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ACCESSION NBR: 8805060295      DOC. DATE: 88/05/03      NOTARIZED: NO      DOCKET #  
 FACIL: 50-305 Kewaunee Nuclear Power Plant, Wisconsin Public Service      05000305  
 AUTH. NAME      AUTHOR AFFILIATION  
 WEBB, T.      Wisconsin Public Service Corp.  
 HINTZ, D.C.      Wisconsin Public Service Corp.  
 RECIPIENT NAME      RECIPIENT AFFILIATION

SUBJECT: LER 88-003-00: on 880403, integranular attack & IGSCC result in defective steam genertor tubes.

W/8      ltr.

DISTRIBUTION CODE: IE22D      COPIES RECEIVED: LTR   1   ENCL   1   SIZE:   6    
 TITLE: 50.73 Licensee Event Report (LER), Incident Rpt, etc.

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<u>RES FILE</u> 02		1	1	RES TELFORD, J	1
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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Kewaunee Nuclear Power Plant	DOCKET NUMBER (2) 0 5 0 0 0 3 1 0 1 5	PAGE (3) 1 OF 015
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TITLE (4) Integrangular Attack and Intergranular Stress Corrosion Cracking Result in Defective Steam Generator Tubes

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)		
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES		DOCKET NUMBER(S)
0	4	03	8	8	8	0	0	05	N/A		0 5 0 0 0
0	4	03	8	8	8	0	0	05			0 5 0 0 0

OPERATING MODE (9)  N

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR § (Check one or more of the following) (11)

20.402(b)	20.408(e)	80.73(a)(2)(iv)	73.71(b)
20.408(a)(1)(ii)	80.38(e)(1)	80.73(a)(2)(v)	73.71(e)
20.408(a)(1)(iii)	80.38(e)(2)	80.73(a)(2)(vi)	<input checked="" type="checkbox"/> OTHER (Specify in Abstract below and in Text, NRC Form 388A)
20.408(a)(1)(iv)	80.73(a)(2)(ii)	80.73(a)(2)(vii)(A)	Tech Specs
20.408(a)(1)(v)	<input checked="" type="checkbox"/> 80.73(a)(2)(iii)	80.73(a)(2)(viii)(B)	4.2.5.a & 4.2.5.c
20.408(a)(1)(vi)	80.73(a)(2)(iv)	80.73(a)(2)(ix)	

LICENSEE CONTACT FOR THIS LER (12)

NAME Tom Webb - Nuclear Engineer		TELEPHONE NUMBER	
AREA CODE 4 1 1 4	4 3 1 3 1 - 1 1 2 1 1		

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRPDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRPDS
B	AIB	SIGI	W11210	Y					

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE)  NO

EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single space typewritten lines) (18)

At 0104 on April 3, 1988, with the Plant in refueling shutdown, the inspection, plugging, and repair of the steam generator tubes were completed for the 1988 refueling outage. The inspection found that 42 tubes in SG A and 51 tubes in steam generator B (SG B) met the Technical Specification definition of defective. Since the number of defective tubes exceeded 1 percent of the total number of tubes inspected, both steam generators were categorized as C-3. As required by Kewaunee's Technical Specifications, the Nuclear Regulatory Commission was notified within 4 hours of determining that a steam generator was in the C-3 category.

The majority of the defects are assumed to be caused by intergranular attack and intergranular stress corrosion cracking (IGA/IGSCC). However, 3 tubes were damaged by a vibrating tube lane blocking device.

Eight of the defective tubes in SG A and 8 of the defective tubes in SG B were plugged. The remaining defective tubes were sleeved. In addition 9 tubes in SG A and 18 tubes in SG B were plugged as a preventive measure. To minimize the effects of IGA/IGSCC in the future, 1862 non-defective tubes were sleeved. The remaining accessible tubes will be sleeved during the 1989 refueling outage. In order to reduce the amount of sludge in the SGs Kewaunee has replaced copper components in the secondary system with stainless steel components, and has sludge lancing and crevice flushing programs in place. Additional measures have been taken to reduce the caustic environment in the tube sheet crevice. The tube lane blocks have been removed from both steam generators to prevent them from causing further damage.

*Handwritten signature/initials*

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

Description of the Event

At 0104 on April 3, 1988, with the plant in refueling shutdown, the inspection, plugging, and repair of the steam generator (SG) tubes (TRB) were completed for the 1988 refueling outage.

The SG tube eddy current inspection program included:

1. an inspection of all the unplugged tubes from the hot leg side through the first tube support plate on the hot leg side,
2. an inspection of 3.6% of the unplugged tubes from the hot leg through the U-bend to the top support plate on the cold leg side, and
3. an inspection of 17.5% of the unplugged tubes through their entire length.

In addition, selected tubes [including samples of degraded, defective, and no detectable degradation (NDD) tubes] were inspected using the rotating pancake coil (RPC) technique. The RPC inspection was implemented in an effort to characterize tube degradation and to supplement the bobbin coil probe inspection results.

The Kewaunee Nuclear Power Plant Technical Specifications (KNPP TS) require that 3% of the tubes in each SG be inspected from the point of entry around the U-bend to the top support plate on the opposite leg. Since this year's inspection program resulted in approximately 21% of the tubes being inspected from the hot leg to the top support plate on the cold leg side, see items 2 and 3 above, the program satisfies the TS requirements.

The inspection found that 1.3 percent of the inspected tubes in steam generator A (42 tubes) and 1.6 percent of the inspected tubes in steam generator B (51 tubes) met the KNPP TS definition of defective. The steam generators at Kewaunee are Westinghouse model 51 with mill annealed inconel 600 tubes. Since greater than 1 percent of the inspected tubes in each steam generator were found to be defective, both steam generators were categorized as C-3. The C-3 category requires:

1. prompt notification of the Nuclear Regulatory Commission (NRC),
2. a written followup to the NRC,
3. plugging or repair of all defective tubes,

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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TEXT (If more space is required, use additional NRC Form 388A's) (17)

4. additional inspection before the steam generator can be considered operable, and
5. increasing the required steam generator inspection frequency to once per 20 months.

The NRC was notified at 2155 on March 14, 1988 via the emergency notification system telephone. This licensee event report is supplied as the written followup to that initial notification. As described later in this report, all defective tubes were either plugged or repaired. Since 21 percent of the unplugged tubes were inspected at least through the U-bend to the top support plate and the remaining tubes were inspected to the first support plate, the additional inspection requirements specified by TS Table 4.2-2 were satisfied. The steam generators will be reinspected in the spring of 1989 during Kewaunee's annual refueling outage.

The steam generator tube inspection and repair results for the 1988 refueling outage are summarized in the following table.

SG	No. of Defective Tubes	No. of Defective Tubes Plugged	No. of Defective Tubes Sleeved	No. of Tubes Plugged as a Preventive Measure	Total No. Of Tubes Sleeved
A	42	8(1)	34	9(1)	989(2)
B	51	8	43	18	950

- Notes:
1. One of the tubes in this category was damaged by a loose tube lane blocking device.
  2. 990 sleeves were actually installed in SG A. However, one sleeve did not meet the sleeving acceptance criteria and therefore will be treated as an unsleeved tube in future SG inspections and as sleeved in all thermal hydraulic calculations.

In SG A, approximately 88% of the defects were located in the tube sheet crevice. Approximately 7% were located at the top of the tube sheet with the remaining 5% located in other locations.

In SG B, approximately 82% of the defects were located in the tube sheet crevice. Approximately 14% were located at the top of the tube sheet with the remaining 4% located in other locations.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

Cause of the Event

The majority of the steam generator tube degradation at Kewaunee is assumed to be caused by intergranular attack and intergranular stress corrosion cracking (IGA/IGSCC). This assumption is based on industry experience with steam generator tube degradation.

IGA/IGSCC is usually associated with a restricted geometry; e.g., the tube sheet crevice or a sludge pile, and with a caustic environment; i.e., a pH greater than 10.

In addition, three tubes were damaged by a vibrating tube lane blocking device. Two of the three tubes were subsequently plugged, the third was determined to be acceptable for service.

Analysis of Event

This report is supplied in accordance with TS 4.2.5.a and TS 4.2.5.c which require a written report be submitted to the NRC within 30 days of completing the steam generator tube repair and plugging.

The following table provides a historical summary of the number of SG tubes plugged each year.

SG	1983	1984	1985	1986	1987	1988	Total
A	23	9	26	26	44	17	145
B	50	17	22	46	79	26	240
							385

In addition to the plugged tubes, 1940 tubes were sleeved this year, resulting in an equivalent plugging percent of 6.93%. This is well within the 10% assumed in the KNPP safety analysis submitted to the NRC in reference 1 and approved by the NRC in reference 2. Since the limits set by the safety analysis have not been exceeded, operation of the plant does not represent a significant hazard to the health and safety of the public.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

Corrective Actions

All tubes found to be defective were either plugged or sleeved in order to minimize the possibility of primary to secondary leakage during the 1988-89 operating cycle. Twenty-seven other tubes were also plugged as a preventive measure.

In addition to repairing or plugging the defective tubes, action has been taken to decrease the effect of IGA/IGSCC in the future. Kewaunee sleeved 1862 non-defective tubes this refueling and will sleeve the remaining accessible tubes during the 1989 refueling outage. In an effort to reduce the production of sludge, all major copper components; e.g., condenser (Cond) tubes, feedwater heater (HX) tubes, etc., in the secondary system have been replaced with stainless steel components. Furthermore, sludge lancing and crevice flushing were conducted during this refueling outage to reduce the amount of existing sludge and to remove contaminants from the tube sheet crevice. Also, in an effort to reduce the caustic environment in the tube crevice and prevent tube support plate denting a secondary system boric acid addition program has been implemented.

To prevent further damage, the tube lane blocking devices have been removed from both steam generators.

Additional Information

Equipment Failure: Westinghouse Model 51 steam generator tubes. The tube material is mill annealed inconel 600.

- Similar Events:
1. Letter from D. C. Hintz to the U.S. NRC Document Control Desk, dated March 31, 1987.
  2. Letter from D. C. Hintz to G. E. Lear dated April 23, 1986.
  3. LER 85-06.
  4. Letter from C. W. Giesler to S. A. Varga dated May 1, 1984.

- References:
1. Letter from D. C. Hintz to the U.S. NRC Document Control Desk dated November 30, 1987.
  2. Letter from J. G. Giitter to D. C. Hintz dated March 1, 1988.

**WISCONSIN PUBLIC SERVICE CORPORATION**

600 North Adams • P.O. Box 19002 • Green Bay, WI 54307-9002

May 3, 1988

10 CFR 50.73

U. S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, D.C. 20555

Gentlemen:

Docket 50-305  
Operating License DPR-43  
Kewaunee Nuclear Power Plant  
Reportable Occurrence 88-003-00

The attached Licensee Event Report for reportable occurrence 88-003-00 is being submitted in accordance with the requirements of 10 CFR 50.73, "Licensee Event Report System."

Sincerely,

D. C. Hintz  
Vice President - Nuclear Power

TJW/jms

Attach.

cc - INPO Records Center  
Mr. Robert Nelson  
US NRC, Region IIIIER2  
1/1