REGULATORY FORMATION DISTRIBUTION SY((RIDS)

ACCESSION NBR:8410120200 DOC.DATE: 84/10/01 NOTARIZED: NO DOCKET #
FACIL:50-269 Oconee Nuclear Station, Unit 1, Duke Power Co. 05000269
50-270 Oconee Nuclear Station, Unit 2, Duke Power Co. 05000270
50-287 Oconee Nuclear Station, Unit 3, Duke Power Co. 05000287
AUTH.NAME AUTHOR AFFILIATION
TUCKER,H.B. Duke Power Co.
RECIP.NAME RECIPIENT AFFILIATION
DENTON,H.R. Office of Nuclear Reactor Regulation, Director
STOLZ,J.F. Operating Reactors Branch 4

SUBJECT: Forwards steam generator operating histories as part of continuing response to request.Info valid through 840630.

DISTRIBUTION CODE: A001D COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 44
TITLE: OR Submittal: General Distribution

NOTES:AEOD/Ornstein:1cy. 05000269
OL:02/06/73
AEOD/Ornstein:1cy. 05000270
OL:10/06/73
AEOD/Ornstein:1cy. 05000287
OL:07/19/74

	RECIPIENT ID CODE/NAME		COPIES LTTR	COPIES ENCL	RECIPIENT ID CODE/NAME		COPIES LTTR	COPIES ENCL
	NRR ORB4 BC	01	7	7				
INTERNAL:	ADM/LFMB		1	0	ELD/HDS4		1	0
	NRR/DE/MTEB		1	1	NRR/DL DIR		1	1
	NRR/DL/ORAB		1	0	NRR/DSI/METB		1	1
	NRR/DSI/RAB		1	1	REG FILE	04	1	1
	RGN2		1	1				
EXTERNAL:	ACRS	09	6	6	LPDR	03	1	1
	NRC PDR	02	1	1	NSIC	05	1	1
	NTIS		1	1				
NOTES:			1	1				

TOTAL NUMBER OF COPIES REQUIRED: LTTR 27 ENCL 24

DUKE POWER COMPANY
P.O. BOX 33189
CHARLOTTE, N.C. 28242

HAL B. TUCKER
VICE PRESIDENT
NUCLEAR PRODUCTION

TELEPHONE
(704) 373-4531

October 1, 1984

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. John F. Stolz, Chief
Operating Reactors Branch No. 4

Re: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287

Dear Sir:

As part of our continuing response to your request for steam generator operating experience updates dated December 9, 1977, please find attached the steam generator Operating Histories for all three Oconee units. The information herein is valid through June 30, 1984 and supersedes all previous information.

Very truly yours,

Hal B. Tucker

RFH/kbc

Attachment

cc: Mr. James P. O'Reilly, Regional Administrator
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

Mr. J. C. Bryany
NRC Resident Inspector
Oconee Nuclear Station

Ms. Helen Nicolaras
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Comm.
Washington, D. C. 20555

A001
1/1

ATTACHMENT 1

OCONEE NUCLEAR STATION

UNIT 1

STEAM GENERATOR OPERATING HISTORY

OCONEE NUCLEAR STATION

UNIT 1

I. BASIC PLANT INFORMATION

Startup Date: July 15, 1973
Utility: Duke Power Company
Location: Seneca, South Carolina
Thermal Power Level: 2568 MWt
NSSS Supplier: Babcock and Wilcox (B & W)
Number of Loops: 2
Steam Generator Supplier, Model No., Type: B & W, 177 FA, Once Through Steam Generator (OTSG)
Number of tubes per Generator: 15,530
Tube Size, Material: Alloy 600; 0.625" OD; 0.557" ID

II. STEAM GENERATOR OPERATING CONDITIONS

Normal Operation

Inlet Temeprature: 602.8°F
Primary Pressure: 2200 psi
Secondary Pressure: 925 psi
Allowed Leak Rate: 0.3 gpm
Primary Flow Rate: 65.66×10^6 lb/hr

Accidents

Design Basis LOCA; Maximum Delta-P: 925 psi
Main Steam Line Break; Maximum Delta-P: 2200 psi

III. STEAM GENERATOR SUPPORT PLATE INFORMATION

Material: SA 212 B Carbon Steel
Design Type: Broached
Design Code: ASME III (through 1967)
Dimensions: 58.7" R, thickness 1.5"
Steam Flow Rate: 5.3×10^6 lb/hr
Tube Dimensions: 5/8" D x .034" wall (nominal)

IV. STEAM GENERATOR BLOWDOWN INFORMATION

Oconee Nuclear Station's Once Through Steam Generators (OTSG) are not designed to perform normal blowdowns. There is no operational requirement to perform normal blowdowns. The steam generator sample line, however, can provide a limited blowdown capability of 1 GPM during power operation.

V. WATER CHEMISTRY SPECIFICATIONS

A. Feedwater (Normal Power Operation)

Total Solids	10 ppb (max)
Cation Conductivity	0.5 μmho/cm (max)
Dissolved Oxygen as O_2	7 ppb (max)
Hydrazine as N_2H_4	1-25 ppb
Silica as SiO_2	20 ppb (max)
Total Iron as Fe	10 ppb (max)
Total Copper as Cu	2 ppb (max)
pH @ 77°F	9.3-9.6
Lead as Pb	1 ppb (max)

Feedwater (Startup*)

Total Iron as Fe	100 ppb (max)
Cation Conductivity	1.0 μmho/cm (max)
Dissolved Oxygen as O_2	100 ppb (max)
Hydrazine	300% of stoichiometric O_2

* Established prior to feeding OTSGs.

B. OTSG Water (Less Then 10% Steaming)

pH	9.0-10.5
Cation Conductivity	10 μmho/cm (max)
Chloride	1.0 ppm (max)
Sodium	2.0 ppm (max)

OTSG Water (Layup)

Ammonia as NH_3	10 ppm (nominal) 2 ppm-20 ppm range
ph @ 77°F	9.5-10.5
Hydrazine	200 ppm initial 50 ppm (min)
Sodium	1.0 ppm (max)
Cation Conductivity	10 μmho/cm (max)

C. Condenser Cooling Water

Condenser Cooling Water is obtained from Lake Keowee. There are no demineralizers or cooling towers installed. The following is a table of representative chemistry values:

Calcium	2.2 ppm
Magnesium	0.7 ppm
Sodium	1.7 ppm
Potassium	0.9 ppm
Bicarbonate Alkalinity	13.6 ppm
Sulfates	1.1 ppm
Chlorides	0.6 ppm
Phosphates	<0.2 ppm
Nitrates	0.1 ppm
Free Carbon Dioxide	11.0 ppm
Silica	6.1 ppm
Total Iron	0.05 ppm
Manganese	0.12 ppm
pH	6.5-7.0

VI. TURBINE STOP VALVE TESTING

Turbine Stop Valve Testing had been performed on a daily basis from initial startup until February 1974, when weekly testing was inititated. In July 1975, the testing frequency was returned to a daily basis for stop valves and weekly for the control valves. In March 1977 when it appeared that stop valve testing might possibly contribute to steam generator tube failure, the frequency was changed back to monthly.

Frequency

Actual: Monthly (maximum time between tests is 6 weeks)
Recommended: Daily (turbine vendor)
Monthly (steam generator vendor)

Power Level

Actual: 65 percent full power, or
94 percent full power if power reduction not desirable
Recommended: 65 percent full power (steam generator vendor)
No recommendation (turbine vendor)

Testing Procedures

Actual: Stroke Length - full - 8.5 inches
- to trip - 8.0 inches
Stroke Rate - open to closed - 13 sec.
- closed to open - 27 sec.
Recommended: same as actual

VII. STEAM GENERATOR TUBE DEGRADATION HISTORY

A. November 1974 - Initial Refueling Inservice Inspection

OTSG 1A:

Number of tubes inspected: 573 (3.69%)
Number of tubes plugged prior to this ISI: 40 (.26%)
Number of tubes plugged this ISI: 0

Eddy-Current Exam Results: No evidence of degradation in excess of 20%.

OTSG 1B:

Number of tubes inspected: 493 (3.17%)
Number of tubes plugged prior to this ISI: 33 (.21%)
Number of tubes plugged this ISI: 0

Eddy-Current Exam Results: No evidence of degradation in excess of 20%.

B. March 1976 - 293 Effective Full Power Days (EFPD) since last refueling inspection

OTSG 1A:

Number of tubes inspected: 469 (3.02%)
Number of tubes plugged prior to this ISI: 40 (.26%)
Number of tubes plugged this ISI: 0

Eddy-Current Exam Results: No evidence of degradation in excess of 20%.

OTSG 1B:

Number of tubes inspected: 495 (3.19%)
Number of tubes plugged prior to this ISI: 33 (.21%)
Number of tubes plugged this ISI: 0

Eddy-Current Exam Results: No evidence of degradation in excess of 20%.

C. August 1977 - 308 EFPD since last refueling inspection

OTSG 1A:

Number of tubes inspected: 2500 (16.10%)
Number of tubes plugged prior to this ISI: 42 (.27%)
Number of tubes plugged this ISI: 5 (.03%)

Eddy-Current Exam Results: All 5 tubes were in periphery region and exceeded degradation limits. All five tubes showed corrosion/erosion type degradation with a maximum

wall thinning of 60%. The defect area was at the 14th support plate. The tubes were 7-4, 8-5, 117-107, 146-14, and 147-11.

OTSG 1B:

Number of tubes inspected: 5004 (32.22%)
Number of tubes plugged prior to this ISI: 53 (.34%)
Number of tubes plugged this ISI: 37 (.24%)

Eddy-Current Exam Results: All tubes were in periphery region. All tubes plugged showed localized OD degradation with a maximum wall thinning of 100%. The defect area was at the 14th support plate except as noted:

88-122 (9th)	8-49	100-124
75-121 (12th)	60-114 (12th)	100-120
76-122 (12th)	100-122 (13th)	101-122
43-108	75-133	62-12
41-110	9-51 (12th)	61-12
16-71	8-48	7-32 (between 12th-13th)
60-127	83-117	133-56 (11th)
61-123	99-125	51-123
17-79 (13th)		

Tubes 43-108 and 83-117 were removed for further study.

Tubes 69-128 and 69-132 were mistakenly plugged. Plugs should have been inserted in Tubes 68-127 and 68-131, respectively.

Tube 17-79 was correctly plugged at the UTS, but the LTS plug was mistakenly inserted in Tube 15-75. Tube 133-56 was correctly plugged at the LTS, but the UTS plug was mistakenly inserted in Tube 132-55.

Tubes 79-2, 133-57, 22-92, and 138-68 were plugged for reasons other than exceeding the degradation limit. The LTS plug for Tube 22-92 was mistakenly inserted in Tube 21-89.

D. August 1978 - 246 EFPD since last refueling inspection

OTSG 1A:

Number of tubes inspected: 1380 (8.89%)
Number of tubes plugged prior to this ISI: 47 (.30%)
Number of tubes plugged this ISI: 3 (.02%)

Eddy-Current Exam Results: All three tubes were in the periphery region and exceeded degradation limits. All three tubes showed localized OD degradation with a maximum wall thinning of 65%. The three tubes and their respective defect areas were: 75-9 at the 15th support plate, and 6-3 and 9-7 at the 14th support plate.

OTSG 1B:

Number of tubes inspected: 1121 (7.22%)
Number of tubes plugged prior to this ISI: 95 (.66%)
Number of tubes plugged this ISI: 36 (.23%)

Eddy-Current Exam Results: All tubes were in the periphery region. Twenty-four tubes showed localized OD degradation with a maximum wall thinning of 75%. The defect area is as noted:

6-32 (14th SP)	55-125 (14th SP)	90-129 (11th SP)
6-51 (14th SP)	64-125 (14th SP)	93-119 (10th SP)
7-1 (14th SP)	69-2 (13th SP)	98-125 (14th SP)
8-45 (14th SP)	85-126 (14th SP)	101-121 (13th SP)
12-68 (13th SP)	85-127 (14th SP)	112-6 (13th SP)
53-125 (12th SP)	86-127 (12th SP)	113-112 (14th SP)
54-2 (11th SP)	89-125 (12th SP)	143-6 (7th SP)
55-124 (14th SP)	90-124 (14th SP)	150-16 (7th SP)

Tubes 77-18 and 85-127 were removed for study.

Tubes 56-126, 66-127, 85-125, and 151-11 were mistakenly plugged.

Tubes 7-2, 72-68, 77-18, and 115-110 were plugged for reasons other than exceeding degration limit.

Tubes 61-89, 68-127, 68-131, and 73-129 were plugged to correct errors made previously.

Plugging of Tubes 15-75, 17-79, 21-89, 22-92, 96-4, 101-4, 132-55, and 133-56, which were previously plugged at only one end, was completed.

E. November 1979 - 303 EFPD since last refueling inspection

OTSG 1A:

Number of tubes inspected: 3100 (24%)
Number of tubes plugged prior to this ISI: 50 (.39%)
Number of tubes plugged this ISI: 12 (.09%)

Eddy-Current Exam Results: The tubes were predominantly located in the periphery region. These tubes showed localized OD degradation with a maximum wall thinning of 65%. The defect area is as noted:

4-14 (14th SP)	8-16 (6th SP)
5-17 (14th SP)	75-7 (15th SP)
78-7 (14th SP)	75-8 (15th SP)
78-22 (14th SP)	79-8 (14th/15th SP)
54-125 (14th SP)	54-127 --
53-124 (14th SP)	75-10 --

Tube 54-127 was mistakenly plugged for Tube 54-125, only the bottom of Tube 75-10 was plugged in error when Tube 75-9 was being removed from service previously.

OTSG 1B:

Number of tubes inspected: 7500 (51%)
Number of tubes plugged prior to this ISI: 132 (.90%)
Number of tubes plugged this ISI: 71 (.48%)

Eddy-Current Exam Results: The tubes were predominantly located in the periphery region. These tubes showed OD degradation, except for Tube 130-23 which showed ID, with a maximum wall thinning of 80%. The defect area is as noted:

6-43 (14th SP)	110-110 (12th SP)	75-120 (14th SP)
50-121 (14th SP)	114-1 (12th SP)	138-2 (7th SP)
7-33 (14th SP)	97-123 (14th SP)	106-110 (14th SP)
77-113 (14th SP)	22-90 (14th SP)	10-65 (14th SP)
79-129 (13th SP)	40-110 (14th SP)	76-119 (14th SP)
102-122 (14th SP)	74-8 (14th SP)	78-125 (12th SP)
114-110 (14th SP)	13-74 (14th SP)	146-26 (6th SP)
150-18 (12th SP)	81-117 (14th SP)	6-28 (10th SP)
140-35 (11th/12th SP)	83-130 (10th SP)	9-61 (14th SP)
19-55 (13th SP)	150-14 (8th SP)	9-62 (14th SP)
5-41 (14th SP)	35-101 (14th SP)	18-73 (9th SP)
8-55 (14th SP)	66-131 (14th SP)	12-71 (14th SP)
14-69 (14th SP)	124-21 (14th SP)	124-22 (14th SP)
35-92 (12th SP)	98-4 (14th SP)	34-7 (14th SP)
51-105 (14th SP)	91-4 (14th SP)	72-8 (13th SP)
41-109 (14th SP)	87-6 (14th SP)	65-125 (14th SP)
50-122 (14th SP)	11-6 (14th SP)	52-108 (7th SP)
73-127 (14th SP)	31-13 (14th SP)	116-7 (12th SP)
74-113 (14th SP)	61-11 (14th SP)	3-10 (13th SP)
130-23 (3rd-4th SP)	61-110 (12th SP)	122-91 (8th SP)
10-4 (14th SP)	46-119 (10th SP)	23-90 --
44-10 (14th SP)	82-130 (13th SP)	151-14 --
72-127 (13th SP)	129-90 (14th SP)	97-120 --
61-10 (14th SP)	70-123 (14th SP)	

Tubes 23-90, 151-14, and 97-120 were mistakenly plugged for Tubes 22-90, 150-114, and 97-123 respectively.

F. July 1981 - 393 EFPD since last refueling inspection

OTSG 1A:

Number of tubes inspected: 2872 (18.4%)
Number of tubes plugged prior to this ISI: 62 (.39%)
Number of tubes plugged this ISI: 5 (.032%)

Eddy-Current Exam Results: The tubes were predominately located in the periphery region. These tubes showed localized OD degradation with a maximum wall thinning of 70%. The defect area is as noted:

61-2 (14th/15th SP)
55-1 (13th SP)
67-2 (14th SP)
71-127 (11th SP)
75-10 (obstruction)

Tube 75-10 was removed due to obstruction.

OTSG 1B:

Number of tubes inspected: 8193 (52%)
Number of tubes plugged prior to this ISI: 203 (1.3%)
Number of tubes plugged this ISI: 40 (-25%)

Eddy-Current Exam Results: The tubes were predominately located in the periphery region. These tubes showed OD degradation with a maxium wall thinning of 80%. The defect area is as noted:

48-85 (LTS)
87-126 (14th SP)
105-121 (14th SP)
117-105 (13th SP)
114-111 (14th SP)
143-5 (11th SP)
130-20 (13th SP)
122-3 (14th SP)
121-4 (14th SP)
116-21 (10th SP)
85-2 (14th SP)
58-3 (14th SP)
70-3 (14th SP)
32-14 (14th SP)
27-7 (12th-13th SP)
11-5 (14th SP)
28-39 (14th SP)
35-91 (12th SP)
44-109 (14th SP)
52-117 (12th SP)
73-120 (14th SP)
75-114 (14th SP)
77-11 (15th SP)
78-1 (14th SP)
76-112 (14th SP)
99-124 (14th SP)
123-13 (14th SP)
121-14 (14th SP)
86-18 (5th-6th SP)
100-3 (14th SP)
122-90 (8th SP)
52-2 (14th-15th SP)
50-2 (13th-14th SP)
27-12 (14th SP)
17-8 (14th SP)
6-10 (13th SP)
26-89 (14th SP)
77-6 (5th SP)
123-1 (15th SP-UTS)
44-110 ---

Tube 123-1 was removed due to obstruction.

Tube 44-110 was mistakenly plugged.

G. July 1983 - 403 EFPD since last refueling inspection

OTSG 1A:

Number of tubes inspected: 3709 (23.9%)
Number of tubes plugged prior to this ISI: 68 (0.44%)
Number of tubes plugged this ISI: 6 (0.04%)

Eddy - Current Exam Results: 13 tubes showed degradation equal to or in excess of 20%; all but two at the 14th support plate.

Six tubes showed localized OD degradation exceeding the 40% plugging limit with a maximum wall thinning of 56%. In all six, the defect area was at the 14th support plate. The tubes were 9-18, 5-10, 5-11, 53-123, 123-83, and 64-127.

OTSG 1B:

Number of tubes inspected: 8067 (51.9%)
Number of tubes plugged prior to this ISI: 244 (1.57%)
Number of tubes plugged this ISI: 18 (0.12%)

Eddy - Current Exam Results: 58 tubes showed degradation in excess of 20% with most occurring at the 13th and 14th support plates. 18 tubes showed localized OD degradation exceeding the 40% plugging limit with a maximum wall thinning of 75%. Following are the tubes removed from service (defect location as noted):

81-125 (14th SP)	73-7 (14th SP)
101-123 (14th SP)	73-8 (13th SP)
107-118 (14th SP)	58-108 (12th SP)
113-5 (13th SP)	80-126 (14th SP)
92-3 (14th SP)	124-12 (14th SP)
45-10 (14th SP)	116-4 (5th SP)
25-87 (14th SP)	60-6 (14th SP)
65-126 (14th SP)	65-127 (14th SP)
69-123 (14th SP)	60-7 (1" above 14th SP)

REGION IDENTIFICATION

Region	# Tubes Within Region
Periphery of Bundle (1)	6806 (43.82%)
Tube Lane (2)	382 (2.46%)
Interior	8342 (53.72%)
Total	15,530

Allowed wall thinning before plugging 40%

(1) Defined as tubes outside a 12 sided polygon connecting support rod positions (~20 rows)

(2) Defined as tubes within 3 rows of open tube lane

VIII. ABNORMAL OPERATIONAL EVENTS

A. October 31, 1976 RO-269/76-17 OTSG 1A

Number of tubes leaking:	1
Number of additional tubes inspected:	15
Total number of tubes plugged/removed:	2

Summary

a) Tube 77-17 plugged due to leakage at UTS.
b) Tube 77-18 also plugged.

B. December 8, 1976 RO-269/76-19 OTSG 1B

Number of tubes leaking:	2
Number of additional tubes inspected:	139
Total number of tubes plugged/removed:	4

Summary

a) 114-109 plugged due to leakage at 14th support plate (SP); 75-18 plugged due to leakage at UTS.

b) Tubes 113-110 and 107-115 also plugged.

C. January 15, 1977 RO-269/77-2 OTSG 1B

Number of tubes leaking:	1
Number of additional tubes inspected:	140
Number of tubes plugged/removed:	2

Summary

a) Tube 75-12 plugged due to crack at UTS.
b) Tube 81-128 also plugged.

D. February 28, 1977 RO-269/77-8 OTSG 1B

Number of tubes leaking:	2
Number of additional tubes insepcted:	490
Number of tubes plugged/removed:	7

Summary

a) Tube 32-13 plugged due to leakage at 14th SP; Tube 77-25 plugged due to leakage at UTS, removed for further study.

b) Tubes 33-14, 2-7, 2-8 also plugged.

c) Tube 101-4 plugged at LTS only; UTS plug mistakenly placed in 96-4.

E. March 22, 1977 RO-269/77-11 OTSG 1B

Number of tubes leaking: 1
Number of additional tubes inpsected: 100
Number of tubes plugged/removed: 5

Summary

a) Tube 77-22 plugged due to crack at 15th SP.
b) Tubes 77-3, 77-5, 77-8, and 77-29 also plugged.

F. May 7, 1977 RO-269/77-16 OTSG 1B

Number of tubes leaking: 1
Number of additional tubes inspected: 507
Number of tubes plugged/removed: 2

Summary

a) Tube 77-15 identified as leaking at crack 1/4" below UTS.
b) Tubes 77-5 also plugged.
c) Tube 75-18 removed (plugged previously).

G. April 27, 1978 RO-269/78-13 OTSG 1B

Number of tubes leaking: 2
Number of additional tubes inspected: 481
Number of tubes plugged/removed: 5

Summary

a) Tube 74-2 plugged due to leakage at UTS; Tube 69-1 plugged due to tube-to-tubesheet leakage at the LTS.

b) Tubes 59-1 and 70-1 plugged as precautionary measure.

c) Tube 77-27 plugged after unsuccessful extraction attempt.

H. October 3, 1978 RO-269/78-24 OTSG 1

Number of tubes leaking: 1

Reviewed previously plugged tubes.

Summary

a) A large leak was observed in Tube 85-125; tube had been severed during the ISI at the 13th support plate for removal of a tube sample and had not been properly plugged.

b) Investigation of previously plugged tubes revealed the following plugging errors existed prior to the outage:

Tube	Outage Plugged	Remarks*
15-75	1977 ISI (September 1977)	LTS plug intened for 17-79
**17-79	1977 ISI	LTS plug missing
21-89	1977 ISI	LTS plug intended for 22-92
**22-92	1977 ISI	LTS plug missing
61-86	OTSG Repairs (January 1973)	LTS and UTS plugged, intended for 61-89
**61-89	OTSG Repairs	Both plugs missing
68-127	1977 ISI	LTS and UTS plugged, intended for 69-128
**69-128	1977 ISI	Both plugs missing
**73-129	OTSG Repairs	Not plugged following FOAK (First-of-a-kind) instrument removal as intended
96-4	2/77 leak outage	UTS plug intended for 101-4
**101-4	2/77 leak outage	UTS not plugged
132-55	1977 ISI	LTS plug intended for 133-56
**133-56	1977 ISI	LTS not plugged.

* Both ends of tube generally plugged--UTS indicates upper tubesheet plug and LTS indicates lower tubesheet plug.

** Tubes not plugged which were to have been removed from service for indicated reasons.

The errors in which tubes were not removed from service (**) constitutes operation of the unit with a degraded RCS boundary.

I. July 23, 1979 RO-269/79-24 OTSG 1B

Number of tubes leaking: 1
Number of additional tubes inspected: 330
Number of tubes plugged/removed: 1

Summary

a) Tube 73-130 plugged and stabilized due to leakage at the 14th support plate.

J. December 26, 1980 RO-269/80-40 OTSG 1A

Number of tubes leaking: 1
Number of additional tubes inspected:
Number of tubes plugged/removed: 1

Summary

a) Tube 78-2 plugged and stabilized due to leakage at the 15th support plate.

b) Tubes 75-6, 75-21, 75-29, 77-32, 78-23 and 78-25 had indications of a maximum wall thinning of 30% at the 15th support plate. They were not plugged and stabilized.

K. February 9, 1982 RO-269/82-03 OTSG 1A

Number of tubes leaking:	1
Number of additional tubes inspected:	372
Number of tubes plugged/removed:	1

Summary

a) Tube 74-2 plugged and stabilized due to leakage at the 15th support plate on the upper tube sheet.

L. March 6, 1982 RO-269/82-06 OTSG 1B

Number of tubes leaking:	1
Number of additional tubes inspected:	374
Number of tubes plugged/removed:	1

Summary

a) Tube 78-2 plugged and stabilized due to leakage at the 15th support plate on the upper tube sheet.

IX. CONDENSER INFORMATION

As stated earlier in Section V of this report, water from Lake Keowee is used to provide condenser cooling. Condenser tubes are made of 304 Stainless Steel. During operation, tube leakage is detected by secondary chemistry analysis for silica; a maximum of 20 ppb is allowed. A search for a tube leak occurs whenever the silica concentration in the secondary begins to increase.

Date	Remarks
November 1974	2 tubes plugged
As of July 1981	Between 11/74 and 7/81, 3 tubes were plugged
July 1981	98 tubes plugged
As of June 1983	Between 7/81 and 6/83, 10 tubes were plugged
June 1983	43 tubes plugged
Total	156 tubes plugged

X. RADIATION EXPOSURE WITH RESPECT TO STEAM GENERATORS

Date	OTSG	Dose (Exam & Repair) (1)	Comment:
11/74	1A & 1B	44	First Refueling ISI
3/76	1A & 1B	28.3	Second Refueling ISI
10/76	1A	22	OTSG 1A leak
12/76	1B	25	OTSG 1B leak
1/77	1B	18.7	OTSG 1B leak
2/77	1B	25.4	OTSG 1B leak
5/77	1B	18	OTSG 1B leak
8/77	1A & 1B	25.7 (exam)	Third Refueling ISI
		20.4 (repair)	
4/78	1B	51.7	OTSG 1B leak
8/78	1A & 1B	276.4	Fourth Refueling ISI
11/79	1A & 1B	57.5 (exam)	Fifth Refueling ISI
		86.9 (repair)	
12/80	1A & 1B	59.5	OTSG 1A leak
7/81	1A & 1B	60.8 (exam)	Sixth Refueling ISI
		102.2 (repair)	
2/82	1A	4.7 (exam)	OTSG 1A Leak
		4.6 (repair)	
3/82	1B	5 (exam)	OTSG 1B Leak
		10.3 (repair)	
7/83	1A	17.4 (exam)	Seventh Refueling ISI
		5.6 (repair)	
	1B	32.7 (exam)	
		13.1 (repair)	
Total	1A & 1B	1015.9	

(1) Dose in person-rem; testing and repair were not always separable.

XI. DEFECT GROWTH

OTSG 1A

Tube Number	% Through Wall Indication 9/77 ISI	9/78 ISI	Growth
4-14	25	40	15
72-128	30	25	--
75-21	20	20	0
75-26	20	20	0
78-22	20	30	10

Type of Degradation: Corrosion/erosion at 14th SP, Tube 4-14; wear, Tube 78-22.

Two tubes which were inspected at the 9/77 ISI and which exceeded degradation limits at the 9/78 ISI were plugged. They exhibited an average degradation growth of approximately 30%.

OTSG 1B

Tube Number	% Through Wall Indication 9/77 ISI	9/78 ISI	Growth
7-54	15	20	5
9-53	10	35	25
12-68	28	38	10
22-90	13	40	27
44-109	25	40	15
90-125	20	35	15
92-117	25	40	15
5-38	0	20	20
6-43	15	25	10
12-9	20	20	0
17-80	18	20	2
18-85	20	20	0
26-6	20	40	20
35-91	20	20	0
58-122	0	23	23
61-110	33	40	7
64-129	0	35	33
73-130	0	25	25
74-8	20	30	10
75-10	0	38	38
75-21	10	10	0
76-119	10	10	0
90-124	15	33	18
91-126	10	33	23
110-111	18	20	2
143-5	20	28	8
Average			13.5

The degradation data presented for OTSG 1B is the result of an independent review of the Eddy-Current Readings, and may not reflect the data presented in the ISI report in all cases. It is considered to be the best data available.

Twenty-two tubes which were inspected at the 9/77 ISI and which exceeded degradation limits at the 9/78 ISI, were plugged. They exhibited an average degradation growth of approximately 32%.

Type of Degradation: Corrosion/erosion at the 14th support plate EFP
Days between 9/77 ISI and 9/78 ISI: 246.

ATTACHMENT 2

OCONEE NUCLEAR STATION

UNIT 2

STEAM GENERATOR OPERATING HISTORY

OCONEE NUCLEAR STATION

UNIT 2

I. BASIC PLANT INFORMATION

Startup Date: September 9, 1974
Utility: Duke Power Company
Location: Seneca, South Carolina
Thermal Power Level: 2568 MWt
NSSS Supplier: Babcock and Wilcox (B & W)
Number of Loops: 2
Steam Generator Supplier, Model No., Type: B & W, 177 FA, Once Through Steam Generator (OTSG)
Number of tubes per Generator: 15,530
Tube Size, Material: Alloy 600; 0.625" OD; 0.557" ID

II. STEAM GENERATOR OPERATING CONDITIONS

Normal Operation

Inlet Temperature: 602.8°F
Primary Flow Rate: 65.66×10^6 lb/hr
Primary Pressure: 2200 psi
Secondary Pressure: 925 psi
Allowed Leak Rate: 1 gpm

Accidents

Design Basis LOCA; Maximum Delta-P: 925 psi
Main Steam Line Break; Maximum Delta-P: 2200 psi

III. STEAM GENERATOR SUPPORT PLATE INFORMATION

Material: SA 212 B Carbon Steel
Design Type: Broached
Design Code: ASME III (through 1967)
Dimensions: 58.7"R, thickness 1.5"
Steam Flow Rate: 5.3×10^6 lb/hr
Tube Dimensions: 5/8" D x .034" wall (nominal)

IV. STEAM GENERATOR BLOWDOWN INFORMATION

Oconee Nuclear Station's Once Through Steam Generators (OTSG) are not designed to perform normal blowdowns. There is no operational requirement to perform normal blowdowns. The steam generator sample line, however, can provide a limited blowdown capability of 1 GPM during power operation.

V. WATER CHEMISTRY SPECIFICATIONS

Water chemistry specifications for Unit 2 are the same as Unit 1, and are contained in Attachment 1, Section V.

VI. TURBINE STOP VALVE TESTING

Turbine stop valve testing procedures for Unit 2 are the same as those for Unit 1 and are contained in Attachment 1, Section VI.

VII. STEAM GENERATOR DEGRADATION HISTORY

A. April 1976 - Initial Refueling Inspection

OTSG 2A

Number of tubes inspected: 479 (3.08%)
Number of tubes plugged prior to this ISI: 3 (.02%)
Number of tubes plugged this ISI: 0

Eddy-Current Exam Results: No evidence of degradation in excess of 20%.

OTSG 2B

Number of tubes inspected: 476 (3.07%)
Number of tubes plugged prior to this ISI: 5 (.03%)
Number of tubes plugged this ISI: 0

Eddy-Current Exam Results: No evidence of degradation in excess of 20%.

B. August 1977 - 277 EFPD since last refueling inspection

OTSG 2A

Number of tubes inspected: 506 (3.26%)
Number of tubes plugged prior to this ISI: 3 (.02%)
Number of tubes plugged this ISI: 0

Eddy-Current Exam Results: No evidence of degradation in excess of 20%.

OTSG 2B

Number of tubes inspected: 987 (6.36%)
Number of tubes plugged prior to this ISI: 8 (.05%)
Number of tubes plugged this ISI: 4 (.03%)

Eddy-Current Exam Results: Three tubes plugged were in the lane region and one in the interior. Maximum degradation was in excess of 40%. All were degraded at the 15th SP except the interior tube, which was at the 12th SP.

The plugged tubes were: 75-5 Lane
75-9 Lane
78-2 Lane
112-29 Interior

C. October 1978 - 289 EFPD since last refueling inspection

OTSG 2A

Number of tubes inspected: 1336 (8.60%)
Number of tubes plugged prior to this ISI: 3 (.02%)
Number of tubes plugged this ISI: 0

Eddy-Current Exam Results: Eight tubes showed degradation in excess of 20%, with a maximum through wall indication of 35%.

OTSG 2B

Number of tubes inspected: 1310 (8.44%)
Number of tubes plugged prior to this ISI: 19 (0.05%)
Number of tubes plugged this ISI: 0

Eddy-Current Exam Results: Eight tubes showed degradation in excess of 20%, with a maximum through wall indication of 35%.

D. March 1980 - 354 EFPD since last refueling inspection

OTSG 2A

Number of tubes inspected: 1895 (12%)
Number of tubes plugged prior to this ISI: 3 (.02%)
Number of tubes plugged this ISI: 0

Eddy-Current Exam Results: Six tubes showed degradation equal to or in excess of 20%, with a maximum through wall indication of 35%.

OTSG 2B

Number of tubes inspected: 1855 (12%)
Number of tubes plugged prior to this ISI: 25 (.16%)
Number of tubes plugged this ISI: 1 (.01%)

Eddy-Current Exam Results: Eleven tubes showed degradation equal to or in excess of 20%. One of these tubes (97-33) was in excess of the 40% plugging limit at 65% of the wall thickness. This tube was degraded at the 12th SP.

E. January 1982 - 400 EFPD since last refueling inspection

OTSG 2A

Number of tubes inspected: 2886 (18.58%)
Number of tubes plugged prior to this ISI: 3 (.02%)
Number of tubes plugged this ISI: 2 (.01%)

Eddy-Current Exam results: The number of OD indications observed increased by 36% as compared to the 3/8 refueling outage ISI. Two of the tubes examined were in excess of the 40% plugging limit. These 2 tubes showed OD degradation with a maximum wall thinning of 43%. The defect area is as noted:

106-116 (13th SP)
107-118 (14th SP)

OTSG 2B

Number of tubes inspected: 3634 (23.4%)
Number of tubes plugged prior to this ISI: 27 (.17%)
Number of tubes plugged this ISI: 7 (.04%)

Eddy-Current Exam results: The number of OD indications observed increased by 115% as compared to the 3/80 refueling outage ISI. Seven of the tubes examined were in excess of the 40% plugging limit, with a maximum through wall indication of 68%. The defect area is as noted:

89-30 (12th SP)
97-32 (12th SP)
104-33 (12th SP)
110-52 (12th SP)
114-65 (12th SP)
119-42 (12th SP)
119-60 (12th SP)

F. October 1983 - 409 EFPD since last refueling inspection

OSTG 2A:

Number of tubes inspected: 2038 (13.1%)
Number of tubes plugged prior to this ISI: 5 (0.032%)
Number of tubes plugged this ISI: 0

Eddy - Current Exam Results: Two tubes showed degradation in excess of 20%, with a maximum through wall indication of 24%

OSTG 2B:

Number of tubes inspected: 3790 (24.4%)
Number of tubes plugged prior to this ISI: 34 (0.22%)
Number of tubes plugged this ISI: 8 (0.052%)

Eddy - Current Exam Results: 15 tubes showed degradation in excess of 20%; all but 3 of these occurred at the 12th support plate. Eight of these tubes were worn in excess of the 40% plugging limit, with the maximum through wall indication being 54%. The defect area is as noted:

33-50 (12th SP)
46-35 (12th SP)

47-83 (12th SP)
87-16 (11th SP)
43-93 (12th SP)
95-44 (12th SP)
106-50 (12th SP)
123-11 (7 in. above 5th SP)

REGION IDENTIFICATION

Region	# Tubes Within Region
Periphery of Bundle (1)	6806 (43.82%)
Tube Lane (2)	382 (2.46%)
Interior	8342 (53.72%)
Total	15,530

Allowed wall thinning before plugging 40%

(1) Defined as tubes outside a 12 sided polygon connecting support rod positions (~20 rows)

(2) Defined as tubes within 3 rows of open tube lane

VIII. ABNORMAL OPERATIONAL EVENTS

A. December 4, 1976 RO-270/76-15 OTSG 2B

Number of tubes leaking:	1
Number of additional tubes inspected:	133
Number of tubes plugged/removed:	3

Summary

a) Tube 77-23 plugged due to leakage at upper tube sheet.
b) Tubes 77-27 and 124-42 also plugged.
c) Tubes 77-23 and 77-27 were removed.

B. October 7, 1977 RO-270/77-12 OTSG 2B

Number of tubes leaking:	1
Number of tubes plugged/removed:	7

Summary

a) Tube 77-25 plugged due to leakage at upper tube sheet

b) Tubes also plugged: 75-21, 77-4, 77-18, 77-19 77-21, 78-4.

c) All previously plugged tubes were replugged as an added precaution.

C. September 18, 1981 RO-270/81-16 OTSG 2B

Number of tubes leaking:	1
Number of additional tubes inspected:	365
Number of tubes plugged/removed:	1

Summary

a) Tube 77-2 plugged due to leakage at 15th support plate.

b) No other inspected tubes showed unacceptable degradation.

IX. CONDENSER INFORMATION

As stated earlier in Section V of this report, water from Lake Keowee is used to provide condenser cooling. Condenser tubes are made of 304 Stainless Steel. During operation, tube leakage is detected by secondary chemistry analysis for silica; a maximum of 20 ppb is allowed. A search for a tube leak occurs whenever the silica concentration in the secondary begins to increase.

Condenser tube leakage: A total of 298 tubes have been plugged. The last inspection was performed February 1982. Information on when the 43 other tubes were plugged is not available.

Date	Remarks
January 1975	2 tubes plugged
As of June 2, 1980	(Condenser-section) A-1 - 49 tubes plugged A-2 - 20 tubes plugged B-1 - 57 tubes plugged B-2 - 47 tubes plugged C-1 - 33 tubes plugged C-2 - 47 tubes plugged Total 253 tubes plugged
As of February 1982	Between 6/80 and 2/82, 43 tubes were plugged
As of October 1983	Between 2/82 and 10/83, 3 tubes were plugged
October 1983	13 tubes were plugged
Total	314 tubes plugged

X. RADIATION EXPOSURE WITH RESPECT TO STEAM GENERATORS

Date	Generator	Dose (Exam & Repair)[1]	Comments
4/76	A & B	2.1	First Refueling ISI
12/76	B	25	OTSG B leak
8/77	A & B	13.5 (exam)	Second Refueling ISI
		36.5 (repair)	SOAK (2) Instrumentation insertion and OTSG repair
10/77	B	18 (exam)	OTSG B leak
1/78	B	11.5	OTSG B leak and SOAK removal
10/78	A & B	23.0	Third Refueling ISI
3/80	A & B	25.4	Fourth Refueling ISI
9/81	2B	27.8 (exam)	OTSG B Leak
		0.4 (repair)	
1/82	2A	19.5 (exam)	Fifth refueling ISI
		5.1 (repair)	
	2B	12.4 (exam)	
		11.9 (repair)	
10/83	2A	15.2	Sixth Refueling ISI
	2B	31.5 (exam)	
		6.9 (repair)	
Total	2A & 2B	285.7	

(1) Dose in person-rem; examination and repair dosages could not always be separated.

(2) SOAK (Second-of-a-Kind) Flow-vibration instrumentation added for additional information on possible causes of OTSG leakage.

XI. DEFECT GROWTH

OTSG 2A

There are no tubes with a degradation history in Steam Generator 2A.
OTSG 2B

		% Through Wall Indication	
Tube Number	Location	8/77 ISI	10/78 ISI
75-14	15th SP	20	30
75-39	3rd - 4th SP	30	30

Type of Degradation: Wear (for Tube 75-14)
EFP Days between 8/77 and 10/78 ISI: 289

ATTACHMENT 3

OCONEE NUCLEAR STATION

UNIT 3

STEAM GENERATOR OPERATING HISTORY

OCONEE NUCLEAR STATION

UNIT 3

I. BASIC PLANT INFORMATION

Startup Date: December 10, 1974
Utility: Duke Power Company
Location: Seneca, South Carolina
Thermal Power: 2568 MWt
NSSS Supplier: Babcock & Wilcox (B & W)
Number of Loops: 2
Steam Generator Supplier, Model No. Type: B & W, 177 FA, Once Through Steam Generator
Number of tubes per Generator: 15,530
Tube Size, Material: Alloy 600; 0.625" OD; 0.557" ID

II. STEAM GENERATOR OPERATING CONDITIONS

Normal Operation

Inlet Temperature: 604°F
Primary Flow Rate: 65.66×10^6 lb/hr
Primary Pressure: 2200 psi
Secondary Pressure: 925 psi
Allowed Leak Rate: 1 gpm

Accidents

Design Basis LOCA; Maximum Delta-P: 925 psi
Main Steam Line Break; Maximum Delta-P: 2200 psi

III. STEAM GENERATOR SUPPORT PLATE INFORMATION

Material: SA 212 B Carbon Steel
Design Type: Broached
Design Code: ASME III (thru 1967)
Dimensions: 58.7"R, thickness 1.5"
Steam Flow Rate: 5.6×10^6 lb/hr
Tube Hole Dimensions: 5/8" D (nominal) x 0.034" wall

IV. STEAM GENERATOR BLOWDOWN INFORMATION

Oconee Nuclear Station's Once Through Steam Generators (OTSG) are not designed to perform normal blowdowns. There is no operational requirement to perform normal blowdowns. The steam generator sample line, however, can provide a limited blowdown capability of 1 GPM during power operation.

V. WATER CHEMISTRY SPECIFICATIONS

Water chemistry specifications for Unit 3 are the same as Unit 1 and are contained in Attachment 1, Section V.

VI. TURBINE STOP VALVE TESTING PROCEDURES

Turbine Stop Valve Testing Procedures for Unit 3 are the same as those for Unit 1 and are contained in Attachment 1, Section VI.

VII. STEAM GENERATOR DEGRADATION HISTORY

A. November 1976 - Initial Refueling Inspection

OTSG 3A

Number of tubes inspected: 586 (3.77%)
Number of tubes plugged prior to this ISI: 78 (0.50%)
(Note: These 78 tubes were plugged due to tube sheet construction errors.)
Number of tubes plugged this ISI: 0
Metalurgical Exam Results: No evidence of degradation in excess of 20%.

OTSG 3B

Number of tubes inspected: 489 (3.15%)
Number of tubes plugged prior to this ISI: 3 (0.02%)
Number of tubes plugged this ISI: 0
Metalurgical Exam Results: Four tubes had degradation between 20-30%. No other tubes showed evidence of degradation in excess of 20%.

B. October 1977 - 289 EFPD since last refueling inspection

OTSG 3A

Number of tubes inspected: 1090 (7.00%)
Number of tubes plugged prior to this ISI: 78 (0.50%)
Number of tubes plugges this ISI: 0
Metalurgical Exam Results: No evidence of degradation in excess of 20%.

OTSG 3B

Number of tubes inspected: 1090 (7.00%)
Number of tubes plugged prior to this ISI: 20 (0.13%)
Number of tubes plugged this ISI: 1 (0.01%)
Metalurgical Exam Results: Six lane tubes had evidence of degradation between 20%-40% at the 15th SP but were not plugged.

C. June 1978 - 160 EFPD since last refueling inspection

OTSG 3A

Number of tubes inspected: 882 (5.68%)
Number of tubes plugged prior to this ISI: 78 (0.50%)
Number of tubes plugged this ISI: 0
Metalurgical Exam Results: No evidence of degradation in excess of 20%.

OTSG 3B

Number of tubes inspected: 1107 (7.13%)
Number of tubes plugged prior to this ISI: 21 (0.14%)
Number of tubes plugged this ISI: 1 (0.01%)
Metalurgical Exam Results: 7 lane tubes showed evidence of degradation of between 20%-40% at the 15th SP but were not plugged. Two other tubes in the bundle showed degradation of between 20%-40% (at the 9th SP and between the 12th and 13th SP respectively) but were not plugged.

D. May 1979 - 264 EFPD since last refueling inspection

OTSG 3A

Number of tubes inspected: 825 (5.31%)
Number of tubes plugged prior to this ISI: 78 (0.50%)
Number of tubes plugged this ISI: 1 (0.01%)

Eddy-Current Exam Results: Six tubes exhibited degradation of 20%-30%, one each at the 9th and 10th SP, three at the 15th SP, and one between the 15th SP and the UTS Tube 75-3 was stabilized due to a through wall indication of approximately 60%.

OTSG 3B

Number of tubes inspected: 825 (5.31%)
Number of tubes plugged prior to this ISI: 22 (0.14%)
Number of tubes plugged this ISI: 1 (0.01%)

Eddy-Current Exam Results: Thirteen tubes exhibited degradation of 20%-30%, ten at the 15th SP and three at the UTS. Tube 77-10, with a through wall indication of 30% at the UTS, was plugged.

E. December 1980 - 308 EFPD since last refueling inspection

OTSG 3A

Number of tubes inspected: 3800 (10%)
Number of tubes plugged prior to this ISI: 80 (0.52%)
Number of tubes plugged this ISI: 0

Eddy-Current Exam Results: Four tubes exhibited degradation of 20%-30%, one each at the 11th, 12th, 14th, and 15th SP. No tube indications exceeded the 40% through wall plugging limitations.

OTSG 3B

Number of tubes inspected: 5230 (21%)
Number of tubes plugged prior to this ISI: 23 (0.15%)
Number of tubes plugged this ISI: 4 (0.03%)

Eddy-Current Exam Results: Twenty-five tubes exhibited degradation equal to or greater than 20%, one between the LTS and 1st SP, two between the 2nd and 3rd SP, one between the 8th and 9th SP, one between the 9th and 10th SP, one at the 10th SP, one at the 13th SP, eight at the 14th SP, two between the 14th and 15th SP. Four tubes (150-14 at the 10th SP and 4-4, 58-2, 62-113 at the 14th SP) exceeded the 40% through wall indication level and had to be plugged.

F. June 1982 - 349 EFPD since last refueling outage

OTSG 3A

Number of tubes inspected: 2863 (18.44%), and 328 (2.11%) partial
Number of tubes plugged prior to this ISI: 82 (0.53%)
Number of tubes plugged this ISI: 5 (.03%)

Eddy-Current Exam Results: Four tubes showed OD degradation with a maximum wall thinning of 86%. The defect area is as noted:

17-82	(15 SP)
47-6	(15 SP)
113-1	(15 SP)

Tube 85-1 would not be examined due to obstruction, and was removed from service by plugging.

OTSG 3B

Number of tubes inspected: 1915 (12.33%)
Number of tubes plugged prior to this ISI: 27 (0.17%)
Number of tubes plugged this ISI: 1 (.01%)

Eddy-Current Exam Results: Tube 100-11 showed OD degradation with a maximum wall thinning of 50% at the 14th tube support plate. This tube was removed from service by plugging.

G. April 1984 - 449 EFPD since last refueling outage

OTSG 3A:

Number of tubes inspected: 2869 (18.5%)
Number of tubes plugged prior to this ISI: 99 (0.64%)
Number of tubes plugged this ISI: 3 (0.019%)

Eddy - Current Exam Results: 13 tubes showed degradation in excess of 20%. Three tubes were worn in excess of 40% and were plugged; these tubes were 93-2 (at the 14th SP), 84-129 (at the 11th SP), and 2-10 (at the 12th SP). The maximum wall thinning was 86% in the last tube.

OTSG 3B:

Number of tubes inspected: 3770 (24.3%)
Number of tubes plugged prior to this ISI: 30 (0.19%)
Number of tubes plugged this ISI: 5 (0.032%)

Eddy - Current Exam Results: 16 tubes showed degradation in excess of 20%, the majority occurring at the 14th and 15th support plates. Five of these were plugged, as they exceeded the 40% limit; these were 13-2 (1 in. above the 14th SP), 75-10 (at the 15th SP), 75-11 (at the 15th SP), 124-93 (1 in. above the 14th SP) and 8-6 (at the 12th SP). The maximum wall thinning was 96% in 124-93.

REGION IDENTIFICATION

Region	# Tubes Within Region
Periphery of Bundle (1)	6806 (43.82%)
Tube Lane (2)	382 (2.46%)
Interior	8342 (53.72%)
Total	15,530

Allowed wall thinning before plugging 40%

(1) Defined as tubes outside a 12 sided polygon connecting support rod positions (~20 rows)

(2) Defined as tubes within 3 rows of open tube lane

VIII. ABNORMAL OPERATIONAL EVENTS

A. July 21, 1976 RO-287/76-10 OTSG 3B

Number of tubes leaking:	1
Number of other tubes inspected:	not available
Number of tubes plugged/removed:	3

Summary

a) Tube 77-11 was plugged due to leakage at the 15th SP.

b) Tubes 81-63, 37-6 were also plugged.

B. February 14, 1977 RO-287/77-2 OTSG 3B

Number of tubes leaking:	1
Number of other tubes inspected:	142
Number of tubes plugged/removed:	11

Summary

a) Tube 77-19 was plugged due to leakage from crack at 15th SP.

b) Tubes 75-2 and 77-12 thru -21 were also plugged.

C. June 10, 1977 RO-287/77-8 OTSG 3B

Number of tubes leaking:	1
Number of other tubes inspected:	133
Number of tubes plugged/removed:	1

Summary

a) Tube 78-1 was plugged due to leakage at 15th SP.

D. July 14, 1977 RO-287/77-10 OTSG 3B

Number of tubes leaking:	1
Number of other tubes inspected:	120
Number of tubes plugged/removed:	2

Summary

a) Tube 77-2 was plugged due to leakage at bottom of upper tube sheet.

b) Tube 77-1 was also plugged.

E. June 14, 1980 RO-287/80-10 OTSG 3A

Number of tubes leaking:	1
Number of tubes inspected:	360
Number of tubes plugged/removed:	1

Summary

a) Tube 77-3 was plugged and stabilized due to leakage at the upper tube sheet.

F. February 11, 1982 RO-287/82-03 OTSG 3A

Number of tubes leaking:	1
Number of additional tubes inspected:	174
Number of tubes plugged/removed:	2

Summary

a) Tube 2-4 was plugged and stabilized due to leakage at the upper tube sheet

b) Tube 75-118 was plugged because it was found to have a 52% through wall indication, no other tubes were removed from service.

G. October 9, 1982 OTSG 3A

Number of tubes leaking:	0
Number of tubes inspected:	909
Number of tubes plugged/removed:	1

Summary

a) Tube 97-106 was removed from service by plugging due to 60% OD degradation indication.

b) No leakers could be located.

H. November 17, 1982 RO-287/82-12 OTSG 3A

Number of tubes leaking:	5
Number of additional tubes inspected:	1,846
Number of tubes plugged/removed:	11

Summary

a) Four tubes (68-4, 78-8, 78-4, and 83-5) were plugged and stabilized due to leakage at the 15th support plate.

b) Tube 65-1 was plugged and stabilized due to leakage at the upper tube sheet.

c) Tubes 46-6, 73-130 and 78-5 showed OD degradation with a maximum wall thinning of 90% at the 15th support plate. These tubes were removed from service by plugging.

d) Tubes 78-8, 78-10 and 79-5 were pulled for laboratory analysis.

I. November 17, 1982 RO-287/82-12 OTSG 3B

Number of tubes leaking:	0
Number of tubes inspected:	432
Number of tubes plugged/removed:	0

Summary

a) The OTSG 3B was inspected as well to ensure that a similar problem as found in OTSG 3A did not exist.

b) No leakers could be located.

J. December 11, 1982 RO-287/82-14 OTSG 3B

Number of tubes leaking:	1
Number of additional tubes inspected:	631
Number of tubes plugged/removed:	2

Summary

a) Tube 77-9 was plugged and stabilized due to leakage at the upper tube sheet.

b) Tube 78-2 showed OD degradation with a maximum wall thinning of 62% at the 15th support plate. This tube was removed from service by plugging.

IX. CONDENSER INFORMATION

As stated earlier in Section V of this report, water from Lake Keowee is used to provide condenser cooling. Condenser tubes are made of 304 Stainless Steel. During operation, tube leakage is detected by secondary chemistry analysis for silica; a maximum of 20 ppb is allowed. A search for a tube leak occurs whenever the silica concentration in the secondary begins to increase.

Condenser tube leakage:

Date	Remarks
August 1976	Two tubes plugged.
October 1976	Identified cause of previous leakage as a broken bypass line support member causing steam to impinge directly on condenser tubes. Plugged approximately 150 tubes that were bent.
February 1977	One tube plugged.
April 1977	One tube plugged.
May 1977	Three tubes plugged.
December 1977	One tube plugged.
June 1982	210 tubes plugged.
April 1984	27 tubes plugged.
Total	395 tubes plugged.

X. RADIATION EXPOSURE WITH RESPECT TO STEAM GENERATORS

Date	Generator	Dose (Exam & Repair) (1)	Comments:
7/76	B	7	OTSG B leak
10/76	A & B	6.2	First Refueling ISI
2/77	B	10.7	OTSG B leak
6/77	B	3.7	OTSG B leak
7/77	B	6.9	OTSG B leak
10/77	A & B	39.3	Second Refueling ISI
6/78	A & B	14.3	Third Refueling ISI
5/79	A & B	15.9	Fourth Refueling ISI
6/80	A	7.5	OTSG A leak
12/80	A & B	17.9	Fifth Refueling ISI
2/82	3A	5.8 (exam)	OTSG A Leak
		23.6 (repair)	
6/82	3A	4.7 (exam)	Sixth Refueling ISI
	and	9.6 (repair)	
	3B	6.6 (exam)	
		1.0 (repair)	
10/82	3A	4.7 (exam)	OTSG A Leak
		0.4 (repair)	
11/82	3A & 3B	7.1 (exam)	OTSG A Leak
		24.6 (repair)	
12/82	3B	4.1 (exam)	OTSG B Leak
		3.3 (repair)	
4/84	3A	20.1 (exam)	Seventh Refueling ISI
		8.8 (repair)	
	3B	20.3 (exam)	
		9.9 (repair)	
Total	3A & 3B	284.0	

(1) Dose in person-rem: Testing and repair were not always separable.

XI. DEFECT GROWTH

OTSG 3B

Tube Number	Location	11/77	6/78	5/79	12/80
75-5	15th SP	25	25	25	20-30
75-6	15th SP	30	30	30	20-30
75-9	15th SP	30	25	25	25
75-10	15th SP	30	25	25	20-25
75-11	15th SP	30	25	25	<20
78-6	15th SP	35	30	25-30	25

No evidence of significant degradation growth in tubes for which data is available.

Approximately 160 EFPD elapsed between 11/77 and 6/78; approximately 264 EFPD elapsed between 6/78 and 5/79.

There are no tubes in OTSG 3A for which degradation growth data is available.