82~~ 1.87 and added to the total accident leakage from any other source and compared to the allowable accident induced leakage limit. For the operational assessment, the difference between the allowable accident induced leakage and the accident induced leakage from sources other than the tubesheet expansion region will be divided by ~~1.82~~ 1.87 and compared to the observed operational leakage. If necessary, an administrative operational leakage limit will be established to not exceed the calculated value.

The second and third commitments of Reference 7 were associated with one time inspections of the steam generator tube expansion transition locations. These inspections have been completed with appropriate entries into the plant corrective program made and a report transmitted to the NRC in Reference 3.

Monitoring for tube slippage has been incorporated into the Steam Generator Program and the results are required to be reported per specification 5.6.8.j in the Steam Generator Tube Inspection Report. All inservice SG tubes were inspected for tube end slippage during Refueling Outage 26 as reported in the Generator Tube Inspection Report (ADAMS Accession No. ML110190222).

Specification 5.5.9.a requires condition monitoring of the performance criteria for accident induced leakage. Specification 5.5.9.b.2 requires the accident induced leakage to be less than the leakage rate assumed in the accident analysis. The accident leakage is the sum of the leakage from below H* from the top of the tubesheet times the leakage rate factor for the most limiting event and accident leakage from any other source. The leakage rate factor for the most limiting event is ~~1.82~~ 1.87. Therefore comparison of the sum of the operational leakage below H* multiplied by ~~1.82~~ 1.87 and total accident leakage from any other source to the leakage rate assumed in the accident analysis is required by specifications 5.5.9.a and 5.5.9.b.

Evaluation of potential accident induced leakage from sources other than the tubesheet expansion region is included in the operational assessment required by the Steam Generator Program. The most recent Condition Monitoring/Operational Assessment determined that the result of dividing the difference between the accident induced leakage and the accident leakage from sources other than the tubesheet expansion region by ~~1.82~~ 1.87 was about ~~82~~ 80 gallons per day (gpd). This value is greater than the operational leakage limit of 75 gpd specified in TS 3.14 and therefore no administrative limit is necessary.

The limiting accident for evaluation of steam generator leakage for the H* methodology is the Main Steam Line Break (MSLB). The MSLB accident analyses use a primary to secondary accident leak rate value of 0.11 gallons per minute (gpm) through the faulted SG and a total value of 0.19 gpm for the two unaffected SGs. When the TS operational leak rate limit of 75 gpd or about 0.052 gpm through any one SG is multiplied by the MSLB leak rate factor applicable to HBRSEP Unit No. 2 of ~~1.82~~ 1.87 from ~~Table 9-7 of WCAP-17091-P [Reference 8]~~ page 5 of reference 9 the maximum primary to secondary accident induced leak rate is less than ~~0.095~~ 0.098 gpm and is bounded by the value of 0.11 gpm assumed for the accident leakage through the faulted SG.

Therefore, because the maximum accident induced leakage rate (considering the H* leak rate factor) is bounded by the assumed primary to secondary accident induced leak rate of the MSLB accident analyses, the technical specification operational leak rate limit of 75 gpd is not required to the revised.

References:

2. Surry Power Station letter to NRC, "Virginia Electric and Power Company (Dominion) Surry Power Stations 1 and 2 Response to Request for Additional Information Related to License Amendment Request for Permanent Alternate Repair Criteria for Steam Generator Tube Inspection and Repair" February 14, 2012 (ADAMS Accession No. MLI2048A676)

2. NRC letter to Surry Power Station, "Surry Power Station, Units Nos. 1 and 2- Request for Additional Information Regarding the Steam Generator License Amendment Request to Revise Technical Specification for Permanent Alternate Repair Criteria (TAC Nos. ME6803 and ME6804)" January 18, 2012 (ADAMS Accession No. ML12006A00l)

3. H. B. Robinson Steam Electric Plant, Unit No. 2, letter to NRC, "Steam Generator Tube Inspection Report" January 13, 2011 (ADAMS Accession No. ML110190222)

4. NRC letter to H. B. Robinson Steam Electric Plant, Unit 2 "Request for Additional Information Regarding the Steam Generator Tube Inservice Inspection Report (TAC NO. ME5411)" August 5, 2011 (ADAMS Accession No. ML11203A814)

5. H. B. Robinson Steam Electric Plant, Unit No. 2, letter to NRC, "Response to NRC Request for Additional Information Regarding the Steam Generator Tube Inservice Inspection Report Dated January 13, 2011" October 26, 2011 (ADAMS Accession No. ML11305A077)

6. NRC letter to H. B. Robinson Steam Electric Plant, Unit 2 "Review of the Steam Generator Tube Inservice Inspection Report for Refueling Outage 26 (TAC NO. ME5411)" August 5, 2011 (ADAMS Accession No. ML12039A194)

7. H. B. Robinson Steam Electric Plant, Unit No. 2, letter to NRC, "H. B. Robinson Steam Electric Plant, Unit No. 2 -Request for Technical Specifications Change Regarding Steam Generator Alternate Repair Criteria" December 16, 2009 (ADAMS Accession No. ML093631212)

8. Westinghouse Electric Company WCAP-17091-P, Revision 0, "H*: Alternate Repair Criteria for the Tubesheet Expansion Region in Steam Generators with Hydraulically Expanded Tubes (Model 44F)" June 2009 (Submitted to NRC as Attachment VI of Reference 7)

9 Westinghouse letter LTR-SGMP-12-30, Revision 1, "Applicability of H* to H. B. Robinson Unit 2 and Recommended Leakage Factor, March 4, 2013"