

May 8, 2008

Mr. Rick A. Muench
President and Chief Executive Officer
Wolf Creek Nuclear Operating Corporation
Post Office Box 411
Burlington, KS 66839

SUBJECT: WOLF CREEK GENERATING STATION – SUMMARY OF CONFERENCE CALL
REGARDING THE SPRING 2008 STEAM GENERATOR TUBE INSPECTIONS
DURING REFUELING OUTAGE 16 (TAC NO. MD8099)

Dear Mr. Muench:

On April 5, 2008, the U.S. Nuclear Regulatory Commission (NRC) staff participated in a conference call with Wolf Creek Nuclear Operating Corporation (the licensee) representatives regarding the ongoing steam generator (SG) tube inspection activities at Wolf Creek Generating Station (WCGS). The discussion was based on a brief summary of the scope and results of the SG tube inspections provided by the licensee. At the time of the conference call, the tube inspections at WCGS were still in progress and discussions were based on the available results at the time of the call. The conference call focused on inspections of the tubes in the tubesheet region.

Subsequent to the conference call, the NRC staff was notified that the licensee planned to inspect 100 percent of the hot-leg tube ends in the two SGs where crack-like indications were detected. In addition, the licensee planned to inspect 20 percent of the hot-leg tube ends in the other two SGs.

Based on this subsequent information, the NRC staff did not identify any issues that warranted immediate follow-up action. The conference call summary is provided as an enclosure to this letter.

If you have any questions regarding this matter, I may be reached at 301-415-3016.

Sincerely,

/RA/

Balwant K. Singal, Senior Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-482

Enclosure: As stated

cc w/encl: See next page

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SUMMARY OF CONFERENCE CALL
WITH WOLF CREEK NUCLEAR OPERATING CORPORATION
REGARDING THE SPRING 2008 STEAM GENERATOR
TUBE INSPECTION RESULTS
AT WOLF CREEK GENERATING STATION

On April 5, 2008, the U.S. Nuclear Regulatory Commission (NRC) staff participated in a conference call with Wolf Creek Nuclear Operating Corporation (the licensee) representatives regarding the ongoing steam generator (SG) tube inspection activities at Wolf Creek Generating Station (WCGS). Prior to the call, the licensee provided a brief summary of the scope and results of their inspections. This summary is provided as an attachment to this summary.

WCGS has four Westinghouse Model F SGs. Each SG has 5626 thermally treated Alloy 600 tubes with an outside diameter of 0.688 inches and a nominal wall thickness of 0.040 inches. The tubes are hydraulically expanded for the full-depth of the tubesheet at each end. The tubes are supported by stainless steel support plates with quatrefoil-shaped holes. The U-bend region of the tubes installed in Rows 1 through 10 was thermally treated after bending in order to reduce stress.

At the time of the conference call, tube inspections were still in progress. The conference call focused on inspections of the tubes in the tubesheet region. Additional information discussed during the conference call and not included in the document provided by the licensee is summarized below:

- Acronyms used in the attached document provided by the licensee include: AVB (anti-vibration bar), CDT (central daylight savings time), circ (circumferential), CL (cold leg), C“y” (column “y”), EPRI (Electric Power Research Institute), HL (hot leg), IARC (interim alternate repair criterion), MCI (multiple circumferential indication), NRC (Nuclear Regulatory Commission), PWSCC (primary water stress-corrosion cracking), R“x” (row “x”), SAI (single axial indication), SCI (single circumferential indication), SG (steam generator), TEC (tube end cold), TEH (tube end hot), TTS (top of tubesheet), TW (through-wall), and +Pt (+Point™).
- The extent of the full length +Point™ inspections in the tubesheet were from 3 inches above the top of the tubesheet to the tube end.
- At the time of the call, eight tubes in SG B were identified with wear indications that were greater than or equal to 40 percent through-wall. All of these indications were attributed to wear at the anti-vibration bars.
- At the time of the call, the analysis of the +Point™ data in SG C was complete.

ENCLOSURE

- At the time of the call, three tubes in SG C were identified with wear indications that were greater than or equal to 40 percent through-wall. All of these indications were attributed to wear at the anti-vibration bars.
- Crack-like indications were only detected near the tube end on the hot leg.
- There were no unusual results associated with the inspections for foreign objects. Some foreign objects were identified (e.g., flexitallic gaskets). For example, a 10-inch long piece of flexitallic gasket was identified in SG B. There was no tube damage associated with this foreign object. This object was retrieved.
- While performing visual inspections near the fourth tube-support plate in SG C with a video probe, the probe's lens, lens head, and two small screws fell into the SG. The pieces are very small. At the time of the call, an analysis was being performed to justify leaving these parts in the SG. This analysis involved reviewing the hardness of the objects and the chemical makeup of the objects.

In the document provided by the licensee, the licensee summarized an argument intended to justify not inspecting 100 percent of the hot-leg tube ends in the two SGs where crack-like indications were identified and not expanding the inspection into the two SGs where no hot-leg tube end inspections were planned. The NRC staff had the following feedback regarding this justification:

- The indications in the hot-leg tube ends have included both circumferentially and axially-oriented indications. The lack of circumferential indications in the sample of tubes inspected in SG C does not indicate (to the NRC staff) that these tubes are not susceptible to circumferential cracking. The inspection results of these two SGs indicate that the tubes in both SGs are potentially susceptible to axial and circumferential crack-like indications.
- The NRC staff is not aware of any data that exists for determining the capability of the tack roll to resist tube pull-out.
- Regardless of the inspection guidance contained within the EPRI SG examination guidelines, the objective of the SG program is to ensure tube integrity. Since crack-like indications have been detected in the sample of tubes inspected in two SGs (B and C), it would appear reasonable to expect that there may be other crack-like indications in the hot-leg tube ends not inspected in SGs B and C and in the hot-leg tube ends in the other two (non-inspected) SGs. Given that there have been no previous inspections of the hot-leg tube-end region at WCGS with probes capable of detecting crack-like indications, it is not clear what assumptions would be made regarding the size of the flaws in the uninspected tubes. The sizes of these flaws (or postulated flaws) are important in assessing tube integrity over the next inspection cycle if a flaw size argument is used in assessing tube integrity.

- Given the issues identified by the NRC staff with the H*/B* approach (an approach intended to justify the structural and leakage integrity of the hydraulically expanded tube-to-tubesheet joint), an assessment of the integrity of the tube ends (inspected and not inspected) should not rely on the H*/B* approach unless (a) the integrity assessment does not rely on those portions of the H*/B* analyses where the NRC staff has identified potential issues or (b) the NRC issues have been addressed. Alternatively, a tube integrity argument that does not rely on an H*/B* approach could be used (e.g., one that relies on assessing the size of the flaw and whether it is capable of resisting loads commensurate with the tube integrity performance criteria).

With respect to the inspections at the cold-leg tube end, the NRC staff had the following comments:

- If the cold-leg tube end is considered susceptible to cracking, the licensee must ensure they satisfy the prescriptive inspection requirements in their technical specifications for this region. For example, 50 percent of the tubes must be inspected (with probes capable of detecting crack-like indications) by the outage nearest the mid-point and 100 percent of the tube must be inspected by the endpoint of the sequential period. The 50 percent sample of the tubes can be performed at the outage after the midpoint of the period. In addition, these inspections can be prorated if it was concluded that the cold-leg tube ends were not susceptible to cracking until after the first inspection in the sequential period (refer to Agencywide Document Access and Management System (ADAMS) Accession No. ML073110083). In addition, the licensee must be able to demonstrate that they will maintain tube integrity as a result of any flaws that may exist in the tube ends on the cold leg.

Subsequent to the April 5, 2008, conference call, the NRC staff was notified that the licensee planned to inspect 100 percent of the hot-leg tube ends in the two SGs where crack-like indications were detected. In addition, the licensee planned to inspect 20 percent of the hot-leg tube ends in the other two SGs.

Based on this subsequent information, the NRC staff did not identify any issues that warranted immediate follow-up action.

**Information Provided by Wolf Creek Nuclear Operating Corporation
Concerning 2008 Steam Generator Tube Inspections**

Inspections being performed during Refueling Outage 16 in the “B” and “C” SGs (recognizing that it is required to complete inspection of 50% of the tubes by the inspection nearest to the arithmetic midpoint of the interval).

- 100% bobbin inspection in all except the U-bends of Rows 1 and 2 from TEH to TEC. The straight legs of Row 1 and Row 2 are being inspected with the bobbin probe from the tube end to the top of the top support plate on both the HL and CL.
- Inspect 50% of the R1 and R2 U-bends with the +Pt probe.
- Inspect 55% of the HL TTS+3/-17” inches with the +Pt probe, including all peripheral rows, two pitches into the bundle. Within this 55% sample, inspect a 20% sample of the tube bundle through the full depth of the tubesheet, TTS+3” to the tube end.
- As a conservative, proactive action, inspect the CL outer tubes, two pitches into the bundle, with the +Pt probe. The extent of the inspection is TTS±3 inches.
- Inspect 50% of the Dings and Dents > 5 volts in the HL. The HL is defined as the length of tubing from the tubesheet HL to the top of the uppermost tube support plate on the CL, i.e., including the U-bends.
- Inspect all prior indications and all I-codes consistent with accepted industry practice.
- Visual inspections of all plugs.

Current Results:

“B” SG – 20% HL full depth +Pt inspection, complete (1120 locations analyzed)

- 4 tubes with circumferential indications identified right at the tube end, one pluggable in accordance with Amendment #178 for tube ends

Tube	Volts	Degrees	Indication	Location	Crack Length	Crack Width	Circ Extent
R2C88	4.0	22	SCI	TEH+0.09	.22	.55	92°
R2C119	3.26	32	SCI	TEH+0.14	.17	.25	42°
R11C107	2.02	41	MCI	TEH+0.02	.28	1.11	185°
R17C108	1.23	58	SCI	TEH+0.06	.15	.33	55°

ATTACHMENT

“B” SG – 100% Bobbin Inspection, ongoing

- 1 tube with AVB Wear greater than the plugging limit
 - R48C97 – 52%

“C” SG –20% HL full depth +Pt inspection, final stages (956 of 1122 locations analyzed)

- 3 tubes with axial indications identified right at the tube end, none pluggable in accordance with Amendment #178 for tube ends

Tube	Volts	Degrees	Indication	Location	Crack Length	Crack Width	Circ Extent
R1C16	1.18	33	SAI	TEH+0.10	.56	.22	37°
R1C40	2.31	31	SAI	TEH+0.02	.19	.46	77°
R20C76	4.28	25	SAI	TEH+0.07	.30	.39	64°

“C” SG – 100% Bobbin Inspection, ongoing

- 2 tubes with AVB Wear greater than the plugging limit
 - R46C79 – 54%
 - R40C86 – 40%

The circumferential crack indication in “B” SG (R11C107) would require inspection expansion in accordance with EPRI TR 1013706, “Steam Generator Management Program: Pressurized Water Reactor Steam Generator Guidelines,” Revision 7, Table 3.2, “Expansion of Sample Plans for Cracks (PWSCC, Outside Diameter Stress-Corrosion Cracking [ODSCC], and Intergranular Attack [IGA]”. This table indicates that for Category C-2 inspection results, the action required is to inspect all remaining tubes or tube sections in the affected sample plan in this SG and a 20% sample of the affected sample plan in each unscheduled SG.

The expansion guidelines in EPRI TR 1013706 would require WCNOG to inspect all remaining tubes in the “B” SG and inspect a 20% sample in the “A” and “D” SGs. WCNOG is preparing a deviation from these guideline requirements. The basis for the deviation includes:

1. Inspections of 2 plants have shown predominantly axial cracks in the tube end region, and these are exempt from plugging by Wolf Creek License Amendment #178 (IARC)
2. In one plant (urethane tack), no circumferential indications were found that required plugging by their IARC.
3. At Wolf Creek (Hard-rolled tack), very few circumferential cracks at the tube-ends were reported, and only one (1) exceeded the License Amendment #178 criteria.

4. In both plants inspected, indications were limited to the tube-ends; no indications above the tube-ends were detected. Tube-ends is defined as less than 0.3 inch from the end of valid EC data.
5. At Wolf Creek, the tack expansions are hard-rolled. Therefore, the underlying assumptions in License Amendment #178 (ie, there are no restraining forces to prevent tube pullout) are false. The availability of a modest pullout force significantly increases the allowable crack angle calculated in the IARC.
6. If the tack expansion is acted on by primary pressure only (no differential thermal expansion), 0.25 inch (axial) of tube with a conservative coefficient of friction of 0.2 increases the allowable crack angle by approximately 30 degrees. The tack expansion is 0.75 inches long; therefore, a 90 degree increase in allowable crack angle is predicted.
7. No leakage was observed; therefore the assumption of 100% TW cracks utilized in the IARC is probably false. Although the maximum depth of the crack may appear as 100 % TW, the morphology of PWSCC would indicate that the majority of the length of the crack is not TW, and therefore, provides additional strength to the joint. If the average TW depth of the crack is 75%, the allowable crack angle increases by 140 degrees. If the average depth of the crack is 65%, a full 360 degree circumferential flaw is acceptable.

WCNOC is pursuing two alternatives: 1) deviation from the EPRI guidelines and 2) preparation for inspections of the "A" and "D" SGs. The preparations for inspecting SGs "A" and "D" would need to occur in a rapid time frame. WCNOC has a mid-outage teleconference scheduled for 4/7/08 with the NRC to discuss the results of the SG inspections. Included as part of this telecon would be a discussion on the deviation (item 3 of NRC letter dated 2/21/08). WCNOC called the NRC Project Manager on 4/4/08 to attempt to reschedule the telecon for later that day as decisions regarding expanded inspection activities will be made on 4/5/08. The purpose of this e-mail is to inform the NRC prior to the 4/7/08 telecon that we are developing a deviation to the expansion requirements in the EPRI guidelines.

Any NRC concerns regarding the deviation that would result in expanding the tube inspections into SG "A" and "D" could result in significant scheduling and resource issues if these are not expressed before 4/5/08 at 11:00 CDT. The current results of the SG tube inspections were discussed with the NRC Region IV inspectors that are on-site.