NORTHEAST UTILITIES
THE CONNECTICUT LIGHT AND POWER COMPANY
THE HARTFORD ELECTRIC LIGHT COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

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June 2, 1982

Docket No. 50-336
A02357

Director of Nuclear Reactor Regulation
Attn: Mr. Robert A. Clark, Chief
Operating Reactors Branch #3
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

References: (1) W. G. Counsil letter to R. A. Clark, dated March 4, 1982.
(2) R. A. Clark letter to W. G. Counsil, dated March 5, 1982 transmitting Amendment No. 73 to Facility Operating License No. DPR-65.

Gentlemen:

Millstone Nuclear Power Station, Unit No. 2
Steam Generator Profilometry Inspection Results

In Reference (1), Northeast Nuclear Energy Company (NNECO) documented its intention to submit the results of the Cycle 5 refueling outage steam generator profilometry inspections within sixty days after startup. This commitment was acknowledged by the NRC Staff in Reference (2).

Profilometry inspection data and NNECO's evaluation of same are hereby provided in the attachment. Although these data are still being analyzed and are currently considered preliminary, significant revisions to the conclusions presented herein are not anticipated. The results of NNECO's evaluations of the profilometry inspections conducted during the Cycle 5 refueling outage confirm the integrity of the steam generator tubes and supports at Millstone Unit No. 2 and assure the continued applicability of the current design basis analyses.

A001

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PDR ADOCK 05000336
Q PDR

We trust you find the attached information satisfactory.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

W. G. Counsil

W. G. Counsil
Senior Vice President

Docket No. 50-336

Attachment

Millstone Nuclear Power Station, Unit No. 2

Steam Generator Profilometry Inspection
Results - Cycle 5 Refueling

May, 1982

Millstone Unit No. 2

STEAM GENERATOR PROFILOMETRY INSPECTIONS
CYCLE 5 REFUELING DECEMBER, 1981

Profilometer inspections of about 800 steam generator (SG) tubes were performed at Millstone Unit No. 2 during the December, 1981 refueling outage. Both hot leg and cold leg sides were inspected, as shown in Table 1. Over 7000 eggcrate intersections were inspected, and analyzed at 0.050 inch axial increments (~300,000 total elevations), to determine physical dent characteristics, and strain. In addition, over 200 support plate intersections were inspected.

Results of the measurements and analyses as a function of tube support elevation are summarized in Tables 2-11 and plotted in Figures 1, 2, and 3.

The following observations regarding eggcrate denting were derived from this information:

1. Dent magnitude and frequency of occurrence were inversely proportional to elevation, with average-maximum, diametrical dents at the upper elevations equal to about one half the value at the lower elevations. (13 mils for elevations 6-9 versus 25 mils for elevations 1-5).

2. Tube intersections, on the cold leg sides, displayed smaller, less frequent dents, and smaller tensile strains than tube intersections at the hot leg sides (e.g., in Steam Generator No. 2, 0.3 percent of the cold leg intersections were dented versus 84 percent of the hot leg intersections).

3. Tubes at the upper eggcrate supports (6-9) displayed fewer dents of significant magnitude (greater than 20 mils diametrical) compared with tubes at the lower eggcrates.

The 1980 inspection data, derived from comparable zetec profilometer probes, were reanalyzed using the same format as was used for the 1981 data. Results of the 1980 reanalyzed data are provided in Tables 12-14. Comparison of the 1980 results with 1981 results are plotted in Figures 4, 5, 6, and 7. This comparison shows essentially no increase in frequency or magnitude of dents. A slight increase in average maximum tensile strain was noted, from 1.5 percent in 1980 to 2.4 percent in 1981. It is to be emphasized that the above comparison between 1980 and 1981 data must be considered with reservations due to the fact that a larger, somewhat different sample population was inspected in 1980. A direct comparison between the same intersections tested in both outages is being developed, but is not yet available.

Two tubes from the hot leg of Steam Generator No. 2, Line 107-Row 41 and Line 107-Row 43, have been profilometer tested in three consecutive outages. The results of these inspections are given in Table 15. As may be seen, a small progression of denting occurred in the last cycle.

These data continue to confirm the integrity of essential steam generator tubes and supports, and assure the continued applicability of current design basis analyses.

Table 1

SUMMARY OF PROFILOMETER INSPECTIONS OF MP-2 STEAM GENERATOR TUBES

DECEMBER 1981 OUTAGE
(Zetec 8 Point Probe)

Steam Generator	Side	Tube Support Elevation	Number Of Intersections Inspected
1	HL	1- 9	3615
1	CL	1- 9	120
1	HL & CL	1- 9	3735
1	HL	10+11	121
1	CL	10+11	0
1	HL & CL	10+11	121
2	HL	1- 9	2283
2	CL	1- 9	1322
2	HL & CL	1- 9	3605
2	HL	10+11	25
2	CL	10+11	73
2	HL & CL	10+11	98
1+2	HL & CL	1- 9	7340
1+2	HL & CL	10+11	219

TABLE 2

RELATIONSHIP BETWEEN MAXIMUM DIAMETRICAL REDUCTION AND ELEVATION

MILLSTONE UNIT No. 2--STEAM GENERATOR No. 1 (CL)

DECEMBER 1981 OUTAGE

ELEVATION	No. OF TESTS	No. OF DENTS(a)	DIAMETRICAL REDUCTION (MILS) AVERAGE(b)	MAXIMUM (c)	STANDARD DEVIATION	% DENTED
1	22	0	--	--	--	0
2	22	1	5.3	5.3	0	5
3	22	0	--	--	--	0
4	20	0	--	--		0
5	18	5	6.3	8.4	1.2	28
6	14	0	--	--	--	0
7	2	0	--	--	--	0
8	1	0	--	--	--	0
9	0	0	--	--	--	--
1-9	120	6	6.2	8.4	1.1	5

(a) A dented intersection is defined as an intersection with one or more diametrical dents greater than or equal to 5 mils.

(b) Average of maximums at elevation.

(c) Single largest valve at elevation.

TABLE 3

RELATIONSHIP BETWEEN AVERAGE ID TENSILE STRAIN AND ELEVATION
MILLSTONE UNIT No. 2--STEAM GENERATOR NO. 1 (CL)

DECEMBER 1981 OUTAGE

ELEVATION	No. OF TESTS	AVERAGE ID TENSILE STRAIN	MAXIMUM ID TENSILE STRAIN	PERCENT OF TUBES GREATER THAN 1% STRAIN	STAN. DEV.
1	22	1.1	1.2	14	0.06
2	22	1.1	1.2	18	0.05
3	22	1.2	1.5	14	0.21
4	20	1.5	2.0	15	0.39
5	18	1.4	1.9	28	0.27
6	14	1.8	2.5	43	0.43
7	2	--	--	0	--
8	0	--	--	--	--
9	0	--	--	--	--
1-9	120	1.4	2.5	20	0.40

TABLE 4

RELATIONSHIP BETWEEN MAXIMUM DIAMETRICAL REDUCTION AND ELEVATION
MILLSTONE UNIT No. 2--STEAM GENERATOR No. 1 (HL)

DECEMBER 1981 OUTAGE

ELEVATION	No. OF TESTS	No. OF DENTS(a)	DIAMETRICAL REDUCTION (MILS) AVERAGE(b)	MAXIMUM(c)	STANDARD DEVIATION	% DENTED
1	455	399	26.9	83.8	18.8	88
2	499	494	32.9	78.5	15.0	99
3	526	526	38.4	83.2	16.3	100
4	486	478	27.6	74.0	14.8	98
5	476	464	29.3	85.9	15.4	97
6	443	402	18.6	61.4	11.4	91
7	377	284	16.6	68.4	12.5	75
8	230	96	11.1	57.6	8.6	42
9	123	17	13.5	53.2	14.1	14
10	104	102	25.9	63.4	17.1	98
11	17	17	15.1	32.8	6.9	100
1-9	3615	3160	27.7	85.9	16.8	87
10+11	121	119	24.4	63.4	16.5	98

(a) A dented intersection is defined as an intersection with one or more diametrical dents greater than or equal to 5 mils.

(b) Average of maximums at elevation.

(c) Single largest value at elevation.

Table 5

RELATIONSHIP BETWEEN FRACTION OF MAXIMUM DENTS > 20 MILS (DIAMETRICAL) AND ELEVATION
MILLSTONE UNIT No. 2--STEAM GENERATOR No. 1 (HL)

DECEMBER 1981 OUTAGE

ELEVATION	No. OF TESTS	MAXIMUM DENTS GREATER THAN 20 MILS (%)
1	455	47
2	499	77
3	526	84
4	486	62
5	476	65
6	443	31
7	377	23
8	230	5
9	123	2
10	104	48
11	17	18
1-9	3615	52
10-11	121	44

TABLE 6

RELATIONSHIP BETWEEN AVERAGE ID TENSILE STRAIN AND ELEVATION
MILLSTONE UNIT No. 2 - STEAM GENERATOR No. 1 (HL)

DECEMBER 1981 OUTAGE

ELEVATION	No. OF TESTS	AVERAGE ID TENSILE STRAIN	MAXIMUM ID TENSILE STRAIN	% OF TUBES >1% STRAIN	STANDARD DEVIATION
1	455	2.7	10.0	78	1.6
2	499	2.9	11.1	89	1.7
3	526	3.0	11.7	89	1.7
4	486	2.4	10.4	77	1.5
5	476	2.5	13.6	72	1.8
6	443	1.9	7.1	45	0.9
7	377	1.8	7.1	31	0.9
8	230	1.6	4.3	26	0.6
9	123	2.3	13.7	26	2.4
10	104	3.1	14.3	34	2.9
11	17	2.1	4.2	35	1.1
1-9	3615	2.6	13.7	66	1.6
10+11	121	3.0	14.3	34	2.7

TABLE 7

RELATIONSHIP BETWEEN MAXIMUM DIAMETRICAL REDUCTION AND ELEVATION
MILLSTONE UNIT No. 2--STEAM GENERATOR No. 2 (CL)

DECMEBER 1981 OUTAGE

ELEVATION	No. OF TESTS	No. OF DENTS(a)	DIAMETRICAL REDUCTION (MILS) AVERAGE(b)	DIAMETRICAL REDUCTION (MILS) MAXIMUM(c)	STANDARD DEVIATION	% DENTED
1	151	0	--	--	--	0
2	151	1	6.4	6.4	0.0	1
3	150	1	5.6	5.6	0.0	1
4	152	1	16.3	16.3	0.0	1
5	151	0	--	--	--	0
6	152	0	--	--	--	0
7	150	0	--	--	--	0
8	142	0	--	--	--	0
9	121	1	5.4	5.4	0.0	1
10	59	55	40.9	63.3	13.6	93
11	14	13	46.8	84.8	19.5	93
1-9	1322	4	8.4	16.3	4.6	0.3
10-11	73	68	42.0	84.8	15.1	93

(a) A dented intersection is defined as an intersection with one or more diametrical dents greater than or equal to 5 mils.

(b) Average of maximums at elevation.

(c) Single largest value at elevation.

TABLE 8

RELATIONSHIP BETWEEN AVERAGE ID TENSILE STRAIN AND ELEVATION
MILLSTONE UNIT No. 2--STEAM GENERATOR No. 2 (CL)

DECEMBER 1981 OUTAGE

ELEVATION	No. OF TESTS	AVERAGE ID TENSILE STRAIN	MAXIMUM ID TENSILE STRAIN	% OF TUBES GREATER THAN 1 % STRAIN	STAN. DEV.
1	151	1.1	1.2	3	0.1
2	151	1.2	1.5	5	0.2
3	150	1.1	1.4	5	0.1
4	152	1.6	2.5	2	0.7
5	151	1.2	1.4	4	0.1
6	152	1.1	1.3	3	0.1
7	150	1.5	2.6	3	0.6
8	142	1.9	3.6	6	0.9
9	121	1.4	2.6	45	0.4
10	59	1.2	1.2	2	0.0
11	14	1.8	2.0	21	0.1
1-9	1322	1.4	3.6	7	0.5
10-11	73	1.7	2.0	5	0.3

TABLE 9

RELATIONSHIP BETWEEN MAXIMUM DIAMETRICAL REDUCTION AND ELEVATION
MILLSTONE UNIT No. 2--STEAM GENERATOR No. 2 (HL)

DECEMBER 1981 OUTAGE

ELEVATION	No. OF TESTS	No. OF DENTS(a)	DIAMETRICAL REDUCTION (MILS) AVERAGE(b)	MAXIMUM(c)	STANDARD DEVIATION	% DENTED
1	301	297	30.4	89.4	16.5	99
2	299	288	15.2	60.6	10.7	96
3	299	297	25.5	78.5	13.3	99
4	300	284	15.6	67.9	10.3	95
5	296	274	16.2	70.8	12.1	93
6	297	207	9.2	40.4	5.2	70
7	253	206	14.2	51.4	10.1	81
8	152	47	11.1	30.1	6.6	31
9	86	8	5.9	7.2	.7	9
10	24	22	56.8	81.4	13.3	92
11	1	1	19.3	19.3	0	100
1-9	2283	1908	19.4	89.4	13.6	84
10+11	25	23	55.2	81.4	15.1	92

(a) A dented intersection is defined as an intersection with one or more diametrical dents greater than or equal to 5 mils.

(b) Average of maximums at elevation.

(c) Single largest value at elevation.

TABLE 10

RELATIONSHIP BETWEEN FRACTION OF MAXIMUM DENTS GREATER THAN 20 MILS (DIAMETRICAL) AND ELEVATION
MILLSTONE UNIT No. 2
STEAM GENERATOR No. 2 (HL)
DEC. 1981 OUTAGE

ELEVATION	No. OF TESTS	MAXIMUM DENTS GREATER THAN 20 MILS, %
1	301	67
2	299	44
3	299	57
4	300	21
5	296	24
6	297	4
7	253	16
8	152	4
9	86	0
1-9	2283	30

TABLE 11

RELATIONSHIP BETWEEN AVERAGE ID TENSILE STRAIN AND ELEVATION
MILLSTONE UNIT No. 2 - STEAM GENERATOR No.2 (HL)

DECEMBER 1981 OUTAGE

ELEVATION	No. OF TESTS	AVERAGE ID TENSILE STRAIN	MAXIMUM ID TENSILE STRAIN	% OF TUBES > 1% STRAIN	STANDARD DEVIATION
1	301	2.7	10.9	82	1.6
2	299	2.3	7.7	75	1.2
3	299	2.7	10.1	72	1.8
4	300	2.1	11.2	41	1.3
5	296	2.2	10.2	40	1.4
6	297	1.74	5.0	26	0.8
7	253	2.2	6.2	25	1.1
8	152	1.6	2.5	11	0.5
9	86	1.7	3.6	36	0.7
10	24	2.0	3.0	8	1.0
11	1	19.0	19.0	100	0.0
1-9	2283	2.4	11.2	49	1.5
10+11	25	7.7	19.0	12	8.1

FIGURE 1

AVERAGE MAXIMUM DIAMETRICAL TUBE DENTS
GREATER THAN 5 MILS VERSUS ELEVATION MILLSTONE UNIT No. 2
DECEMBER 1981 OUTAGE

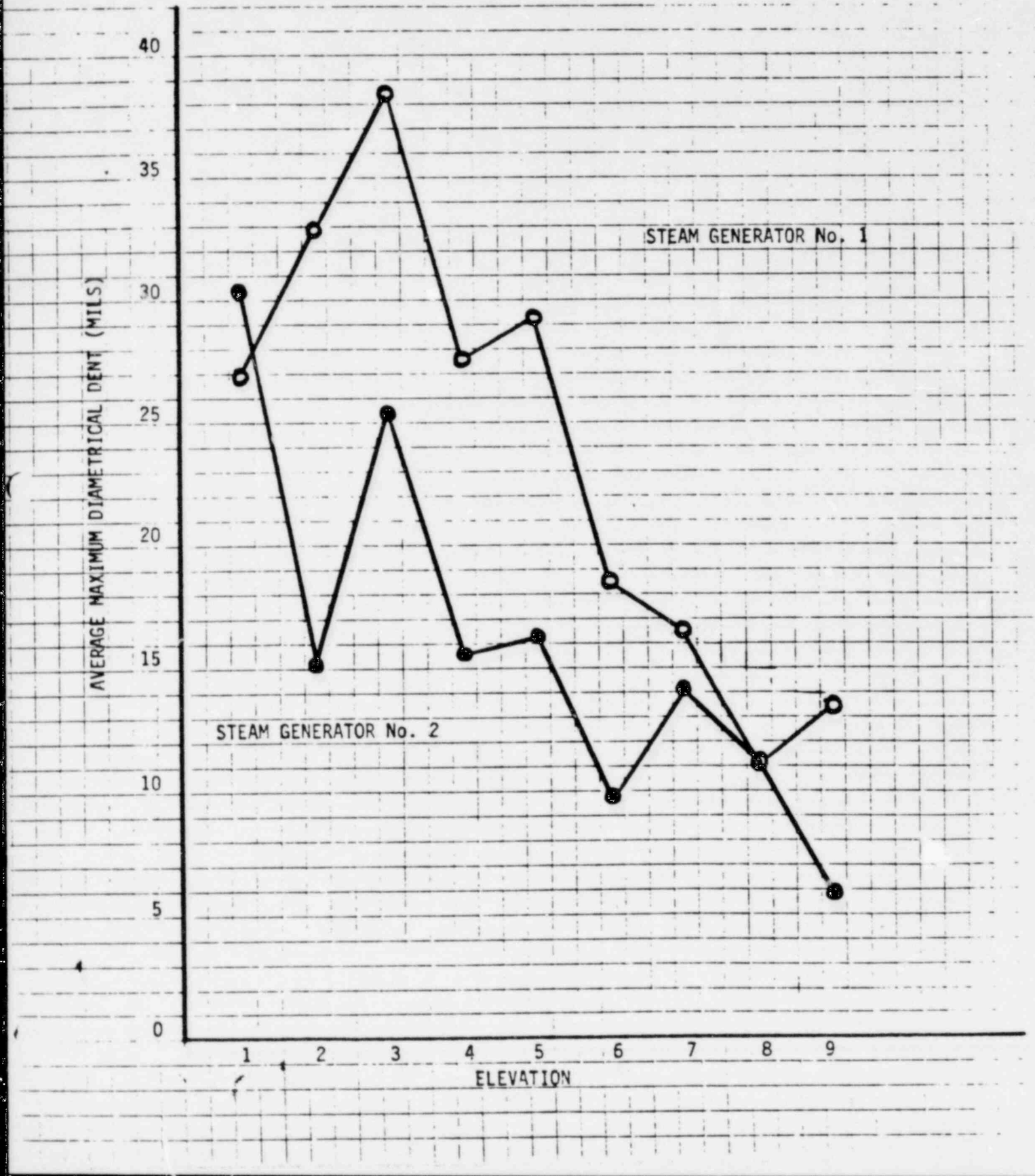


FIGURE 2
PERCENT OF INTERSECTIONS INSPECTED WITH
DIAMETRICAL DENTS GREATER THAN 20 MILS VERSUS ELEVATION
MILLSTONE UNIT No. 2
DECEMBER 1981 OUTAGE

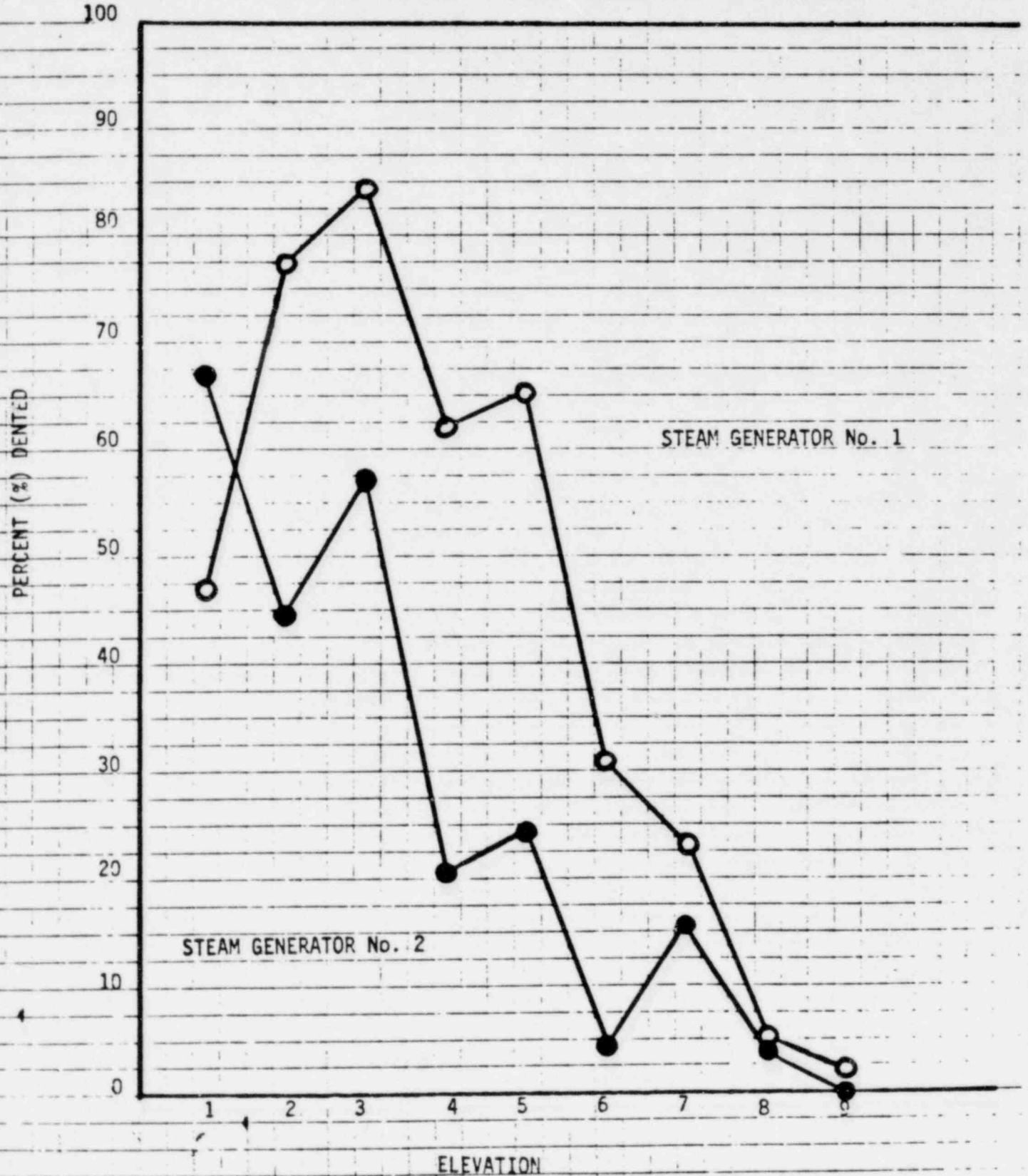


FIGURE 3
AVERAGE MAXIMUM TUBE STRAIN
VERSUS ELEVATION MILLSTONE UNIT No. 2
DECEMBER 1981 OUTAGE

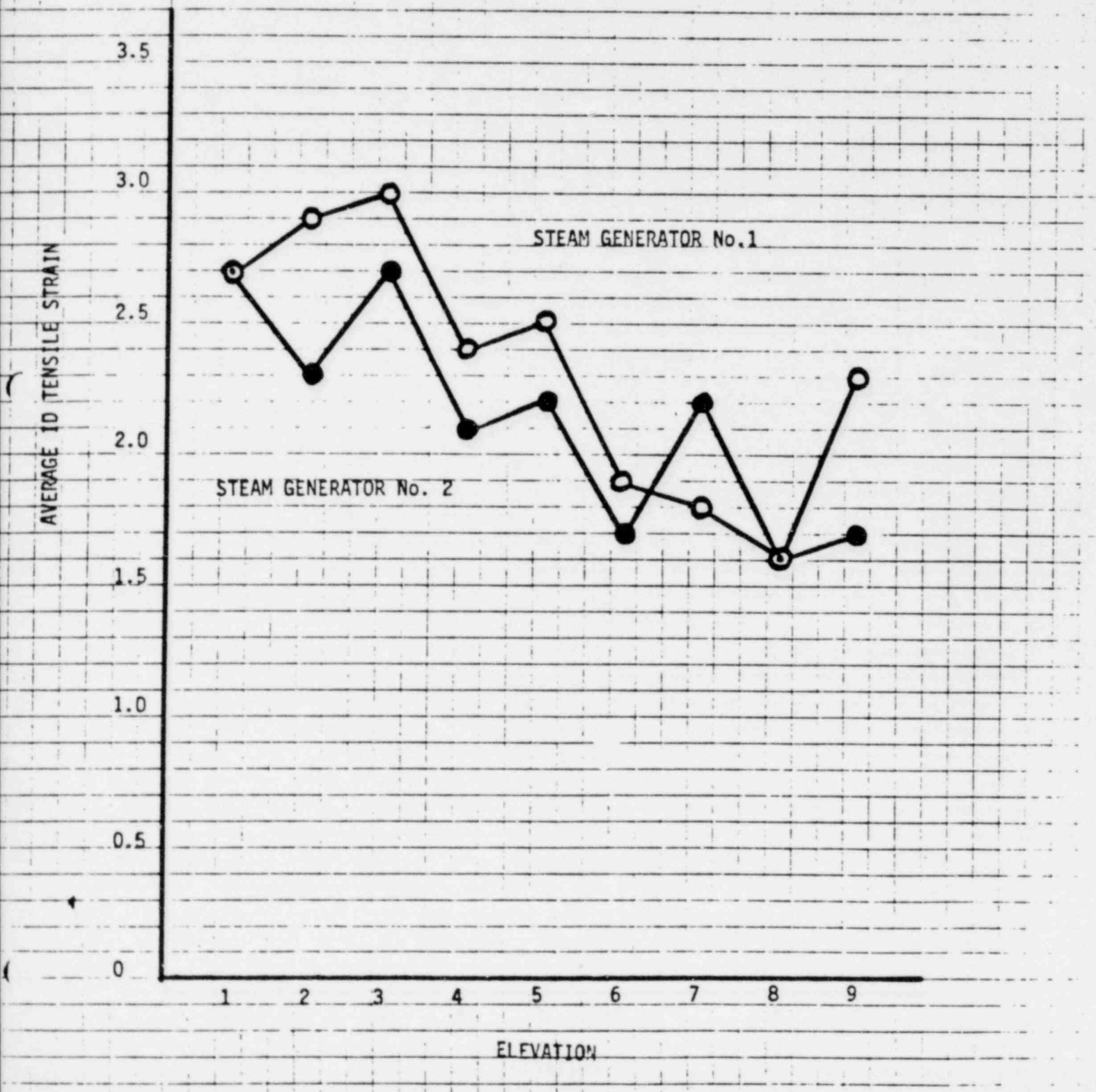


TABLE 12

RELATIONSHIP BETWEEN MAXIMUM DIAMETRICAL REDUCTION AND ELEVATION
MILLSTONE UNIT No. 2--STEAM GENERATOR No. 2 (HL)

AUGUST 1980 OUTAGE

ELEVATION	No. OF TESTS	No. OF DENTS(a)	DIAMETRICAL REDUCTION (MILS) AVERAGE(b)	DIAMETRICAL REDUCTION (MILS) MAXIMUM(c)	STANDARD DEVIATION	% DENTED
1	143	139	27.9	56.1	12.0	97
2	143	130	19.6	57.1	11.9	91
3	143	139	22.7	55.1	11.8	97
4	141	123	16.3	41.7	9.8	87
5	142	123	17.5	59.5	12.3	87
6	137	60	10.4	36.6	7.1	44
7	123	78	12.3	46.6	9.2	63
8	21	3	12.4	23.9	8.2	14
9	1	0	--	--	--	0
1-9	994	795	19.3	59.5	12.3	80

(a) A dented intersection is defined as an intersection with one or more diametrical dents greater than or equal to 5 mils.

(b) Average of maximums at elevation.

(c) Single largest valve at elevation.

TABLE 13

RELATIONSHIP BETWEEN FRACTION OF MAXIMUM DENTS >20 MILS (DIAMETRAL) AND ELEVATION

MILLSTONE UNIT NO. 2; STEAM GENERATOR NO. 2 .

AUGUST 1980 OUTAGE -- ZETEC PROFILOMETER

ELEVATION	NO. OF TESTS	MAX. DENTS >20 MILS, %
1	143	70
2	143	35
3	142	50
4	141	30
5	142	27
6	137	6
7	124	10
8	21	5
9	0	0
1-9	994	33

TABLE 14

RELATIONSHIP BETWEEN AVERAGE ID TENSILE STRAIN AND ELEVATION
MILLSTONE UNIT No. 2 - STEAM GENERATOR No. 2 (HL)

AUGUST 1980 OUTAGE

ELEVATION	No. of TESTS	AVERAGE ID TENSILE STRAIN	MAXIMUM ID TENSILE STRAIN	% OF TUBES > 1% STRAIN
1	143	1.6	2.8	63
2	143	1.6	3.3	42
3	143	1.6	3.3	45
4	141	1.5	3.0	28
5	142	1.3	2.4	28
6	137	1.3	1.6	7
7	123	1.6	2.4	11
8	21	1.1	1.1	5
9	1	--	--	0
1-9	994	1.5	3.3	32

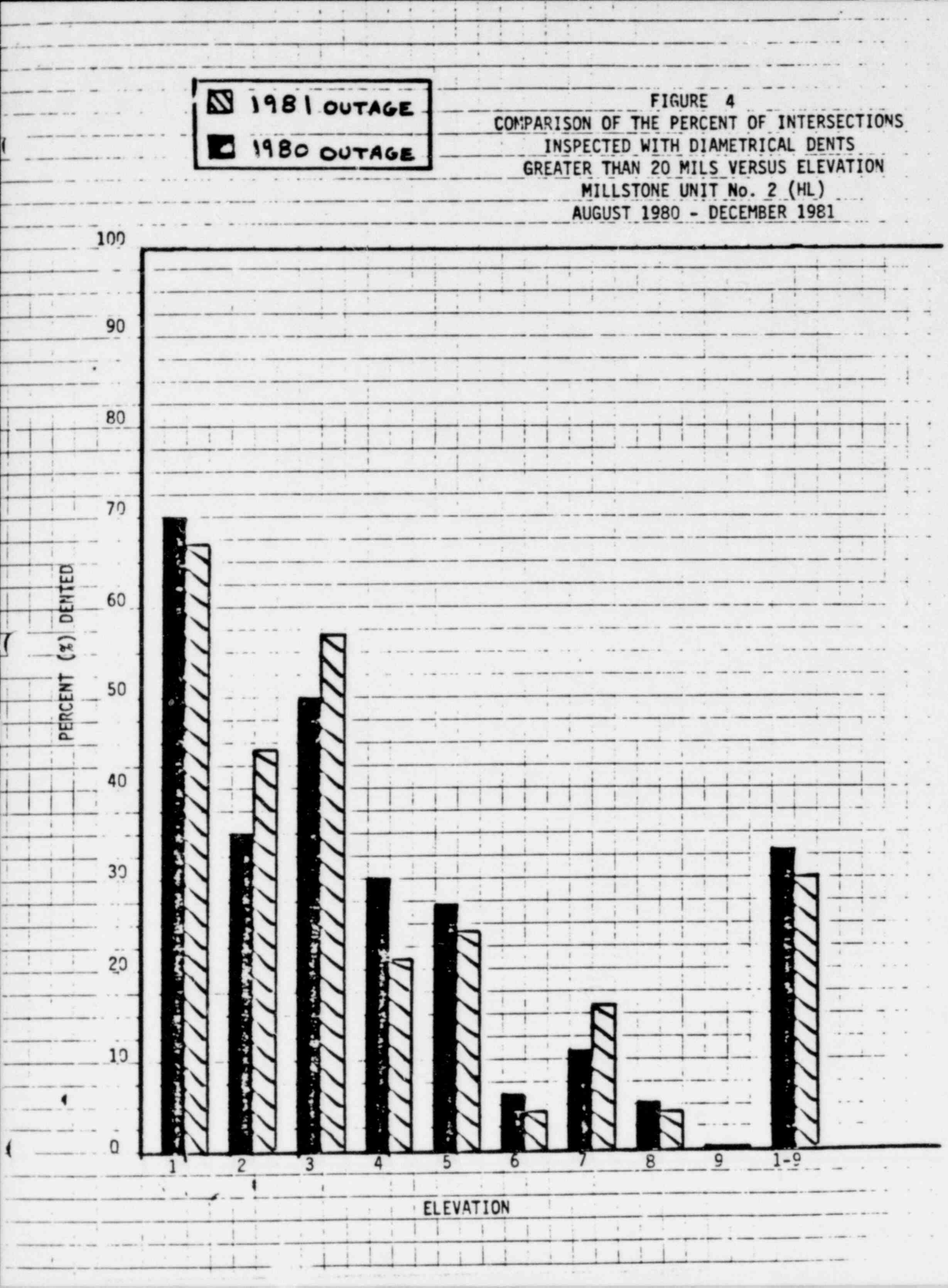


FIGURE 4
COMPARISON OF THE PERCENT OF INTERSECTIONS
INSPECTED WITH DIAMETRICAL DENTS
GREATER THAN 20 MILS VERSUS ELEVATION
MILLSTONE UNIT No. 2 (HL)
AUGUST 1980 - DECEMBER 1981

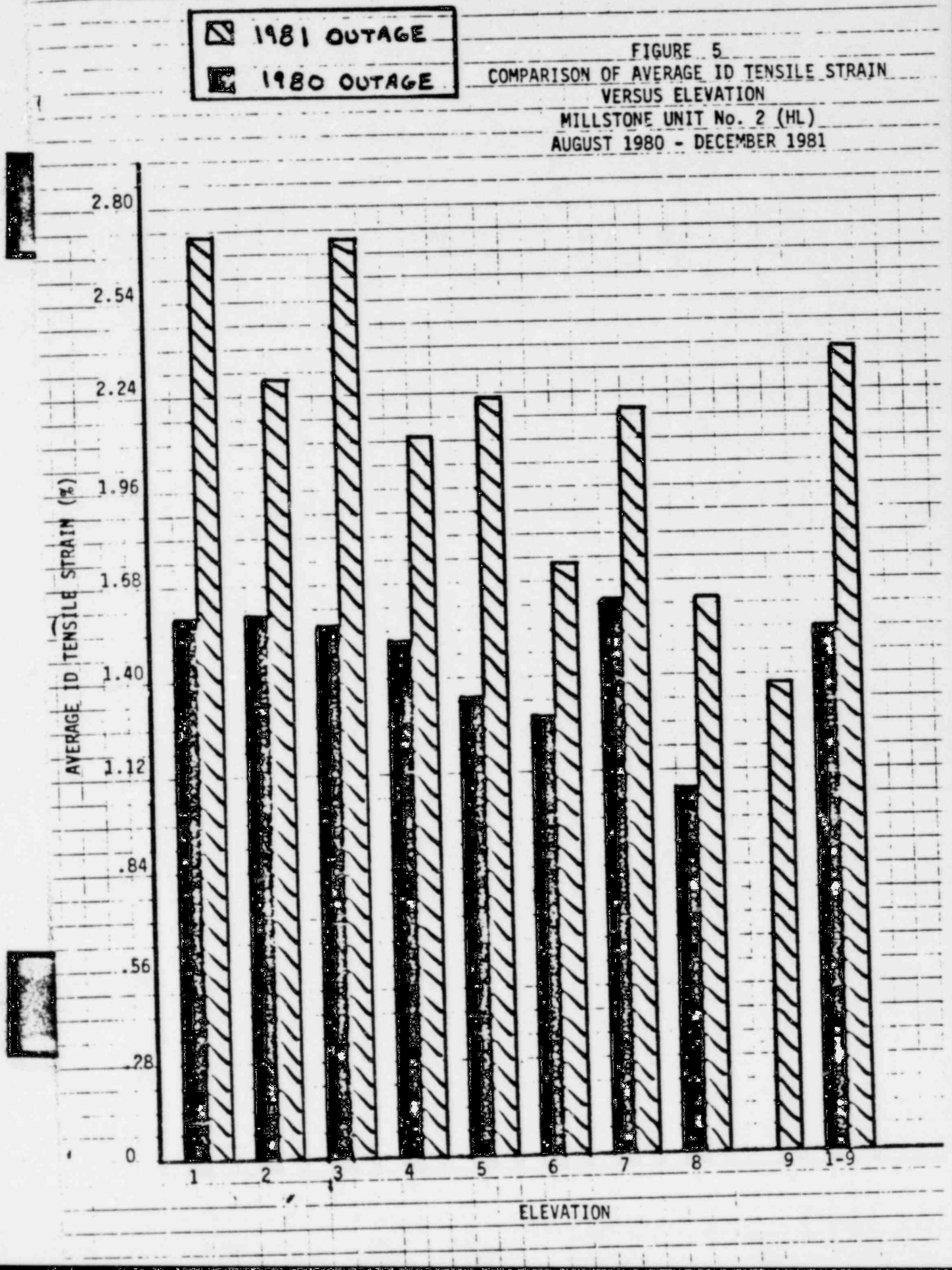
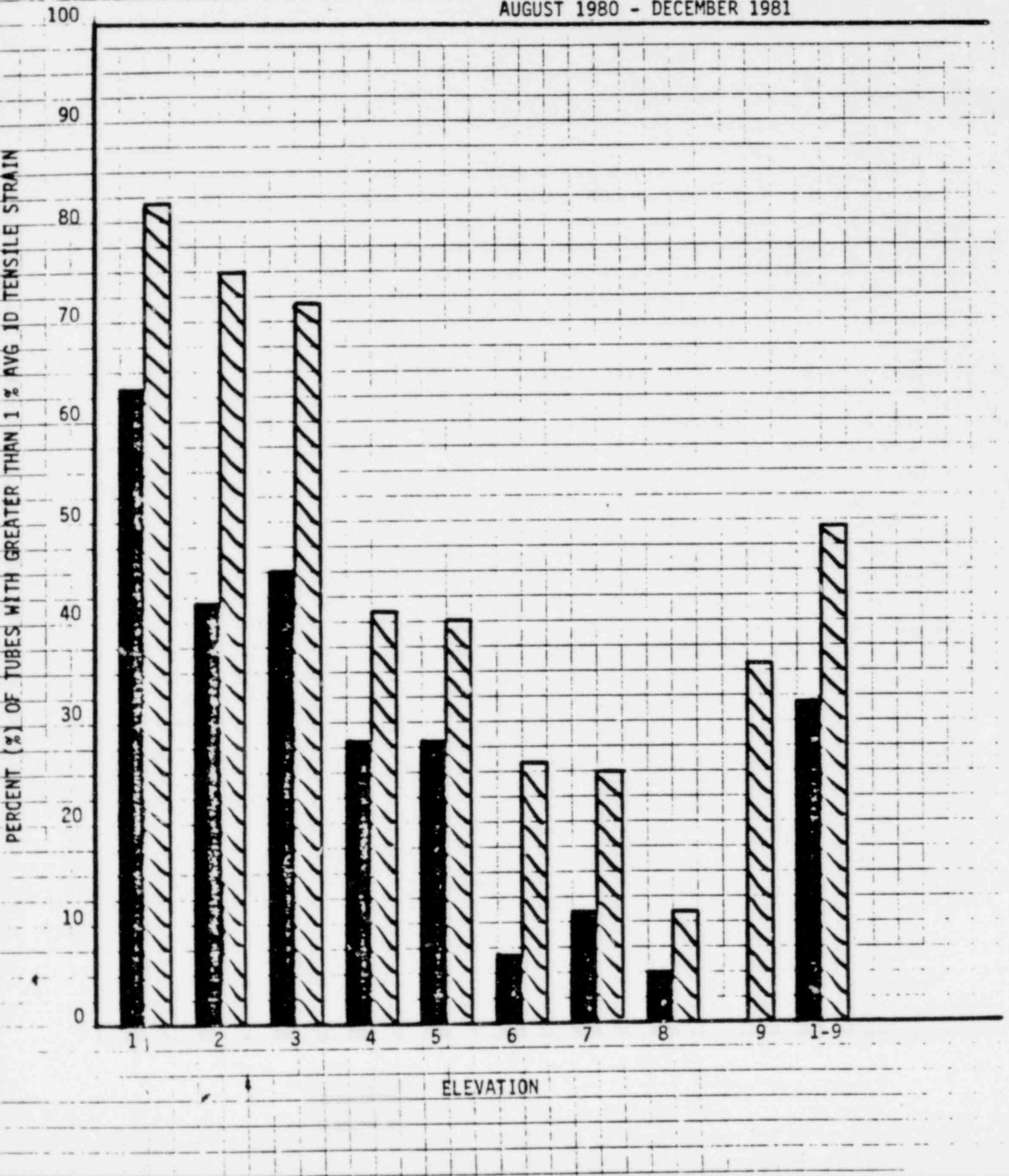


FIGURE 5
COMPARISON OF AVERAGE ID TENSILE STRAIN VERSUS ELEVATION
MILLSTONE UNIT No. 2 (HL)
AUGUST 1980 - DECEMBER 1981

FIGURE 6
COMPARISON OF THE PERCENT OF INTERSECTIONS INSPECTED WITH AVERAGE ID TENSILE STRAIN GREATER THAN 1 PERCENT VERSUS ELEVATION
MILLSTONE UNIT No. 2 (HL)
AUGUST 1980 - DECEMBER 1981



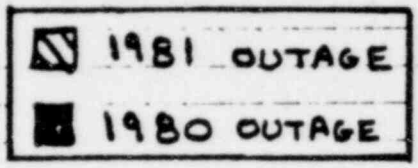


FIGURE 7
COMPARISON OF THE PERCENT OF INTERSECTIONS INSPECTED WITH DIAMETRICAL DENTS GREATER THAN 20 MILS VERSUS ELEVATION - MILLSTONE UNIT No. 1 (HL)

AUGUST 1980 - DECEMBER 1981

TABLE 15

PROFILOMETRY MEASUREMENTS OF DENT PROGRESSION IN EGG CRATES
MILLSTONE UNIT No. 2, STEAM GENERATOR No. 2

EGG CRATE No.	MAX DIAMETRICAL DENT, MILS			MAX ID BENDING STRAIN, %		
	1979	1980	1981	1979	1980	1981
L 107 R 41						
1	23	17	24	-0.9	-1.3	-1.1
2	42	35	37	-1.7	-1.4	-2.2
3	10	39	43	-2.6	-2.0	-1.8
4	39	20	45	-1.9	-2.0	-2.3
5	16	17	21	-1.0	-0.8	-1.1
6	40	37	40	-1.8	-1.1	-1.6
L 107 R 43						
1	48	43	46	-2.2	-1.8	-2.2
2	18	15	19	-1.4	-0.8	-1.1
3	14	9	18	-0.7	-0.7	-1.2
4	10	7	16	-0.8	-0.4	-1.4
5	23	22	20	-0.8	-1.2	-1.4
6	18	15	16	-1.3	-0.9	-1.1
Average Both Tubes						
1-6	25	23	29	-1.4	-1.2	-1.5