WOLF CREEK
NUCLEAR OPERATING CORPORATION

Terry J. Garrett
Vice President, Engineering

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ET 08-0009

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

Reference:
1) Letter dated April 28, 2005, from J. N. Donohew, USNRC, to R. A. Muench, WCNOC, "Wolf Creek Generating Station – Issuance of Exigent Amendment RE: Steam Generator (SG) Tube Surveillance Program (TAC NO. MC6757)"

2) Letter dated October 10, 2006, from J. N. Donohew, USNRC, to R. A. Muench, WCNOC, "Wolf Creek Generating Station – Issuance of Amendment RE: Steam Generator Tube Inspections Within the Tubesheet (TAC NO. MD 2467)

3) Letter ET 06-0004 dated February 21, 2006, from T. J. Garrett, WCNOC, to USNRC

4) Letter WO 07-0012, dated May 3, 2007, from S. E. Hedges, WCNOC, to USNRC

5) Letter ET 07-0043, dated September 27, 2007, from T. J. Garrett, WCNOC, to USNRC

Subject: Docket No. 50-482: Revision to Technical Specification (TS) 5.5.9, "Steam Generator (SG) Program" for Interim Alternate Repair Criteria

Gentlemen:

Pursuant to 10 CFR 50.90, Wolf Creek Nuclear Operating Corporation (WCNOC) hereby requests an amendment to Facility Operating License No. NPF-42 for the Wolf Creek Generating Station (WCGS). This amendment application proposes a one cycle revision to Technical Specification (TS) 5.5.9, "Steam Generator (SG) Program," to incorporate an interim alternate repair criteria (ARC) in the provisions for SG tube repair criteria during Refueling Outage 16 and the subsequent operating cycle. This change is supported by Westinghouse Electric Company LLC, LTR-CDME 08-11 P-Attachment, "Interim Alternate Repair Criterion (ARC) for Cracks in the Lower Region of the Tubesheet Expansion Zone."

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References 1 and 2 approved one-cycle revisions to TS 5.5.9 to exclude from inspection and repair, portions of the tube below the top of the tubesheet in the WCGS steam generators. Reference 3 proposed a permanent revision to TS 5.5.9 to exclude portions of the tube below the top of the tubesheet in the WCGS steam generators. References 4 and 5 provided responses to Requests for Additional Information associated to the permanent revision to TS 5.5.9.

On December 20, 2007, NRC Division of Operating Reactor Licensing personnel contacted WCNOC executive management and indicated that the Staff would not be able to approve the proposed permanent revision to TS 5.5.9 to support the Spring 2008 refueling outage (March 2008). The Staff indicated that they would entertain a one-cycle amendment request but would entail changes from the currently approved one-cycle amendments. Subsequently, teleconferences were held with the NRC Technical Branch on January 3, 2008 and January 16, 2008, to discuss aspects of the additional one-cycle interim alternate repair criteria. This amendment application does not supersede the proposed permanent amendment request provided in Reference 3 including the additional information provided in References 4 and 5.

Attachment I provides the evaluation in support of this amendment application. Attachments II through IV provide the markup of TS pages, proposed TS Bases changes, and retyped TS pages. Attachment III is provided for information only. Final TS Bases pages will be implemented pursuant to TS 5.5.14, "Technical Specifications (TS) Bases Control Program." Attachment V contains a list of commitments.

WCNOC requests the proposed change be approved by March 21, 2008 to support Refueling Outage 16, which is scheduled to start in March, 2008. Once approved, the amendment will be implemented prior to MODE 4 entry during startup from Refueling Outage 16.

Enclosure I provides the proprietary Westinghouse Electric Company LLC LTR-CDME-08-11 P-Attachment, "Interim Alternate Repair Criterion (ARC) for Cracks in the Lower Region of the Tubesheet Expansion Zone." Enclosure II provides the non- proprietary Westinghouse Electric Company LLC LTR-CDME-08-11 NP-Attachment, "Interim Alternate Repair Criterion (ARC) for Cracks in the Lower Region of the Tubesheet Expansion Zone." As Enclosure I contains information proprietary to Westinghouse Electric Company LLC, it is supported by an affidavit signed by Westinghouse Electric Company LLC, the owner of the information. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR 2.390 of the Commission's regulations. Accordingly, it is respectfully requested that the information, which is proprietary to Westinghouse, be withheld from public disclosure in accordance with 2.390 of the Commission's regulations. This affidavit, along with Westinghouse authorization letter, CAW-08-2381, "Application for Withholding Proprietary Information from Public Disclosure," is contained in Enclosure III.

It has been determined that this amendment application does not involve a significant hazard consideration as determined per 10 CFR 50.92. Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment needs to be prepared in conjunction with the issuance of this amendment.

The amendment application was reviewed by the Plant Safety Review Committee. In accordance with 10 CFR 50.91, a copy of this amendment application, with attachments and non-proprietary enclosures, is being provided to the designated Kansas State official.

If you have any questions concerning this matter, please contact me at (620) 364-4084 or Mr. Richard D. Flannigan at (620) 364-4117.

Sincerely,

Terry J. Garrett

TJG/rlt

Attachments: I - Evaluation
II - Markup of Technical Specification pages
III - Markup of Technical Specification Bases pages (for information only)
IV - Retyped Technical Specification pages
V - List of Regulatory Commitments

Enclosure I - Westinghouse Electric Company LLC LTR-CDME-08-11 P-Attachment, "Interim Alternate Repair Criterion (ARC) for Cracks in the Lower Region of the Tubesheet Expansion Zone"
II - Westinghouse Electric Company LLC LTR-CDME-08-11 NP-Attachment, "Interim Alternate Repair Criterion (ARC) for Cracks in the Lower Region of the Tubesheet Expansion Zone"
III - Westinghouse Electric Company LLC LTR-CAW-08-2381, "Application for Withholding Proprietary Information from Public Disclosure"

cc: E. E. Collins (NRC), w/a, w/e
T. A. Conley (KDHE), w/a, w/e (Enclosure II only)
J. N. Donohew (NRC), w/a, w/e
V. G. Gaddy (NRC), w/a, w/e
B. K. Singal (NRC), w/a, w/e
Senior Resident Inspector (NRC), w/a, w/e

STATE OF KANSAS)
) SS
COUNTY OF COFFEY)

Terry J. Garrett, of lawful age, being first duly sworn upon oath says that he is Vice President Engineering of Wolf Creek Nuclear Operating Corporation; that he has read the foregoing document and knows the contents thereof; that he has executed the same for and on behalf of said Corporation with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By _____
Terry J. Garrett
Vice President Engineering

SUBSCRIBED and sworn to before me this 8th day of February, 2008.

_____
Notary Public

NOTARY PUBLIC STATE OF KANSAS
CINDY NOVINGER
My Appt. Exp. 7/8/2010

Expiration Date 7/8/2010

EVALUATION

1.0 SUMMARY DESCRIPTION

This amendment application proposes a one cycle revision to the Wolf Creek Generating Station (WCGS) Technical Specification (TS) 5.5.9, "Steam Generator (SG) Program," to incorporate an interim alternate repair criteria in the provisions for SG tube repair criteria during Refueling Outage 16 and the subsequent operating cycle. This amendment application requests approval of an interim alternate repair criterion (IARC) that requires full-length inspection of the tubes within the tubesheet but does not require plugging tubes if any circumferential cracking observed in the region greater than 17 inches from the top of the tubesheet (TTS) is less than a value sufficient to permit the remaining circumferential ligament to transmit the limiting axial loads. This amendment application is required to preclude unnecessary plugging while still maintaining structural and leakage integrity.

Approval of this amendment application is requested to support Refueling Outage 16 (Spring 2008) and the subsequent eddy current inspection interval as the existing one-cycle amendment expires at the end of the current operating cycle.

2.0 DETAILED DESCRIPTION

TS 5.5.9 requires that a SG tube program be established and implemented to ensure that SG tube integrity is maintained. SG tube integrity is maintained by meeting specified performance criteria (in TS 5.5.9.b) for structural and leakage integrity, consistent with the plant design and licensing bases. TS 5.5.9 requires a condition monitoring assessment be performed during each outage during which the SG tubes are inspected to confirm that the performance criterion is being met. TS 5.5.9 also includes provisions regarding the scope, frequency, and methods of SG tube inspections. Of relevance to the amendment application, these provisions require that the number and portions of tubes inspected and methods of inspection shall be performed with the objective of detecting flaws of any type that may be present along the length of a tube, from the tube-to-tubesheet weld at the tube inlet to the tube-to-tubesheet weld at the tube outlet, and that may satisfy the applicable tube repair criteria. The applicable tube repair criteria, specified in TS 5.5.9.c, are that tubes found by an inservice inspection to contain with a depth equal to or exceeding 40 percent of the nominal tube wall thickness shall be plugged.

References 1 and 2 approved one-cycle revisions to TS 5.5.9 to exclude from inspection and repair, that portion of the tube below 17 inches from the top of the tubesheet in the WCGS steam generators. Reference 3 proposed a permanent alternate repair criterion (ARC) to TS 5.5.9 to limit the inspection depth in the SG tube expansion zone, known as H*/B*. References 4 and 5 provided responses to Requests for Additional Information associated to the permanent revision to TS 5.5.9. The H*/B* ARC seeks to minimize the depth of rotating coil inspection of the SG tubes within the tubesheet. The premise of H*/B* is that the expansion joint provides sufficient structural restraint to prevent the tube from pulling out of the tubesheet under normal operating and accident conditions, and that the accident induced leakage during accident conditions is bounded by a factor of two on the observed normal operating leakage. On December 20, 2007, NRC Division of Operating Reactor Licensing personnel contacted Wolf Creek Nuclear Operating Corporation (WCNOC) executive management and indicated that the

Staff would not be able to approve the proposed permanent revision to TS 5.5.9 to support the Spring 2008 refueling outage (March 2008). The H*/B* approach remains a valid approach for addressing degradation in the lower portion of the tube.

Enclosure I (Reference 6) provides the technical justification for an interim alternate repair criterion (IARC) that requires full-length inspection of the tubes within the tubesheet, but does not require plugging tubes if the extent of any circumferential cracking observed in the region greater than 17 inches from the top of the tubesheet (TTS) is less than a value sufficient to permit the remaining circumferential ligament to transmit the limiting axial loads [the greater of 3 times the normal operating (NOP) or 1.4 times the steam line break (SLB) end cap loads]. Axial cracks below 17 inches from the TTS are not relevant to the tube pullout arguments because axial cracks do not degrade the axial load carrying capability of the tube. Axial cracks do not require plugging if they are below 17 inches from the top of the tubesheet.

The calculation of the limiting circumferential ligament has been defined. The calculation assumes that friction loads between the tube and tubesheet from any source are zero. This assumption avoids potential effects of uncertainties in tube and tubesheet material properties.

Also, based on the same assumption that the contact pressure between the tube and the tubesheet from any source is zero, this evaluation provides a basis for demonstrating that the accident induced leakage will always meet the value assumed in the plant's safety analysis if the observed leakage during normal operating conditions is within its allowable limits. The need to calculate leakage from individual cracks is avoided by the calculation of the ratio of accident induced leakage to normal operating leakage.

Although the tube-end weld is specifically excluded from the tube by TSTF-449, Rev. 4 (Reference 7) it is, nevertheless, also necessary to consider the capability of a degraded weld to prevent tube pullout for this IARC. Because of the underlying assumption of zero friction load between the tubes and the tubesheet, the weld must provide the IARC's ultimate structural restraint of the tube within the tubesheet. Therefore, a limiting ligament size has also been determined for the tube-to-tubesheet weld and is discussed below.

Proposed Changes To Current TSs

TS 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 40% of the nominal tube wall thickness shall be plugged.

The following alternate tube repair criteria may be applied as an alternative to the 40% depth-based criteria:

1. For Refueling Outage 15 and the subsequent operating cycle, degradation found in the portion of tube below 17 inches from the top of the hot leg tubesheet does not require plugging. All tubes with degradation identified in the portion of tube within the region from the top of the hot leg tubesheet to 17 inches below the top of the tubesheet shall be removed from service."

This criterion would be revised as follows, as noted in italic type:

"c. Provisions for SG tube repair criteria. Tubes found by inservice inspection to contain flaws with a depth equal to or exceeding 40% of the nominal tube wall thickness shall be plugged.

The following alternate tube repair criteria *shall* be applied as an alternative to the 40% depth-based criteria:

1. For Refueling Outage *16 and subsequent 18-month eddy current inspection interval, tubes with less than or equal to a 214 degree circumferential service-induced crack-like flaw found in the portion of the tube below 17 inches from the top of the tubesheet do not require plugging. Tubes with greater than a 214 degree circumferential service-induced crack-like flaw found in the portion of the tube below 17 inches from the top of the tubesheet shall be removed from service.*

For Refueling Outage 16 and subsequent 36-month eddy current inspection interval, tubes with less than or equal to a 183 degree circumferential service-induced crack-like flaw found in the portion of the tube below 17 inches from the top of the tubesheet do not require plugging. Tubes with greater than a 183 degree circumferential service-induced crack-like flaw found in the portion of the tube below 17 inches from the top of the tubesheet shall be removed from service.

For Refueling Outage 16 and subsequent 18-month and 36-month eddy current inspection intervals, tubes with service-induced crack-like flaws located within the region from the top of the tubesheet to 17 inches below the top of the tubesheet shall be removed from service. Tubes with service-induced axial cracks found in the portion of the tube below 17 inches from the top of the tubesheet do not require plugging."

TS 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, and that may satisfy the applicable repair criteria. For Refueling Outage 15 and the subsequent operating cycle, the portion of the tube below 17 inches from the top of the hot leg is excluded. The tube-to-tubesheet weld is not part of the tube....."

This criterion would be revised as follows, as noted in strikethrough text and italic type:

"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, and that may satisfy the applicable repair criteria. ~~*For Refueling Outage 15 and the subsequent operating cycle, the portion of the tube below 17 inches from the top of the hot leg is excluded.*~~ *For Refueling Outage 16 and the 36-month eddy current inspection interval, SGs in which the portion of the tube below 17 inches from the top of the tubesheet has no greater than 183 degree circumferential service-induced crack-like flaws are excluded from the requirements of d.3 below.* 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.

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

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.

3. If crack indications are found in any SG tube, 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."

TS 5.6.10 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; and

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

TS 5.6.10 would be revised to add the following 3 additional reporting criteria:

h. Following completion of an inspection performed in Refueling Outage 16 (and any inspections performed in the subsequent 18-month inspection interval or 36-month inspection interval), the number of indications and location, size, orientation, and whether initiated on primary or secondary side for each service-induced crack-like flaw within the thickness of the tubesheet;

i. Following completion of an inspection performed in Refueling Outage 16 (and any inspections performed in the subsequent 18-month inspection interval or 36-month inspection interval), the primary to secondary LEAKAGE rate observed in each SG (if it is not practical to assign 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 which is the subject of the report; and

j. Following completion of an inspection performed in Refueling Outage 16 (and any inspections performed in the subsequent 18-month inspection interval or 36-month inspection interval), the calculated accident leakage rate from the portion of the tube 17 inches below the top of the tubesheet for the most limiting accident in the most limiting SG.

The TS requirements proposed in this License Amendment Request are structured in consideration of the WCNOC's SG Management program and the scheduling of SG tube inspections. Stress corrosion crack indications have not been detected in the WCGS SGs, therefore, the current SG tubing eddy current inspection strategy can be continued, in which 2 SGs are inspected in a given refueling outage and the other 2 SGs are inspected in the subsequent refueling outage. The proposed TS requirements would allow the flexibility to change the current inspection strategy without the need for an additional license amendment.

3.0 TECHNICAL EVALUATION

An evaluation has been performed in Enclosure I to assess the need for removing tubes from service due to the occurrence of circumferentially or axially oriented cracks in a tubesheet. The conclusions of the evaluation are primarily threefold:

1. Axial cracks in tubes below a distance of 17 inches below the top of the tubesheet can remain in service in the WCGS SGs as they are not a concern relative to tube pullout and leakage capability.

2. Circumferentially oriented cracks in tubes with an azimuthal extent of less than or equal to 214 degrees can remain in service for one cycle of operation (18-month SG tubing eddy current inspection interval). Circumferentially oriented cracks in tubes with an azimuthal extent of less than or equal to 183 degrees can remain in service for one 36-month SG tubing eddy current inspection interval.

3. Circumferentially oriented cracks in the tube-to-tubesheet welds with an azimuthal extent of less than or equal to 294 degrees can remain in service for one cycle of operation (18-month SG tubing eddy current inspection interval). Circumferentially oriented cracks in the tube-to-tubesheet welds with an azimuthal extent of less than or equal to 263 degrees can remain in service for one 36-month SG tubing eddy current inspection interval.

A bounding analysis approach is utilized for both the minimum ligament calculation and leakage ratio calculation. "Bounding" means that the most challenging conditions from the plants with hydraulically expanded Alloy 600TT tubing is used. Three different tube diameters are represented by the affected plants (11/16" dia., Model F; 3/4" dia., Model D5; 7/8" dia., Model 44F). The most limiting conditions for structural evaluation depend on tube geometry and applied normal operating loads; thus the conditions from the plant that result in the highest stress in the tube are used to define the minimum required circumferential ligament. The limiting leak rate ratio depends on the leak rate values assumed in the safety analysis and allowable normal operating leakage that results in the longest length of undegraded tube.

It was identified late on February 8, 2008, that the References and Tables in Section 5 of Enclosure I refers to the wrong section (e.g., Reference 6-1 should be 5-1). Westinghouse is planning to issue an errata to the enclosed report to correct this error.

Discussion of Performance Criteria

The performance criteria of NEI 97-06, Rev. 2 (Reference 8) are the basis for these analyses. The performance criteria in the WCGS TSs, which are based on NEI 97-06, Rev. 2, are:

The structural integrity performance criterion is:

> *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.*

The structural performance criterion is based on ensuring that there is reasonable assurance that a steam generator tube will not burst during normal operation or postulated accident conditions.

The accident-induced leakage performance criterion is:

> *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 steam generator. Leakage is not to exceed 1 gpm per SG.*

Primary-to-secondary leakage is a factor in the dose releases outside containment resulting from a limiting design basis accident. The potential primary-to-secondary leak rate during postulated design basis accidents shall not exceed the offsite radiological dose consequences required by 10 CFR Part 100 guidelines or the radiological consequences to control room personnel required by GDC-19, or other NRC-approved licensing basis.

The IARC for the tubesheet region are designed to meet these criteria. The structural criterion regarding tube burst is inherently satisfied because the constraint provided by the tubesheet to the tube prohibits burst.

Limiting Structural Ligament Discussion

As defined in Enclosure I, the bounding remaining structural ligament which meets the NEI 97-06, Rev. 2, Performance Criterion described above and required for the tube to transmit the operational loads is 115 degrees arc. This assumes that the residual ligament is 100% of the tube wall in depth. A small circumferential initiating crack is predicted to grow to a throughwall condition before it is predicted to reach a limiting residual ligament. A residual ligament in a part-throughwall condition is not a significant concern, because of the assumption that all circumferential cracks detected are 100% throughwall.

Consideration of NDE Uncertainty

The NDE uncertainty must be addressed to assure that the as-indicated circumferential arc of the reported crack is a reliable estimate of the actual crack. ETSS 20510.1 (Reference 9) describes the qualified technique used to detect circumferential PWSCC in the expansion transitions and in the tubesheet expansion zone (TEZ). The qualification data is provided in the ETSS.

The fundamental assumption for the IARC is that all circumferential cracks detected are 100% throughwall. Thus, even a shallow crack of small length will be considered to be throughwall. Further, tube burst is not an issue for the IARC because of the constraint provided by the tubesheet; rather, it is axial separation of the tube that is the principal concern. Assuming that all circumferential cracks are throughwall reduces the inspection uncertainty to length of the cracks only. Further, the accuracy of the length determination is an issue only when the indicated crack approaches the allowable crack length (the complement of the required residual ligament) and if the indicated crack length is a reasonable estimate of the structural condition of the tube.

Prior investigations have correlated the axial strength of the tube to the Percent Degraded Area (PDA) of the flaw (Reference 10). PDA takes into account the profile of the existing crack, including non-throughwall portions and shallow tails of the crack. Using the data from ETSS 20510.1 for cracks with a 90%, or greater, throughwall condition from both NDE and destructive examination, a comparison of the actual crack lengths and corresponding PDA for the cracks to a theoretical PDA which assumes that cracks are 100% throughwall has been made. All of the points with a PDA of 60%, or greater fall below the theoretical PDA line. As the crack lengths increase, the separation of the actual PDA from the theoretical PDA tends to increase.

The conclusion that the as-indicated crack angle is conservative is further supported by considering the characteristics of the eddy current probes. Each probe has a "field of view," that is, a window of finite dimension in which it detects flaws. The field of view for the + Point probe typically varies between 0.1 inch to 0.2 inch depending on the specific characteristics of the probe. Therefore, as the probe traverses its path, a flaw will be detected as the leading edge of the field of view first crosses the location of the flaw, continuing until the trailing edge of the field of view passes the opposite end of the flaw. This is known as "lead-in" and "lead-out" of the probe and the effect of these are to render the indicated flaw length greater than the actual flaw length. Therefore, it is concluded that the indicated flaw length will be conservative relative to the actual flaw length, especially when it is assumed that the entire length of the indicated flaw is 100% throughwall

Based on the above, it is concluded that if the detected circumferential cracks are assumed to be 100% throughwall, the as-indicated crack lengths will be inherently conservative with respect to the structural adequacy of the remaining ligament. Therefore, no additional uncertainty factor is necessary to be applied to the as-measured circumferential extent of the cracks.

Consideration of Crack Growth

The growth of cracks due to PWSCC in this submittal request is dictated by four default growth rates from Reference 6. The distribution of growth rates is assumed to be lognormal. Typical values and conservative values are given, although it is recommended in Reference 11 to use the default values only when the historical information is not available and not to use the typical values unless the degradation is mild. (No significant crack growth data exists for the circumferential cracking in the tubesheet expansion region.) Both sets provided in Reference 6 have mean values and 95% upper bound values. For this analysis, the typical 95% upper bound growth rate is used.

The circumferential growth rates are expressed as inches per effective full power year (EFPY).

Table 1.0 Calculation of Required Minimum Ligament for 18 and 36 Months Operating Periods

	Bounding Structural Ligament	EFPY	Growth (In./EFPY) (1)	Growth (Deg./EFPY) (2)	Growth for Operating Period (degrees)	Minimum Structural Ligament (degrees)	Critical Ligament (degrees)
Tube	18 Calendar Month (CM) Operation	1.5	.12	20.65	31	115	146
	36 CM Operation	3.0	.12	20.65	62	115	177
1) 95% upper value of typical growth rates from Reference (6) 2) Based on smallest (Model F) mean tubesheet bore dimension							

The residual structural ligament must be adjusted for growth during the anticipated operating period between the current and the next planned inspection. Typically, the operating periods for the affected plants are 18 calendar months (1.5 EFPY); however, some plants have planned outages in which no primary side inspections will be performed. Thus, cycle length adjustments are made to the minimum structural ligament required. For the WCGS SGs, referring to Table 1.0 above, the maximum allowable throughwall circumferential crack size in a SG tube is 214° (=360° – 146°) for one cycle of operation (18-month SG tubing eddy current inspection interval). For the 36-month SG tubing eddy current inspection interval, the maximum allowable through wall circumferential crack size in a SG is 183 degrees (=360° - 177°). No additional uncertainty factor is necessary to be applied to the as-measured circumferential extent of the cracks.

Primary-to-Secondary Leakage Discussion

A basis, using the D'Arcy formula for flow through a porous medium, is provided to assure that the accident induced leakage for the limiting accident will not exceed the value assumed in the safety analysis for the plant if the observed leakage during normal operation is within its limits for the bounding plant is discussed in Reference 1. The bounding plant envelopes all plants who are candidates for applying H*/B*. The D'Arcy formulation was previously compared to other potential models such as the Bernoulli equation or orifice flow formulation and was found to provide the most conservative results.

Assuming zero contact pressure in the tube joint, the length of undegraded crevice required to limit the accident induced leakage to less than the value assumed in the safety analysis for the limiting plant is calculated to be 3.78 inches. By definition of the IARC, a tube that can remain in service has an undegraded crevice of 17 inches. Therefore, a factor of safety of 4.5 is available (17 inches /3.78 inches). Expressed in length terms, the length margin in the crevice is 13.22 inches. Significant margin on crevice length is available even if only the distance below the neutral axis of the tubesheet is considered. This distance is approximately 6.5 inches. A factor of safety of 1.72 is available. Expressed in length terms, the length margin in the crevice is 2.72 inches below the neutral axis of the tubesheet. During normal operating conditions, the tubesheet flexes due to differential pressure loads, causing the tubesheet holes above the neutral axis to dilate, and below the neutral axis, to constrict. No mechanical benefit is assumed in the analysis due to tubesheet bore constriction below the neutral axis of the tubesheet; however, first principles dictate that the tubesheet bore and crevice must decrease. Therefore, the leakage analysis provided is conservative.

Based on the above, with a length of undegraded crevice of 17 inches, it is concluded that if the normal operating leakage is within its allowable value, the accident induced leakage will also be within the value assumed in the WCGS safety analysis. The total increase in leakage during a postulated accident condition would be less than a factor of 2.5 (0.25 gpm allowable leakage during a SLB event/0.1 gpm allowable leakage during normal operating conditions).

Reporting Requirements

In the January 3, 2008 and January 16, 2008, NRC/industry teleconferences, the NRC indicated that TS 5.6.10 should include reporting requirements applicable to the implementation of the IARC. WCNOC is proposing reporting requirements based on the response provided in Reference 4 to question 24 with some modifications.

- The proposed reporting requirements are only required for the applicable period of the IARC.

- Enclosure I calculated a value of the calculated accident leakage rate from the most limiting accident in the most limiting SG to be greater than 2 times the maximum operational primary to secondary leakage rate. Therefore, the reporting requirements do not include a requirement to describe how the calculated accident leakage rate from the most limiting accident was determined if the leakage rate is less than 2 times the maximum operational primary to secondary leakage rate.

Inspection and Repair of Tube

The tube below the IARC depth will be examined with a qualified technique, e.g., +Point probe. Axial flaws have no impact on the structural integrity of the tube in this region and may be left in service. Circumferential indications which exceed the maximum acceptable tube flaw size of 214 degrees will be plugged for the 18-month SG tubing eddy current inspection interval, and circumferential indications which exceed the maximum acceptable tube flaw size of 183 degrees will be plugged for the 36-month SG tubing eddy current inspection interval. Flaws that require plugging will result in expansion per EPRI, "Pressurized Water Reactor Steam Generator Examination Guidelines." Stress concentration areas may be used to define the extent of the expansion, e.g., if a repairable indication is located in a BLG/OXP, the expansion may be limited to the non-inspected BLG/OXPs.

Inspection and Repair of Tube End Welds

For the tube end weld eddy current examination, the weld will be evaluated on a best effort basis for crack-like indications. Crack-like indications in the tube end weld that exceed the maximum acceptable weld flaw size of 294 degrees for the 18-month SG tubing eddy current inspection interval and that exceed the maximum acceptable weld flaw size of 263 degrees for the 36-month SG tubing eddy current inspection interval will be visually examined on a "best effort" basis with inspection systems capable of achieving a resolution similar to the Maximum Procedure Demonstration Lower Case Character Height as discussed in ASME Section XI. Dose rates in steam generator channel heads will typically necessitate performance of the inspection using remote inspection systems.

If the visual examination confirms that a flaw is present in the weld-to-tube interface and exceeds the maximum acceptable weld flaw size described in the preceeding paragraph, the tube will be plugged. This approach is conservative based on the assumption that the full visible length of indications are through wall. Defense in depth during operation is provided by application of a conservative ratio of steam line break leakage to normal operating leakage, and the associated special technical specification reporting requirement proposed in this request.

Tubes containing visual indications in the tube end weld that exceed the acceptance criteria will be removed from service by tube plugging. The installed plug joint becomes the pressure boundary. Plug installation results in significant contact pressure between the tube and the plug, as well as the tube and the tubesheet. This pressure, as demonstrated by the plug qualifications, meets all applicable loading and design conditions. The high contact pressures in the expanded plug load path will limit leakage, such that it would be indistinguishable from indications left inservice in the length of the tube below 17 inches from the top of the tubesheet and is, therefore, bounded by the leakage analysis for the IARC.

If the visual examination confirms that the weld-to-tube joint is sound and a flaw exists in the weld-to-clad joint, the tube is also acceptable to leave in service. Leaving the tube in service is acceptable because the attached weld prevents the tube from being ejected in an accident scenario.

An evaluation for tube end welds that require plugging will be completed under the Corrective Action Program to provide reasonable assurance that unacceptable welds are removed from service.

4.0 REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements

Steam Generator (SG) tube inspection and repair limits are specified in Section 5.5.9, "Steam Generator (SG) Program" of the WCGS Technical Specifications (TS). The current TS require that flawed tubes be repaired if the depths of the flaws are greater than or equal to 40 percent through wall. The TS repair limits ensure that tubes accepted for continued service will retain adequate structural and leakage integrity during normal operating, transient, and postulated accident conditions, consistent with General Design Criteria (GDC) 14, 15, 30, 31, and 32 of 10 CFR 50, Appendix A. Specifically, the GDC state that the Reactor Coolant Pressure Boundary (RCPB) shall have "an extremely low probability of abnormal leakage . . . and gross rupture" (GDC 14), "shall be designed with sufficient margin" (GDCs 15 and 31), shall be of "the highest quality standards practical" (GDC 30), and shall be designed to permit "periodic inspection and testing . . . to assess . . .structural and leaktight integrity" (GDC 32). Structural integrity refers to maintaining adequate margins against gross failure, rupture, and collapse of the steam generator tubing. Leakage integrity refers to limiting primary to secondary leakage during all plant conditions to within acceptable limits.

Based on the considerations discussed 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 with the implementation of the interim alternate repair criteria discussed above.

4.2 No Significant Hazards Consideration

WCNOC 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

Of the various accidents previously evaluated, the proposed changes only affect the steam generator tube rupture (SGTR) event evaluation and the postulated steam line break (SLB), locked rotor and control rod ejection accident evaluations. Loss-of-coolant accident (LOCA) conditions cause a compressive axial load to act on the tube. Therefore, since the LOCA tends to force the tube into the tubesheet rather than pull it out, it is not a factor in this amendment request. Another faulted load consideration is a safe shutdown earthquake (SSE); however, the seismic analysis of Model F steam generators has shown that axial loading of the tubes is negligible during an SSE.

At normal operating pressures, leakage from primary water stress corrosion cracking (PWSCC) below 17 inches from the top of the tubesheet is limited by both the tube-to-tubesheet crevice and the limited crack opening permitted by the tubesheet constraint. Consequently, negligible normal operating leakage is expected from cracks within the tubesheet region.

For the SGTR event, the required structural margins of the steam generator tubes is maintained by limiting the allowable ligament size for a circumferential crack to remain in service to 214 degrees below 17 inches from the top of the tubesheet for the 18-month SG tubing eddy current inspection interval and to remain in service 183 degrees below 17 inches from the top of the tubesheet for the 36-month SG tubing eddy current inspection interval. Tube rupture is precluded for cracks in the hydraulic expansion region due to the constraint provided by the tubesheet. The potential for tube pullout is mitigated by limiting the allowable crack size to 214 degrees for the 18-month SG tubing eddy current inspection interval and to 183 degrees for the 18-month SG tubing eddy current inspection interval. These allowable crack sizes take into account eddy current uncertainty and crack growth rate. It has been shown that a circumferential crack with an azimuthal extent of 214 degrees for the 18-month SG tubing eddy current inspection interval and an azimuthal extent of 183 degrees for the 36-month SG tubing eddy current inspection interval meet the performance criteria of NEI 97-06, Rev. 2, "Steam Generator Program Guidelines" and Regulatory Guide (RG) 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes." Likewise, a visual inspection will be conducted to confirm that a circumferential crack of greater than 294 degrees for the 18-month SG tubing eddy current inspection interval and a circumferential crack of greater than 263 degrees for the 36-month SG tubing eddy current inspection interval do not remain in service in the tube-to-tubesheet weld metal in any tube mitigating the potential for tube pullout. Therefore, the margin against tube burst/pullout is maintained during normal and postulated

accident conditions and the proposed change does not result in a significant increase in the probability or consequence of a SGTR.

The probability of a SLB is unaffected by the potential failure of a SG tube as the failure of a tube is not an initiator for a SLB event. SLB leakage is limited by leakage flow restrictions resulting from the leakage path above potential cracks through the tube–to-tubesheet crevice. The leak rate during postulated accident conditions (including locked rotor and control rod ejection) has been shown to remain within the accident analysis assumptions for all axial or circumferentially oriented cracks occurring 17 inches below the top of the tubesheet. Since normal operating leakage is limited to 0.10 gpm (150 gpd), the attendant accident condition leak rate, assuming all leakage to be from indications below 17 inches from the top of the tubesheet would be bounded by 0.25 gpm. This value is within the accident analysis assumptions for the limiting design basis accident for WCGS, which is the postulated SLB event.

Based on the above, the performance criteria of NEI-97-06, Rev. 2 and draft Regulatory Guide (RG) 1.121 continue to be met and the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

(2) Does the proposed change create the possibility of a new or different accident from any accident previously evaluated?

Response: No

The proposed change does not introduce any changes or mechanisms that create the possibility of a new or different kind of accident. Tube bundle integrity is expected to be maintained for all plant conditions upon implementation of the interim alternate repair criteria. The proposed change does not introduce any new equipment or any change to existing equipment. No new effects on existing equipment are created nor are any new malfunctions introduced.

Therefore, based on the above evaluation, the proposed changes do not create the possibility of a new or different kind of accident from any accident previously evaluated.

(3) Does the proposed change involve a significant reduction in a margin of safety?

Response: No

The proposed change maintains the required structural margins of the steam generator tubes for both normal and accident conditions. NEI 97-06, Rev. 2 and RG 1.121 are used as the basis in the development of the limited tubesheet inspection depth methodology for determining that steam generator tube integrity considerations are maintained within acceptable limits. RG 1.121 describes a method acceptable to the NRC staff for meeting GDC 14, 15, 31, and 32 by reducing the probability and consequences of an SGTR. RG 1.121 concludes that by determining the limiting safe conditions of tube wall degradation beyond which tubes with unacceptable cracking, as established by inservice inspection, should be removed from service or repaired, the probability and consequences of a SGTR are reduced. This RG uses safety factors on loads for tube burst that are consistent with the requirements of Section III of the 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 in a tube or the tube-to-tubeshet weld, Reference 6 defines a length of remaining tube ligament that provides the necessary resistance to tube pullout due to the pressure induced forces (with applicable safety factors applied). Additionally, it is shown that application of the limited tubesheet inspection depth criteria will not result in unacceptable primary-to-secondary leakage during all plant conditions.

Based on the above, it is concluded that the proposed changes do not result in any reduction of margin with respect to plant safety as defined in the Updated Safety Analysis Report or bases of the plant Technical Specifications.

Conclusion

Based on the above, WCNOC concludes that the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c) and, accordingly, a finding of "no significant hazards consideration" is justified.

4.3 Precedent

Wolf Creek Nuclear Operating Corporation was previously granted similar TS changes. One was granted on April 28, 2005 (Reference 1) that involved a one-cycle change to TS 5.5.9, "Steam Generator (SG) Tube Surveillance Program," regarding the required SG inspection scope during Refueling Outage 14 and the subsequent operating cycle. The other change was granted on October 10, 2006 (Reference 2) that involved a one-cycle change to TS 5.5.9, "Steam Generator (SG) Tube Surveillance Program," regarding the required SG inspection scope for Refueling Outage 15 and the subsequent operating cycle. These changes modified the inspection requirements for portions of the SG tubes within the hot leg tubesheet region of the SGs.

5.0 ENVIRONMENTAL CONSIDERATION

WCNOC 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 need be prepared in connection with the proposed amendment.

6.0 REFERENCES

1. Letter dated April 28, 2005, from J. N. Donohew, USNRC, to R. A. Muench, WCNOC, "Wolf Creek Generating Station – Issuance of Exigent Amendment RE: Steam Generator (SG) Tube Surveillance Program (TAC NO. MC6757)."

2. Letter dated October 10, 2006, from J. N. Donohew, USNRC, to R. A. Muench, WCNOC, "Wolf Creek Generating Station – Issuance of Amendment RE: Steam Generator Tube Inspections Within the Tubesheet (TAC NO. MD 2467).

3. Letter ET 06-0004 dated February 21, 2006, from T. J. Garrett, WCNOC, to USNRC.

4. Letter WO 07-0012, dated May 3, 2007, from S. E. Hedges, WCNOC to USNRC.

5. Letter ET 07-0043, dated September 27, 2007, from T. J. Garrett, WCNOC to USNRC.

6. LTR-CDME-08-11, "Interim Alternate Repair Criteria (ARC) for Cracks in the Lower Region of the Tubesheet Expansion Zone," January 2008.

7. TSTF-449, Rev. 4, "Steam Generator Tube Integrity," Technical Specifications Task Force Standard Technical Specification Change Traveler, April 14, 2005.

8. NEI 97-06, Rev. 2, "Steam Generator Program Guidelines," May 2005.

9. ETSS #20510.1; Technique for Detection of Circumferential PWSCC at Expansion Transitions.

10. EPRI TR-107197; Depth Based Structural Analysis Methods for Steam Generator Circumferential Indications; November 1997.

11. EPRI 1012987; "Steam Generator Integrity Assessment Guidelines," July 2006.

ATTACHMENT II

MARKUP OF TECHNICAL SPECIFICATION PAGES

5.5 Programs and Manuals

5.5.9 Steam Generator (SG) Program (continued)

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 40% of the nominal tube wall thickness shall be plugged.

shall

The following alternate tube repair criteria ~~may~~ be applied as an alternative to the 40% depth-based criteria:

1. For Refueling Outage 15 and the subsequent operating cycle, degradation found in the portion of the tube below 17 inches from the top of the hot leg tubesheet does not require plugging. All tubes with degradation identified in the portion of tube within the region from the top of the hot leg tubesheet to 17 inches below the top of the tubesheet shall be removed from service.

INSERT 5.0-12A

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, and that may satisfy the applicable tube repair criteria. For Refueling Outage 15 and the subsequent operating cycle, the portion of the tube below 17 inches from the top of the hot leg tubesheet is excluded. 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.

INSERT 5.0-12B

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

(continued)

INSERT 5.0-12A

16 and subsequent 18-month eddy current inspection interval, tubes with less than or equal to a 214 degree circumferential service-induced crack-like flaw found in the portion of the tube below 17 inches from the top of the tubesheet do not require plugging. Tubes with greater than a 214 degree circumferential service-induced crack-like flaw found in the portion of the tube below 17 inches from the top of the tubesheet shall be removed from service.

For Refueling Outage 16 and subsequent 36-month eddy current inspection interval, tubes with less than or equal to a 183 degree circumferential service-induced crack-like flaw found in the portion of the tube below 17 inches from the top of the tubesheet do not require plugging. Tubes with greater than a 183 degree circumferential service-induced crack-like flaw found in the portion of the tube below 17 inches from the top of the tubesheet shall be removed from service.

For Refueling Outage 16 and subsequent 18-month and 36-month eddy current inspection intervals, tubes with service-induced crack-like flaws located within the region from the top of the tubesheet to 17 inches below the top of the tubesheet shall be removed from service. Tubes with service-induced axial cracks found in the portion of the tube below 17 inches from the top of the tubesheet do not require plugging.

INSERT 5.0-12B

For Refueling Outage16 and the 36-month eddy current inspection interval, SGs in which the portion of the tube below 17 inches from the top of the tubesheet has no greater than 183 degree circumferential service-induced crack-like flaws are excluded from the requirements of d.3 below.

5.6 Reporting Requirements

5.6.10 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. 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; and

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

INSERT 5.0-26

INSERT 5.0-26

h. Following completion of an inspection performed in Refueling Outage 16 (and any inspections performed in the subsequent 18 month inspection interval or 36-month inspection interval), the number of indications and location, size, orientation, and whether initiated on primary or secondary side for each service-induced crack-like flaw within the thickness of the tubesheet;

i. Following completion of an inspection performed in Refueling Outage 16 (and any inspections performed in the subsequent 18 month inspection interval or 36-month inspection interval), the primary to secondary LEAKAGE rate observed in each SG (if it is not practical to assign 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 which is the subject of the report; and

j. Following completion of an inspection performed in Refueling Outage 16 (and any inspections performed in the subsequent 18 month inspection interval or 36-month inspection interval), the calculated accident leakage rate from the portion of the tube 17 inches below the top of the tubesheet for the most limiting accident in the most limiting SG.

ATTACHMENT III

MARKUP OF TECHNICAL SPECIFICATION BASES PAGES
(for information only)

BASES

APPLICABLE SAFETY ANALYSES

The steam generator tube rupture (SGTR) accident is the limiting design basis event for SG tubes and avoiding an SGTR is the basis for this Specification. The analysis of an SGTR event assumes a bounding primary to secondary LEAKAGE rate equal to the operational LEAKAGE rate limits in LCO 3.4.13, "RCS Operational LEAKAGE," plus the leakage rate associated with a double-ended rupture of a single tube. The accident analysis for an SGTR assumes the contaminated secondary fluid is released to the atmosphere via SG atmospheric relief valves and safety valves.

The analysis for design basis accidents and transients other than an SGTR assume the SG tubes retain their structural integrity (i.e., they are assumed not to rupture.) In these analyses, the steam discharge to the atmosphere is based on the total primary to secondary LEAKAGE from all SGs of 1 gallon per minute or is assumed to increase to 1 gallon per minute as a result of accident induced conditions. For accidents that do not involve fuel damage, the primary coolant activity level of DOSE EQUIVALENT I-131 is assumed to be equal to the LCO 3.4.16, "RCS Specific Activity," limits. For accidents that assume fuel damage, the primary coolant activity is a function of the amount of activity released from the damaged fuel. The dose consequences of these events are within the limits of GDC 19 (Ref. 2), 10 CFR 100 (Ref. 3) or the NRC approved licensing basis (e.g., a small fraction of these limits).

Steam generator tube integrity satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

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 a 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, a 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. For Refueling Outage 14 and the subsequent operating cycle, degradation found in the portion of the tube below 17 inches from the top of the hot leg tube sheet does not require plugging. The portion of the tubes below 17 inches from the top of the hot leg tube sheet is excluded from tube inspections (Ref. 7) The tube-to-tubesheet weld is not considered part of the tube.

INSERT B 3.4.17-2

INSERT B 3.4.17-2

In order to preclude unnecessarily plugging tubes in the SGs, an evaluation (Reference 7) has been performed to assess the need for removing tubes from service due to the occurrence of circumferentially or axially oriented cracks in a tubesheet. For Refueling Outage 16 and subsequent 18-month eddy current inspection interval, tubes with less than or equal to a 214 degree circumferential service-induced crack-like flaw found in the portion of the tube below 17 inches from the top of the tubesheet do not require plugging. Tubes with greater than a 214 degree circumferential service-induced crack-like flaw found in the portion of the tube below 17 inches from the top of the tubesheet shall be removed from service.

For Refueling Outage 16 and subsequent 36-month eddy current inspection interval, tubes with less than or equal to a 183 degree circumferential service-induced crack-like flaw found in the portion of the tube below 17 inches from the top of the tubesheet do not require plugging. Tubes with greater than a 183 degree circumferential service-induced crack-like flaw found in the portion of the tube below 17 inches from the top of the tubesheet shall be removed from service.

For Refueling Outage 16 and subsequent 18-month and 36-month eddy current inspection intervals, tubes with service-induced crack-like flaws located within the region from the top of the tubesheet to 17 inches below the top of the tubesheet shall be removed from service. Tubes with service-induced axial cracks found in the portion of the tube below 17 inches from the top of the tubesheet do not require plugging.

BASES

REFERENCES

1. NEI 97-06, "Steam Generator Program Guidelines."

2. 10 CFR 50 Appendix A, GDC 19.

3. 10 CFR 100.

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."

7. License Amendment No. 162, "Wolf Creek Generating Station – Issuance of Exigent Amendment RE: Steam Generator (SG) Tube Surveillance Program (TAC NO. MC6757)," April 28, 2005.

Westinghouse letter LTR-CDME-08-11-P-Attachment, "Interim ARC to Minimize Plugging of Tubes due to Cracks in the Lower Region of the Tubesheet," January 2008.

ATTACHMENT IV

RETYPED TECHNICAL SPECIFICATION PAGES

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.

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 1 gpm per SG.

(continued)

5.5 Programs and Manuals

5.5.9 Steam Generator (SG) Program (continued)

at the tube inlet to the tube-to-tubesheet weld at the tube outlet, and that may satisfy the applicable tube repair criteria. For Refueling Outage16 and the 36-month eddy current inspection interval, SGs in which the portion of the tube below 17 inches from the top of the tubesheet has no greater than 183 degree circumferential service-induced crack-like flaws are excluded from the requirements of d.3 below. 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.

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

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.

3. If crack indications are found in any SG tube, 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.

e. Provisions for monitoring operational primary to secondary LEAKAGE.

(continued)

5.6 Reporting Requirements

5.6.6 Reactor Coolant System (RCS) PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR)

a. RCS pressure and temperature limits for heat up, cooldown, low temperature operation, criticality, hydrostatic testing, and PORV lift settings as well as heatup and cooldown rates shall be established and documented in the PTLR for the following:

1. Specification 3.4.3, "RCS Pressure and Temperature (P/T) Limits," and

2. Specification 3.4.12, "Low Temperature Overpressure Protection System."

b. The analytical methods used to determine the RCS pressure and temperature and Cold Overpressure Mitigation System limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

1. NRC letter dated December 2, 1999, "Wolf Creek Generating Station, Acceptance for Referencing of Pressure Temperature Limits Report (TAC No. MA4572)," and

2. WCAP-14040-NP-A, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves," January, 1996.

c. The PTLR shall be provided to the NRC upon issuance for each reactor vessel fluence period and for any revision or supplement thereto.

5.6.7 Not Used.

5.6.8 PAM Report

When a report is required by Condition B or F of LCO 3.3.3, "Post Accident Monitoring (PAM) Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the instrumentation channels of the Function to OPERABLE status.

5.6.9 Not Used.

(continued)

LIST OF REGULATORY COMMITMENTS

The following table identifies those actions committed to by WCNOC in this document. Any other statements in this submittal are provided for information purposes and are not considered to be commitments. Please direct questions regarding these commitments to Mr. Richard Flannigan at (620) 364-4117.

COMMITMENT	Due Date/Event
The license amendment will be implemented prior to MODE 4 entry during startup from Refueling Outage 16.	Prior to MODE 4 entry during startup from Refueling Outage 16
For the tube end weld eddy current examination, the weld will be evaluated on a best effort basis for crack-like indications. Crack-like indications in the tube end weld that exceed the maximum acceptable weld flaw size of less than or equal to 294 degrees for the 18-month SG tubing eddy current inspection interval and that exceed the maximum acceptable weld flaw size of 263 degrees for the 36-month SG tubing eddy current inspection interval will be visually examined on a "best effort" basis with inspection systems capable of achieving a resolution similar to the Maximum Procedure Demonstration Lower Case Character Height as discussed in ASME Section XI.	Prior to MODE 4 entry during startup from Refueling Outage 16
An evaluation for tube end welds that require plugging will be completed under the Corrective Action Program to provide reasonable assurance that unacceptable welds are removed from service.	Per the Corrective Action Program