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Dale E. James
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1CAN100501

October 21, 2005

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

SUBJECT: Response to Request for Additional Information on Generic Letter 2004-01, Requirements for Steam Generator Tube Inspections
Plant Name Arkansas Nuclear One, Unit 1
Docket No. 50-313
License No. DPR-51

REFERENCES:

1. NRC letter dated August 30, 2004, *Generic Letter 2004-01, Requirements for Steam Generator Tube Inspections* (0CNA080412)

2. Entergy letter dated October 28, 2004, *Response to Generic Letter 2004-01, Requirements for Steam Generator Tube Inspections* (0CAN100403)

3. NRC letter dated July 12, 2005, *Response to Generic Letter 2004-01, Requirements for Steam Generator Tube Inspections* (0CNA070504)

Dear Sir or Madam:

In Reference 1 the NRC issued Generic Letter 2004-01 that requested information regarding past and proposed practices on inspection of steam generator tubes using the most appropriate 10CFR50, Appendix B inspection methods. The response to the requested information for Arkansas Nuclear One (ANO), Units 1 and 2 was provided in Reference 2. The response for ANO-2 was accepted by the NRC in Reference 3. However, a request for additional information was received for ANO-1 on April 29, 2005. A draft response on the ANO-1 RAI was provided to the staff on August 3, 2005. This letter provides the formal response to the NRC's request for additional information.

Entergy is not making any commitments as a result of our response to this letter. If you have any questions or require additional information, please contact Steve Bennett at 479-858-4626.

A115

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

Executed on October 21, 2005.

Sincerely,

DEJ/sab

Attachment: Response to NRC Requests for Additional Information for ANO-1 GL 2004-001, Requirements for Steam Generator Tube Inspections

cc: Dr. Bruce S. Mallett
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Attachment

to

1CAN100501

Response to NRC Requests for Additional Information for ANO-1 GL 2004-001, Requirements for Steam Generator Tube Inspections

Response to NRC Requests for Additional Information for ANO-1
GL 2004-001, Requirements for Steam Generator Tube Inspections

RAI 1

Please provide the technical basis demonstrating that the bobbin coil is capable of reliably detecting the potential forms of degradation (e.g., intergranular attack (IGA), stress corrosion cracking (SCC)) in this area, considering that other plants with similar design steam generators have stated tubes in the kidney region require the use of rotating coil for better detection of IGA due to sludge build up in the upper portion of the lower tubesheet crevice.

Response:

The kidney region in the Arkansas Nuclear One, Unit 1 (ANO-1) steam generators (SG) has been defined by the area bounded by dents and sludge at the lower tubesheet (LTS) interface. Table 1 provides the bobbin and Rotating Probe Coil (RPC) inspections that have been performed at the lower tubesheet for the last five outages.

Bobbin coil examination has been qualified for the detection of IGA and Outer Diameter (OD) SCC under the following Examination Techniques Specification Sheets (ETSS):

96008.1 Detection of Axial ODSCC in the Sludge Pile Region
96009.1 Detection of IGA/ODSCC in OTSG Upper Tubesheet

These qualifications have been performed in accordance with the requirements of the EPRI *PWR Steam Generator Examination Guidelines* (Reference 1). Revision 6 of the EPRI *PWR Steam Generator Examination Guidelines* allow the use of these techniques if it can be demonstrated through the site-validation process that the detection and sizing capabilities developed in accordance with Appendix H are applicable to site specific conditions for each existing and potential damage mechanism. This is accomplished through a documented pre-outage review of:

1. All parameters on the qualified ETSS as compared to the site specific ETSS to determine equivalency.
2. Site-specific signals (for existing degradation mechanisms only) compared to ETSS signals to determine if the degradation mechanisms are characterized correctly.
3. A qualified technique's tubing essential variables to ensure that the application is consistent with site-specific SG conditions. The review shall establish that tubing test variables (for example denting, deposits, tube geometry, noise) of the tubes in the qualification data set are comparable in voltage, phase and signal characteristics to generator signals. The review shall determine if noise signals (for example denting, deposits, tube geometry, system noise) in the area of interest pose the potential for degrading the probability of detection.

This review was performed and documented in Reference 2.

The conditions of number 1 above have been met for establishing that the techniques used at ANO-1 are equivalent to the technique qualified. This has been performed either through

direct verification of compliance that the variable is the same or through engineering analysis with supporting technical justification that the variable is equivalent to that qualified.

For the conditions of number 2 above where indications have been detected with the bobbin probe and confirmed using the RPC probe these signals have been compared to indications in the qualification data set to establish that the indications have been correctly characterized and that the in generator signals are similar. This has been performed based on indications from the previous outage or from an earlier outage when the degradation mechanism was detected.

The conditions of number 3 above now establish whether the technique can be used without the concern that the probability of detection (POD) being degraded by the effect of extraneous test variables. The pulled tube data used in qualification 96009.1 with the exception of one tube from Rancho Seco all came from the ANO-1 steam generators. This eliminates any concern that differences could be the caused by material variation. Tube geometry in the upper tubesheet (UTS) and LTS is also identical. To establish that the qualification for the UTS is applicable to the LTS for denting, deposits and noise need to be addressed.

Noise in the LTS was compared to the noise for the qualification data set and to the noise in the UTS. Volts peak-to-peak (Vpp) and Volts Vertical Max (Vmx) measurements were taken for each tube in the qualification data set and for each tube chosen across the upper and LTS face. Figures 1 and 2 below provide a comparison of the values for the qualification data set, and for tubes in the UTS and LTS. When comparing the noise values between the UTS and LTS, the LTS maximum noise values were higher than the comparable UTS value but were still well below the maximum value from the qualification data set value. Comparison of the signal characteristics between the upper and LTS shows little difference in amplitude. In most instances noise remained in the horizontal plane for both tubesheets with little or no vertical component. The vertical voltage readings for both tubesheets in both steam generators is less than the vertical voltage measurements taken in the EPRI qualification data and will not degrade the POD. Based on the results of the bobbin noise data from 1R17 it is believed that the difference in noise between the UTS and LTS would not degrade the POD of qualification 96009.1.

A review of the OD deposits from pulled tube samples has been performed. Tube 31-40 was taken from the LTS while tube 80-18 was removed from the UTS. The only difference was the depth of the deposit. The LTS sample had a thicker deposit ~1100 nanometers or 0.0011 millimeters verses the UTS which had a depth of ~185 nanometers or 0.000185 millimeters. The overall thickness in both the UTS and the LTS are insignificant. The chemical makeup of the two areas were primarily a mixture of magnetite and hematite. The UTS had a slightly higher percentage of magnetite. Since tube 80-18 is one of the ANO-1 pull tubes used in the qualification data set there is no difference in surface deposits that would affect the eddy current (ECT) results and degrade the POD at the LTS.

Dents can pose a challenge to the detection performance of the bobbin probe. The largest number of dents in the ANO-1 steam generators is located at the LTS interface. It is because of this and the reported degradation at similar plants that ANO-1 implemented a sampling campaign in the lower tubesheet. From 1R15 to 1R18, ANO-1 performed 2,728 +Point examinations at the LTS in steam generator "A" (SGA) and 3,075 +Point examination at the LTS in steam generator "B" (SGB). There has been no degradation detected at

dented locations with the +Point probe for dents located at the lower tubesheet. In addition, all indications of degradation in the sludge pile and LTS crevice detected with the +Point probe have also been detected with the bobbin probe. This helps to demonstrate that the bobbin POD has not been degraded by the presence of sludge within the crevice and also that there is no active degradation associated with denting at the LTS.

Based on the results of the site-validation of qualifications 96008.1 and 96009.1 and the large number of +Point examinations performed at the LTS without a missed indication by the bobbin probe, it can be concluded that the detection performance of the bobbin probe has not been degraded at the LTS in the ANO-1 steam generators. In addition the +Point examinations have shown that there is no active degradation associated with the dents at the LTS interface.

RAI 2

In addition, for each indication within the sludge pile and in other areas of the lower tubesheet (excluding tube end cracking), provide a summary that includes the indication's location, the nature of the indication (IGA, SCC, etc.), the indication's severity (length and depth), and whether the indication was detected by bobbin coil inspection, rotating probe inspection, or both.

Response:

Tables 2 and 3 provide the indications that have been detected in the LTS over the last 5 SG tube inspections. All indications in the LTS crevice and sludge pile have been detected by the bobbin and +Point probes. Volumetric indications detected in both steam generators had characteristics of IGA similar to the indications known to exist in the UTS. Axial indications detected in SGB are characteristic of ODSCC.

RAI 3

Discuss whether rotating probe inspections detected indications that were not detected by the bobbin coil probe, and if so, the implications of this finding.

Response:

There were two volumetric indications detected at the LTS expansion area in 1R18. It is not expected that the bobbin probe would detect these indications since the probe is not qualified for detection of degradation in the expansion area.

RAI 4

Discuss if the bobbin coil technique used in the lower tubesheet region meets the industry standards (e.g., Appendix H). If this technique does not meet the industry standards, discuss your future plans for qualifying the inspection technique to industry standards. If this technique does not meet industry standards and you have no plans to qualify the technique to industry standards, provide the acceptance standard, specification or criteria you are using and the technical basis for this standard, specification, or criteria to ensure the adequacy of this technique.

Response:

The bobbin probe techniques used in the LTS and sludge pile at ANO-1 are 96008.1 and 96009.1 for the detection of ODSCC and IGA. Qualification 96009.1 has been extended to the LTS based on the results of a documented site-validation of the technique. The techniques have been site-validated in accordance with Reference 1 and meet industry standards for examinations performed in the LTS. Since these techniques are not qualified for the detection of indications at dented locations and to address concern that the bobbin POD may be degraded at the LTS crevice, ANO-1 has performed a +Point examination to detect the onset of degradation.

RAI 5

If as a result of your response to the questions above, you conclude that full compliance with the TS in conjunction with Criteria IX, XI and XVI of 10 CFR Part 50, Appendix B, requires corrective actions, please discuss your proposed corrective actions as requested by GL 2004-01, Requested Information #2. In addition, if the inspections are not being performed consistent with the NRC position on the requirements, please submit a safety assessment as requested in GL 2004-01, Requested Information #3.

Response:

Based on the discussions above, ANO is in compliance with the TS and the NRC position.

REFERENCES:

1. EPRI Report, *PWR Steam Generator Examination Guidelines*, Revision 6, 1003138, October 2002
2. *ANO Unit 1 1R18 Eddy Current Examination Technique Site Equiv*alency, ER-ANO-2004-0046-00

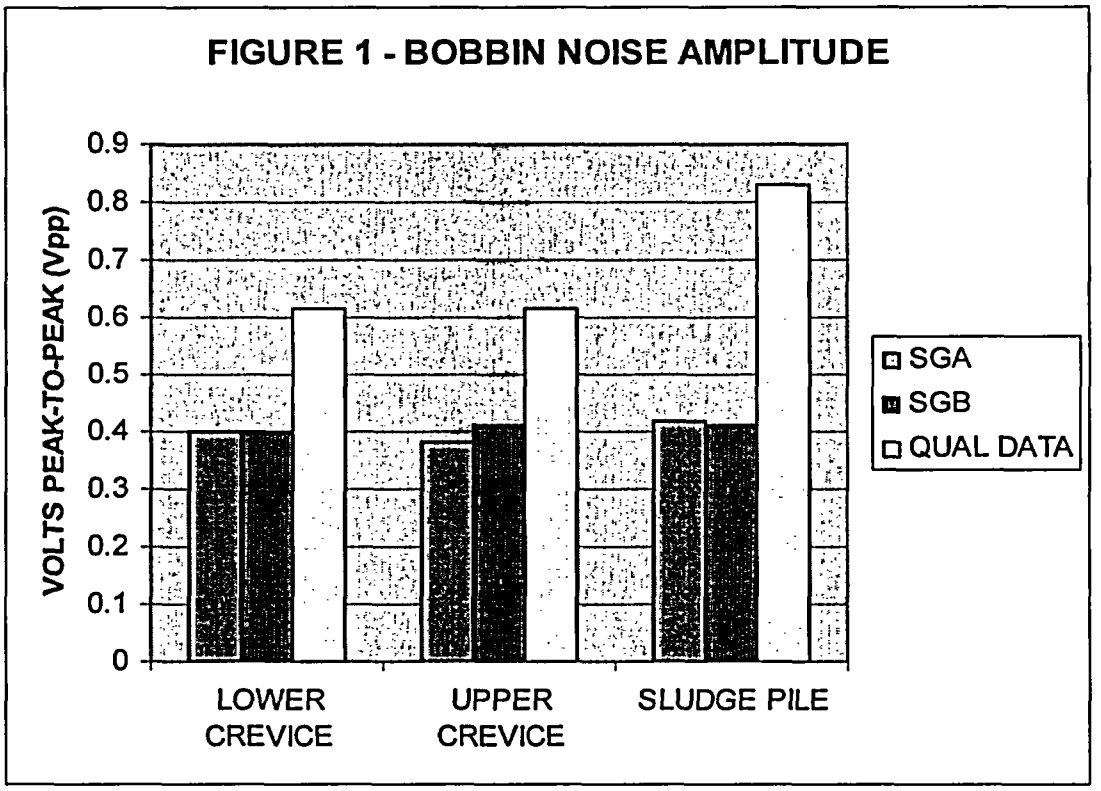
FIGURE 1 - BOBBIN NOISE AMPLITUDE
VOLTS PEAK-TO-PEAK (Vpp)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
LOWER CREVICE
UPPER CREVICE
SLUDGE PILE
SGA
SGB
QUAL DATA

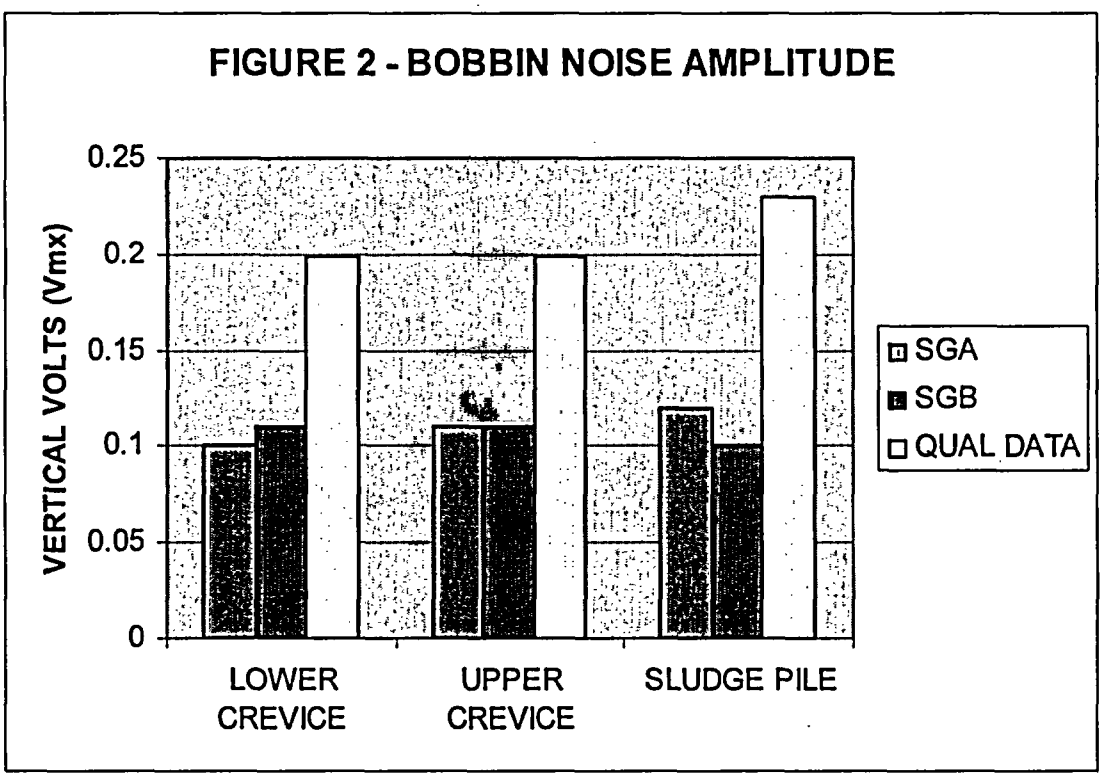
FIGURE 2 - BOBBIN NOISE AMPLITUDE
VERTICAL VOLTS (Vmx)
0.25
0.2
0.15
0.1
0.05
0
LOWER CREVICE
UPPER CREVICE
SLUDGE PILE
SGA
SGB
QUAL DATA

Table 1
Lower Tubesheet Inspection Scope

Outage	Date	Bobbin Scope (%)		RPC Scope (%)		
		SGA	SGB	SGA	SGB	Extent
1R14	3/98	100	100	*	*	*
1R15	9/99	100	100	20	20	+2/-16
1R16	3/01	100	100	20	100	+4/-8
1R17	10/02	100	100	20	20	+4/-4
1R18	4/04	100	100	21	21	+4/-4

*Only a sample of the dents and bobbin indications at the LTS were inspected during this outage.

Table 2
Steam Generator A Lower Tubesheet Indications

OUTAGE	SG	ROW	TUBE	BOBBIN					RPC								DM
				VOLTS	DEG	IND	LOC	INCH	VOLTS	DEG	IND	CIRC	AXIAL	DEPTH	LOC	INCH	
1R14	A	75	69	0.68	135	NQI	LTS	0.63	0.24	140	SVI	0.18	0.16	1	LTS	0.66	IGA
1R14	A	76	73	1.21	127	NQI	LTS	1.68	0.19	108	SVI	0.26	0.12	1	LTS	1.65	IGA
1R14	A	77	70	1.33	125	NQI	LTS	0.85	0.08	64	SVI	0.28	0.13	62	LTS	0.9	IGA
1R14	A	81	75	0.72	108	NQI	LTS	0.81	0.83	141	SVI	0.28	0.18	23	LTS	0.57	IGA
1R15	A	47	101	0.31	57	NQI	LTE	22	0.25	107	SVI	0.12	0.12	0	LTS	-1.77	IGA
1R18	A	90	76						0.83	5	SVI	0.28	0.22	11	LTE	0.59	IGA/SCC
1R18	A	99	57						0.47	5	SVI	0.14	0.14	10	LTE	1.54	IGA/SCC

Table 3
Steam Generator B Lower Tubesheet Indications

OUTAGE	SG	ROW	TUBE	BOBBIN					RPC								DM
				VOLTS	DEG	IND	LOC	INCH	VOLTS	DEG	IND	CIRC (IN)	AXIAL (IN)	DEPTH (%TW)	LOC	INCH	
1R14	B	29	44	0.37	100	NQI	LTS	0.25	0.47	72	SAI		0.16	15	LTS	0.27	SCC
1R16	B	68	69	0.34	91	NQI	LTE	22.1	0.38	81	SAI		0.15	51	LTS	-1.91	SCC
1R17	B	82	76	0.65	81	MBM	LTS	1.98	0.25	104	SVI	0.36	0.32	0	LTS	1.93	IGA

DM – Damage mechanism
IGA – Intergranular attack
LTE – Lower tube end
LTS – Lower tubesheet
MBM – Mill burnish mark
NQI – Non-Quantifiable Indication
RPC – Rotating pancake coil
SAI – Single Axial Indication
SCC – Stress Corrosion Cracking
SVI – Single Volumetric Indication