

# WOLF CREEK

NUCLEAR OPERATING CORPORATION

Terry J Garrett  
Vice President, Engineering

July 14, 2005  
ET 05-0013

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

- References:
- 1) Letter dated March 30, 2005, from J. N. Donohew, USNRC, to R. A. Muench, WCNOG
  - 2) Letter WO 03-0063, dated November 10, 2003 from B. T. McKinney, WCNOG, to USNRC
  - 3) Letter WM 04-0046, dated October 27, 2004, from R. A. Muench, WCNOG, to USNRC

Subject: Docket 50-482: Wolf Creek Nuclear Operating Corporation's (WCNOG's) Response to Request for Additional Information Regarding the Steam Generator Tube Inspection Summary Reports for the Fall 2003 Outage (TAC No. MC5022)

Gentlemen:

Reference 1 requested additional information regarding the steam generator tube inspection summary reports for Wolf Creek Nuclear Operating Corporation's (WCNOG's) Fall 2003 outage (References 2 and 3). The attachment to this letter lists the NRC's questions and provides WCNOG's response to each of those questions.

There are no commitments associated with this submittal. If you have any questions concerning this matter, please contact me at (620) 364-4084, or Mr. Kevin Moles at (620) 364-4126.

Very truly yours,



Terry J. Garrett

TJG/rlg

Attachment

cc: J. N. Donohew (NRC), w/a  
W. B. Jones (NRC), w/a  
B. S. Mallett (NRC), w/a  
Senior Resident Inspector (NRC), w/a

A001

**Response to Request for Additional Information Regarding the Steam Generator Tube Inspection Summary Reports for the Fall 2003 Outage**

1. Describe what actions, if any, were taken to verify that the steam generator tubes were manufactured (i.e., processing, heat treatment, etc.) as specified so as to exhibit optimal resistance to degradation (refer to NRC Information Notice 2002-21 Supplement 1, dated April 1, 2003). If tubes with non-optimal tube processing were identified, discuss the results of the inspections performed on these tubes.

*The Refuel 13 (RF13) Degradation Assessment categorizes Tube Support Plate (TSP) Outside Diameter Stress Corrosion Cracking (ODSCC) as a relevant degradation mechanism for Wolf Creek due to the confirmed ODSCC at Seabrook in 2002. Analysis of the Seabrook situation concluded that the principal contributor to the ODSCC was elevated residual stress in a small number of tubes, and identified a characteristic bobbin signal that would identify tubes in the rows <11 that may have elevated residual stress.*

*Prior to RF13, the tubes in the Wolf Creek Steam Generators (SGs) were evaluated for this characteristic signal, and no such signal was identified in any of the SGs.*

*No ODSCC was detected in SGs A and D during the RF13 inspection. A potential ODSCC indication would first be indicated in the bobbin program by the presence of Distorted Support Plate Indications (DSI) at the TSPs. In SG-A, 19 DSI indications were reported at TSP Hot Leg (HL) and Cold Leg (CL) locations, and 10 DSI indications were reported at the HL and CL flow baffle. In SG-D, 22 DSI indications were reported at the TSP HL and CL locations, and 29 DSI indications were reported at the HL and CL flow baffle. The normal inspection practice is to clear the indication or confirm degradation at all bobbin I-codes by subsequent testing with the +Point probe. +Point testing cleared all of the DSI indications reported at the TSPs in SGs A and D at Wolf Creek. The industry recommendations for screening for potential elevated residual stress tubes do not require tubes with DSI indications at the tube support plates to be removed from service. Because of this, and because the DSI indications were cleared by +Point examination, none of the tubes with DSI indications were removed from service.*

**Response to Request for Additional Information Regarding the Steam Generator Tube Inspection Summary Reports for the Fall 2003 Outage**

2. On page one of its November 10, 2003 report, the licensee indicated that one damaged mechanical plug in steam generator D was replaced with a welded plug. Discuss what caused the damage to this mechanical plug and the extent of the damage, including if the plug was replaced for a reason other than inadequate structural integrity for plant restart from the outage (e.g., because of future inspection concerns, long-term cracking concerns, expected reduction in structural integrity during next operating cycle, etc.). If the plug was replaced because of inadequate structural integrity, discuss the implications this could have on the rest of the plugs in the steam generator.

*This tube plug was damaged as a result of a primary side loose part in the hot leg channel head of Steam Generator D (Reference INPO Operating Experience 13865, Loose Parts in Steam Generator Caused by Apparent Failure of Inconel 750 B Control Rod Guide Tube Support Pin (Slit Pin) Assembly; and NRC Information Notice 2004-10, Loose Parts in Steam Generators). As a result of this event, the mechanical plug at R7C88 in the hot leg of Steam Generator D was determined to have the most significant deformation, but not sufficient to impact structural integrity of the steam generator. Although the inspection revealed that the plug was intact and acceptable, it was determined to be prudent and conservative to replace it. Replacement of this plug removed any uncertainty regarding the potential for primary to secondary side leakage.*

3. On page two of its October 27, 2004 report, the licensee indicated that six possible loose parts indications were identified in steam generator A and four, in steam generator D. With respect to these indications, discuss the following:

- a. Was there any wear associated with the loose part indications or were these signals just indications that a loose part may be present.
- b. Was a visual inspection performed at these locations.
- c. Was foreign object search and retrieval performed and were any loose parts removed from the steam generators. If any loose parts were not removed, address whether an assessment was made of the impact that the loose parts could have on tube integrity during the interval between tube inspections.

*The following table summarizes the possible loose parts (PLP) indications found in SGs A and D during the RF13 inspection. These indications were detected during the 55% HL Top of Tubesheet (TTS) 3-coil +Point Rotating Pancake Coil (RPC) program and the 100% bobbin coil inspection of the tubes.*

*The tubes surrounding the tubes with PLP indications were tested using the +Point probe to confirm the presence or absence of a loose part.*

*No degradation was found at any of these locations.*

*Visual inspections were performed at all locations of indicated possible loose parts. As noted in the table, foreign objects were removed from the area of some of the PLP indications, while other PLP indications were found to have sludge rocks or sludge collars, which have been shown to be benign with respect to potential tube wear.*

**Response to Request for Additional Information Regarding the Steam Generator Tube Inspection Summary Reports for the Fall 2003 Outage**

*Foreign object search and retrieval included all of the areas where PLP signals were reported. Several metal objects were removed as noted in the table, but some other small metallic objects could not be removed. In some instances, visual examination revealed the presence of hardened sludge, (i.e., "sludge rocks" or collaring). The metallic pieces remaining in the SGs are of a size that is comparable to previously analyzed objects (e.g., short length (0.125" typ) of small diameter (0.015" typ) wire) which have been found acceptable for continued operation. Similarly, hardened sludge has been analyzed previously with regard to the potential for tube wear and has been found to have insignificant potential for tube damage.*

*Wolf Creek RF13 PLP Calls*

SG	Row	Col	Location	Ind.	RF13	RF13 FOSAR
A	1	106	TSH+1.78"	PLP	No degradation	Metal chip; removed
	15	114	TSH+2.06"	PLP	No degradation	Sludge rock, not removed
	16	114	TSH+2.29"	PLP	No degradation	Sludge rock, not removed
	22	101	TSH+2.24"	PLP	No degradation	Metal curl; removed
	22	101	TSH+2.48"	PLP	No degradation	Metal curl; removed
	23	101	TSH+2.33"	PLP	No degradation	Metal curl; removed
D	9	76	TSC+1.51"	PLP	No degradation	Collaring
	9	75	TSC+1.66"	PLP	No degradation	Collaring
	13	62	TSH+5.63"	PLP	No degradation	Collaring
	29	51	TSH+2.25"	PLP	No degradation	Sludge rock, not removed

4. On page two of the inservice inspection report submitted by letter dated October 27, 2004, the licensee indicated that two permeability variation indications were identified in steam generator A and three, in steam generator D. Because permeability variations can affect the ability to effectively assess the condition of the tube, discuss whether the tubes with the permeability variation indications were plugged or left in service. In addition, discuss whether these signals were of sufficient magnitude to effectively assess the condition of the tube. If the tubes were not plugged and the permeability variations affected the ability to assess the condition of the tubes, discuss the basis for leaving them in service.

*Both Permeability Variation (PVN) indications in SG-A were in tube R20C111 in the tube expansion region below the top of the tubesheet. No degradation has been detected in the tubesheet expansion region of the Wolf Creek SGs to date; thus it is extremely unlikely that these PVN indications mask degradation. Further, because of their location in the tubesheet expansion region, there is no risk of tube burst. No leakage has been observed at Wolf Creek. Therefore, these PVNs were retained in service.*

**Response to Request for Additional Information Regarding the Steam Generator Tube Inspection Summary Reports for the Fall 2003 Outage**

Two of the SG-D PVNs were located just above the top of the tubesheet. No stress corrosion degradation has been reported in the Wolf Creek SGs. The inspection history was reviewed to determine if a flaw could be masked by the PVN signals. Since no degradation has been reported in the regions where the PVN's were identified, the tubes were kept in service. A third PVN was resolved as 18% throughwall wear at an anti-vibration bar (AVB) and was evaluated against the 40% plugging criterion of the Technical Specification. This tube was retained in service as well.

5. On page two of its October 27, 2004 report, the licensee indicated that one volumetric indication was identified in steam generator A and five, in steam generator D. Discuss if these indications are the same as (1) the top of the tubesheet indications and (2) the indication found near the fifth support plate on the hot leg side of steam generator D. If they are not, discuss the nature and cause of these indications.

A complete list of volumetric (VOL) indications is provided in the following table. Among the indications are four located just at the tubesheet, and two others located in SG D at the HL of TSP 5. The VOL indications located at the top of the tubesheet are discussed in the reply to question 6, below.

*Wolf Creek RF13 Volumetric (VOL) Indications*

SG	Row	Col	Location	Indication	Size (depth)
A	48	38	TSH +0.05"	VOL	11%
D	15	65	5H +0.0"	VOL	14%
	44	61	5H-0.55"	VOL	14%
	21	117	TSH -0.03"	VOL	9%
	27	97	TSH -0.64"	VOL	9%
	31	21	TSH +0.08"	VOL	9%
Sizing by the method of ETSS 21998.1					

The indications at the 5<sup>th</sup> support plate in SG-D were also reported at the prior inspection, RF11. History lookup of these indications showed that the indications had not changed since RF11. The indications were sized using the method of ETSS #21998.1. The original attribution of these indications of wear due to a prior resident foreign object is validated by the absence of observed growth. Since the indications are shallow (14% TW) and have no growth, the tubes (R15C65 and R44C61) were retained in service.

6. On page 32 of its October 27, 2004 report, the licensee addressed four tubes with volumetric indications. The licensee judged these indications to be a result of wear with previous foreign objects or due to manufacturing anomalies. With respect to these indications, address the following:

- a. Did the indications initiate from the inside or outside diameter of the tube.
- b. Depending on whether the indications are initiated from either the inside or outside diameter of the tube, discuss the cause of these indications (e.g., previous loose parts or manufacturing anomalies). If the indications are initiated from the outside diameter, are located below the top of the tubesheet, and attributed to loose parts, discuss how the damage is postulated to have

**Response to Request for Additional Information Regarding the Steam Generator Tube Inspection Summary Reports for the Fall 2003 Outage**

occurred. If the indications are in the interior of the bundle and are attributed to loose parts, discuss whether any loose parts were found in the vicinity of these tubes. In addition, discuss how it was confirmed that the indications were not caused by some other mechanism (e.g., inter-granular attack).

c. If the indications are attributed to manufacturing anomalies, discuss past inspection results of these tubes.

d. Given that some indications are located in the interior of the tube bundle, and this location is an unusual location for a loose part, discuss any theories and conclusions regarding the cause of the loose parts.

*The table in the response to question 5, above, summarizes the tubes with volumetric indications at the top of the tubesheet (TTS).*

*The VOL indications were all Outside Diameter (OD) in nature from the eddy current data.*

*In SG-A, one tube was reported from the Tubesheet Hot (TSH) +Point program to have a VOL indication, most likely indicative of wear since it is reported at 0.05" above TSH. This location is typical of axial distance above the top of the tubesheet for foreign object impingement wear throughout the industry.*

*In SG-D, the indications on tubes R31C21-TSH+0.08" and R21C117, TSH-0.03 are most likely indicative of wear since they are reported at the TTS. The apparent location of the indication in R21C117, just below the top of the tubesheet, is most likely a reflection of the locating accuracy of the EC probe, but could also be in a crevice resulting from the tube expansion location normal tolerance. Prior studies have shown that the actual position of the expansion transition can vary by approximately 0.3" from the top of the tubesheet. Thus, an apparent location of a VOL indication 30 mils below the top of the tubesheet can reasonably be anticipated.*

*The indication in SG-D tube R27C97 is at TSH-0.64". A potential source of this indication could be a geometric anomaly that occurred during manufacturing such as expansion into a burr or undercut remaining from the tubesheet drilling process. Prior operating experience indicates that a VOL indication can arise from expansion over a burr in the tubesheet bore. Similarly, expansion into a local undercut resulting from the tubesheet drilling process can be interpreted as a volumetric indication. Both conditions are benign. This indication was sized as 9% throughwall.*

*Look-back analysis to RF 11 showed that these indications were present at RF11; however, none of them was reported as a VOL in prior inspections. None of the indications were associated with a possible loose part (PLP) call at RF13.*

*Inter Granular Attack (IGA) is a corrosion degradation mechanism which would be expected to grow in the 2 cycles from RF11 to RF13. Since no change in this indication was observed since RF11, it is improbable that the indication is IGA. Furthermore, at the time of the RF13 inspection, no corrosion degradation had been detected in any A600TT tubed steam generator; thus, it was not considered credible that this indication was corrosion related.*

**Response to Request for Additional Information Regarding the Steam Generator Tube  
Inspection Summary Reports for the Fall 2003 Outage**

*Since these indications are not a challenge to the structural integrity of the tubes, and there is no mechanism for growth of these indications, the tubes were permitted to remain in service. These indications will be monitored during future inspections.*

*It is Wolf Creek's experience that loose parts can migrate into and out of the interior of the tube bundle. Therefore, possible loose part (PLP) indications from either the bobbin program or the +Point program are checked by +Point testing of the surrounding tubes to verify that no foreign object or degradation is present. In addition, visual inspections were performed to locate possible loose parts. If testing and/or visual inspection shows no foreign objects are resident, and no degradation is observed on the tube with a PLP call, the tube is permitted to remain in service. However, if the presence of a foreign object is indicated, and/or there is degradation of the tube with the PLP call, additional evaluation and action is required, possibly including stabilization of the damaged tube and its surrounding neighboring tubes if the object cannot be removed.*