Entergy

Entergy Nuclear Operations, Inc.
Palisades Nuclear Plant
27780 Blue Star Memorial Highway
Covert, MI 49043

November 20, 2007 Technical Specification 5.6.8

U. S. Nuclear Regulatory Commission
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Palisades Nuclear Plant
Docket 50-255
License No. DPR-20

Response to Request for Additional Information Steam Generator Tube Assessment from the 2006 Refueling Outage (TAC No. MD5391)

Dear Sir or Madam:

By letters dated April 26, 2006 (ML061160510), April 11, 2007 (ML071090247), and June 19, 2007 (ML071780216), Nuclear Management Company, LLC (former license holder) and Entergy Nuclear Operations, Inc. (ENO) submitted information pertaining to the 2006 steam generator tube inspections at the Palisades Nuclear Plant.

By electronic mail dated September 24, 2007, the NRC requested additional information on the June 19, 2007, *Steam Generator Tube Integrity Assessment from the 2006 Refueling Outage*. Enclosure 1 provides the ENO response for the requested information.

Summary of Commitments

This letter contains no new commitments and no revision to existing commitments.

Christopher J. Schwarz
Site Vice President
Palisades Nuclear Plant

Enclosure

CC Administrator, Region III, USNRC
Project Manager, Palisades, USNRC
Resident Inspector, Palisades, USNRC

ENCLOSURE 1
RAI RESPONSE ON STEAM GENERATOR TUBE INTEGRITY ASSESSMENT FROM THE 2006 REFUELING OUTAGE

By electronic mail dated September 24, 2007, the NRC requested additional information on the Entergy Nuclear Operations, Inc. (ENO) June 19, 2007, letter *Steam Generator Tube Integrity Assessment from the 2006 Refueling Outage.* The requested information and ENO responses follow.

Nuclear Regulatory Commission (NRC) Request

1. *You indicated that the location, orientation, and measured sizes of service-induced indications were included in Tables 4A, 4B, and 4C. These tables do not appear to contain all service-induced indications, since none of the wear indications listed in Table 6 are included in these tables. Please clarify. Please provide the sizes for the wear indications in Tables 4B and 4C (since presumably they were sized and are less than 40% throughwall).*

Entergy Nuclear Operations, Inc. (ENO) Response

1. Table 6 contains all wear conditions for steam generator (SG) tubes that were plugged during the refueling outage. Tables 4B and 4C contain the information for the SG tubes that were inspected, had indications, and remained in service. Table 4B contains a listing of all indications due to tube wear at structures for SG E-50A. Table 4C contains a listing of all indications due to tube wear at structures for SG E-50B. The depth indication (size) is recorded in the "Percent" column. The "Location" column nomenclature used in Tables 4A, 4B, 4C and 6 is defined in Table 6A.

NRC Request

2. *In Table 3, you highlighted various degradation mechanisms for which you inspected. Please clarify this table. In particular, discuss whether you consider dents and dings greater than five volts susceptible to axial and circumferential primary water stress corrosion cracking [PWSCC] and outside diameter stress corrosion cracking (ODSCC).*

ENO Response

2. The first section of Table 3 identifies previously known active degradation mechanisms. The next section of Table 3 has the resolution for classification of indications for manufacturing burnish marks (MBMs) listed, and the final section of Table 3 has the potential degradation mechanisms.

   One of the potential degradation mechanisms in Table 3 is axial ODSCC at dents and dings greater than five volts (fourth row in the table). This potential

mechanism became an active degradation mechanism in the 2006 inspection. During the inspection, an axial ODSCC indication was reported at a 10.5 volt freespan ding in SG E-50A. All SG tubes with dents and dings greater than five volts were examined for axial ODSCC with +Pt^{TM} (motorized rotating pancake coil). The degradation mechanism classification and inspection scope is based on previous inspection results. Circumferential ODSCC at dents and dings was considered to be non-relevant. Conditions conducive to circumferential ODSCC development are not present in the Palisades SGs.

PWSCC for either axial or circumferential directions at dents and dings greater than five volts is considered non-relevant for Palisades SGs. The support structures are fabricated from stainless steel, and thus cannot experience denting in the classical sense (i.e., due to carbon steel corrosion resulting in magnetite formation sufficient to deform the tube). Dents in the Palisades SGs are dings which reside within the bounds of the structure after final assembly. Dings do not include tensile residual stresses on the tube inside diameter.

NRC Request

3. *Please provide the scope and results of any secondary side inspections (including foreign object search and retrieval) performed during the 2006 outage.*

ENO Response

3. Secondary inspection in the SGs included annulus and tube lane foreign object search and retrieval (FOSAR).

   Review of the FOSAR video performed on SG E-50A hot leg identified a machine screw, a loose part between tubes R97 C26 and R96 C25 and small pieces of demister wire (that came from the turbine moisture separator reheater) near the divider plate. The machine screw has been removed from the secondary side of the hot leg in the annulus.

   Retrieval attempts were unsuccessful in removing the loose part between tubes R97 C26 and R96 C25. This loose part was identified by eddy current testing in 1998. It shows no wear and has been tracked for six refueling outages with no change. There is no change in the 100, 200, or 300 kHz +Pt^{TM} channels on this part over this time. Eddy current testing will continue to track the condition of this tube each refueling outage.

   FOSAR examination was also completed in the cold leg of SG E-50A and the hot and cold legs of SG E-50B. One loose part in SG E-50B was identified near the periphery and could not be removed. The loose part was in contact with tube R131 C76, and indicated loose part wear. Three additional tubes were in contact with this loose part (tubes R128 C75, R129 C76 and R130

C75). Stabilizers were added to all four tubes, which were then plugged to remove them from service. The loose part in contact with these four tubes was identified initially by eddy current examination. Additional loose parts identified in SGs E-50A and E-50B were small sludge rocks and demister wire that left no indications of tube wear in either the hot or cold legs. Pieces of turbine moisture separator reheater demister wire that had carried over to the secondary sides of SGs E-50A and E-50B, which were too small to retrieve, were left next to the divider plate. A previous vendor evaluation of the two types of fine mesh demister wire found in the secondary side of Palisades SGs determined the demister wire would not have an adverse impact on SG tubes or overall plant operation. ENO review of this previous evaluation concluded its conclusions remain valid.

NRC Request

4. *Please clarify Table 6 and the discussion on in-situ pressure testing. Table 6 does not appear to address the results of condition monitoring, but the discussion on in-situ pressure testing does appear to address some of the results of the condition monitoring assessment. With respect to condition monitoring, please address the following [items 4a, 4b, and 4c]:*

ENO Response

4. Table 6 identifies the SG tubes that were plugged due to indications during condition monitoring inspections. Tables 4B and 4C provide the results of all the remaining tubes that were examined but not plugged. One tube in Table 6, SG E-50A, row 71, column 84, met the criteria that required an in-situ pressure test. The in-situ pressure testing for this tube is discussed following Table 6B.

NRC Request

4a. Please discuss whether a bladder was used at the location of the flaw during the in-situ pressure testing.

ENO Response

4a. No bladder was used during the in-situ pressure test.

NRC Request

4b. Please confirm that none of the structural integrity performance criteria contained within the Technical Specifications were exceeded (e.g., factor of 1.2 on combined primary loads).

ENO Response

4b The Technical Specifications section 5.5.8b.1 steam generator tube integrity structural integrity performance criterion was satisfied.

NRC Request

4c. Please confirm that you satisfied the accident-induced leakage performance criterion and please provide the leak rate you calculated during this assessment, making sure to include leakage from all sources (e.g., plugs).

ENO Response

4c. The Technical Specifications section 5.5.8b.2 steam generator tube integrity accident-induced leakage performance criterion was satisfied. Leakage did not exceed the 0.3 gallon per minute (gpm) limit. Primary-to-secondary leak rate measured using condenser off-gas (Xenon-133 or Xenon-135) was <0.001 gpm for operating cycle 19 with a slightly decreasing trend over the cycle. This leak rate trended down to $<2x10^{-5}$ gpm at the end of operating cycle 19.

No leakage was predicted for the 2006 to 2007 operating cycle due to observed SG tube degradation at the 2006 refueling outage. All plugs installed in the Palisades SGs post-operation are Westinghouse ribbed mechanical plugs, which are leak-tight for all plant conditions. The Palisades SGs also contain 308 tubes plugged pre-service in SG E-50A, and 309 tubes plugged pre-service in SG E-50B. Of the tubes plugged pre-service, one tube in SG E-50A and four tubes in SG E-50B are plugged using welded plugs, which are leak tight. The remaining tubes plugged pre-service are plugged using Combustion Engineering (C-E) roll plugs, which are also designed to be leak tight for all plant conditions.

NRC Request

5. Clarify the entries in Table 4A since several of the freespan indications seem to be below the top of the tubesheet and some of the eggcrate indications appear to be in the freespan.

ENO Response

5. Any indication in Table 4A with a noted location of "TSH" is located either within the top of the tubesheet hot-side, or within the sludge pile. These indications were reported from the tubesheet region +Pt™ examination program.

   Any indication in Table 4A with a noted location of "0xH" or "VSx" is located either at eggcrates or in the freespan. The "Elevation" report is used to identify whether the indication is located within the structure (+/- 1 inch) or in the freespan.

   A revised version of Table 4A is attached. The additions to the table are in bold print. A comment that had inadvertently been omitted in the two rows for SG E-50B, row 131, column 76, was added. Also, the SG tube that was in-situ tested in E-50A, row 71, column 84, was added to the eggcrate and freespan section of the table where it also had inadvertently been omitted.

NRC Request

6. *Clarify the number of axial ODSCC indications in the freespan and eggcrate locations. Table 5 indicates two indications are at eggcrates and one indication is in the freespan; however, Table 6 only lists one indication at an eggcrate (R71C84) and two indications in the freespan (R133C90 and R80C131).*

ENO Response

6. There are typographical errors in Table 5. The numerical entries for axial ODSCC eggcrate and axial ODSCC freespan were inadvertently reversed. The Table 6 data are correct. Table 5 should have shown two tubes plugged due to axial ODSCC in the freespan locations and one tube plugged due to axial ODSCC in the eggcrate location. A revised version of Table 5 is attached. The corrections are in bold print.

Revised Table 4A Location and Measured Sizes of Service Induced Indications

SG	Row	Col	IND	Location	Elevation	+Pt Volts	Length (axial) (inch)	Length (circ) (degrees)	Mechanism	+Pt Depth Voltage	Comments
Tubesheet and Sludge Pile Region											
A	34	47	SAI	TSH	0.02	0.53	0.17		Axial PWSCC	40.53	
A	26	53	SAI	TSH	0.43	0.18	0.2		Axial ODSCC	48.34	
A	70	75	SAI	TSH	0.61	0.24	0.14		Axial ODSCC	52.69	
A	73	96	SAI	TSH	0.57	0.26	0.2		Axial ODSCC	53.98	
A	77	78	SCI	TSH	0.04	0.48		55	Circ ODSCC	64.85	
A	72	81	SCI	TSH	-0.04	0.17		40	Circ ODSCC	47.52	
A	72	87	SCI	TSH	-0.01	0.45		74	Circ ODSCC	63.61	
A	56	105	SAI	TSH	0.22	0.27	0.22		Axial ODSCC	54.58	
A	56	105	SAI	TSH	0.22	0.24	0.22		Axial ODSCC	52.69	
A	24	109	SAI	TSH	-0.44	0.61	0.28		Axial PWSCC	43.22	
A	24	109	SAI	TSH	-0.97	0.72	0.31		Axial PWSCC	46.62	
A	27	118	SCI	TSH	-0.01	0.52		105	Circ ODSCC	66.42	
A	57	128	SCI	TSH	0.11	0.12		48	Circ ODSCC	42.81	
A	90	67	SVI	TSH	0.33	0.21	0.13	45	Wear		<40%TW using ETSS 21998.1
B	29	48	SAI	TSH	0.64	0.28	0.21		Axial ODSCC	55.18	
B	131	76	SVI	TSH	0.39	0.24	0.22	69	Wear		**<40%TW using ETSS 21998.1**
B	131	76	SVI	TSH	0.01	0.29	0.16	61	Wear		**<40%TW using ETSS 21998.1**
B	79	90	SAI	TSH	0.71	0.3	0.2		Axial ODSCC	56.33	
B	74	95	SAI	TSH	0.84	0.2	0.27		Axial ODSCC	49.89	

Revised Table 4A Location and Measured Sizes of Service Induced Indications

SG	Row	Col	IND	Location	Elevation	+Pt Volts	Length (axial) (inch)	Length (circ) (degrees)	Mechanism	+Pt Depth Voltage	Comments
Eggcrate and Freespan											
A	**71**	**84**	**SAI**	**01H**	**-0.22**	**0.44**	**0.81**		**Axial ODSCC**	**63.18**	
A	93	32	SAI	VS6	16.84	0.95	0.18		Axial ODSCC	79.57	
A	133	90	SAI	04H	7.52	0.2	0.34		Axial ODSCC	49.89	
A	80	131	SAI	05H	18.61	0.13	0.3		Axial ODSCC	43.85	
A	80	131	SAI	05H	19.06	0.07	0.27		Axial ODSCC	36.43	
A	80	131	SAI	05H	24.22	0.14	0.27		Axial ODSCC	44.83	
A	80	131	SAI	05H	25.48	0.11	0.24		Axial ODSCC	41.71	
A	80	131	SAI	05H	25.66	0.11	0.33		Axial ODSCC	41.71	
A	80	131	SAI	06H	3.48	0.09	0.18		Axial ODSCC	39.27	
A	80	131	SAI	06H	11.38	0.13	0.3		Axial ODSCC	43.85	
SG	**Row**	**Col**	**IND**	**Location**	**Elevation**	**+Pt Volts**	**Length (axial) (inch)**	**Length (circ) (degrees)**	**Mechanism**	**+Pt Depth Voltage**	**Comments**
In Situ Pressure Testing											
A	71	84	SAI	01H	-0.22	0.44	0.81		Axial ODSCC	63.18	Flaw signal affected by ding. In-situ pressure tested, no leak, no burst

Revised Table 5
Tube Plugging Summary by Damage Mechanism

Tube Plugging Summary	SG E-50A	SG E-50B
Wear – Vertical Straps	4	1
Wear – Diagonal Bar	1	0
Wear – Volumetric Loose Part	1	2
Possible Loose Part (TBP)	0	3
Circumferential ODSCC TTS	5	0
Axial ODSCC TTS	5	3
Axial ODSCC Freespan	**2**	0
Axial ODSCC Eggcrate	**1**	0
Axial ODSCC Greater than 5V Dings	1	0
Axial PWSCC Tubesheet	1	0
Restricted Tube	1	0
Administrative (TBP)	0	1
2006 Outage Total	22	10
Preservice Tubes Plugged	308	309
Effective Tubes Plugged	402	373
Effective Tubes Plugged Percentage	4.9%	4.5%