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W3F1-2006-0066

December 27, 2006

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

SUBJECT: Response to Request for Additional Information (RAI)
Regarding RF13 Steam Generator Tube Inspections
Waterford Steam Electric Station, Unit 3
Docket No. 50-382

REFERENCES:
1. Entergy letter dated May 24, 2005 "Combined C-3 and 15-Day Special Report SR-05-001-00 on the 13th Refueling Outage Steam Generator Tube Inservice Inspection" (W3F1-2005-0037))
2. Entergy letter dated May 17, 2006 "12-Month Special Report SR-06-001-00 on the 13th Refueling Steam Generator Tube Inservice Inspection" (W3F1-2006-0024)
3. NRC letter dated October 11, 2006, Request for Additional Information Regarding Steam Generator Tube Inspections

Dear Sir or Madam:

In Reference 1, Entergy Operations, Inc. (Entergy) provided the number of tubes plugged in each Steam Generator (S/G) in refueling outage 13, as specified by Technical Specification (TS) 4.4.4.5.a, within 15 days following completion of S/G tube Inservice Inspection (ISI). In Reference 2, Entergy provided the complete eddy current test results for refueling outage 13, as specified by TS 4.4.4.5.b, within 12 months following the inspection. The report contained the number and extent of tubes inspected, the location and percent of wall-thickness penetration for each indication of an imperfection, and the identification of tubes plugged or sleeved.

On October 11, 2006, Entergy received an NRC request for additional information to support the review of the 13th Refueling Outage Steam Generator Tube Inservice Inspection. On December 8, 2006, Entergy and a member of your Staff held a conference call to discuss the status of the RAI response and Waterford-3's need to revise the reply date. A two week extension to the original reply date of December 11, 2006 was granted. Entergy's response is contained in Attachment 1.

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There are no new commitments contained in this letter. If you have any questions or require additional information, please contact Ron Williams at 504-739-6255.

Sincerely,

RJM/RLW

Attachment:

1. Response to Requests for Additional Information (RAI) Regarding RF13 Steam Generator Tube Inspections

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Attachment 1

W3F1-2006-0066

Response to Request for Additional Information (RAI)
Regarding RF13 Steam Generator Tube Inspections

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RAI 1 - On page 3 of the May 24, 2005, report and page 3 of the May 17, 2006, report, you indicated that possible loose parts indications were identified during the inspection. Please discuss the scope and results of the foreign object search and retrieval on each steam generator (SG). If any loose parts were identified, discuss whether the loose parts were removed. If the parts were not removed or the locations were not visually inspected, please discuss the results of any evaluations performed to ensure these parts (or suspected parts) would not result in a loss of tube integrity for the period of time between inspections.

Entergy Response:

During RF13 (April 2005), the as found condition of the SG thermal liner resulted in the initiation of Condition Report CR-WF3-2005-01762. A second Condition Report, CR-WF3-2005-01861, was initiated based on concerns from eddy current examination that identified potential loose parts (PLPs). There were 41 PLPs identified in SG 31 and 17 PLPs in SG 32 when the CR was written.

An evaluation of the loose parts was performed during RF13. The evaluation, contained in CR-WF3-2005-01861, concluded that 12 tubes in SG 31 and 3 tubes in SG 32 should be plugged / stabilized as a preventive measure against potential wear. Waterford 3 implemented a contingency Foreign Object Search and Retrieval (FOSAR) inspection on SG 31 because of concerns of potential pieces from the degraded condition of the FW Thermal Liner, previously identified in CR-WF3-2005-01762. The FOSAR inspection revealed a few minor sized objects (e.g. small diameter wire) which were of low concern due to their small cross section relative to flow. One object, a mechanical SG plug called a "Pop-a-Plug," was found in SG 31 Blowdown lane, which was not previously identified as a PLP by eddy current examination. The Pop-a-Plug was removed. This condition was also entered into the site's Corrective Action Program as CR-WF3-2005-01958. The potential pieces from the degraded condition of the FW Thermal Liner were not seen during the FOSAR inspection and therefore concluded not to exist.

Based on the FOSAR results from SG 31, additional actions to perform a FOSAR on SG 32 were considered unnecessary. This plant management decision was based on a future secondary side inspection scheduled for RF14 (Fall 2006) along with sludge lancing activities that were considered a normal activity associated with the inspection. The decision not to inspect SG 32 was later determined to be a deviation to Section 3.8 of the NEI 97-06 Guideline Requirements.

Section 3.8 specifies that a secondary side visual examination shall be performed each time the secondary side of the SG is opened for maintenance access. Condition Report CR-WF3-2006-0933 was entered into the plant's Corrective Action Program and a deviation was processed in accordance with the requirements of the EPRI SG Administrative Procedures and Entergy Procedures.

The following Tables 1 and 2 for SG 31 and 32, respectively, list the potential loose parts based on eddy current results.

TABLE 1
WATERFORD 3 SG 31 RF13 POTENTIAL LOOSE PART SUMMARY

PLP COUNT	SG	ROW	COL	VOLTS	LOCATION	POSITION	WEAR (YES/NO)	FLOW (HIGH/LOW)	FINAL DISPOSITION
1	31	1	27	0.85	TSH	0.22	No	High	Inservice
2	31	1	29	0.89	TSC	0.08	No	High	Inservice
3	31	2	28	0.61	TSH	0.23	No	High	Inservice
4	31	12	116	0.41	TSH	0.14	No	Low	Inservice
5	31	14	40	0.44	TSH	0.26	No	Low	Inservice
6	31	14	158	1.10	TSH	0.13	No	Low	Inservice
7	31	15	159	0.83	TSH	0.21	No	Low	Inservice
8	31	20	150	0.69	TSH	0.12	No	Low	Inservice
9	31	33	5	0.96	TSH	0.21	No	High	Inservice
10	31	38	112	1.87	TSC	0.63	No	High	Inservice
11	31	41	149	0.84	TSH	0.19	No	Low	Inservice
12	31	45	141	1.02	TSH	0.42	No	Low	Inservice
13	31	47	73	0.62	TSH	0.29	No	Low	Plugged
14	31	51	139	0.69	TSH	0.12	No	Low	Inservice
15	31	55	45	0.91	TSH	0.24	No	Low	Inservice
16	31	60	98	0.67	TSH	0.16	No	Low	Inservice
17	31	70	148	1.26	TSH	0.30	No	Low	Inservice
18	31	74	154	0.75	TSH	0.38	No	Low	Inservice
19	31	79	123	0.18	TSH	0.35	No	Low	Inservice
20	31	83	117	0.99	TSH	0.20	No	Low	Inservice
21	31	87	121	0.95	TSH	0.16	No	Low	Inservice
22	31	90	124	1.00	TSH	0.89	No	Low	Inservice
23	31	91	117	1.38	TSH	0.04	No	Low	Inservice
24	31	92	152	0.86	TSH	0.37	No	Low	Inservice
25	31	94	152	1.12	TSH	0.16	No	Low	Inservice
26	31	99	31	0.71	TSH	0.10	No	High	Inservice
27	31	100	30	0.39	TSH	0.11	No	High	Inservice
28	31	104	128	1.18	TSH	0.31	No	Low	Inservice
29	31	104	130	0.80	TSH	0.14	No	Low	Inservice
30	31	116	106	0.76	TSH	0.08	No	Low	Inservice
31	31	119	67	0.66	TSH	0.21	No	Low	Inservice
32	31	125	111	0.58	TSH	0.62	No	Low	Inservice
33	31	126	122	0.53	TSH	0.66	No	High	Plugged/ Stabilized
34	31	127	121	1.17	TSH	0.62	No	High	Plugged/ Stabilized

35	31	128	122	0.38	TSH	0.40	No	High	Plugged/ Stabilized
36	31	136	112	0.85	TSH	0.36	No	High	Plugged/ Stabilized
37	31	137	111	0.67	TSH	1.11	No	High	Plugged/ Stabilized
38	31	138	110	0.89	TSH	0.30	No	High	Plugged/ Stabilized
39	31	138	112	1.12	TSH	0.12	No	High	Plugged/ Stabilized
40	31	138	112	1.10	TSH	0.64	No	High	Plugged/ Stabilized
41	31	139	111	0.83	TSH	0.90	No	High	Plugged/ Stabilized
42	31	139	113	1.01	TSH	0.12	No	High	Plugged/ Stabilized
43	31	139	113	0.95	TSH	0.58	No	High	Plugged/ Stabilized

TABLE 2
WATERFORD 3 SG 32 RF13 POTENTIAL LOOSE PART SUMMARY

PLP COUNT	SG	ROW	COL	VOLTS	LOCATION	POSITION	WEAR (YES/NO)	FLOW (HIGH/LOW)	FINAL DISPOSITION
1	32	3	115	0.76	TSH	0.36	No	Low	Inservice
2	32	7	59	1.46	TSH	0.43	No	Low	Inservice
3	32	19	121	0.24	TSH	0.24	No	Low	Inservice
4	32	30	36	0.86	TSH	0.17	No	Low	Inservice
5	32	32	36	0.73	TSH	0.12	No	Low	Inservice
6	32	71	149	1.63	TSH	0.11	No	Low	Inservice
7	32	73	115	0.62	TSH	0.30	No	Low	Inservice
8	32	82	94	0.61	TSH	0.68	No	Low	Inservice
9	32	88	86	1.21	TSH	0.34	No	Low	Inservice
10	32	91	89	1.30	TSH	0.52	No	Low	Inservice
11	32	107	111	0.74	TSH	0.28	No	Low	Inservice
12	32	109	79	1.13	TSH	0.22	No	Low	Inservice
13	32	111	93	0.73	TSH	0.29	No	Low	Inservice
14	32	112	114	0.68	TSH	0.26	No	Low	Inservice
15	32	113	71	0.67	TSH	0.16	No	Low	Inservice
16	32	127	131	1.16	TSH	10.05	No	High	Plugged/ Stabilized
17	32	128	130	1.13	TSH	10.94	Yes	High	Plugged/ Stabilized
18	32	142	74	0.89	TSH	0.33	No	High	Plugged/ Stabilized

RAI 2 - On page 2 of the May 24, 2005, report, Table 2.1 states that you expanded the inspection of wear scars for SG 31, but not for SG 32. Then, on page 2 of the May 17, 2006, report, Table 3.1 states that you did not expand the inspection of wear scars for SG 31, but you did for SG 32. Please clarify this discrepancy.

Entergy Response:

There is an error in reporting the expansion in the May 2005 report. The May 2006 report is correct, expansion was in SG32.

RAI 3 - On page 2 of the May 17, 2006, report, you indicated in Table 3.1 that you identified 188 new wear scars in SG 31 and 214 new wear scars in SG 32. Please discuss the cause for the apparent increase in the number of new wear scars.

Entergy Response:

Waterford-3 has chemically cleaned Steam Generators in RF10 and RF12. One suspected cause of increased wear is the possibility of more tube bundle movement due to the removal of corrosion product from throughout the bundle and a thickness reduction of the structures. Waterford-3 Steam Generators have carbon steel supports which were susceptible to metal removal during the chemical cleaning.

During Cycle 13 there were no plant reactor trips and the turbine was only removed from service once. It is unlikely that any particular transient was the cause of the increased wear.

RAI 4 - On page 3 of the May 24, 2005, letter, you indicated in Table 2.2 that four volumetric indications were detected in the cold leg of SG 31 and one volumetric indication was detected in the hot leg of SG 32. Please discuss the nature, cause, and severity of these indications.

Entergy Response

Table 2.2 lists all pluggable indications. Some tubes contain more than one indication.

The four volumetric indications on SG 31 cold leg are adjacent to each other: R1 C171, R3 C171, R2 C172 and R2 C172. The previous inspection results (RF12) at each of these locations were all NDD. The location is adjacent to the blowdown lane and near the periphery of the tube bundle. The flaw could have been caused by a loose part which was no longer present when visually examined.

The one hot leg (HL) volumetric indication on SG 32 is associated with a loose part. R128 C130 was stabilized and plugged. This volumetric indication was specifically evaluated and documented in the station's Corrective Action Program, condition report CR-WF3-2005-01861.

The condition report evaluated the HL indication associated with a loose part as follows:

> *Only one PLP identified in RF13 has caused wear. The loose part was identified on ECT inspection of tube 128-130. The PLP indication was located approximately 10 inches above the hot leg top of tubesheet in SG32.*
>
> *The potential loose part associated with PLP indication called on 128-130 is acceptable to remain in service because:*
>
> 1. *The loose part is lodged between two tubes and has been so lodged for at least 1 cycle. History review of the tube indicates the tube had a possible loose part during the RF12 inspection. Wear caused by the part during the last cycle was classified as very small. Thus, it is fully expected that the potential loose part is lodged in a very stable manner within the two tubes. The wear is not expected to increase significantly over the course of another cycle nor will it move during the next cycle.*
>
> 2. *In the unlikely event the loose part should move, the potential for the loose part to cause a leak in a tube is small because the moved loose part will have to start the wear process over and the chances developing into a deep enough wear scar to cause a leak in a relocated spot in less than a cycle is small.*
>
> 3. *Tube 128-130 was preventatively plugged and stabilized.*

RAI 5 - On page 4 and page 7 of the May 24, 2005, report, you indicated in Tables 3.1.1 and 3.3.1 that there has been a reduction in the number of detected indications of circumferential and axial cracking at the top of the tube sheet when compared to past outages. Please discuss any insights you have concerning the "trend." In addition, please discuss the reduction in the number of free-span indications. Include in your response a discussion on the noise levels associated with the SG eddy current data.

Entergy Response

Waterford 3 has completed 100% HL Top of Tubesheet (TTS) examinations since RF06 (1994). The inspection depth has changed: RF8 +2/-2; RF9 +2/-2; RF10 +2/ -5; RF11 +2 / -5; RF12 +3 / -8; and RF13 +3 / -11. The chemical cleaning in RF10 (2000) created interfering signals from copper which remains a concern and was the driving issue for conducting a second chemical cleaning in RF12 (2003).

The varying inspection depth should cause additional tube flaw identification. The assumption being that there is a population of tubes which have not been examined with the rotating pancake probe (RPC).

Insights

RF12 and RF13 were much improved over RF10 and RF11 with respect to interfering signals from copper. SG 31 is the leading SG for flaw discovery; this is a normal phenomenon for PWRs though there is no specific explanation of why SG 31 would lead.

The RF10 number of axial indications (22 in each SG) was probably influenced by the interfering copper signals which may have been overcome by conservative eddy current calls.

Bobbin Freespan Indications

Extensive history reviews in the freespan was performed during the inspection by the resolution analysts. All freespan indications reported by Bobbin were reviewed by both a Primary and a Secondary resolution analyst at least back to 1994 RFO6. If the indication had not changed from history, it was reported as DFH (Differential Freespan History Review) or as ADH (Absolute Freespan History Review). Those indications which either were new or showed a change from RFO6 1994 historical data were reported as a DFI (Differential Freespan Indication) and +Pt RPC tested. A total of 22 indications in SG 31 and 12 in SG 32 were reported as a DFI in freespan and none showed degradation when tested with +Pt RPC. The DFI calls were left in the database for future tracking. The result of the freespan bobbin indication historical review is as follows:

	SG 31	SG 32
DFH (Freespan Differential History Reviewed)	911	796
ADH (Freespan Absolute History Reviewed)	1	3

Eddy Current Noise

During the inspection eddy current data quality was continuously monitored throughout the data acquisition and analysis processes. All of the data quality requirements in EPRI PWR SG Examination Guidelines, Rev. 6 required to be implemented was addressed either by the data quality monitoring software, acquisition operators, data quality analyst or data analysts. Prior to the start of the outage a comparison of RF12 data with the EPRI qualified techniques was performed as part of the site validation process. This comparison showed that the data from RF12 was as good as or better than the data used in the EPRI qualification data sets. During the inspection, any tube that did not meet the data quality standards was given the "Retest Bad Data" (RBD) analysis code signifying that the tube was required to be retested.

In preparation for the Waterford-3 RF14 inspection, a comparison was performed between the RF13 data and the EPRI qualified techniques. This comparison, again, showed that the data collected in RF13 was as good as or better than the data used in the EPRI qualification data sets. The most challenging degradation mechanism in the Waterford-3 steam generators is ODSCC located in eggcrate supports using the bobbin probe for detection. For this region of the Waterford-3 steam generators, the average noise was measured as 0.90 Vpp in SG 31 and 0.95 Vpp in SG 32. The maximum noise measurement was 1.93 Vpp in SG 31 and 2.11 Vpp in SG 32. This compares to an average noise measurement of 1.33 Vpp and a maximum noise measurement of 3.33 Vpp for EPRI qualification 96008.1 for detection of ODSCC at non-dented eggcrate supports. For rotating probe techniques, using the +Point coil, noise measurements were compared in the Low Row U-Bends and at the hot leg expansion transitions. The results of this comparison are summarized in the table below:

Noise Measurement Data From:	Probe	Vpp Ave	Vpp Max
EPRI Qualification 96511.2 Low Row U-Bend			
Apex	+Point	1.09	1.62
Tangent	+Point	1.49	2.90
RF13 Low Row U-Bend (Data Combined for SG 31 and SG 32)			
Apex	+Point	1.04	1.52
Tangent	+Point	0.94	1.24
EPRI Qualification 20510.1 Expansion Transition	+Point	0.59	1.20
EPRI Qualification 20511.1 Expansion Transition	+Point	0.35	0.62
RF13 Expansion Transition			
SG 31	+Point	0.35	0.52
SG 32	+Point	0.43	0.75

The above information helps to illustrate that overall data quality in the Waterford-3 steam generators for both the bobbin and +Point probes is good. In addition, measures have been implemented to ensure that bad or noisy data is not accepted.