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INCIDENT REPORT

TO:
Mr. Norman C. Moseley

FROM: Duke Power Company
Mr. Norman C. Moseley
Charlotte, North Carolina
William O. Parker, Jr.

DATE OF DOCUMENT
7/28/77
DATE RECEIVED
8/19/77

LETTER
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DESCRIPTION

PLANT NAME:
Oconee Unit No. 3
RJL 8/19/77

(1-P)

ENCLOSURE

Licensee Event Report (RO 50-287/77-10) on 7/14/77 concerning primary-to-secondary system leakage in "3B" once-through steam generator.....

DO NOT REMOVE

ACKNOWLEDGED

(5-P)

NOTE: IF PERSONNEL EXPOSURE IS INVOLVED SEND DIRECTLY TO KREGER/J. COLLINS

1 CY ENCL REC'd

FOR ACTION/INFORMATION

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LIC ASST.:	Sheppard

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CONTROL NUMBER

772310072

DUKE POWER COMPANY

POWER BUILDING

422 SOUTH CHURCH STREET, CHARLOTTE, N. C. 28242

WILLIAM O. PARKER, JR.
VICE PRESIDENT
STEAM PRODUCTION

July 28, 1977

TELEPHONE: AREA 704
373-4083

Regulatory

File Cy₃

Mr. Norman C. Moseley, Director
U. S. Nuclear Regulatory Commission
Suite 818
230 Peachtree Street, Northwest
Atlanta, Georgia 30303



Re: Oconee Unit 3
Docket No. 50-287

Dear Mr. Moseley:

Pursuant to Sections 6.2 and 6.6.2 of the Oconee Nuclear Station Technical Specifications, please find attached Reportable Occurrence Report R0-287/77-10.

Very truly yours,

William O Parker Jr
William O. Parker, Jr. */JL*

LJB:ge
Attachment

cc: Director, Office of Management Information
and Program Control

772310072

DUKE POWER COMPANY
OCONEE UNIT 3

Report No.: RO-287/77-10

Report Date: July 28, 1977

Occurrence Date: July 14, 1977

Facility: Oconee Unit 3, Seneca, South Carolina

Identification of Occurrence: Primary-to-secondary system leakage in "3B"
once-through steam generator

Conditions Prior to Occurrence: Unit at 97 percent full power

Description of Occurrence:

On July 14, 1977, Oconee Unit 3 was shutdown to investigate a gradual increase in radiation levels as registered by air ejector monitor 3RIA-40. This increase, occurring over 17 days of operation, indicated a possible primary-to-secondary system leak occurring in the "3B" once-through steam generator (OTSG). The reactor was in hot shutdown on July 15, 1977 and preparations were made to drain the Reactor Coolant System and investigate the source of the leak.

The Reactor Coolant System was cooled and drained and an internal inspection of the "3B" OTSG was initiated within 3 days. One leaking tube was removed from service. The Nuclear Regulatory Commission was informed of these actions in our letter of July 21, 1977 to Mr. E. G. Case, Acting Director, Office of Nuclear Reactor Regulation.

Apparent Cause of Occurrence:

Eddy current testing was performed and revealed one leaking tube, identified as tube number 02 in row 77. A fiber optics examination of the leaking tube was also made. The leaking tube was discovered to have a 60°-90° circumferential crack at the bottom of the upper tube sheet. The tube was plugged by insertion of a stabilizing rod. Eddy current examinations of approximately 120 other tubes revealed no additional tube leaks. One additional tube, tube 1 of row 77, located on the open tube lane, was also plugged and stabilized as a precautionary measure although the tube had no eddy current signal distortion.

With regard to this and previous Oconee steam generator tube leaks, evaluation by Duke and the OTSG vendor, the Babcock & Wilcox Company, is continuing. However, there is no evidence to date to indicate that the leaks have resulted from tube wastage/thinning, chemical attack, or intergranular stress-corrosion cracking. Studies indicate, however, that leaks occurring in the tube lanes are caused by propagation of a local defect by high cycle fatigue due to vibration.

Analysis of Occurrence:

Primary-to-secondary system leakage, resulting from this occurrence, was calculated to be approximately 0.4 gallons per minute. This was detected by installed radiation monitoring equipment. The leakage did not exceed

the operational limits of Oconee Technical Specification 3.1.6.1, however, a reactor shutdown was initiated upon indication of an increase of the radiation indication.

The calculated gaseous activity released to the environment via the air ejectors was approximately 2.03 curies. This amount is considered insignificant in comparison to the station's annual release limit.

This report describes the tenth occurrence of steam generator tube leakage experienced on the three Oconee units. In the first three occurrences and the fifth, sixth, eighth and tenth occurrence, the defective tubes edged an open tube lane (a radial row with no tubes, used for inspection purposes). In the fourth instance, the defective tube was angularly located approximately 150° counterclockwise from the locations of the other defective tubes and was not adjacent to an open tube lane. In the seventh instance, the leaking tube was located approximately 45° clockwise from the open tube lane. In the ninth occurrence, the leaking tube was on the outer circumference of the tube lane next to the lane edging an open tube lane and therefore was subjected to approximately the same vibration as the tubes edging the open lane. Table 1 provides a summary of the major OTSG tube experience at Oconee.

It is considered that this incident did not affect the health and safety of the public.

Corrective Action:

The leaking tube, tube 02 of row 77 was plugged with a stabilizing rod inserted in the top and explosively plugged at the bottom. Tube 01 of row 77 was also plugged in the same manner.

As stated in RO-269/77-2 submitted by my letter of January 31, 1977, the OTSG vendor, Babcock & Wilcox, is currently involved in a program to further evaluate the cause of the tube failures. This program includes a review of deposit samples, a computer evaluation of all available eddy current data, a review of visual observations from fiber-optics and videotapes, and macro-microscopic analysis of two of the defective tubes that were removed from the Oconee Unit 2 "2B" OTSG, one which was removed from the Unit 1 "1B" OTSG, and one tube removed along with its stabilizing rod from the Unit 1 "1B" OTSG. The open lane flow characteristics are being analyzed and a detailed stress/vibration analysis is being conducted on the tubes in rows 75 and 77. A review has been made of the Oconee station operating history, the Oconee steam generator manufacturing history and previously conducted OTSG analysis and testing results.

Additionally, an instrumentation package has been devised and installed on Oconee Unit 2 "2B" OTSG to assist in the identification of the cause of the tube leaks.

SUMMARY OF MAJOR OTSG TUBE EXPERIENCE AT OCONEE

GENERATOR	ROW	TUBE	ELEVATION	DATE	LANE TUBE	LEAKER	CONDITION	ACTION	RO#	# TUBES EXAMINED (excludes leakers)
1-A	77	17	Tubesheet	10/31/76	Yes	Yes	Crack	Plugged	RO-269/76-17	15
1-A	77	18	Tubesheet	10/31/76	Yes	No	Distorted Eddy Current Signal	Plugged		
1-B	114	109	14th Plate	12/8/76	No	Yes	No Visual Inspection	Nailed	RO-269/76-19	139
1-B	113	115	14th Plate	12/8/76	No	No	Distorted Eddy Current Signal	Plugged		
1-B	113	110	14th Plate	12/8/76	No	No	Similar to 114/109	Nailed		
1-B	75	18	Tubesheet	12/8/76	Yes	No	300° Crack	Nailed		
1-B	75	12	Tubesheet	1/15/77	Yes	Yes	350° Crack	Nailed	RO-269/77-2	140
1-B	81	128	Tubesheet	1/15/77	No	No	Eddy Current Indication	Nailed		
1-B	32	13	14th Plate	2/28/77	No	Yes	Eddy Current Indication	Nailed	RO-269/77-8	3%
1-B	33	14	14th Plate	2/28/77	No	No	Eddy Current Indication	Nailed		
1-B	77	25	14th Plate	2/28/77	Yes	No	Eddy Current Indication	Removed		
1-B	2	7	13th Plate	2/28/77	No	No	Eddy Current Indication	Plugged		
1-B	2	8	13th Plate	2/28/77	No	No	Eddy Current Indication	Plugged		
1-B	101	40	4th Plate	2/28/77	No	No	Eddy Current Indication	Plugged		

SUMMARY OF MAJOR OTSG TUBE EXPERIENCE AT OCONEE (CONT'D)

GENERATOR	ROW	TUBE	ELEVATION	DATE	LANE TUBE	LEAKER	CONDITION	ACTION	RO#	# TUBES EXAMINED (excludes leakers)
1-B	77	25	Tubesheet	3/22/77	Yes	Yes	Weld Crack	Replug- ged	RO-269/77-11	100
1-B	77	3,5,8,	---	3/22/77	Yes	No	Distorted Eddy Current Signal	Plugged		
1-B	77	15	Tubesheet	5/7/77	Yes	Yes	Crack	Plugged	RO-269/77-16	507
1-B	77	18	---	5/7/77	Yes	No	---	Removed		
1-B	17	5	---	5/7/77	No	No	Distorted Eddy Current Signal	Plugged		
2-B	77	23	Tubesheet	12/4/76	Yes	Yes	270° Crack, Hole	Removed	RO-270/76-15	133
2-B	77	27	15th Plate	12/4/76	Yes	No	Wear Appearance	Removed		
2-B	124	42	12th Plate	12/4/76	No	No	Eddy Current Indication, 40-60%	Plugged		
2-B	118	52	12th Plate	12/4/76	No	No	Similar to 124/42, 15%	Left		
3-B	77	11	15th Plate	7/21/76	Yes	Yes	No Visual Inspection	Plugged	RO-287/76-10	9
3-B	77	19	15th Plate	2/14/77	Yes	Yes	Eddy Current 45° Crack	Nailed	RO-287/77-2	142
3-B	77	12,13,14,15 16,17,18,20, 21		2/14/77	Yes	No	Eddy Current	Nailed		
3-B	75	2		2/14/77	Yes	No	Eddy Current	Nailed		
3-B	78	1	15th Plate	6/10/77	No	Yes	90° Crack & 1/8" longitudinal	Nailed	RO-287/77-8	133

SUMMARY OF MAJOR OTSG TUBE EXPERIENCE AT OCONEE (CONT'D)

GENERATOR	ROW	TUBE	ELEVATION	DATE	LANE TUBE	LEAKER	CONDITION	ACTION	RO#	# TUBES EXAMINED (excludes leakers)
3-B	77	2	Tubesheet	7/14/77	Yes	Yes	60°-90° Crack	Nailed	RO-287/77-10	120
3-B	77	1	---	7/14/77	Yes	No	---	Nailed		

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