



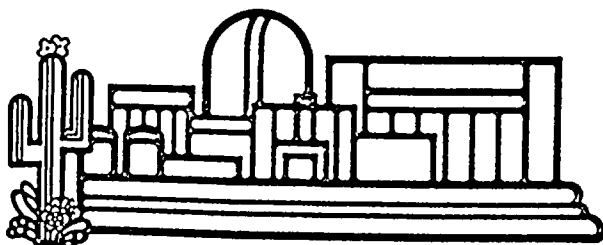
Arizona Nuclear Power Project

# NDE Summary Report

UNIT 1 STEAM GENERATOR EDDY CURRENT EXAMINATION

1ST REFUELING OUTAGE

OCTOBER 1987



8803150307 880224  
PDR ADOCK 05000528  
DCD



PALO VERDE NUCLEAR GENERATING STATION  
UNIT 1 STEAM GENERATOR EDDY CURRENT EXAMINATION  
1ST REFUELING OUTAGE  
OCTOBER 1987

ARIZONA NUCLEAR POWER PROJECT  
P. O. BOX 52034  
PHOENIX, AZ 85072

PREPARED BY: *[Signature]* DATE: 1/7/88  
REVIEWED BY: Michael J. Anderson DATE: 1/7/88  
APPROVED BY: *[Signature]* DATE: 1-7-88  
COMMERCIAL SERVICE DATE: 1/28/86  
REPORT DATE: 1/07/88



## INDEX

1.0 Summary

2.0 Examination Results

3.0 Examination Techniques and Equipment

APPENDIX A - Summary Data Sheets

APPENDIX B - Tubesheet Maps

APPENDIX C - Form NIS-1



## UNIT 1 STEAM GENERATOR EDDY CURRENT EXAMINATION

### 1.0 Summary

On October 2, 1987, Unit 1 was shutdown for its first refueling outage. A full Technical Specification examination was performed with an initial sample of approximately 2375 tubes in each steam generator. All tubes were examined from the cold leg side and all tubes were examined full length with the exception of row 1 and some row 2 tubes which were examined through the U-bend to the extent practical.

The initial examination results fell into category C-1 in both steam generators and no supplementary testing was required. However, due to available time in the schedule approximately 1375 additional tubes were examined in steam generator 12 with all results falling into category C-1.

### 2.0 Examination Results

The examination results revealed additional wear indications at the lower eggcrates on the cold leg side of both steam generators in the low row corners of the tube bundles. Two degraded tubes were identified in steam generator 11. The summary data sheets in Appendix A list all tubes in both steam generators with thru wall indications from 0 - 100% and distorted tube support signals with probable indications (DSI).

Several tubes were identified in each steam generator as having minor dings and dents. The majority of these indications were identified either during the January 1987 leaker outage or the baseline examination. No significant changes were observed.

Several tubes in the outer periphery in steam generator 12 have small indications and the third, fourth and fifth eggcrates. The indications are <20% thru wall and extremely small however, there does appear to be some growth since the examination performed in January 1987.

Three tubes in steam generator 11 were observed as having batwing indications. The indications are extremely small (<20%, 0.5 volts). One tube in steam generator 11 had an indication at vertical strap 5. The indication was present in the January 1987 examination and has grown from 29% thru wall and 1.43 volts to 34% thru wall and 1.85 volts. One tube in steam generator 12 had an 23% thru wall indication 2½ inches above the tubesheet.

Possible loose part (PLP) indications were observed in both steam generators. These indications were present during the January 1987 examination and no wear of the tube wall has occurred. Sludge profiling was also performed during the examination and was found to be very minor. Steam generator 11 had 251 tubes and steam generator 12 had 67 tubes in the sample with sludge indications. The average depth is less than 1 inch and the maximum depth observed was 1.8 inches.





The examination resulted in plugging an additional 11 (eleven) tubes in steam generator 11 and one tube in steam generator 12. The tube sheet maps in Appendix B show the total tubes plugged in each steam generator to date and the examination extent during this outage. The NIS-1 form in Appendix C lists each of the tubes, by row and column, plugged as a result of this examination. In addition to the above tube plugs, four plug welds (R1C188, R2C187, R2C185 and R4C185) in steam generator 12 hot leg were repair welded as they visually appeared to be leaking slightly. The following Engineering Evaluation Requests (EER) were initiated to track the examination results and subsequent plugging: 87-RC-227, 87-RC-228, 87-RC-240, 87-RC-251, 87-RC-253, 87-RC-259 AND 87-RC-260.

### 3.0 Examination Techniques and Equipment

The eddy current examination was performed by Conam Inspection using Zetec MIZ-18 digital data aquisition and analysis systems. The following test frequencies were used during the examination:

- 550 kHz differential and absolute
- 300 kHz differential and absolute
- 100 kHz differential and absolute
- 20 kHz differential and absolute

The majority of the tubes in the examination sample were tested with Zetec manufactured 0.610" SFM/HF probes. The tubes in rows 1 thru 10 were examined with a 0.590" SFM/HF probe. A Zetec SM-4 remote fixture was used for probe positioning and tubesheet templates were installed for tube location verification.



APPENDIX A

Summary  
Data  
Sheets



### LEGEND

- ROW: Indicates the row number of a given tube.
- LIN: Indicates the column number of a given tube.
- LEG: Indicates the tube leg from which examination was performed; either the hot (H) leg or cold (C) leg.
- EXTENT REQ: Indicates the tube length required to be examined, i.e., F/L - full length, 07H-seventh support on hot leg side.
- EXTENT TST: Indicates the tube length actually examined.
- REM: Remarks column used for comments relating to examination.
- REEL: Indicates reel number data was recorded on.
- PROBE: Indicates probe diameter and style used for examination.
- LOCATION: Gives indication location relative to known landmarks such as supports and batwings.
- VOLTS: Indicates the peak-to-peak voltage of a given indication response.
- DEG: The measured phase angle of a given indication response.
- %: The percent through the tube wall of a given indication based on the measured phase angle and the calibration curve established for that particular channel.
- CH: Indicates the channel used to measure and evaluate a given indication.



CUMULATIVE REPORT  
10/87, ARIZONA PUBLIC SERVICE CO., PALO VERDE, UNIT 1

STEAM GENERATOR: 1  
LOCATION: ALL  
CRITERIA: 0% TO 100%, DSI

PAGE: 1 OF 1  
DATE: 11/02/87  
TIME: 16:50:51

EXTENT										CURRENT				
ROW	LINE	HEAT#	LEG	REQ	TS	REMI	REEL	PROBE	LOCATION	VOLTS	MIL	DEG	X	CH
71	41		C	IF/LITEH			0011590SM101C-	0.4		0.71	168	(20	M1	
21	51		C	107HITEH			0011590SM103C-	0.8		0.51	145	(20	M1	
31	121		C	IF/LITEH			0011590SM101C-	0.3		0.91	161	(20	M1	
11	141		C	107H107H			0011590SM104C+	0.6		0.91	147	(20	M1	
351	161		C	IF/LITEH			0171610SM102C+	14.8		3.51	171	201	11	
491	361		C	IF/LITEH			0171610SM102H+	9.0		2.11	101	201	11	
			C	IF/LITEH			0171610SM102H+	13.3		4.01	121	201	11	
			C	IF/LITEH			0171610SM102H+	16.2		2.61	111	201	11	
			C	IF/LITEH			0171610SM104H+	6.4		9.21	231	201	11	
751	541		C	IF/LITEH			0171610SM102C+	4.6		3.41	121	201	11	
			C	IF/LITEH			0171610SM102C+	1.9		3.11	111	201	11	
			C	IF/LITEH			0171610SM101C+	32.1		2.61	111	201	11	
971	641		C	IF/LITEH			0171610SM1TSC+	2.2		2.11	111	201	11	
401	831		C	IF/LITEH			0141610SM104H+	15.5		1.41	141	201	11	
381	931		C	IF/LITEH			0171610SM1BW1-	1.9		0.51	153	(201	11	
411	961		C	IF/LITEH			0241610SM1BW1-	1.9		0.51	59	DSI	M1	
1571	1041		C	IF/LITEH			0301610SM101H+	13.8		1.61	101	201	11	
711	1081		C	IF/LITEH			0201610SM1VSS+	1.2		1.81	133	361	11	
721	1111		C	IF/LITEH			0241610SM101H+	14.6		2.31	101	201	11	
			C	IF/LITEH			0241610SM105H+	3.4		1.91	71	201	11	
			C	IF/LITEH			0241610SM101C+	8.6		1.21	101	201	11	
1151	1241		C	IF/LITEH			0241610SM106H+	38.3		1.51	51	(201	11	
			C	IF/LITEH			0241610SM106H+	39.7		3.21	61	201	11	
571	1581		C	IF/LITEH			0361610SM104H+	3.6		1.81	181	201	11	
			C	IF/LITEH			0361610SM103H+	38.2		4.01	191	201	11	
1061	1651		C	IF/LITEH			0341610SM1BW2-	1.0		1.51	152	(201	11	
111	1681		C	107HITEH			0271590SM102C+	2.2		1.31	61	(201	11	
111	1861		C	107H107H			0361610SM103C+	0.0		0.41	111	351	M1	
			C	107H107H			0361610SM103C-	0.9		0.41	120	201	M1	
31	1861		C	IF/LITEH			0261610SM103C+	1.1		0.61	126	DSI	M1	
21	1871		C	107HITEH			0261590SM105C+	0.1		0.61	118	251	M1	
			C	107HITEH			0261590SM104C+	0.2		1.41	109	381	M1	

NUMBER OF TUBES SELECTED FROM CURRENT OUTAGE: 21

NO TREND ANALYSIS REQUESTED





CUMULATIVE REPORT  
10/87, ARIZONA PUBLIC SERVICE CO., PALO VERDE, UNIT 1

STEAM GENERATOR: 2  
LOCATION: ALL  
CRITERIA: 0% TO 100%, DSI

PAGE: 1 OF 1  
DATE: 11/02/87  
TIME: 17:08:27

ROW	LINE	HEAT#	LEG	REQ	TEST	REEL	PROBE	LOCATION	VOLTS	SIMIL	DEG	%	CHI
21	31		C	IF/LITEH	0011590SM102C+	0.86			0.61		135	DSI	M1
99	22		C	IF/LITEH	0241610SM103C+	1.0			0.41		106	DSI	M1
			C	IF/LITEH	0091610RM103C+	0.9			0.41		102	DSI	M1
98	23		C	IF/LITEH	0091610RM103C+	1.0			0.31		119	DSI	M1
			C	IF/LITEH	0241610SM103C+	0.9			0.31		119	DSI	M1
38	79		C	IF/LITEH	0181610SM104H+	11.7			2.91		11	20	11
125	82		C	IF/LITEH	0181610SM104H+	14.5			6.11		14	20	11
			C	IF/LITEH	0181610SM102H+	27.8			5.01		10	20	11
			C	IF/LITEH	0181610SM103H+	12.4			10.31		13	20	11
			C	IF/LITEH	0181610SM106H+	0.5			6.51		13	20	11
158	83		C	IF/LITEH	0121610SM104C-	0.9			0.31		73	DSI	M1
			C	IF/LITEH	0241610SM104C-	1.0			0.41		85	DSI	M1
158	87		C	IF/LITEH	0241610SM105C-	0.7			0.41		136	DSI	M1
			C	IF/LITEH	0131610SM105C-	0.8			0.31		63	DSI	M1
77	108		C	IF/LITEH	0221610SM107H+	37.5			4.01		14	20	11
154	119		C	IF/LITEH	0321610SM106C+	0.0			0.51		137	(20)	M1
			C	IF/LITEH	0321610SM103C-	0.9			0.41		58	DSI	M1
93	120		C	IF/LITEH	0361610SM104H+	8.4			6.21		6	20	11
			C	IF/LITEH	0361610SM104H+	10.1			1.51		6	20	11
			C	IF/LITEH	0361610SM104H+	40.7			5.01		7	20	11
			C	IF/LITEH	0361610SM106H+	24.9			3.21		5	(20)	11
			C	IF/LITEH	0361610SM18W1+	0.9			3.51		5	(20)	11
			C	IF/LITEH	0361610SM18W1+	2.1			4.41		3	(20)	11
			C	IF/LITEH	0361610SM1VS5+	1.7			3.81		5	(20)	11
			C	IF/LITEH	0361610SM1VS6+	5.4			4.41		6	20	11
			C	IF/LITEH	0361610SM1VS6+	8.7			13.11		7	20	11
			C	IF/LITEH	0361610SM106C+	13.3			2.21		7	20	11
151	120		C	IF/LITEH	0321610SM104C-	0.2			0.61		128	(20)	M1
109	122		C	IF/LITEH	0361610SM106H+	35.3			2.81		7	20	11
103	126		C	IF/LITEH	0361610SM101C+	15.8			5.41		15	20	11
112	127		C	IF/LITEH	0361610SM105C+	13.0			3.51		16	20	11
145	134		C	IF/LITEH	0321610SM103C+	0.9			0.81		124	(20)	M1
144	135		C	IF/LITEH	0321610SM103C+	0.8			0.51		107	DSI	M1
143	136		C	IF/LITEH	0321610SM103C+	0.8			0.51		127	(20)	M1
141	138		C	IF/LITEH	0331610SM106H+	0.0			0.81		122	DSI	11
47	156		C	IF/LITEH	0521610SM1TSC+	4.6			2.11		15	20	11
11	182		C	IF/LITEH	0291590SM104C-	1.0			0.41		88	DSI	M1
11	184		C	IF/LITEH	0301590SM103C+	0.8			0.51		147	DSI	M1
29	184		C	IF/LITEH	0361610SM1TSC+	2.5			0.21		143	23	11

NUMBER OF TUBES SELECTED FROM CURRENT OUTAGE: 22

NO TREND ANALYSIS REQUESTED



**APPENDIX B**

**Tubesheet  
Maps**



# 12/87, ARIZONA PUBLIC SERVICE CO., PALO VERDE, UNIT 1

STEAM GENERATOR: 1  
DATE: 12/30/87  
LOCATION: ALL  
CRITERIA: PLG

PROC: 73TI-9RC01 REV 1  
TIME: 14:02  
STAY

PLG

42

EVALUATED

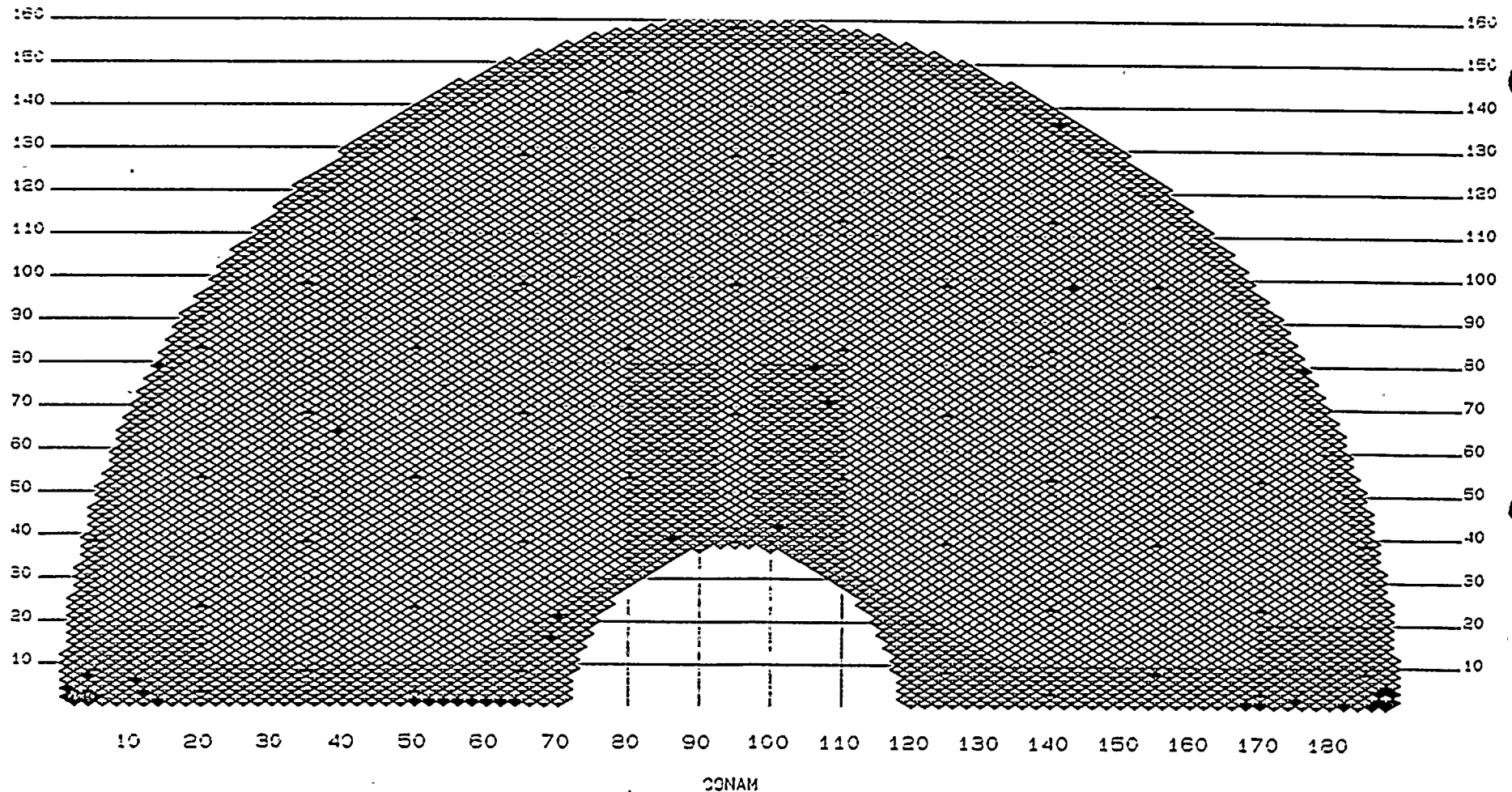
-

FIXTURE  
TEMPLATE

-

-

Page B1 of 2





# 12/87, ARIZONA PUBLIC SERVICE CO., PALO VERDE, UNIT 1

STEAM GENERATOR: 2  
 DATE: 12/30/87  
 LOCATION: ALL  
 CRITERIA: PLG

PROC: 73TI-9RC01 REV 1  
 TIME: 15:16  
 STAY

PLG

41

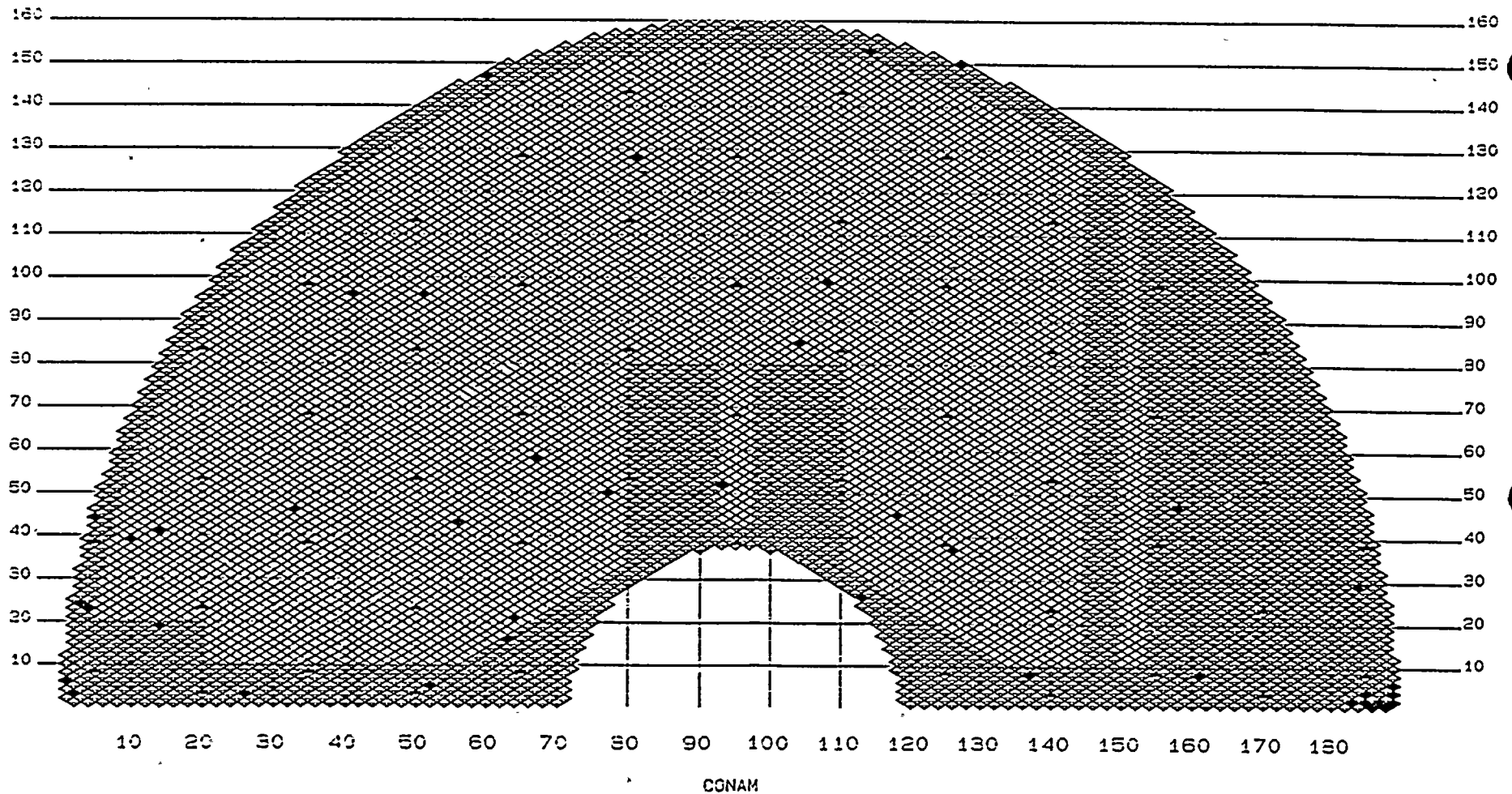
EVALUATED

-

FIXTURE  
 TEMPLATE

-

-







APPENDIX C

Form  
NIS-1



## FORM NIS-1

## OWNERS' DATA REPORT FOR INSERVICE INSPECTIONS

1. OWNER Arizona Public Service, et. al.  
ADDRESS P. O. Box 52034, Phoenix, Az. 85072
2. PLANT Palo Verde Nuclear Generating Station  
ADDRESS 4 Miles South, Wintersburg, Az.
3. UNIT NO. 1 4. OWNERS CERTIFICATE OF AUTHORIZATION N/A
5. COMMERCIAL SERVICE DATE 1/28/86
6. COMPONENTS INSPECTED:

COMPONENT OF APPURTENANCE	MANUFACTURER OR INSTALLER	SERIAL NUMBER	STATE OR PROVINCE	NATIONAL BOARD NO
1MRCEE01A Steam Generator 11 Tubing	Combustion Engineering	78273-1	N/A	22499
1MRCEE01B Steam Generator 12 Tubing	Combustion Engineering	78273-2	N/A	22500



FORM NIS-1 (BACK)

7. EXAM DATES 10/21/87 TO 11/2/87 8. INSP INTERVAL FROM 1/28/86 TO 1/27/96.
9. ABSTRACT OF EXAMINATION. INCLUDE A LIST OF EXAMINATIONS AND A STATEMENT CONCERNING STATUS OF WORK REQUIRED FOR CURRENT INTERVAL.

A total of 2375 tubes were examined in Steam Generator 11 and a total of 3754 tubes were examined in Steam Generator 12.

10. ABSTRACT OF CONDITIONS NOTED

Steam Generator 11: Three degraded tubes were identified. Several tubes had miscellaneous dings and dents and one tube had a possible loose part indication.

Steam Generator 12: No degraded tubes were identified, however, several tubes had <20% thru wall indications. Several tubes had miscellaneous dings and dents and two tubes had possible loose part indications.

11. ABSTRACT OF CORRECTIVE MEASURES

The following tubes were plugged as a result of this examination:

SG11: R1C186, R2C187, R7C4, R2C5, R3C12, R1C14, R1C168, R71C108, R1C62, R1C64, and R6C11.

SG12: R29C184

In addition, the following tube plug welds installed during the January, 1987 Leaker Outage in the hot leg of SG12 were repair welded: R1C188, R2C187, R2C185, and R4C185.

WE CERTIFY THAT THE STATEMENTS MADE IN THIS REPORT ARE CORRECT AND THE EXAMINATIONS AND CORRECTIVE MEASURES TAKEN CONFORM TO THE RULES OF THE ASME CODE, SECTION XI.

DATE 1-7-88 SIGNED Arizona Public Service Co. BY JBH

CERTIFICATE OF INSERVICE INSPECTION

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and the State or Province of AZ.,

employed by Kemper Group of Long Grove, IL.

have inspected the components described in this OWNERS REPORT during the period 10/87 to 11/87, and state that to the best of my knowledge and belief, the Owner has performed examinations and taken corrective measures described in this OWNERS REPORT in accordance with the requirements of the ASME Code, Section XI. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the examinations and corrective measures described in this OWNERS REPORT. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

INSPECTOR JC Keenan COMMISSIONS NB 2938/AZ 193  
Nat'l Board, State, Province

DATE 1-7-88

