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Fall 2005 Unit 1 (U1R29) Steam Generator Tube Inspection Report

In accordance with the requirements of Point Beach Nuclear Plant Technical Specification 5.6.8, "Steam Generator Tube Inspection Report," Nuclear Management Company, LLC (NMC), is submitting the results of the fall 2005 Unit 1 (U1R29) steam generator tube inservice inspections.

The enclosed report includes the following:

1. Number and extent of tubes inspected.
2. Location and percent of all thickness penetration for each indication.
3. Identification of tubes plugged or repaired.

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



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Site Vice-President, Point Beach Nuclear Plant
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Enclosure

cc: Administrator, Region III, USNRC
Project Manager, Point Beach Nuclear Plant, USNRC
Resident Inspector, Point Beach Nuclear Plant, USNRC
PSCW

ENCLOSURE

FALL 2005 UNIT 1 (U1R29) STEAM GENERATOR TUBE INSPECTION REPORT

The Point Beach Nuclear Plant (PBNP) steam generator tube inspection program for U1R29 was conducted in accordance with the requirements of PBNP Technical Specifications 5.5.8 and 5.6.8, NEI 97-06, "Steam Generator Program Guidelines," and EPRI 1003138, "PWR Steam Generator Examination Guidelines." The 29th refueling outage was completed on November 24, 2005. Past inspections of these steam generators have resulted in classification of Category C-1; therefore, this inspection was not required by PBNP Technical Specifications, NEI, or EPRI guidelines. However, because of secondary side steam generator fouling, NMC performed an additional inspection of the Unit 1 'A' steam generator.

The PBNP Unit 1 steam generators are Westinghouse Model 44F with thermally treated, 7/8-inch outer diameter, 0.050 inch wall, Inconel 600 tubing manufactured by Westinghouse. The tubes are on a 1.234" square pitch and were hydraulically expanded the full depth of the tubesheet. The row 1 U-bends have a 2.19" radius, and the first 8 rows were stress relieved after bending. The tubes are supported by a stainless steel flow distribution baffle with round holes, six stainless steel tube support plates with quatrefoil holes and two sets of chrome-plated Inconel anti-vibration bar assemblies. The PBNP Unit 1 steam generators were replaced late in 1983, during refueling outage 11. The replacement steam generators have accumulated approximately 17.7 effective full power years of operation since then.

The U1R29 steam generator inspection was limited to the 'A' steam generator and consisted of the following.

- Bobbin coil inspection of 50% (1607 tubes) of the active tubes over the full length of the tube. This included all tubes with previous anti-vibration bar wear and signature tubes. Signature tubes have potential elevated susceptibility to tube support plate Outside Diameter Stress Corrosion Cracking based on evaluation of past inspection data. The 'A' steam generator has 45 signature tubes.
- Rotating pancake coil inspection of 20% (19 tubes) of the row 1 U-bends.
- Rotating pancake coil inspection of 20% (644 tubes) of the tubesheet: full length hot leg tubes to 3" above the tubesheet.
- Rotating pancake coil inspection of 146 special interest tests, including all freespan dings/dents over 5 volts and dings/dents over 2 volts at supports.

As a result of this inspection, no steam generator tube degradation that required plugging was detected, and no tubes were plugged. The plugging limit at PBNP is 40% through-wall as specified in PBNP Technical Specification 5.5.8.a.6. Tubes are

also plugged upon any indication of circumferential or axial cracking. Minor tube wear at the anti-vibration bars, at the hot leg top of tubesheet and at the cold leg supports continues to be monitored.

Fifty-two wear indications in 31 tubes were found in the 'A' SG anti-vibration bar area. None of these indications were required to be repaired, and all tubes remained in service. Table 1 shows all anti-vibration bar wear indications along with an historical comparison. Based on the growth rate of the wear indications, no indications are expected to exceed the plugging criterion during the next two cycles.

Table 1 – Anti-Vibration Bar Wear History, % Through-Wall, SG A

Row	Column	Location	2005	2004	2001	1998	1995
22	8	AV3	3%	-	-	-	-
32	14	AV3	7%	5%	3%	9%	4%
33	18	AV3	18%	25%	21%	-	-
33	18	AV4	11%	16%	13%	-	-
35	18	AV2	11%	10%	6%	INR	9%
38	22	AV3	10%	12%	6%	10%	8%
40	25	AV2	9%	6%	5%	9%	6%
40	27	AV3	8%	5%	4%	6%	5%
34	33	AV1	14%	10%	10%	5%	11%
34	33	AV2	11%	7%	7%	7%	10%
33	37	AV4	14%	9%	13%	7%	8%
45	41	AV1	10%	6%	6%	7%	6%
45	41	AV4	8%	7%	6%	7%	6%
40	42	AV1	14%	12%	13%	-	23%
45	42	AV1	14%	-	-	-	-
38	43	AV1	24%	23%	19%	12%	11%
38	43	AV2 ⁻¹	17%	16%	-	-	-
38	43	AV2 ⁺¹	22%	23%	19%	12%	8%
45	43	AV1	18%	13%	12%	15%	11%
45	43	AV4	9%	8%	8%	-	-
40	44	AV3	11%	13%	10%	7%	5%
40	47	AV3	15%	10%	13%	10%	12%
33	48	AV3	9%	13%	9%	-	-
45	49	AV1	15%	19%	14%	13%	18%
45	52	AV4	5%	-	-	-	-
19	54	AV1	8%	-	-	-	-
19	54	AV2	17%	12%	14%	13%	7%
19	54	AV4	17%	12%	16%	12%	13%
38	54	AV3	26%	25%	18%	14%	15%
38	54	AV4	9%	-	-	-	-
35	56	AV1	18%	14%	15%	5%	6%
35	56	AV2	27%	27%	27%	9%	13%

Row	Column	Location	2005	2004	2001	1998	1995
19	61	AV1	13%	12%	18%	10%	12%
19	61	AV2	16%	15%	23%	13%	14%
19	61	AV4	5%	6%	8%	-	-
31	63	AV2	18%	20%	14%	9%	12%
31	63	AV3	11%	10%	5%	5%	2%
34	65	AV3	5%	9%	6%	1%	-
34	65	AV4	11%	15%	12%	6%	7%
33	66	AV1	14%	20%	14%	9%	8%
33	66	AV2	10%	13%	11%	9%	4%
33	66	AV3	4%	5%	5%	4%	4%
39	68	AV4	9%	9%	8%	9%	6%
34	69	AV1	8%	3%	7%	1%	-
34	69	AV2	16%	11%	14%	6%	9%
27	71	AV2	10%	6%	11%	5%	4%
27	71	AV3	15%	10%	12%	3%	2%
27	71	AV4	7%	5%	6%	-	-
32	71	AV2	15%	11%	9%	10%	6%
32	71	AV3	11%	-	-	-	-
33	71	AV2	16%	13%	17%	5%	6%
33	71	AV3	14%	6%	10%	-	-

Nineteen wear indications in 16 tubes were found in the 'A' SG peripheral hot leg tubes at the top of tubesheet. Table 2 lists the percent through-wall of these indications. All of these indications were reported in 2004, except a 1% indication in row 33/column 78 and a 5% in row 41/column 28. Both of these minor indications were present in 2004 data but not reported by eddy current. These indications first appear in the U1R28 inspection data, and this wear was concluded to be the result of damage from maintenance equipment during U1R26. Secondary side visual inspection during U1R28 and the current inspection confirmed that no objects that could cause continued wear are present. Comparison of the 2004 and 2005 data supports this original conclusion. The depth of these indications is significantly below the plugging criterion, and since the source of the wear is no longer present, no growth is anticipated, and all tubes remained in service.

Table 2 – Mechanical Wear History, % Through-Wall, SG A

Row	Column	Location	2005	2004
37	20	TSH +0.61"	4%	4%
37	20	TSH +0.70"	1%	1%
41	28	TSH +0.54"	5%	-
42	30	TSH +0.57"	5%	5%
43	33	TSH +0.60"	3%	5%
44	36	TSH +0.66"	4%	6%
45	41	TSH +0.64"	3%	4%
45	42	TSH +0.66"	1%	3%
45	43	TSH +0.63"	2%	1%
45	44	TSH +0.64"	3%	4%
45	45	TSH +0.59"	4%	10%
45	46	TSH +0.57"	2%	7%
45	47	TSH +0.56"	2%	5%
43	60	TSH +0.53"	7%	7%
42	63	TSH +1.55"	1%	1%
42	63	TSH +2.67"	1%	1%
42	63	TSH +0.57"	11%	11%
33	78	TSH +0.75"	1%	-
31	80	TSH +0.73"	4%	3%

Four wear indications in 4 tubes were found in the 'A' SG at cold leg supports. Three of these were reported in 2004, but had never been reported previous to 2004. When compared to 1995 inspection data, these indications showed no significant change. Table 3 lists the percent through-wall of these indications. The depth of these indications is significantly below the plugging criterion, and all tubes remained in service.

Table 3 – Cold Leg Support Wear, % Through-Wall, SG A

Row	Column	Location	2005	2004
39	24	03C +0.38"	11%	12%
41	65	02C +0.41"	16%	18%
39	67	02C +0.38"	7%	-
21	85	02C +0.38"	12%	10%

During this inspection of the 'A' steam generator, 3 dents were identified at 2.0 to 4.99 volts and 131 dings identified at 2.0 to 4.99 volts. Two of the dents were at supports, and 54 of the dings were located at supports or anti-vibration bars. An additional 53 dings were identified at 5 volts or greater. These indications were further investigated with rotating pancake coil, and the results were "no defect found."

The 'A' steam generator has one manufacturing anomaly. The tube at row 38/column 69 is not expanded the full length of the tubesheet. This tube is routinely inspected by rotating pancake coil from the tube end to the top of tubesheet and during U1R29, as in the past, no degradation was found. The tube remains in service.

One possible loose part indication was reported by eddy current in SG 'A' at 0.36 inch above the hot leg top of tubesheet in row 8/column 25. No degradation was observed in conjunction with the indication. However, all tubes adjacent to this indication were also tested with rotating pancake coil. Secondary side visual inspection verified that no loose part was present, and this indication was subsequently dispositioned, and the tube remains in service.

A small foreign object was found and retrieved during the secondary side visual inspection near cold leg row 1&2/column 78. The object was a small steel pin approximately 1-1/4" long by approximately 1/4" diameter. Subsequently, 18 tubes in the vicinity of this location were inspected with rotating pancake coil. No degradation was observed in conjunction with the loose part in any of the tubes. The site investigated possible sources of the part and concluded that the object was not transported to the steam generator, but may have been from steam generator maintenance equipment.

The secondary side of the 'A' steam generator was cleaned and inspected. Sludge lance equipment fit up properly, validating that the wrapper plate has not shifted. Therefore, wrapper plate inspection was not performed as discussed in our response to NRC Generic Letter 97-06. Sludge lancing removed 31 pounds of sludge from the top of the tubesheet. The post sludge lancing visual inspection of the tubesheet confirmed that some hard adhering scale was not being washed off the tubesheet, and future chemical cleaning of the secondary side is planned. Inspection of the upper support plate revealed no degradation, nor was support plate degradation anticipated given that the plates are stainless steel. However, the inspection did confirm the presence of heavy scale on the outside of the tubes. The 'A' steam generator steam drum was also inspected and no significant degradation of the swirl vanes, moisture separators or feed ring J nozzles were found. Note that samples of these areas are visual inspected, and it is not practical to inspect 100% of all these areas. Minor weld burn through from construction was noted in two closely spaced J nozzles. The condition was evaluated and determined not to affect nozzle function. No flow induced corrosion was found. The 'B' steam generator was not cleaned or inspected during the U1R29 outage.

Since the Unit 1 steam generators were replaced, tube wear has been minimal. There are presently a total of 10 tubes plugged in the Unit 1 steam generators - four tubes in the 'A' steam generator and six tubes in the 'B' steam generator. No tubes have been plugged for stress corrosion cracking and only four of these ten tubes were plugged as a result of service-induced wear - one tube in the 'A' steam generator and three in the 'B' steam generator. There are three tubes in the 'A' steam generator and one tube in the 'B' steam generator that were plugged prior to placing the steam generators in

service, plus an additional two tubes in 'B' steam generator were plugged because of damage during steam generator wrapper modification.

Tubes Plugged in Steam Generator A		
Row	Column	Date Plugged
1	5	During Manufacture (Welded in plugs)
3	90	During Manufacture (Welded in plugs)
20	87	During Manufacture (Welded in plugs)
21	63	April 1991(690TT plugs)

Tubes Plugged in Steam Generator B		
Row	Column	Date Plugged
1	1	April 1988 / Replaced with 690TT plugs in April 2001
2	1	April 1988 / Replaced with 690TT plugs in April 2001
30	60	April 1991 (690TT plugs)
32	38	April 2001 (690TT plugs)
35	51	April 1995 (690TT plugs)
43	40	March 1984 / Replaced with 690TT plugs in April 2001

A steam generator tubesheet map is depicted on the next page to aid in the understanding of tube locations.

In summary, based on the inspection results, no tubes needed to be repaired. The tube integrity and leakage criterion specified in NEI 97-06 are expected to be satisfied for the next cycle of operation. In accordance with Point Beach Technical Specifications and EPRI Steam Generator Examination Guidelines, the next scheduled inspection of Unit 1 steam generators is planned for refueling outage 30 during the spring of 2007.

Abbreviations	
AVx	Various Anti-Vibration bar locations, numbered from hot leg to cold leg. If Anti-Vibration location is superscripted, there are multiple indications at the location.
TSH	Top of Tubesheet Hot Leg
02C	2nd support plate cold leg side
03C	3rd support plate cold leg side
INR	Indication Not Reportable Condition where a previously reported indication is detectable but does not meet the current reporting level.

