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ET 03-0003

U. S. Nuclear Regulatory Commission  
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- References:
- 1) Letter ET 00-0006, dated February 15, 2000, from Richard A. Muench, WCNO, to USNRC
  - 2) Letter ET 02-0046, dated December 11, 2002, from Gary B. Fader, WCNO, to USNRC

Subject: Docket No. 50-482: Response to Follow-up Questions Concerning the Results of the Eleventh Steam Generator Tube Inservice Inspection

Gentlemen:

This letter is submitted in response to questions provided by Jack Donohew of your staff via e-mail dated July 2, 2003, requesting supplemental information regarding the results of the eleventh steam generator tube inservice inspection. The attachment contains the questions and Wolf Creek's response.

No commitments are contained in this correspondence.

If you have any questions concerning this matter, please contact me at (620) 364-8831, extension 8384, or Mr. Kevin Moles at (620) 364-4126.

Very truly yours,

*Kevin Scherich*

Kevin L. Scherich

KLS/rig

Attachment

A047

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cc: J. N. Donohew (NRC), w/a  
D. N. Graves (NRC), w/a  
T. P. Gwynn (NRC), w/a  
Senior Resident Inspector (NRC), w/a

Response to Follow-up Questions Concerning the Results of the Eleventh Steam Generator  
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*Question 1: On page 2 of 34 in Attachment 1 to the letter, the report indicates that two tubes in Steam Generator B were tested using ultrasonic examination techniques and that no crack-like indications were identified in the inspected regions. The report does not indicate which two tubes were tested. Provide the following additional information: identify the location of the tubes which were tested; what indications were observed in the tubes that prompted the ultrasonic inspection; describe the observed degradation of the tubes, explain how the indications were dispositioned, and provide the basis for how they were dispositioned.*

Response:

In Steam Generator (SG)-B Tube R55C71, a circumferential oriented indication was reported just below the top of the tubesheet during the Plus Point (+Point) program. This was the first inspection that +Point examination was performed at the top of the tubesheet on this tube. This indication could not be adequately resolved based on the +Point data and comparison with prior industry experience, but was thought to be a geometric indication due to the +Point evaluation. Without strong conclusive evidence, this indication was tested with the Ultrasonic Testing/Eddy Current (UTEC) system, which confirmed that it was a geometric indication due to a small dimple on the tube. No crack-like indications were observed. Tube R55C71 was administratively plugged because of the ambiguity of the +Point signal despite the resolution by UTEC. UTEC is fully qualified for the type of indication found; however, it is not fully qualified for circumferential stress corrosion cracking in the transition region. Nevertheless, UTEC has been demonstrated to have superior performance for circumferential cracking compared to the existing qualified EPRI ultrasonic testing (UT) technique. Wolf Creek chose to administratively plug the tube because UTEC was not fully qualified for circumferential cracking and therefore should not be used as a basis for retaining the tube inservice.

An additional tube in SG-B was also examined with an ultrasonic evaluation to further characterize a top of tubesheet (TTS) volumetric indication. SG-B, Tube R30C24, was examined with the UTEC system as an independent overview of the indication characteristics. The results of the UTEC examination confirmed that the indication was a volumetric indication, not indicative of cracking. The results also corroborate the prior interpretation of these indications as volumetric indications and not crack or crack precursor signals. Additional information is discussed in the answer to question 3 of this response.

*Question 2: On page 3 of 34 of Attachment 1 to the letter, two indications were identified in Steam Generator B on the cold leg side of tube row 17, column 5. Provide additional information regarding the observed degradation, any additional inspections performed to characterize these indications, and the final disposition, and the basis for the disposition, for these indications.*

Response:

In SG-B, Tube R17C5, an indication of wear was reported at the quatrefoil land within the second support plate on the cold leg side. There is only one indication in Tube R17C5. Potential mechanisms for wear at a tube support plate (TSP) are flow-induced vibration of the tube or the presence of a foreign object. The latter is considered the most likely, since the location of the

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tube is the second tube from the periphery of the bundle, typically the location where foreign objects are located. Flow induced vibration at the TSPs has not been observed in the model F (11/16" diameter tubes) steam generators. The tube was reported free of degradation in Refueling Outage (RF) 10 (1999).

The indication was sized for the call of record with +Point according to the sizing process of Exam Technique Specification Sheet (ETSS) 21998, and was determined to have a depth of 26% through-wall (TW). (The indication was sized for information only at 9% with bobbin using the Anti-Vibration Bar wear standard.) ETSS 21998 is known to provide conservative estimates. Since the indication depth plus the sizing uncertainty is significantly less than the structural limit, the requirements for condition monitoring are met for this indication.

The +Point inspection of this indication did not reveal the presence of a loose part at the time of the inspection. Since additional growth is not expected without a loose part present, the requirements for operational assessment were met. The tube was also conservatively assessed assuming additional growth would occur, using the 26% depth at RF12 (2002) and the NDD (no detectable degradation) at RF10 to define a growth rate. On this basis, the projected depth at the next scheduled inspection would be less than the structural limit, thus satisfying the requirements for operational assessment.

*Question 3: A number of indications were identified during the 2002 inspection at the top of the hot-leg portion of the tubesheet (refer to the Tube Indication Tables for Steam Generators B and C in Attachment 1 to the letter). Some of these indications were identified during the previous inspection of these tubes in 1999 (the results are attached to the letter dated February 15, 2000 (ET 00-0006), which provided Special Report 99-002, the Ninth Steam Generator Tube Inspection Report), whereas others were not. For indications that were present during the previous inspection, the depth of degradation appears to have increased.*

*For the indications identified near the top of the tubesheet in 1999 and/or 2002, discuss the causes of these indications and the actions taken to confirm the causes (e.g., ultrasonic testing, visual testing, tube pulls). The staff notes that many of the indications are located in peripheral tubes. If the indications were attributed to wear associated with loose parts in the steam generator, discuss whether foreign object search and retrieval (FOSAR) was performed and the results of the FOSAR. For locations where the indications appear to have grown, if no loose parts were found at these locations in 1999 (based on FOSAR or eddy current testing), discuss why the indications have grown given the absence of a confirmed loose part. Further, if the indications are not the result of wear, discuss the basis for leaving the indications in service.*

**Response:**

Top of Tubesheet volumetric indications left in service at RF10 have not grown. Several additional indications were found in tubes that were not inspected previously by +Point. The following is a summary of the results and how these conclusions were reached.

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During RF12, small volumetric, wear-like indications were found at the top of the tubesheet hot leg on one tube in SG-B and on 11 tubes in SG-C as summarized in the table below. During RF10, in SG C, eight tubes were reported with similar indications; seven of the eight were again identified in RF12 and one indication was not reportable (INR). Four additional similar indications were found on tubes not previously inspected during the +Point TTS program in SG-C.

During RF12, these indications were sized for depth using the ETSS 21998 procedure, and also sized using a procedure that calibrates the +Point probe to the anti-vibration bar (AVB) wear standard as previously performed in RF10. ETSS 21998 is known to provide very conservative estimates of indication depth; therefore, both sizing methods were applied during RF12 to provide a reference point for relative growth rate over the last two operating cycles.

As stated above in response to question 1, the indication in SG-B, Tube R30C24, was also examined with the UTEC system as an independent overview of the indication characteristics. The results of the UTEC examination confirmed that the indication was a volumetric indication, not indicative of cracking. The results also corroborate the prior interpretation of these indications as volumetric indications and not crack or crack precursor signals.

Foreign Object Search and Retrieval (FOSAR) was performed at the completion of tubesheet cleaning to ensure no loose parts/objects were in the steam generators that could cause tube degradation. In addition, loose part monitoring was performed on all bobbin coil data and 100% of the outer periphery of the hot leg top of tubesheet was inspected during the +Point inspection. All tubes with possible loose part indications as well as adjacent tubes were +Point inspected and visually inspected.

#### +Point Volumetric Calls at the TTS

SG	Row	Col	RF10			RF12		
			Location	Call	Depth <sup>1</sup>	Location	Call	Depth <sup>2</sup>
B	30	24	Not inspected			TSH+0.22"	VOL	11/25 <sup>4</sup>
C	16	5	TSH+.31	PCT	3%	TSH+0.24"	VOL	3/8
C	3	13	TSH+.43	PCT/ PLP <sup>3</sup>	4%		INR	
C	43	37	TSH+.59	PCT	12%	TSH+0.42"	VOL	9/23
C	56	51	TSH+.23	PCT	9%	TSH+0.03"	VOL	7/17
C	46	58	TSH+.40	PCT	5%	TSH+0.38"	VOL	5/14
C	41	101	TSH+.33	PCT	7%	TSH+0.25"	VOL	5/15
C	41	102	TSH+.46	PCT	15%	TSH+0.40"	VOL	9/24
C	42	102	TSH+.29	PCT	7%	TSH+0.27"	VOL	5/13
C	12	121	Not inspected			TSH+.49	VOL	3/9

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C	8	92	Not inspected	TSH+1.46	VOL	6/17
C	1	87	Not inspected	TSH+3.38	VOL	8/22
C	32	63	Not inspected	TSH+0.49"	VOL	5/14
<ol style="list-style-type: none"> <li>1. Sized by calibrating the +Point probe to the AVB wear standard.</li> <li>2. Sized by calibrating the +Point probe to the AVB wear standard and by ETSS 21998; second value is ETSS 21998 value.</li> <li>3. This location also had a loose parts call (PLP) associated with the percent PCT call.</li> <li>4. UTEC examination sized the depth of this indication at about 15% TW.</li> </ol>						

*Question 4: On page 2 of 34 of Attachment 1 to the letter, the summary discusses a special interest program and a review of freespan indications. If these indications are imperfections, as defined in the Wolf Creek Technical Specifications, provide a summary of the various locations and the causes of the indications.*

**Response:**

A Special Interest +Point rotating pancake coil (RPC) program included all bobbin "T" codes (signals that were new or changed after a historical review). All 5.00 volts or greater dents on the hot leg side were inspected. A 5% sample of "H" codes and 5% sample of "S" codes were inspected. The "H" codes are primarily due to manufacturing burnish mark (MBM) signals and small (<2 volt) dent signals that have rotated into the flaw plane. These are resolved by history look-back and are monitored to ensure characteristics are not changing. The "S" codes are signals that have been +Point inspected for diagnostic purposes at some previous time and were then determined to be non-degradation. These signals are tracked to detect signal change and are resolved by history look-back. The following are the indication totals for each special interest category.

**Summary of RF12 Inspection Results<sup>1</sup>**

Indication/Signals	Description	SG B	SG C
DNG	Freespan Ding (Total / >5V)	183/42	295/73
DNT	Dents at Structures (Total / >5V)	389/196	298/114
FSH/FSS	Freespan signals history / RPC (Includes burnish marks)	455/0	677/0
PCT	AVB % Wear Indications (Bobbin Sizing)	711	480
PLP	Possible Loose Parts	18	4
PVN	Permeability Variation	4	4
VOL	Volumetric Indications - +Point	1	11
WAR	Wear (non-crack-like) at FDB and TSP	6	4
1. Numbers may differ from EC database due to duplicate entries in database			