From: "Robert C Douglas" <rcdougla@duke-energy.com>
To: <lno@nrc.gov>
Date: 5/19/03 11:49AM
Subject: Discussion Points for SG Tube Inspection Call

The attached PDF file provides Duke's handout for the call.

Bob Douglas
864-885-3073 - Desk
864-885-3401 - FAX

(See attached file: SFX4DC.pdf)

CC: "Larry E Nicholson" <lenicholson@duke-energy.com>

Enclosure 2

OCONEE UNIT 3

STEAM GENERATOR TUBE INSPECTION DISCUSSION POINTS

1. Discuss whether any primary to secondary leakage existed in this unit prior to shutdown.
   Response: **Primary to secondary leakage at time of shutdown was less than 2 gpd and had not changed during the cycle.**

2. Discuss the results of secondary side pressure tests.
   Response: **No secondary side pressure tests were conducted.**

3. For each steam generator, provide a description of areas examined, including the expansion criteria utilized and type of probe used in each area. Also, be prepared to discuss your inspection of the tube within the tubesheet, particularly the portion of the tube below the expansion/transition region.
   Response: **Scope of the inspection is shown on the attachment A. The expanded region of the tube is inspected with qualified Plus-Pt from the roll transition to the tube end.**

4. Discuss any exceptions taken to the industry guidelines.
   Response: **One exception to SG Examination Guidelines, Rev 5 concerning the volumetric inspection of I-690 rolled plugs. ONS-3 S/Gs are scheduled for replacement at EOC-21 in fall of 2004 and I-690 rolled plugs will not exceed 10.2 EFPY. I-690 rolled plugs have been inservice for significantly longer periods with no degradation observed. Visual exams have been completed for all plugs with no indications of leakage or movement.**

5. Provide a summary of the number of indications identified to-date of each degradation mode and steam generator tube location (e.g., tube support plate, top-of-tubesheet, etc.). Also provide information, such as voltages, and estimated depths and lengths of the most significant indications.

Response: **Below is the number of tubes plugged for categories shown:**

	3A OTSG	3B OTSG
Capture Locations	**19**	**9**
Tube Defects		
IGA	**13**	**41**
Wear	**0**	**0**
Freespan SCC/IGA	**330**	**100**
Roll Transition PWSCC	**15**	**32**
Impingement	**22**	**6**
Dent SCC	**1**	**1**
Misc.	**10**	**6**
Dent/Vol Combination	**4**	**7**
Sleeve	**1**	**1**
Total Plugged 3EOC-20	**415**	**203**
Total Cumulative Plugged	**1580**	**1018**
	10.2%	**6.6%**

Details of the depth, length and voltage will be provided in future report of inspection findings.

6. Describe repair/plugging plans for the SG tubes that meet the repair/plugging criteria.
Response: **All tubes meeting the plugging criteria are being repaired by plugging with exception of indications in the original rolled transition in upper tube sheet which can be repaired with reroll repair approved for ONS. Reroll repairs have been performed as follows:**

S/G 3A: 19 tubes reroll repaired that were left in service
S/G 3B: 27 tubes reroll repaired that were left in service

7. Discuss the previous history of SG tube inspection results, including any "look backs" performed. Specifically for significant indications or indications where look backs are used in support of dispositioning (e.g., manufacturing burnish marks).
Response: **All bobbin indications will have Plus-Pt exam and will be dispositioned based on this result. Previous data is not used directly in dispositioning process for ONS units.**

8. Discuss, in general, new inspection findings (e.g., degradation mode or location of degradation new to this unit).
Response: **No new degradation mechanism has been seen. Current active mechanisms for ONS-3:**
   a. **Tube Support Plate Fretting Wear (None Plugged this outage)**
   b. **Impingement**
   c. **ODIGA in tubesheet crevice and freespan**
   d. **PWSCC in upper tubesheet rolls, dents, and plugs**
   e. **ODSCC in dents and freespans above the 7th TSP**
   f. **Sleeve IGA/SCC in expansion transitions**

9. Discuss your use or reliance on inspection probes (eddy current or ultrasonic) other than bobbin and typical rotating probes, if applicable.
Response: **Standard bobbin and plus point probes were used as listed in Attachment 1.**

10. Describe in-situ pressure test plans and results, if applicable and available, including tube selection criteria.
Response: **Following is the number of tubes identified for in-situ testing. All testing followed EPRI guidelines for hold times. Maximum pressure was approx. 4300 psig, which represents 3 times normal delta-P plus adjustments for testing.**

	3A OTSG	3B OTSG
Number Tested	12 (axial indications)	1 (axial indications)
Results	No Leakage	No Leakage

11. Describe tube pull plans and preliminary results, if applicable and available; include tube selection criteria.
Response: **No plans for pulling a tube were identified.**

12. Discuss the assessment of tube integrity for the previous operating cycle (i.e., condition monitoring).
Response: **No significant primary to secondary leakage existed or occurred during the past operating cycle. Results of in-situ testing indicate that no tubes exceeded structural acceptance criteria at the end of this cycle.**

13. Provide the schedule for steam generator-related activities during the remainder of the current outage.
Response: **All eddy current inspections are complete, in-situ pressure tests are completed and tube plugging is in progress.**

14. Once Through Steam Generators - if you have Babcock and Wilcox (B&W) welded plugs installed in the steam generators, be prepared to discuss the actions taken in response to Framatome's notification of the effect of tubesheet hole dilation on the service life of B&W welded plugs.

Response: **Framatome ANP analyzed the allowed heatup/cooldown cycles for each plug type. It was verified that the service life limits would not be exceeded prior to SG replacements, which are scheduled for the next refueling on each unit. All repair products used, except those listed below, are fully qualified for original 40 year operating life.**

Plug Type	# Plugs-ONS3	Allowed Cycles	Current Cycles
OEM Welded Plugs	14	205	87
Remote Welded Plugs	136	33	11
Taper Welded	43	205	67

15. Once Through Steam Generators - describe your inspection/plugging plans with respect to the industry identified severed tube issue (NRC Information Notice (IN) 2002-02 and IN 2002-02, Supplement 1).

Response: **The severed tube issue was addressed for ONS-3 during the previous outage EOC-19. As a result of additional information on tubes plugged with OEM welded plugs, the tubes below are being captured by surrounding with plugged/stabilized tubes. These tubes had welded plugs installed pre-service with the tube potentially violated and not stabilized.**

S/G 3A: 4 tubes
S/G 3B: 3 tubes

16. If steam generators contain thermally treated tubing (Alloy 600 or 690), discuss actions taken (if any) based on Seabrook's recent findings (Reference Information Notice (IN) 2002-21)?

Response: **All the tubing on ONS-3 is I-600 sensitized tubing in straight lengths and would not be subject to degradation similar to Seabrook.**

Attachment A: OCONEE NUCLEAR STATION STEAM GENERATOR INSPECTION AND MAINTENANCE WORKSCOPE
Unit: 3 EOC: 20

	ACTIVITY	Quantities				BASIS / COMMENTS	PROBES
		S/G A		S/G B			
		H/L	C/L	H/L	C/L		
1.0	ECT Tube Examinations						
1.1	Bobbin (full length)	14,294		14,716		100% in-service tubes	0.510 dia Mid-frequency
1.2	RPC Special Interest	2,712		1,773		All bobbin indications	0.460, and 0.400
						All dings .	diameter Plus-Pt
1.3	RPC Lane & Wedge	222		212		100% tubes surrounding the sleeved	0.460 dia. Plus-Pt.
						region 2 rows around	
1.4	RPC Rolls – UTS	14,026		14,475		100% in service tubes less sleeved	0.460 dia. Plus-Pt.
1.5	RPC Rolls – at Manufacture		0		0	100% Re-rolled in Manufacture	0.460 dia. Plus-Pt.
1.6	RPC Re-roll UTS	135		260		100 % of re-rolled locations	0.460 dia. Plus-Pt.
1.7	RPC Kidney Area		2070		2132	100 % from top of tubesheet plus 2 inch Minus 12 inches below the LTS	

2.0	**Plug & Sleeve Exams**						
2.1	RPC Rolled Plugs - I 600	15	66	11	44	I-600 100% H/L and C/L	
	RPC Rolled Plugs - I 690	-	-	-	-	I 690 see exception	
2.2	RPC Thimble Plugs	-	29	-	-	40% of total in 3A	
2.3	Bobbin – Sleeves	268		241		100% in-service sleeves	0.410 dia. bobbin
2.4	RPC – Sleeves	268		241		100% in-service sleeves at roll joints	0.400 dia. Plus-Pt.
3.0	**ECT Testing of Repairs**						
3.1	Current Outage Re-rolls	22		28		100% Bobbin profilometry and RPC	
3.2	Current Outage Sleeves	0		0		No sleeves installed	
4.0	**Visual Exams**						
4.1	Rolled Plugs	1088	1097	748	756	100% for leakage and damage	
4.2	Welded Plugs	53	46	49	45	100% for leakage and damage	
4.3	Sleeve Plugs	24	N/A	18	N/A	100% for indications of leakage	
4.4	Ribbed Plugs	0	22	0	14	100% for indications of leakage	
4.5	Explosive Plugs	N/A	N/A	N/A	N/A	100% for indications of leakage	
4.6	Thimble Plugs						
	TOTAL plug visuals	1165	1165	815	815		

4.7	Internals Inspection					BWOG Internals Degradation Assessment this RFO	
4.8	Internal FDW header insp.					Not required for Unit 3 this outage	
4.9	Tube/TSP/TS Inspection					None	
4.10	Skewed Tube Verification					Complete in previous outage	
5.0	**Plug Repairs**						
5.1	Ribbed Plugs	N/A	N/A	N/A	N/A		
5.2	Rolled Plug removal	0	0	0	1	I-600 based on ECT	
5.3	Welded Plugs	0	0	0	0	None Required	
5.4	Explosive Plugs	0	0	0	0	None Required	
5.5	Thimble Plugs	0	0	0	0	None Required	
6.0	**Tube Repairs**						
6.1	Rolled Plugs						
	new	415	415	203	203	Includes tubes to 'capture'	
	Replacements	0	0	0	1		
	sleeve plugs	5	N/A	3	N/A		
	Stabilizers	35	4	20	2		
6.2	Re-Rolls	22		28			
6.3	Sleeves	-		-		None Installed	

6.4	Tube End Repair					As req'd for plug/stabilizer insertion & in-situ	
7.0	Other Tests (non-ECT)						
7.1							
	At shutdown					None due to leakage < 2gpd	
	Prior to start-up					None required	
7.2	In-situ Pressure Test	12		1		All axial indications, no leakage	
8.0	Primary Maint/PM						
8.1	Manways-removal/reinstall.	Y	Y	Y	Y		
8.2	Nozzle dams-installation	-	Y	-	Y		
9.0	Secondary - Maint./PM	N	N	N	N		
9.1	Sludge Lancing	N	N	N	N		
9.2	Internals Inspection	N	N	N	N		
9.3	FOSAR	N	N	N	N		
9.4	FDW Riser leak repairs	N	N	N	N		

From: "Robert C Douglas" <rcdougla@duke-energy.com>
To: <lno@nrc.gov>
Date: 5/20/03 2:40PM
Subject: NRC question - ONS-3 steam generators

The info requested by Emmett in our 5/19 call is provided below.

Bob Douglas
864-885-3073 - Desk
864-885-3401 - FAX
----- Forwarded by Robert C Douglas/Gen/DukePower on 05/20/2003 02:30 PM

James H Batton
05/20/2003 02:17 PM
To: Robert C Douglas/Gen/DukePower@DukePower, William M Sample/Gen/DukePower@DukePower
cc: Judy E Smith/Gen/DukePower@DukePower
Subject: NRC question - ONS-3 steam generators

Bob,
Below is Blake Lowery's response to Emmett Murphy's 5/19 conference call question regarding the circ indication in the Lower Tubesheet of 3A steam generator tube 132-81.

Please forward this response to Emmett.

I will provide a copy of this response to Jerry Blake, Region II, who is currently on site.

Jim Batton
Phone: 864 885-3893
----- Forwarded by James H Batton/Gen/DukePower on 05/20/2003 01:52 PM

Bryce B Lowery Jr
05/20/2003 01:40 PM
To: James H Batton/Gen/DukePower, William M Sample/Gen/DukePower
cc:
Subject: NRC question

The circ indication was in an 11 volt dent. The indication PDA is 35% with a load carrying ability in excess of 4000 lbs. This is well above the worst case MSLB load of 2870 lbs. If you assume it to leak, the MSLB leakage is calculated to be well below the maximum allowable of 1 gpm.

From: "Robert C Douglas" <rcdougla@duke-energy.com>
To: "Leonard Olshan" <LNO@nrc.gov>
Date: 5/22/03 1:18PM
Subject: Re: Fwd: Revised followup

The attached PDF file below provides our response.

Bob Douglas
864-885-3073 - Desk
864-885-3401 - FAX

(See attached file: SFX5AC.pdf)

"Leonard Olshan" <LNO@nrc.gov> 05/21/2003 10:41 AM

To: <rcdougla@duke-energy.com>
cc:
Subject: Fwd: Revised followup

----- Message from "Emmett Murphy" <ELM@nrc.gov> on Wed, 21 May 2003 10:40:32 -0400 -----

To: "Leonard Olshan" <LNO.owf4_po.OWFN_DO@nrc.gov>

Subject: Revised followup

Lenny, I've reconsidered. My follow up questions for Oconee are limited to the following:

I would like to get a little more detail on measured depth and length of the circumferential crack in tube 132-81 and a brief explanation as to how they determined the axial load capacity at the cracked cross section.

NRC Question re ECT Indication in ONS-3 SG A:

[Provide] a little more detail on measured depth and length of the circumferential crack in tube 132-81 and a brief explanation as to how they determined the axial load capacity at the cracked cross section.

Duke Response:

The indication measured 0.96 inches in circumferential extent with a range of depths from 19% to 98% throughwall.

The following is a summary of the axial force equations from the EPRI Flaw Handbook.

The total axial force that can be resisted by a straight tube in an OTSG with circumferential degradation is given by the following equation,

$$F_{Ax} = (S_y + S_u)\pi R_m t F_N \ ,$$

where F_N is given by the smaller of,

$$F_N = 1.02514 - 2.13295\ \xi + 2.241114\ \xi^2 - 0.90909\ \xi^3,$$

or,

$$F_N = 1.2128 \left(\frac{R_m}{R_i}\right)^2 (1-\xi), \quad \text{where} \quad \xi = \frac{PDA}{100}.$$

When tube rotation is effectively prevented, as for circumferential cracking well within the tubesheet crevice, the latter equation for F_N is appropriate. When tube rotation is limited but not effectively prevented by the presence of lateral tube supports, as for circumferential cracking in the freespan, the first equation for F_N includes a limited bending effect in addition to direct tensile loading. Both equations are based on experimental data for steam generator tubing with circumferential EDM slots.