Entergy

Entergy Nuclear Operations, Inc.
Palisades Nuclear Plant
27780 Blue Star Memorial Highway
Covert, MI 49043
Tel 269 764 2000

August 06, 2008 Technical Specification 5.6.8

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Palisades Nuclear Plant
Docket 50-255
License No. DPR-20

Response to Request for Additional Information on 2007 Steam Generator Tube Inspection Report (TAC No. MD 8649)

Dear Sir or Madam:

By letter dated April 7, 2008 (ML080980422), Entergy Nuclear Operations, Inc. (ENO) submitted information pertaining to the 2007 steam generator tube inspections at the Palisades Nuclear Plant.

By electronic mail dated June 17, 2008, the Nuclear Regulatory Commission requested additional information on the 2007 steam generator tube inspection report. 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
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION ON 2007 STEAM GENERATOR TUBE INSPECTION REPORT

By letter dated April 7, 2008, Entergy Nuclear Operations, Inc. (ENO) submitted information pertaining to the 2007 steam generator tube inspections at the Palisades Nuclear Plant (PNP). By electronic mail dated June 17, 2008, the Nuclear Regulatory Commission (NRC) requested additional information on the 2007 Steam Generator Tube Inspection Report. The requested information and ENO responses follow.

NRC Request

1. *One tube was identified that had an indication attributed to tube-to-tube wear. Regarding this indication and this degradation mechanism, please address the following:*

   a. *Please discuss the root cause for this degradation mechanism (i.e., why have the tubes moved in close proximity such that tube-to-tube wear is occurring). Please discuss the extent to which this mechanism been observed in similarly designed and operated steam generators (include in this discussion historic growth rates, a general discussion on the severity of the indications detected, and the region of the tube bundle affected).*

ENO Response

a. The tubes have not moved into this condition; the condition has been present since steam generator manufacture. No formal root cause analysis has been performed. The likely cause is due to manufacturing tolerances associated with tube bending for the square bend region. If the horizontal run distance between square bend centers is on the high side of the tolerance range and the next higher row tube has a horizontal run distance between square bend centers on the low side of the tolerance range, the tube-to-tube gap just below the square bend would be reduced. Another possible cause is a square bend with bend angle not equal to 90 degrees. While not common, this condition has been observed in other similar designed steam generators. Indications at other units have experienced depth of penetration similar to that observed at PNP. An observation in 2005 from a plant with similar steam generators shows the proximity condition occurred at the square bend to horizontal run section of tubing. As this condition is related to steam generator manufacture and there have been no industry reports of high depth wear at these locations, the implied growth rates are considered extremely low.

NRC Request

b. *Please discuss whether the integrity of the diagonal bars adjacent to this tube was verified. For example, for the tubes surrounding the tube in row 136, column 77, were the diagonal bars verified to be at the correct axial elevation? (Refer to Information Notice 2005-29, "Steam Generator Tube and Support Configuration"). In addition, were any visual inspections of the batwing performed (i.e., on the exterior of the tube bundle)?*

ENO Response

b. Integrity of the diagonal bars was verified by +Point^{TM} (+Pt) rotating pancake coil (RPC) testing which shows both bars are located at the same elevation. Bobbin data from the last two refueling outages were reviewed for the characteristic batwing shift eddy current signature; no such signatures were reported.

NRC Request

c. *Please discuss the results of any visual inspections in this area.*

ENO Response

c. A "bottom up" visual inspection was performed of the center of tubesheet region from the secondary side of the tubesheet. No failed diagonal bars were identified. The diagonal bars positioning observed at the last refueling outage (1R19) inspection was consistent with prior visual inspections.

NRC Request

d. *Please discuss the results of any rotating probe inspections performed in row 138, column 77, prior to the plugging of this tube in 1998.*

ENO Response

d. No +Pt RPC examination was performed on row 138 (R138), column 77 (C77), prior to 1998.

NRC Request

e. *Please discuss whether there is any evidence that the tubes adjacent to the tube in row 136, column 77 are in close proximity either through visual examination or from a review of the eddy current data (historic or present).*

ENO Response

e. Due to the steam generator design, the only tubes that can experience a proximity condition for this area of the steam generator are located in the same column; the diagonal bars provide spacing in the row direction. Visual examination of internal bundle locations in triangular pitch steam generators is difficult and likely will not produce data sufficient to determine this proximity condition. Eddy current data was reviewed with no evidence of tube proximity on R134 C77.

NRC Request

f. *It was indicated that the indication attributed to tube-to-tube wear could not be identified in the bobbin coil data. Nonetheless, the bobbin coil data for all tubes in rows 130 through 138 was re-reviewed with no abnormal signals being detected.*

   In addition, the rotating probe data from all tubes with wear scars at the diagonal bar (hot-leg and cold-leg) for the tubes in rows 134 through 138 was reviewed and all wear observed in these tubes was associated with the diagonal bar. Please discuss, the extent of condition (i.e., which tubes could potentially come in contact). Why was the rotating probe data for tubes in rows less than 134 not re-reviewed to confirm that all of the wear was associated with a support? In addition, discuss the extent to which rotating probe examinations were performed in this region to confirm the absence of additional indications of tube-to-tube wear (given that the indication could not be detected with the bobbin coil data).

ENO Response:

f. Plus Point RPC data was obtained only for those locations with bobbin reported wear scars. All other locations in rows 134 through 138 with wear scars were found to have experienced wear with the diagonal bar, not tube-to-tube wear. The bobbin data for large row tubes was reviewed for observation of diagonal bar-cold leg (DBC) or diagonal bar-hot leg (DBH) reports in the same column and successive rows; no such locations were observed. If a tube-to-tube contact condition were present in any of the other locations it is expected that such a condition would have been reported either in the production or resolution process. The potential for

tube proximity is reduced with decreasing vertical span length (i.e., decreasing row count) from the square bend to the closest eggcrate as the eggcrate forms another tube positioning control point. Additional RPC testing was not performed as the lack of bobbin coil detection is associated with the shallow indication depth. Had more significant depths associated with tube-to-tube proximity been present, a bobbin coil signal would have been produced. This is why a review of all bobbin data for rows 130 and higher was performed. No atypical signals were noted. Additional RPC testing was not performed as the bobbin coil can detect a tube-to-tube proximity condition. The review of bobbin data for rows 130 through 138 included a thorough review of the appropriate channel for observation of potential tube-to-tube contact; no such conditions were reported.

NRC Request

g. *How would tube-to-tube wear be distinguished from wear attributed to a transient loose part? Have any wear indications been observed in the free span that were attributed to loose parts (and in an area where tube-to-tube contact could occur)? Were any tubes returned to service with wear attributed to loose parts?*

ENO Response

g. Wear due to tube-to-tube proximity can be distinguished from loose part wear using several parameters. Tube-to-tube wear involves extended longitudinal lengths with very gradual depth tapers. Tube loose part wear typically involves a very short affected length with rapid depth tapers. Eddy current data (both bobbin and +Pt RPC) can be used to identify the presence of a foreign object. No wear was identified with eddy current data, and no foreign objects were identified in an area where tube-to-tube contact could occur. For the three tubes plugged due to foreign object tube wear the locations were at vertical straps (with objects assumed to be wedged between the tube and vertical strap assembly) or just above an eggcrate support. These structures control tube positioning and spacing, thus, there is no potential for tube-to-tube wear at these locations. The two tubes, one in each steam generator, with wear attributed to loose parts were removed from service by tube plugging.

NRC Request

2. *Your report indicates that the possible loose parts in both steam generators were reviewed during the foreign object search and retrieval and that no loose parts required removal in steam generator "A" since only small sludge rocks*

were identified. However, the report also indicates that three tubes were plugged in steam generator "A" as a result of interaction with a possible loose part. Please clarify this discussion. Were only possible loose part indications near the top of the tubesheet inspected visually (during the foreign object search and retrieval)? Was the part near the tube in row 129, column 108, at the 8th cold-leg tube support verified to be present? In response to the possible loose part and the associated volumetric indication in the tube located in row 129, column 108, this tube was plugged and stabilized and a nearby tube (row 128, column 109, with just a possible loose part indication) was plugged. If the possible loose part was not removed from this location, please discuss the likelihood that this tube could wear as a result of the possible loose part and lead to tube severance which could then impact other adjacent non-plugged tubes). Is monitoring of this non-stabilized tube planned for future outages?

ENO Response

2. No metallic foreign objects were identified at the top of tubesheet region. For those tubes plugged due to foreign objects, the objects were located in upper bundle regions. The object located above the 8th cold leg support was reported by eddy current examination. There is essentially no potential for this object to result in a tube severance. The location is near the periphery, and high in the bundle. At this location, flow directions are vertically oriented and any tube wear is likely due to tube vibration against the object. Such wear will have low growth rates and can be self-limiting. Without sufficient cross-flow velocities there is essentially no potential for a tube severance, either of the tube reported with wear, or the adjacent tube without wear. The industry position regarding stabilization of such indications in vertically oriented flow locations is considered an extreme conservatism. Monitoring of the non-stabilized tube is not planned for future refueling outages. However, as all tubes are inspected using the bobbin coil at each outage, those currently active tubes surrounding these locations will be inspected each refueling outage.

NRC Request

3. *On page 6 of your April 7, 2008, letter, you imply that the tube in row 136, column 77, was plugged due to interaction with a possible loose part; however, previously you indicated that this tube was plugged as a result of tube-to-tube wear. Please clarify.*

ENO Response

3. R136 C77 was plugged due to tube-to-tube wear. This is discussed on pages 4 and 5 of the Steam Generator Tube Inspection Report. The inclusion of R136 C77 with the tubes on page 6 as attributed to loose part wear is in error.

NRC Request

4. Regarding Table 4A in your April 7, 2008 letter, please clarify the information contained within the column entitled "+Pt [+Point™] Depth Voltage." Is this column providing the depth of the indications based on the voltage of the signal from the +Point™ coil?

ENO Response

4. This column provides the indication depth using a regression of +Pt signal amplitude and indication maximum depth, developed from pulled tube data.

NRC Request

5. Tables 4B and 4C in your April 7, 2008 letter, contain all indications due to tube wear for tubes that remain in service. In Table 4B, the tube in row 129, column 108, is listed. Please clarify whether this tube was plugged. If so, please confirm that this table only contains indications that remain in service. Similarly, Table 4C contains the tube in row 70, column 13. Please clarify whether this tube was plugged. If so, please confirm that this table only contains indications that remain in service.

ENO Response

5. The tube in row 129, column 108, in Table 4B, was stabilized and removed from service by plugging. A comparison of Table 4B, steam generator E-50A indications for tubes that remained in service, and Table 6, condition monitoring results and identification of tubes plugged, identified that there were eight line items in Table 4B that contained tubes with indications that were removed from service in the 2007 refueling outage. The following line items in Table 4B contain those tubes that did not remain in service:

No.	SG	Row	Column	Depth in Percent	Location	Elevation	Status
860	A	129	108	12	08C	0.83	<TS
934	A	136	77	23	DBC	1.84	<TS
963	A	116	89	22	VS1	0.86	<TS
1372	A	116	89	36	VS4	-1.2	<TS
1373	A	116	89	40	VS4	-0.97	≥TS
1487	A	116	89	18	VS6	-0.81	<TS
1488	A	116	89	41	VS6	0.92	≥TS
1386	A	121	82	15	VS4	-0.78	<TS

The tube in row 70, column 13, in Table 4C, was stabilized and removed from service by plugging. A comparison of Table 4C, steam generator E-50B indications for tubes that remained in service, and Table 6, condition monitoring results and identification of tubes plugged, identified one line item (the tube in row 70, column 13) in Table 4C contained an indication and was removed from service in the 2007 refueling outage. The following line item in Table 4C contains that tube.

No.	SG	Row	Column	Depth in Percent	Location	Elevation	Status
834	B	70	13	13	VS4	-0.79	<TS

The remaining tubes in Tables 4B and 4C remained in service.

NRC Request

6. *Please confirm that your examinations of dents/dings included dents/dings on both the hot-leg and cold-leg side of the steam generator. If not, please provide the technical basis for not inspecting the dents/dings on the cold leg in light of operating experience that cracking at dents/dings can occur on the cold leg (prior to being observed on the hot-leg) and the finding of axial crack in a greater than 5 volt ding at the fourth vertical strap (row 23, column 102, in steam generator B).*

ENO Response

6. All dents (i.e., >2V as reported by bobbin coil analysis) at eggcrates, both hot and cold legs, all freespan dings >5V (as reported by bobbin coil analysis) from hot leg top of tubesheet to cold leg top of tubesheet, and all dents ≥3.5V

(as reported by bobbin coil analysis) at vertical straps and diagonal bars were inspected with the +Pt coil.

NRC Request

7. *During your 2007 steam generator tube inspections, the indication at the hot-leg diagonal bar in the tube located in row 99, column 138, was sized at 7-percent through-wall. This indication had previously been sized at 17-percent through wall and is located near a tube that had previously been plugged due to wear with the wrap around bar (row 99, column 140). Please discuss any insights on why the size of the indication appeared to have decreased between inspections. Are these results consistent with the uncertainty associated with sizing wear indications?*

ENO Response

7. These results are consistent with bobbin coil non-destructive examination sizing uncertainty, particularly for such low amplitude signals.