REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)
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50-287/270/287

REC: CASE E G
NRC

ORG: PARKER W O
DUKE PWR

DOCDATE: 02/16/78
DATE RCVD: 02/21/78

DOCTYPE: LETTER NOTARIZED: NO

COPIES RECEIVED
LTR 1 ENCL 1

SUBJECT:
RESPONSE TO NRC'S LTR DTD 12/09/77...FURNISHING INFO CONCERNING STEAM GENERATOR OPERATING HISTORY.

PLANT NAME: OCONEE - UNIT 1
OCONEE - UNIT 2
OCONEE - UNIT 3

REVIEWER INITIAL: XJM
DISTRIBUTER INITIAL:

********** DISTRIBUTION OF THIS MATERIAL IS AS FOLLOWS **********

NOTES:
1. M. CUNNINGHAM - ALL AMENDMENTS TO FSAR AND CHANGES TO TECH SPECS

GENERAL DISTRIBUTION FOR AFTER ISSUANCE OF OPERATING LICENSE.
(DISTRIBUTION CODE A001)

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J COLLINS**W/ENCL

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WALHALLA, SC**W/ENCL
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DISTRIBUTION: LTR 40 ENCL 39
SIZE: 1P+14P+17P

CONTROL NBR: 780530010

********** THE END **********

apt

DUKE POWER COMPANY
POWER BUILDING
422 SOUTH CHURCH STREET, CHARLOTTE, N. C. 28242

WILLIAM O. PARKER, JR.
VICE PRESIDENT
STEAM PRODUCTION

TELEPHONE: AREA 704
373-4083

February 16, 1978

Mr. Edson G. Case, Acting Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

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

Dear Sir:

In response to your letter of December 9, 1977 concerning steam generator operating history, please find attached the information requested with regard to the Oconee Nuclear Station.

Very truly yours,

William O. Parker, Jr.

KRW:ge

Attachments

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S
1/1

780530010

ATTACHMENT 1

OCONEE NUCLEAR STATION

UNIT 1

STEAM GENERATOR 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 Temperature: 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 (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 Than 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 initiated. 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

INSERVICE INSPECTION RESULTS

A. November 1974

Initial Refueling Inservice Inspection

Steam Generator 1A:

Number of Tubes Inspected: 573 (3.69%)

Number of tubes plugged: 0

Metalurgical Exam Results: No evidence of degradation in excess of 20%

Steam Generator 1B:

Number of Tubes Inspected: 493 (3.17%)

Number of Tubes plugged: 0

Metalurgical Exam Results: No evidence of degradation in excess of 20%.

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

Steam Generator 1A

Number of tubes inspected: 469 (3.02%)

Number of tubes plugged: 0

Metalurgical Exam Results: No evidence of degradation in excess of 20%

Steam Generator 1B

Number of Tubes Inspected: 495 (3.19%)

Number of tubes plugged: 0

Metalurgical Exam Results: No evidence of degradation in excess of 20%

C. August 1977 - 308 EFPD since last refueling inspection

Steam Generator 1A

Number of tubes inspected: 2500 (16.10%)

Number of tubes plugged prior to this ISI: 2 (.01%)

Number of tubes plugged this ISI: 5 (.03%)

Metalurgical Exam Results: All 5 tubes were in periphery region and exceeded degradation limits. All five tubes showed localized OD degradation with a maximum wall thinning of 60%. The defect area was at the 14th support plate. The tubes were 8-5, 117-107, 146-14, 147-11 and 7-4.

Steam Generator 1B

Number of tubes inspected: 5004 (32.22%)

Number of tubes plugged prior to this ISI: 19 (0.1%)

Number of tubes plugged this ISI: 34 (0.22%)

Metalurgical Exam Results:

All tubes were in the periphery region.

All tubes plugged showed localized OD degradation with a maximum wall thinning of almost 100%.

The defect area was at the 14th support plate except as noted:

88-122 (9th)	64-125[1]	99-125	138-68
68-127	37-4	100-124	51-123
75-121 (12th)	8-49	101-120	68-131[1]
76-122 (12th)	60-114 (12th)	101-122	
43-108[2]	100-122 (13th)	93-110	
41-110	75-113 (14th)	62-11	
16-71	9-51 (12th)	61-12	
17-79 (13th)	8-48	7-32 (between 12th-13th)	
60-127	76-111	7-53 (11th)	
61-123	83-117	133-56 (11th)	

(1) not plugged this ISI

(2) removed for further study

Tubes 22-92, 133-57, and 79-2 were also plugged during this ISI for reasons other than exceedance of degradation limit.

REGION IDENTIFICATION

Region	# Tubes Within Region
Periphery of Bundle (1)	6806 (43.82%)
Tube Lane (2)	636 (4.09%)
Interior	8088 (52.08%)
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) Within 5 rows of open tube lane

VIII. ABNORMAL OPERATIONAL EVENTS

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

Number of tubes leaking 1

Number of additional tubes inspected 15

Total number plugged/removed 2

Summary

a) Tube 77-17 plugged due to leakage

b) Tube 77-18 also plugged

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

Number of tubes leaking 1

Number of additional tubes inspected 139

Number of tubes plugged/removed 4

Summary

a) 114-109 plugged due to leakage at 14th support plate (SP)

b) Tubes 113-110, 75-18, 113-115, also plugged

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

Number of tubes leaking 1

Number of tubes additional inspected 140

Number of tubes plugged/removed 2

Summary

a) Tube 75-12 plugged due to crack at upper support plate

b) Tube 81-128 also plugged

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

Number of tubes leaking 1

Number of additional tubes inspected ~3%

Number of tubes plugged/removed 6

Summary

a) Tube 32-13 plugged due to leakage at 14th SP

b) Tubes also plugged: 101-4, 33-14, 2-7, 77-25, 2-8.

c) Tube removed: 77-25

E. March 22, 1977 RO-269/77-17 OTSG 1 B

Number of tubes leaking 1

Number of additional tubes inspected 100

Number of tubes plugged/removed 5

Summary

a) Tube 77-25 identified as leaker (weld failure in old plug)

b) Tubes also plugged: 77-3, 77-5, 77-8, 77-22, 77-29

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

Number of tubes leaking 1

Number of additional tubes inspected 507

Number of tubes plugged/removed 3

Summary

a) Tube 77-15 identified as leaker with crack 1/4" below upper tube sheet

b) Tube 17-5 also plugged

c) Tube 75-18 removed

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.

Condensor tube leakage:

Date	Remarks
November 1974	2 tubes plugged

X. RADIATION EXPOSURE WITH RESPECT TO STEAM GENERATORS

Date	Generator	Dose (Exam & Repair) (1)	Comment:
11/74	A & B	44	First Refueling ISI
3/76	A & B	28.3	Second Refueling ISI
10/76	A	22	OTSG A leak
12/76	B	25	OTSG B leak
1/77	B	18.7	OTSG B leak
2/77	B	25.4	OTSG B leak
5/77	B	18	OTSG B leak
8/77	A & B	25.7 (exam) 20.4 (repair)	Third Refueling ISI
Total	A & B	391	

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

XI. DEGRADATION GROWTH

OTSG 1B

Tube Number	Location	2/76	1/77	5/77	9/77
90-124	14th S.P.	--	--	20-30%	25-30%
113-112	14th S.P.	--	--	30%	30%
81-128	14th S.P.	60% (1)	80%	--	--
98-128	14th S.P.	--	--	0%	35%

No evidence of real degradation growth in tubes 90-124 and 113-112.

Tube 81-128 was plugged 1/77 and tube 98-128 is still in service.

EFPD between 2/76 - 1/77 is approximately 179.

EFPD between 5/77 - 9/77 is approximately 63.

(1) Computer evaluation techniques not available at time but tube was backchecked when 80% indication was observed.

There are no tubes with a degradation history in Steam Generator 1A.

ATTACHMENT 2

OCONEE NUCLEAR STATION

UNIT 2

STEAM GENERATOR 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: 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 (thru 1967)

Dimensions: 58.7"R, thickness 1.5"

Steam Flow Rate: 5.3×10^6 lb/hr

Tube Hole Dimensions: 5/8" D (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

INSERVICE INSPECTION RESULTS

A. April 1976 - Initial Refueling Inspection

Steam Generator 2A

Number of tubes inspected: 479 (3.08%)

Number of tubes plugged prior to this ISI: 0

Number of tubes plugged this ISI: 0

Metalurgical Exam Results: No evidence of degradation in excess of 20%

Steam Generator 2B

Number of tubes inspected: 476 (3.07%)

Number of tubes plugged prior to this ISI: 0

Number of tubes plugged this ISI: 0

Metalurgical Exam Results: No evidence of degradation in excess of 20%

B. August 1977 - 277 EFPD since last refueling inspection

Steam Generator 2A

Number of tubes inspected: 506 (3.26%)

Number of tubes plugged prior to this ISI: 0

Number of tubes plugged this ISI: 0

Metalurgical Exam Results: No evidence of degradation in excess of 20%

Steam Generator 2B

Number of tubes inspected: 987 (6.36%)

Number of tubes plugged prior to this ISI: 3 (.02%)

Number of tubes plugged this ISI: 4 (.03%)

Metalurgical 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

REGION IDENTIFICATION

Region	# Tubes with Region
Periphery of Bundle (1)	6806 (43.82%)
Tube Lane (2)	636 (4.09%)
Interior	8088 (52.08%)
Total	15,530

Allowed wall thinning before plugging = 40%

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

(2) Within 5 rows of open tube lane.

VIII. ABNORMAL OPERATIONAL EVENTS

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 also plugged: 77-27, 124-42

c) Tubes removed: 77-27, 77-23

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
January 1975	2 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) 36.5 (repair)	Second Refueling ISI SOAK Instrumentation insertion 1 (2) and OTSG repair
1/78	B	11	OTSG B leak and SOAK removal
10/77	B	18 (exam)	OTSG B leak
Total	A & B	106.1	

(1) Dose in man-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. DEGRADATION GROWTH

OTSG 2B

Tube Number	Location	12/76	6/77
75-5	15th S.P.	60%	85%
75-9	15th S.P.	40%	60%
75-14	15th S.P.	20%	20%

EFPD between 12/76 - 6/77 is approximately 180.

Tube 75-5 has since been stabilized, tube 75-9 has been removed and tube 75-14 is still in service.

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

ATTACHMENT 3

OCONEE NUCLEAR STATION

UNIT 3

STEAM GENERATOR 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)

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

Steam Generator 3A

Number of tubes inspected: 586 (3.77%)

Number of tubes plugged prior to this ISI: 0

Number of tubes plugged this ISI: 0

Metalurgical Exam Results: No evidence of degradation in excess of 20%.

Steam Generator 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: 4 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

Steam Generator 3A

Number of tubes inspected: 1090 (7.00%)

Number of tubes plugged prior to this ISI: 0

Number of tubes plugges this ISI: 0

Metalurgical Exam Results: No evidence of degradation in excess of 20%

Steam Generator 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: 0

Metalurgical Exam Results: 6 lane tubes had evidence of degradation between 20%-40% at the 15th SP but were not plugged.

REGION IDENTIFICATION

Region	# Tubes With Region
Periphery of Bundle (1)	6806 (43.82%)
Tube Lane (2)	636 (4.09%)
Interior	8088 (52.08%)
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) Within 5 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 about 10 feet below tube sheet.

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

b) Leak rate was approximately doubled by mainsteam stop value test conducted while leak was monitored

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

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

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	5.4	First Refueling ISI
2/77	B	9.1	OTSG B leak
6/77	B	3.5	OTSG B leak
7/77	B	63	OTSG B leak
10/77	A & B	21.5	Second Refueling ISI
Total	A & B	52.8	

(1) Dose in man-rem: Testing & repair were not always separable.

XI. DEGRADATION GROWTH

There are no tubes in either Steam Generator A or B with a degradation history.