Consumers Power Company

General Offices: 212 West Michigan Avenue, Jackson, Michigan 49201 • Area Code 517 788-0550

09
B06521

March 3, 1978

Director, Nuclear Reactor Regulation
Att: Mr Dennis L Ziemann, Chief
Operating Reactors Branch No 2
US Nuclear Regulatory Commission
Washington, DC 20555

DOCKET 50-255 - LICENSE DPR-20 -
PALISADES PLANT - STEAM GENERATOR -
SUPPORT PLATE CRACKING

The attached report entitled, "Investigation For Steam Generator Support Plate Cracking at Palisades During February 1978," provides the information requested by letter dated January 30, 1978.

This information was provided on a preliminary basis at the February 21, 1978 meeting between Consumers and the NRC and by letter dated February 27, 1978.

David P. Hoffman

David P Hoffman
Assistant Nuclear Licensing Administrator

CC: JGKeppler, USNRC

A001
S
1/40

780650043

INVESTIGATION FOR STEAM GENERATOR

SUPPORT PLATE CRACKING AT PALISADES

DURING FEBRUARY 1978

I. INTRODUCTION

On February 2, 1978 representatives of Combustion Engineering, Inc briefed CPCo personnel on the subject of support plate cracking encountered recently at Milestone 2. Subsequent to the meeting, a letter from the NRC dated 1/30/78 was received which required a CPCo response regarding possible support plate cracking in the steam generators at Palisades. Specifically, the following information was requested:

(a) When CPCo will determine whether the problem of support plate cracking exists at Palisades.

(b) Justification for continued operation until the inspection of the tube support plates.

(c) A description of what CPCo plans to do, and when, if the problem is found at Palisades.

At the time of the receipt of the above information request, Palisades was shutdown for refueling and steam generator surveillance testing. Additional steam generator inspection and analysis of results were performed as a result of the NRC request, therefore (b) above does not require further attention. The information presented in this report addresses (a) and (c).

II. SUMMARY AND CONCLUSIONS

Standard steam generator tube eddy current test results obtained during the current outage were reviewed for the number and location of any blocked tube indications. Tube dent magnitude and distribution information collected during the same examination were studied on a support plate by support plate basis to identify any region or pattern of significant denting and to study tube/support plate conditions in the area of hard spots created where support plate attaching lugs are fastened to the generator shroud. Additional tubes located in these outer peripheral areas were added to the ECT inspection program in order to insure adequate coverage. These additional points were analyzed as above for dent magnitude and tube blockage.

Evaluation of the data indicated that two tubes in steam generator A hot leg were blocked and another tube constricted. These occurrences were located at the 11th support plate. Analysis of dent magnitudes for the remaining tubes examined at this support in generator A indicate a maximum dent magnitude of 5.8 mils. The average dent magnitude was 1.2 mils. Prior to startup, the blocked tubes and constricted tube were plugged. No other tube blockage was revealed.

For steam generator A, the average dent magnitude was 1.1 mils in the hot leg and 1.6 mils in the cold leg. Correspondingly, for B generator the values were 0.8 mils and 2.0 mils.

Comparing the low dent magnitudes indicated in the Palisades steam generators to those experienced at Milestone 2 during the November 1977 inspection and considering the fact that, out of a significant number of tubes tested, only two were found blocked, we conclude that it is unlikely that support plate cracking of the type and magnitude found at Milestone in November of 1977 exists at Palisades at this time.

These results do not warrant accepting the risk (Reference 1) of increased tube degradation inherent in placing the units in dry layup for further visual inspection. Due to lack of accessibility, only the two uppermost support plates could possibly be inspected and then only on a limited basis. Test results of these supports indicate average dent magnitudes of less than 2 mils with no tube blockage or tube dent concentrations evident.

Dent magnitudes measured during the recent steam generator inspection at Palisades were compared with dent magnitude information collected during the February 1976 inspection. Incidence of denting and dent growth rates were calculated. Frequency of denting increased during the last operating cycle (approximately 20 months of operation). Dent growth rate averaged less than 2 mils during the period.

Considering the slow growth rate and the low magnitude of denting now present in the Palisades steam generators, there is some assurance that during the next operating cycle, dent magnitude will not approach the magnitudes present at Milestone prior to detection of cracking in the support plates. Based upon these results, we concluded that the safe operation of the units is not impared during the next cycle and that further inspection is not required at this time. During the next refueling and steam generator examination at Palisades, the condition of steam generator support plates will again be checked. It is probable that, in the time interval of the next operating cycle, a more direct inspection technique to verify condition of support plates will be developed and applied to Palisades.

If, during future inspections of the Palisades steam generators support plate cracking is evident, we anticipate a more detailed inspection of the affected areas would be immediately performed to ascertain the full magnitude of the problem and gather complete information regarding damage to tubes, damage to support plate, support plate movement and/or distortion. Only with this detailed specific information in hand could we determine our specific action and schedule for analytical and repair work to minimize the possibility of further tube and generator degradation.

III. DISCUSSION

A. Inspection and Analysis Techniques.

At the time of receipt of information concerning the Milestone support plate problem, Palisades was shutdown for refueling, steam generator tube inspection and other miscellaneous outage tasks. At the request of Consumers Power Company, representatives from Combustion Engineering, Inc briefed CPCo personnel on the Milestone situation. With the information provided at that meeting, CPCo evaluated various techniques that could possibly be used to detect the presence of any cracking in steam generator support plates at Palisades. Included in the evaluation were direct methods of detection, i.e., visual inspection and low frequency ECT capable of detecting cracks, and indirect analysis methods based upon detecting some other measurable, related event such as denting of tubes and tube blockage from which support plate cracking could be deduced.

As a result of the evaluation, it was concluded that an indirect method would be selected for use. Consultation with CE, CPCo's NDT Services Section and consultants in the NDT field indicated that an ECT technique to directly inspect for cracking in supports was not readily available for use. A review of the design of the Palisades steam generators indicated that only the small uppermost support plate could be easily inspected for cracking. However, even this region would require a dry layup condition on the secondary side. In repeated correspondence between CPCo and the Commission (see Reference 1), CPCo has stressed reluctance to place the generators in this condition.

From the Milestone information, it was apparent that large dent magnitudes together with blocked tubes concentrated in certain hard areas are indicative of support plate cracking, and further that denting is the cause of the plate deformation, stress build up, and eventual plate cracking. The dent magnitude information gathered at Milestone and correlated to cracking actually observed there offers a basis on which to compare similar results from the Palisades generators. Therefore, a detailed analysis of dent magnitude and blocked tube data was performed using data collected during the current inspection (supplemented as noted in Section III, B) and the previous inspection of February 1976.

The data analyzed in this report was taken with a standard circumferential wound ECT probe. Equipment configuration was that for a standard test with an operating frequency of 400 KHz. One exception is noted - the standard 0.540 inch probe failed to pass through one tube in generator A (Quad III, L14, R85) but a subsequent retest was made with a 0.470 inch probe. The smaller diameter probe passed through the constricted segment.

The magnitude of denting in the Palisades steam generators was estimated by comparing the dent signals from the generators with ECT signals produced by passing the probes through sample tubes with several different levels of local reduction in diameter. In certain areas, the dent signal saturated the equipment set at normal sensitivities due to the large dent magnitude. So as not to lose valuable dent magnitude information or increase data acquisition time, the ECT data was taken at a reduced sensitivity during the push of the probe through the tubes and normal sensitivity data collected during the withdrawal of the probe.

A special study was conducted which analyzed the results of the reduced sensitivity data for tubes with saturated (at normal sensitivity) dent signals. The study concentrated on those saturated signals from tubes in the vicinity of hard spots created by the support plate lugs attached to the shroud (tubes located along the outer periphery), on tubes with saturated signals at support plate 11, and saturated tubes in the cold legs. The study concluded that a saturated signal indicated a maximum dent magnitude of 5.8 mils. For the analyses that follow, 5.8 mils is assumed as an upper bound for all saturation indications.

ECT data from 1976 was reanalyzed to provide dent magnitude history information for tubes tested in 1978.

All dent magnitude information was computerized for easier data manipulation.

B. Denting Magnitude and Distribution.

The evaluation described in Section III, A of this report was performed on each support location of each tube included in the steam generator tube inspection program in which a circumferential wound probe was passed (0.540 inch probe diameter used in hot legs and bend areas, 0.580 inch probe diameter used in cold legs). This sample amounted to approximately 1979 tubes in steam generator A and 1505 tubes in steam generator B. The distribution of the tubes thus inspected is shown on Figures 1a, 1b, 1c and 1d. In addition to recording the magnitude of dents found at these locations, any tube blockage was also noted. Figures 1a and 1c also specify those tubes making up a supplemental inspection to gain further data on denting in the area of hard spots located along the outer periphery of the tube bundle.

Tables 1 thru 4 summarize the results of the dent magnitude analyses performed on the data. Sample sizes, denting frequency and dent magnitude distribution is noted along with average dent magnitudes. The average dent magnitude calculation assumed 5.8 mil dents at saturated locations. Locations with no dents indicated were not used in the averaging process.

As indicated in Tables 1 thru 4, the frequency of denting appears greater in steam generator B while the magnitude is slightly larger in the A generator. The magnitude of denting is slightly greater in the cold legs than the hot legs.

Tube blockage was found at only three tube locations - Quad II and III, Line 5, Row 114 and Quad III, Line 14, Row 85. All tubes are located in steam generator A and appear blocked at the eleventh (11) support plate. Figure 2 illustrates the relative location of this support plate in the Palisades steam generator design. A subsequent retest of two tubes using a 0.470 inch probe resulted in the smaller diameter probe passing through tube L14, R85.

Figure 3 presents the locations of the blocked tubes, constricted tube and dent magnitude distribution. Overall dent magnitude at this support plate is low as is the case with other dented supports. No significant concentration of large magnitude denting is noted in the critical area of hard spots. The blocked tubes and much of the denting seems to be associated with the thin legiments created by adjacent cut outs. Absent is the appearance of blocked or severely dented adjacent tubes (as was found at Milestone). Such a condition would offer strong evidence that cracking of supports had occurred.

C. Dent Growth Rate.

The 1978 dent magnitude values were compared with 1976 dent data to arrive at apparent dent growth rates for the last operating period. This last cycle included 20 months of operation. Where saturated signals were present, dent magnitudes, equal to 5.8 mils, were assumed.

Two calculations were performed. The first case considered only those tube support plate intersections where an apparent positive dent growth rate existed. The second case considered all growth indications both positive and negative. Dent growth rate information is arranged in Tables 5 and 6. Data from the tables indicate a very slow dent growth rate in both generators.

D. Comparison to Milestone Results.

Table 7 summarizes dent information from Milestone 2 steam generator tube inspections conducted in May and November of 1977. This data was obtained during the meeting held with representatives of Combustion Engineering on February 2, 1978. This information was previously provided to the NRC (see Reference 2).

Comparing the Milestone data from the May inspection to similar ECT data recently collected at Palisades and presented in Tables 1 thru 6, the following is noted:

1) Average dent magnitude was on the order of 2 times higher for Milestone as it currently is for Palisades.

2) Dent magnitude ranged from 2 mils to 14 mils for Milestone whereas current Palisades denting ranges from much less than 1 mil to approximately 5.8 mils.

The November inspection at Milestone revealed concentrated areas of high dent magnitudes and blocked tubes in the upper support plates. Visual inspection discovered the presence of support plate cracks in the vicinity of the dented and blocked tubes. These areas were associated with hard spots of the plates created by the plate attachment lug configuration. Based upon the results of similar ECT inspections conducted at Palisades and reviewed in this report, no concentrated areas of high magnitude denting or tube blockage was found in the generators.

REFERENCES

1.0 Letter dated 12/7/77 from D P Hoffman to A Schwencer, Chief, Director of Nuclear Reactor Regulation, USNRC (Response 2).

2.0 Letter dated 1/11/78 from D C Switzer, Northeast Nuclear Energy Company to G Lear, Chief, Operating Reactors Branch #3, USNRC.

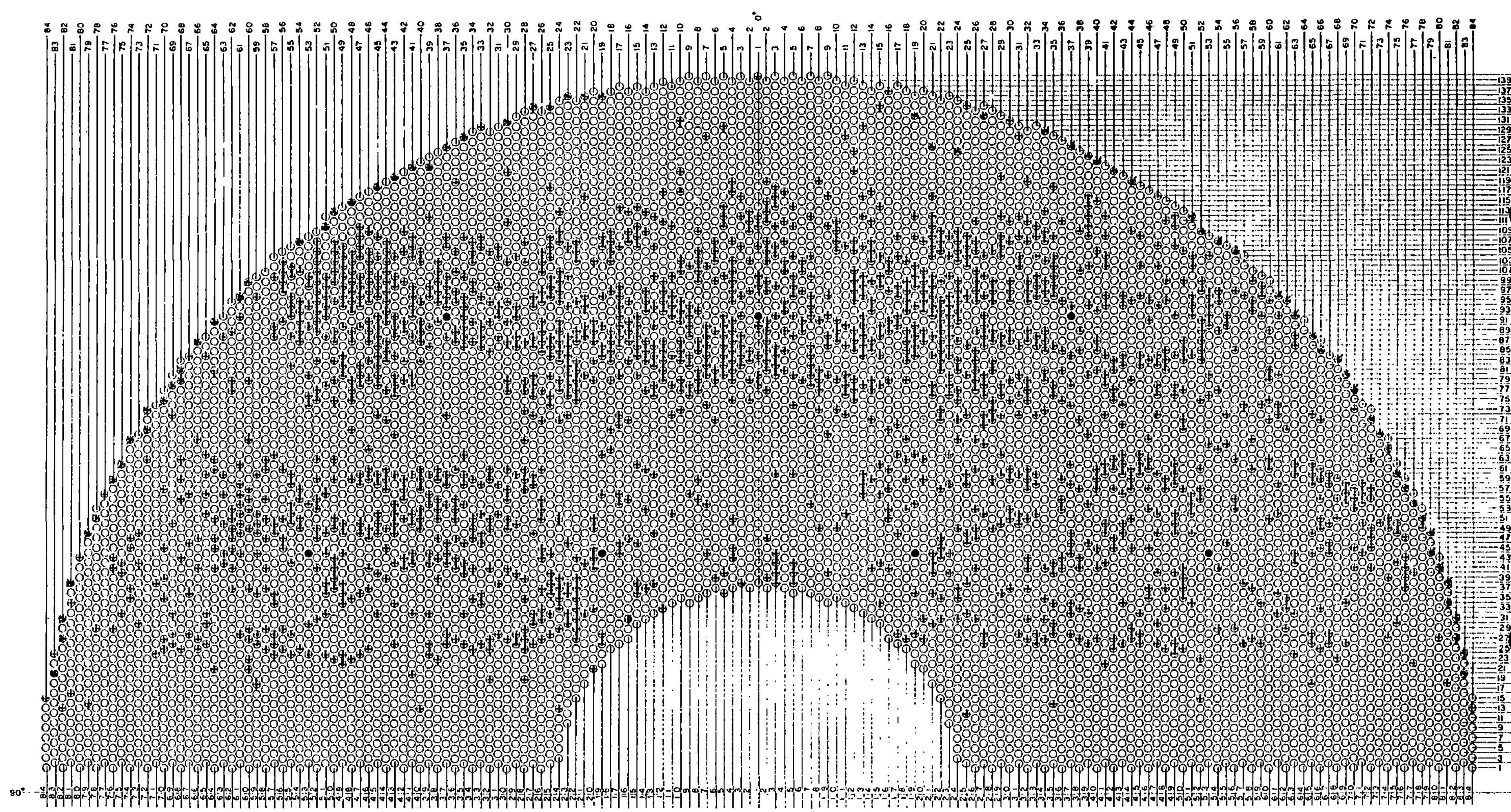


Figure 1 A - Location of Tubes Inspected
Steam Generator A - Hot Leg

● - Stay Locations
+ - Tested
✱ - Supplemental Tube Tested

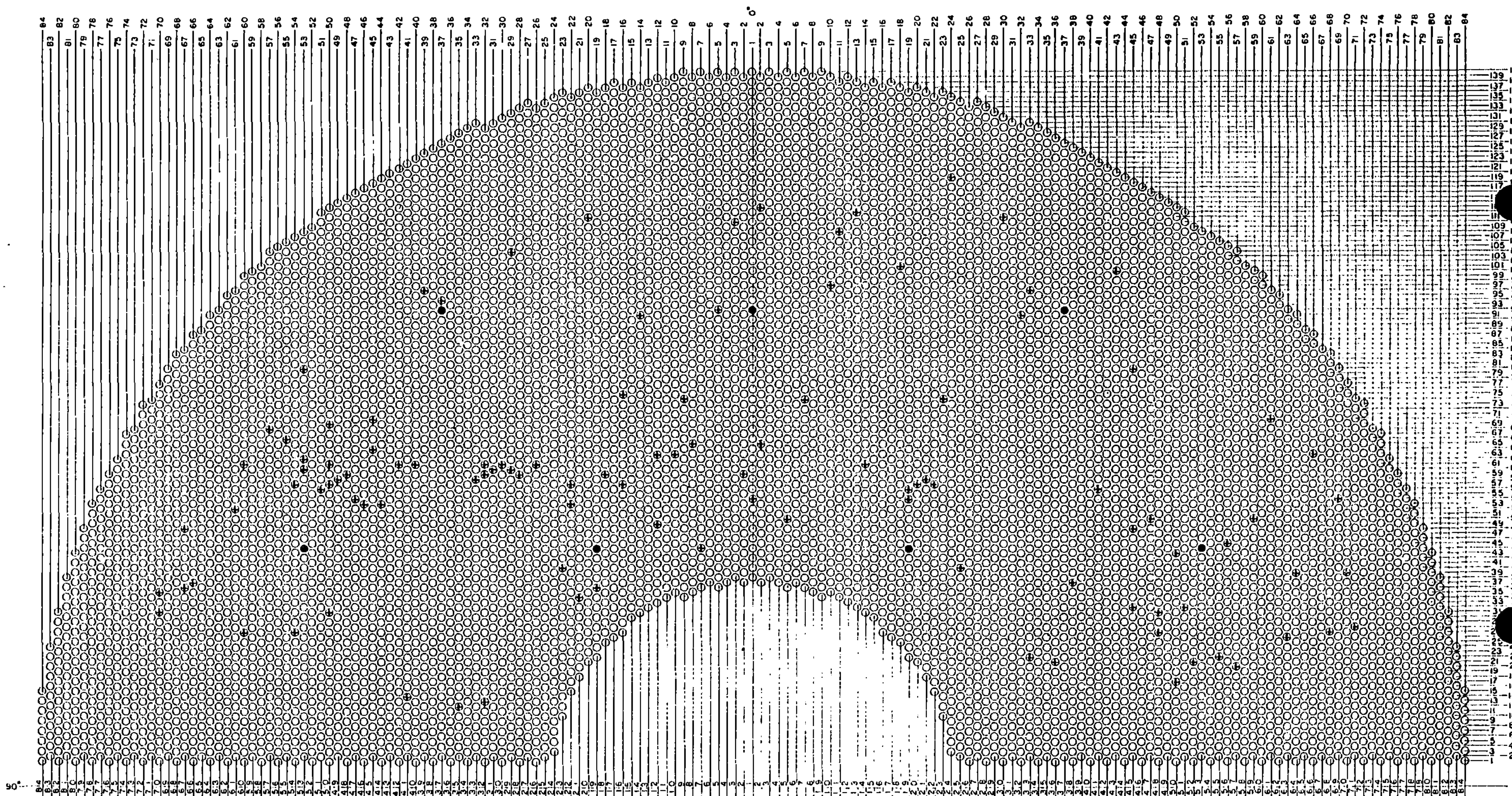


Figure 1 B - Location of Tubes Inspected
Steam Generator A - Cold Leg

- ● - Stay Locations
- + - Tested
- ✱ - Supplemental Tube Tested

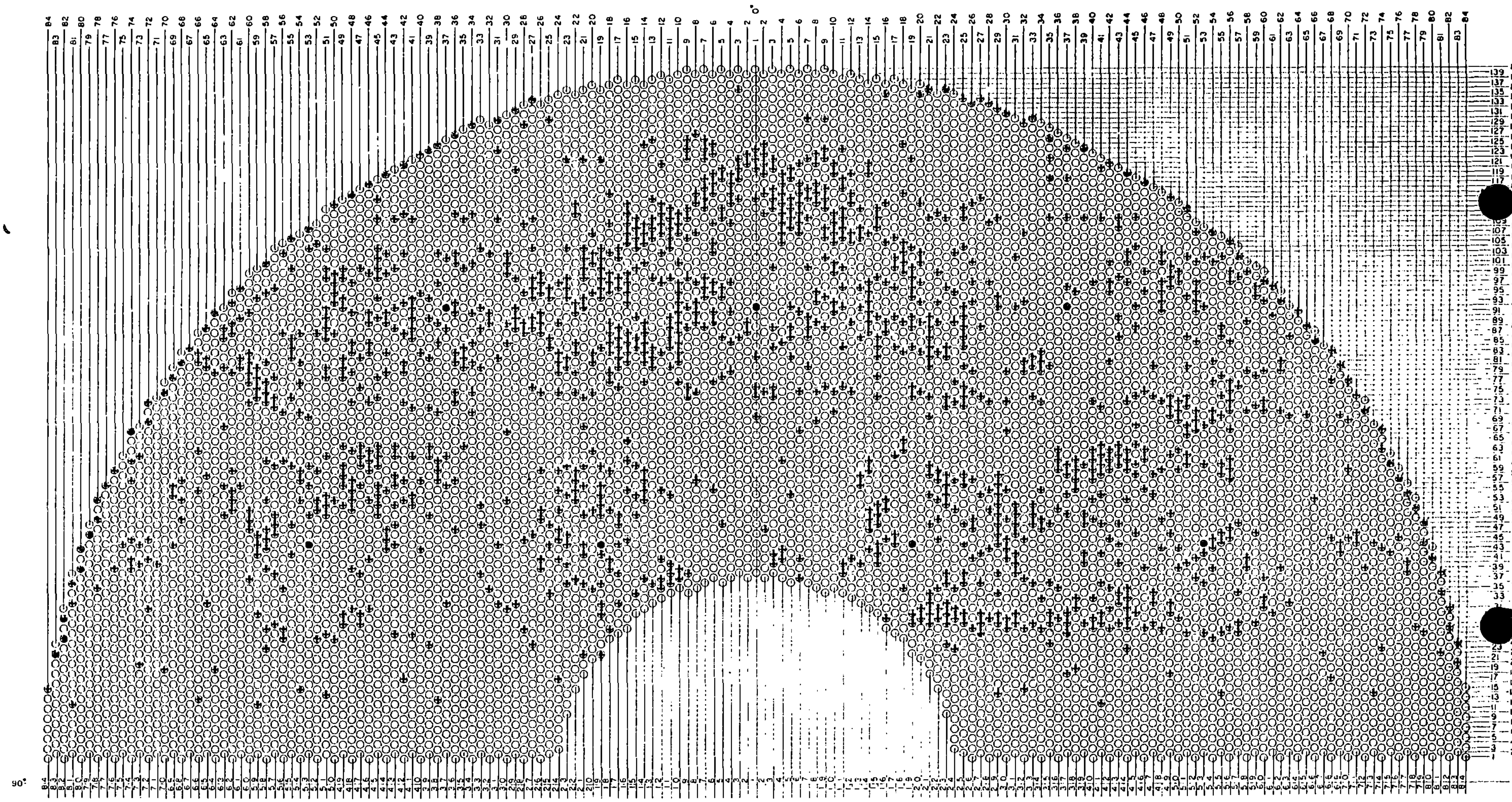


Figure 1 C - Location of Tubes Inspected
Steam Generator B - Hot Leg

● - Stay Locations
+ - Tested
✱ - Supplemental Tube Tested

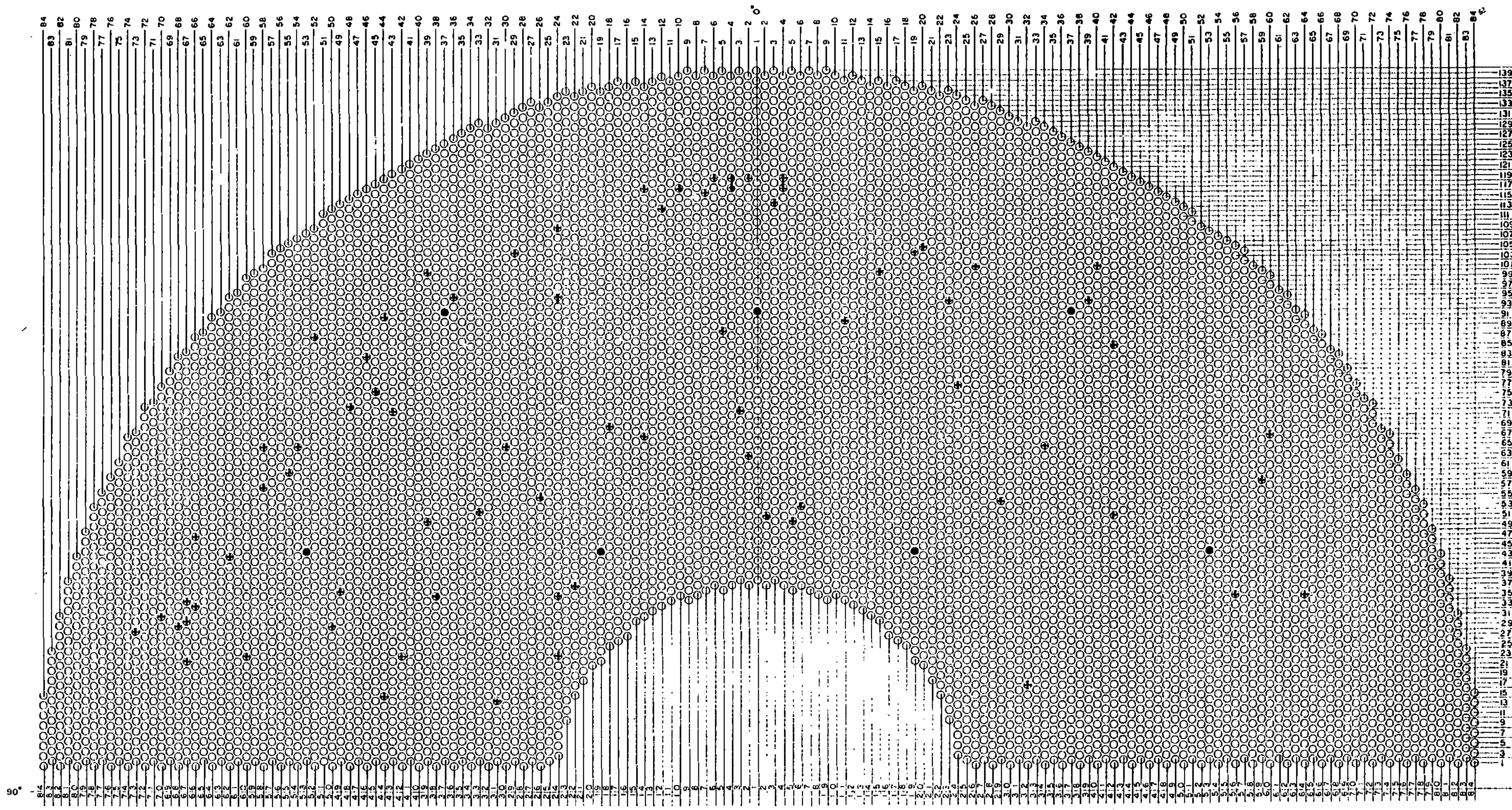
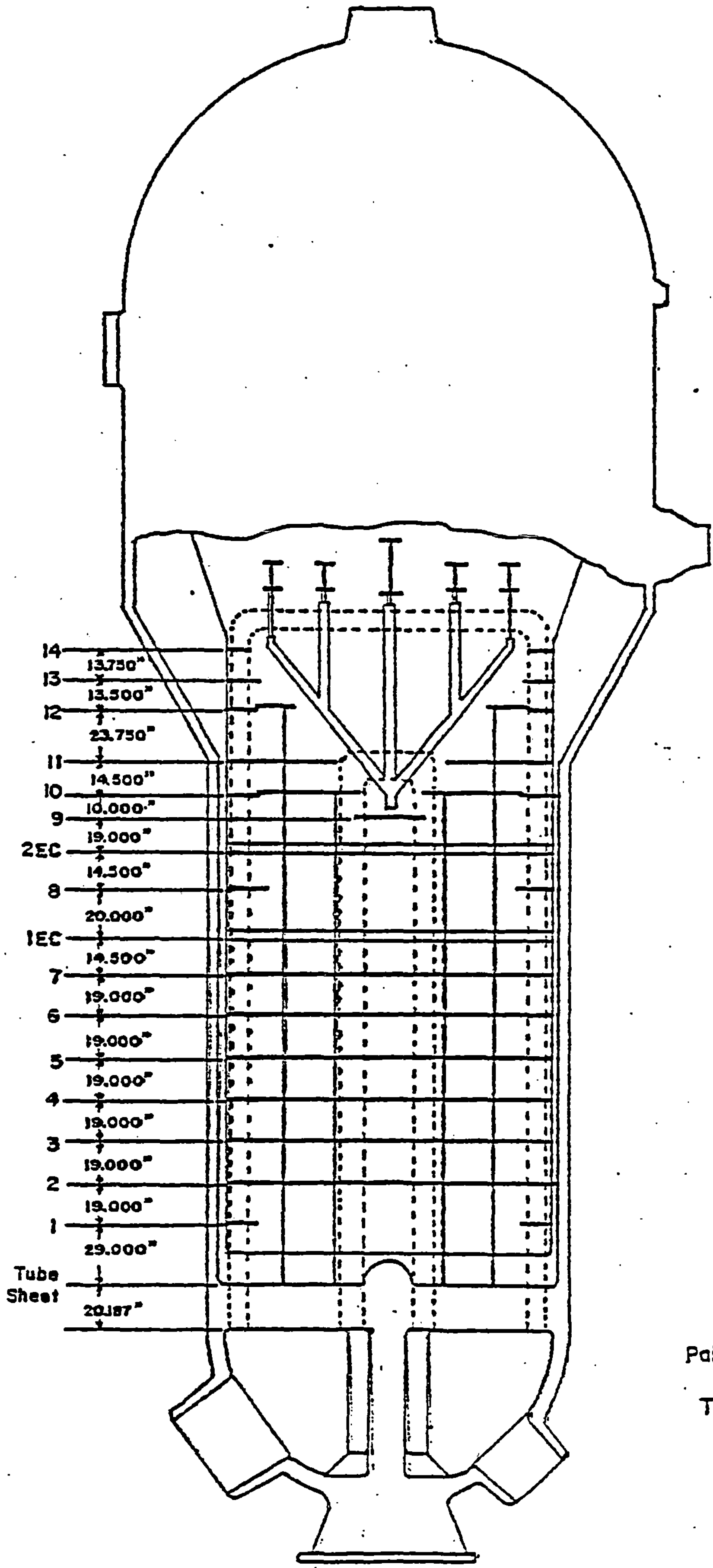


Figure 1 D - Location of Tubes Inspected
Steam Generator B - Cold Leg

● - Stay Locations
+ - Tested
* - Supplemental Tube Tested

FIGURE 2 -
STEAM GENERATOR
SUPPORT LOCATIONS



Palisades Steam Generators
Tube Sheet & Supports

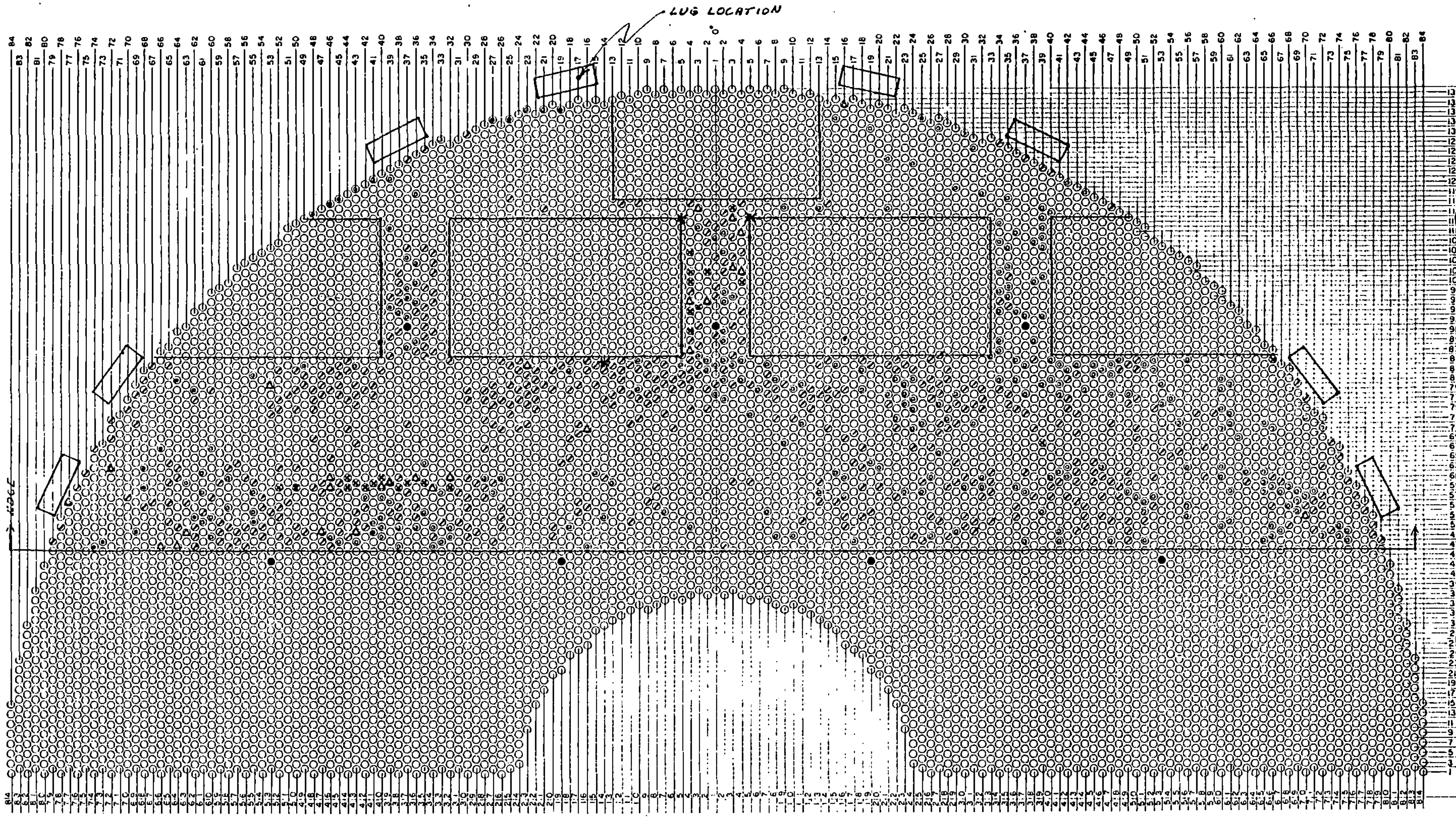


Figure 3 - Dent Magnitude Distribution
Steam Generator A - Hot Leg SUPPORT PLATE 11

● - Stay Location
• - No Dent
✱ - Blocked Tube
/ - Denting ≤ 2 mils
Δ - Denting ≥ 2 mils and < 4 mils
X - Denting ≥ 5.8 mils

Note - Heavy Lines indicate cut out boundaries.

TABLE 1

PALISADES A GENERATOR DENT MAGNITUDE DISTRIBUTION FOR 1/78 - HOT LEG

FEB 20 1978

DENT MAGNITUDE (Mils)	TS	1	2	3	4	5	6	7	1E	8	2E	9	10	11	12	13	14	HL	CL	TOTAL
0	0	9	839	265	130	615	616	788	1839	23	1434	20	521	301	252	12	6	0	0	8120
<=.1	0	3	67	4	1	31	26	24	0	1	0	0	10	5	2	1	0	0	0	175
<=.3	0	2	277	79	68	144	133	133	0	0	0	5	85	61	28	1	0	0	0	1016
<=.5	0	1	206	89	47	88	60	72	1	1	3	3	80	56	37	2	0	0	0	746
<=.7	0	1	205	160	129	122	76	54	4	0	4	3	125	113	57	6	3	0	0	1064
<=.8	0	1	73	68	57	39	13	18	0	0	2	3	71	50	34	3	2	0	0	439
<=.9	0	1	48	107	95	43	24	23	0	0	4	8	82	78	47	4	1	0	0	570
<=1.1	0	0	30	35	49	13	5	8	1	0	0	1	55	34	29	2	4	0	0	266
<=1.2	0	0	15	75	72	22	6	7	1	0	0	1	49	43	56	2	2	0	0	351
<=1.3	0	1	3	35	36	12	2	8	0	0	1	0	33	21	20	1	0	0	0	173
<=1.5	0	1	5	53	77	12	6	5	0	0	0	5	31	22	35	3	0	0	0	256
<=1.7	0	0	1	15	18	1	0	1	0	0	0	0	13	9	17	0	0	0	0	75
<=1.9	0	0	1	37	36	6	0	2	1	0	0	0	21	26	27	1	0	0	0	153
<=2.2	0	0	0	12	18	2	0	1	0	0	0	0	6	7	9	0	0	0	0	55
<=2.5	0	0	1	22	34	2	1	1	0	0	0	0	8	10	12	1	2	0	0	94
<=2.7	0	0	0	14	14	3	0	1	0	0	0	0	6	5	16	0	1	0	0	60
<=3.0	0	0	0	25	19	2	0	2	0	0	0	1	2	6	5	1	1	0	0	55
> *	0	0	1	68	71	3	0	15	1	0	0	1	13	24	30	6	2	0	0	235
TOTAL	0	11	939	898	941	550	352	375	9	2	14	31	691	570	463	34	18	0	0	5798
AVERAGE	-	0.6	0.6	1.4	1.5	0.7	0.7	0.8	1.5	0.3	0.8	1.1	1.0	1.2	1.5	1.9	1.9	-	-	1.1
NO SUPPORT	0	1931	23	684	980	682	883	684	3	1823	3	1800	638	979	1137	1896	1328	0	0	15584

Mean Dent Magnitude 1.1 mils

Standard Deviation 1.1 mils

* Assume 5.8 mils

TABLE 2

PALISADES A GENERATOR DENT MAGNITUDE DISTRIBUTION FOR 1/78 - COLD LEG

DENT MAGNITUDE (Mils)	TS	1	2	3	4	5	6	7	1E	8	2E	9	10	11	12	13	14	HL	CL	TOTAL
0	0	0	20	5	32	35	59	43	104	0	104	2	42	34	13	1	0	0	0	494
<=.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<=.3	0	0	6	2	2	2	4	0	0	0	0	0	1	5	0	0	0	0	0	22
<=.5	0	0	6	2	6	0	2	0	0	0	1	2	1	4	0	0	0	0	0	24
<=.7	0	0	13	7	14	2	7	1	2	0	0	1	3	8	0	0	0	0	0	58
<=.8	0	0	5	4	2	0	0	2	1	0	1	2	2	1	0	0	0	0	0	20
<=.9	0	0	9	4	6	4	1	0	1	0	0	0	2	1	0	0	0	0	0	28
<=1.1	0	0	5	3	1	0	2	0	1	0	0	0	1	1	0	0	0	0	0	14
<=1.2	0	0	5	4	4	1	4	0	0	0	0	1	1	5	1	0	0	0	0	26
<=1.3	0	0	1	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	6
<=1.5	0	0	8	4	3	0	3	1	1	0	1	0	0	1	0	0	0	0	0	22
<=1.7	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	4
<=1.9	0	0	5	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	3
<=2.2	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2
<=2.5	0	0	4	1	2	0	1	0	0	0	0	0	0	1	0	0	0	0	0	9
<=2.7	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
<=3.0	0	0	5	1	2	0	1	0	0	0	2	0	0	1	0	0	0	0	0	12
> *	0	0	11	10	10	2	0	0	0	0	1	0	0	1	0	0	0	0	0	35
TOTAL	0	0	87	45	55	12	28	4	6	0	5	7	12	30	1	0	0	0	0	293
AVERAGE	-	-	1.8	2.1	1.9	1.6	1.1	1.0	1.0	-	2.9	0.9	0.8	1.1	1.2	-	-	-	-	1.6
NO SUPPORT	0	108	3	60	22	62	22	63	0	108	0	99	55	46	94	107	108	0	0	957

Mean Dent Magnitude 1.6 mils

Standard Deviation 1.7 mils

* Assume 5.8 mils.

TABLE 3

PALISADES B GENERATOR DENT MAGNITUDE DISTRIBUTION FOR 1/78 - HOT LEG

FEB 2 0 1978

DENT MAGNITUDE (Mils)	1S	1	2	3	4	5	6	7	1E	8	2E	9	10	11	12	13	14	HL	CL	TOTAL
0	0	4	229	72	16	246	230	213	1457	43	1454	12	362	182	149	44	8	0	0	4720
<=.1	0	12	189	23	4	162	117	146	0	6	0	3	158	95	41	7	0	0	0	963
<=.3	0	4	348	111	20	156	156	223	0	4	0	12	194	145	98	9	1	0	0	1486
<=.5	0	2	229	66	31	102	74	103	1	3	1	3	103	81	67	5	1	0	0	872
<=.7	0	6	170	94	62	86	57	89	0	1	0	2	57	63	62	3	1	0	0	753
<=.8	0	7	105	73	52	43	33	46	0	2	0	5	30	29	37	4	0	0	0	466
<=.9	0	3	55	92	61	52	28	33	0	0	1	2	34	22	30	4	0	0	0	417
<=1.1	0	2	26	59	58	27	17	22	0	0	0	1	13	11	16	2	0	0	0	254
<=1.2	0	3	26	74	74	20	8	19	0	0	1	1	11	7	27	2	1	0	0	274
<=1.3	0	4	9	55	55	9	4	16	0	0	0	0	7	7	8	1	0	0	0	175
<=1.5	0	0	7	55	45	8	10	11	0	0	0	0	3	3	10	0	0	0	0	152
<=1.7	0	0	6	38	30	4	1	3	0	0	0	0	0	3	1	0	0	0	0	86
<=1.9	0	3	4	32	43	6	2	2	0	0	0	0	1	2	5	1	1	0	0	102
<=2.2	0	0	0	11	33	1	1	3	0	0	0	0	0	2	3	0	1	0	0	55
<=2.5	0	0	2	21	30	2	2	2	0	0	0	0	0	1	1	0	0	0	0	61
<=2.7	0	0	1	16	24	0	0	0	0	0	0	0	1	2	2	0	0	0	0	46
<=3.0	0	0	1	10	24	3	1	0	0	0	0	0	2	0	1	1	0	0	0	43
X *	0	0	1	32	82	8	0	11	0	0	0	0	5	2	3	1	0	0	0	145
TOTAL	0	51	1179	862	728	689	511	729	1	16	3	29	619	475	412	40	6	0	0	6350
AVERAGE	-	0.7	0.5	1.2	1.8	0.6	0.5	0.6	0.5	0.4	0.9	0.5	0.5	0.5	0.7	0.8	1.1	-	-	0.8
NO SUPPORT	0	1407	47	518	709	519	711	511	1	1403	5	1413	473	797	493	1370	1443	0	0	12217

Mean Dent Magnitude 0.8 mils

Standard Deviation 1.1 mils

* Assume 5.8 mils

INFORMATIONAL COPY ONLY — Uncontrolled

CPCO P&T OPERATING SERVICES

TAB

PALISADES B GENERATOR DENT MAGNITUDE DISTIBUTION FOR 1/78 - COLD LEG

DENT MAGNITUDE (Mils)	TS	1	2	3	4	5	6	7	1E	8	2E	9	10	11	12	13	14	HL	CL	TOTAL
0	0	4	12	6	3	27	30	31	74	7	74	0	32	21	15	3	0	0	0	339
<=.1	0	1	5	0	1	1	5	0	0	0	0	4	2	2	4	0	0	0	0	25
<=.3	0	0	15	2	0	4	2	1	0	0	0	2	5	6	0	0	0	0	0	37
<=.5	0	1	8	2	0	1	2	0	0	0	0	0	0	1	1	0	0	0	0	16
<=.7	0	1	9	1	1	1	4	0	0	0	0	0	1	1	1	1	0	0	0	20
<=.8	0	0	4	0	0	0	1	0	0	0	0	1	2	0	0	0	0	0	0	8
<=.9	0	1	5	1	4	0	3	1	0	0	0	0	0	2	0	0	0	0	0	17
<=1.1	0	0	1	0	1	2	0	0	0	0	0	0	0	0	1	0	0	0	0	5
<=1.2	0	0	4	1	3	2	1	2	0	0	0	0	0	0	0	0	0	0	0	13
<=1.3	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3
<=1.5	0	0	1	1	1	1	0	1	0	0	0	0	0	1	1	0	0	0	0	7
<=1.7	0	0	2	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	4
<=1.9	0	0	1	3	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	6
<=2.2	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	3
<=2.5	0	0	0	1	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	5
<=2.7	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
<=3.0	0	0	2	3	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	7
> *	0	0	3	19	28	0	0	1	0	0	0	0	0	0	2	0	0	0	0	53
TOTAL	0	4	60	35	45	14	20	9	0	0	0	7	11	14	11	1	0	0	0	231
AVERAGE	-	0.6	1.0	3.9	4.2	1.0	0.7	2.0	-	-	-	0.2	0.6	0.6	1.6	0.7	-	-	-	2.0
NO SUPPORT	0	67	3	34	27	34	25	35	1	68	1	68	32	40	49	71	75	0	0	630

Mean Dent Magnitude 2.0 mils

Standard Deviation 2.2 mils

* Assume 5.8 mils.

TABLE 5

STEAM GENERATOR A

Dent Growth Rate

HOT LEG:

Sample Size: 6972

Mean Growth Rate 0.2 mils for cycle

Standard Deviation 1.0 mils

As above (positive growth only) 0.9 mils for cycle

Standard Deviation 1.2 mils

COLD LEG:

Sample Size: 138

Mean Growth Rate 0.7 mils for cycle

Standard Deviation 1.7 mils

As above (positive growth only) 1.8 mils for cycle

Standard Deviation 1.9 mils

TABLE 6

STEAM GENERATOR B

Dent Growth Rate

HOT LEG:

Sample Size: 6166

Mean Growth Rate 0.2 mils for cycle

Standard Deviation 0.9 mils

As above (positive growth only) 0.7 mils for cycle

Standard Deviation 1.0 mils

COLD LEG:

Sample Size: 31

Mean Growth Rate 1.4 mils for cycle

Standard Deviation 1.8 mils

As above (positive growth only) 1.4 mils for cycle

Standard Deviation 1.8 mils

Table 7

MILESTONE 2 RESULTS

Dent Assessment (Values in Mils)

	MAY 1977	NOV. 1977
Average Dent Magnitude:		
Tube Support Plate 10 -		
Hot Leg	5.6 (Range 2-8)	6.4 (96 dents reassessed)
Cold Leg	8.6 (Range 6-14)	9.7 (6 dents reassessed)
Tube Support Plate 11 -		
Hot Leg	4.9 (Range 3-14)	6.0 (51 dents reassessed)
Cold Leg	7.9 (Range 5-13.5)	- (no dents reassessed)
Average Dent Magnitude All Tubes Inspected:		
Tube Support 10 - Hot Leg	--	6.9 (258 tube sample)
Tube Support 11 - Hot Leg	--	6.4 (133 tube sample)
Constricted Tubes:		
Tube Support 10	0	20
Tube Support 11	0	44

Average Dent Growth based on dents reassessed in November = 1.2 mils (153 dents)