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SUBJECT: Forwards final draft progress rept on rock monitoring instrumentation,W/one oversize figure.Aperture card is available in PDR. ~~E66~~ RPD

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May 30, 1984
(NMP2L 0069)

Mr. A. Schwencer, Chief
Licensing Branch No. 2
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Schwencer:

Re: Nine Mile Point Unit 2
Docket No. 50-410

Enclosed for your review are six (6) copies of the final draft of our progress report on the rock monitoring instrumentation at Nine Mile Point Unit 2.

Very truly yours,

C. V. Mangan
Vice President
Nuclear Engineering & Licensing

Enclosure

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Section 2.5.4.13 of the FSAR presents a description of, and data from, the various types of instrumentation that have been installed in proximity to the excavations for Unit 2. The information presented in the FSAR, in turn, was an update of that provided in Response Q361.5 (NRC Request for Additional Information) submitted in February 1980. Generally, the FSAR provides data and analyses through 1981.

It is the purpose of this report to provide information regarding the status of the instrumentation and report on the results obtained through March 1984. Details of the purpose for the instrumentation and methods of installation have been provided previously and will not be repeated here. Table 1 updates Table 2.5-33 of the FSAR and provides a summary of the instrumentation at Nine Mile Point as well as a listing of the locations and current status. Figures 1 and 2 illustrate the locations of the instrumentation relative to the site excavations, and Fig. 3 depicts the relationship of the inclinometers and extensometers relative to the stratigraphic column. Instrumentation that is currently being monitored includes inclinometers, extensometers, piezometers, and linear-displacement sensors (gap gauges). Readings of all other instrumentation reported in the FSAR have been discontinued.

In general, the results of all the instrumentation, taken collectively, indicate that the design criteria established for rock movement are sufficient and will not be exceeded during the projected life of the facility. The instrumentation is predominantly affected by seasonal temperature changes but some very small long-term displacements can be recognized.

During the period of monitoring detailed in this report, the most notable affect on instrumentation readings (beyond temperature-induced fluctuations) was the rewatering of the intake shaft and reactor excavation starting in December 1982. The water level in the shaft was allowed to rise from (approximately) elevation 125 feet before December 1982 to between elevation 200 and 220 feet after January 1983. The water level in the shaft has been maintained above elevation 200 feet throughout the period of monitoring described in this report.

The water level in the reactor excavation was allowed to rise from below the bottom of the excavation (elevation 163 feet) to just below the elevation of the electrical tunnel benches (elevation 206 feet). This level was maintained until June 1983 when the pumps were again turned on and the reactor excavation dewatered. This dewatered status of the reactor excavation has been maintained from mid-June through the end of this monitoring period.

INCLINOMETERS

Depth-displacement profiles of inclinometers that were monitored for all of the monitoring period are provided for readings taken in March 1984 (Figs. 4-23). Inclinometer I-3 has been blocked since December 1983; therefore, the November 1983 reading is the

most recent one available. Inclinometers SI-3, SI-4, SI-5, 803, and RS-2 were abandoned during the monitoring period and the records presented are the last taken.

Radwaste Inclinometers (800 Series)

Five inclinometers (805, 806, 810, 820, and 821) are currently being read to monitor any minor rock adjustments that might be associated with the Radwaste thrust structure. Almost four years of monitoring of these inclinometers have revealed two distinct types of movement--one is a small but steady long-term displacement and the other a more abrupt displacement directly associated with the rewatering of the shaft and reactor excavations.

The long-term displacements are evident at about elevation 215 feet in inclinometers 805, 810, and 821 (Figs. 24-26). This movement is very small (0.1-0.2 mm/yr) and is directed toward the north. This zone of movement is above the rock units that were rewatered. Interestingly, the other radwaste inclinometers do not show these displacements. Neither the direction of the movement nor the magnitude will affect the structures at the site.

All other displacements of note in the radwaste inclinometers seem to be associated with the rewatering of the shaft and reactor excavation at the beginning of 1983. The time-displacement plots of inclinometers 806, 820, and 821 at elevation 90 feet (Figs. 27-29) illustrate this reaction. In each of these instruments, displacements start near the beginning of 1983, take approximately four months to reach maximum displacement of about 0.5 mm, and then remain at that level. All displacements are toward the west. It is postulated that these displacements may be a buoyancy effect that, because of the direction of the maximum principal stress and a pronounced fabric developed by the Radwaste structure, results in small, irreversible displacements toward the west. This same phenomenon is recorded at elevation 175 feet in inclinometer 820 (Fig. 30). The total displacement of this level is 0.8 mm, but movement at this depth is not recorded in any of the other inclinometers.

The most pronounced zone of displacement in the radwaste inclinometers is recorded in inclinometer 806 at elevation 240-248 feet (Fig. 31). This zone has shown a steady displacement toward the northeast of approximately 0.7 mm/yr for the last two-and-one-half years. It is very near the top of the bedrock and is not recorded in inclinometer 805, which is only about 100 feet to the west. Because the direction of displacement in this zone is toward the northeast (away from all site structures) and similar movement does not occur in other inclinometers, there does not appear to be any adverse consequences to the present design criteria.

Intake Shaft Inclinometers

Like the radwaste inclinometers, the inclinometers around the intake shaft exhibit two distinct types of movement--one is a long-term progressive movement associated with excavation and the other is a result of rewatering. The long-term progressive movement in the displacement plots of SI-8 and SI-9 (Figs. 32 and 33) are superimposed on the rewatering displacement. Inclinometers SI-8 and SI-9 are located on the east bench of the screenwell shaft and the displacement zones correspond with the elevation of the shaft bottom and the east tunnel. The long-term displacements are estimated to be between .2 and .4 mm/yr.

The displacements associated with the rewatering of the shaft generally show movement toward the shaft and/or the tunnels. Inclinometers west of the shaft (I-3, I-2, SI-6) record displacements toward the east and northeast while inclinometers on the east bench (SI-8, SI-9) move toward the south and southwest. Only inclinometer SI-10 is anomalous in that it shows a one-time displacement associated with rewatering that has a northeast trend. All the rewatering displacements range from 0.4 to 1.0 mm and then level off.

Reactor Excavation Inclinometers

None of the reactor excavation inclinometers (SI-20, SI-21, SI-22, and SI-23) have shown any discernable movement except SI-23, which has shown small step-line displacements toward the west (away from the excavation) between elevations 76 and 110 feet (Fig. 34). The overall rate of movement in this zone is less than 0.3 mm/yr.

EXTENSOMETERS

Reactor Excavation Extensometers

Extensometer EX-20 (Fig. 35) is the only extensometer located in close proximity to the reactor excavation. The upper part of the extensometer illustrates typical temperature-related movements and two zones below elevation 127 feet (127-92 feet and 92-54 feet) have expanded. From the timing of the initiation of the expansion, it appears that it may be related to the rewatering of the reactor excavation. However, both zones were below the water table before the rewatering, and the expansion has continued even after the water was drawn down again in June 1983. Total expansion in these two zones since 15 December 1981 has been 0.011 inches (elevation 127 to 92 feet) and 0.026 inches (elevation 92 feet to 54 feet).

Intake Shaft Extensometers

Extensometers in the area of the intake shaft have been subjected to variations in temperature because of the proximity to the open shaft as well as the normal exposure from the ground surface. Consequently, the extensometer records (Figs. 36-41) are dominated by temperature-related responses. Extensometers EX-1 through EX-4 are constructed with steel rods that have a higher coefficient of expansion than the rock. As a result, their reactions to temperature changes are seemingly out-of-phase (Fig. 42). On the other hand, EX-5 and EX-6 use invar rods that produce an in-phase response to temperature changes (Fig. 43). The plots of total movement of each of the extensometers near the shaft indicate a steady shrinkage of the uppermost zone of rock (Oswego Sandstone and Transition Zone) of between 0.01-0.02 inches/year. This shrinkage may be attributed to the drying out of this rock unit that, prior to site activities, was below the water table. However, there are a number of events that have occured in 1982 and 1983 that affect the interpretation of the movements. Construction of buildings around and above the shaft and instruments has changed the degree of exposure to outside air temperature changes, thus reducing the variations in seasonal readings. Also, these buildings may cause some small settlement simply because of increased load. The raising of the water table in December 1982-January 1983 caused a change in the effective stress in the rock, subjected more rock units to swelling, and also transferred the heat of reaction of the curing concrete in the shaft to the rock mass. It is very difficult to isolate the rock mass reaction to each of these events. However, the net sum of the events on individual extensometers can be observed. Some extensometers (EX-1, EX-2) demonstrate a continuation of the shrinkage of the upper rock units; however, it appears that the rate of shrinkage has decreased. In other extensometers (EX-5, EX-6), the overall rate of shrinkage appears unchanged. (In EX-3 and EX-4, it is still difficult to determine if there is a continued shrinkage.) In all the inclinometers, the seasonal fluctuations are less pronounced.

In summary, while there are many factors that may affect interpretation of the readings, it is clear that the overall rock mass reaction is that of minor shrinkage (maximum 0.02 inches/ year).

Inclined Extensometers

Beyond temperature effects in the uppermost zones of HEX-2, there does not appear to be any consistent net expansion or contraction greater than 0.01 inches in either of the inclined extensometers (Figs. 44-45).

GAP GAUGES

The program for monitoring the structural gaps between Category I structures began in the fall of 1981. A total of 14 gauge locations are being monitored, many with multiple instruments. The results of the monitoring are presented as Figs. 46-59. In most of the locations, the displacement normal to the reactor containment is measured but, in several instances (G-2A, G-3S, G-4S), a shear component is also monitored.

In general, all the gap gauges provide similar results: a cyclic variation of the gap width in phase with seasonal temperature variations. Notably, gap gauges G-5A and G-5B provide almost identical results despite the fact that they are located at opposite ends of the reactor excavation. This, coupled with the fact that the readings are proportionally identical to the 15-day temperature average, indicates there is no net closure (or opening) in the north-south direction (Fig. 60).

Movement in the east-west direction can best be deduced from examination of the G-1 series of gauges. Gauge G-1B has been monitored for the longest period (since November 1981) and, upon first examination, the readings tend to suggest a net closure of the gap over time. However, at this point, it is difficult to determine if this closure is actually a progressive rock displacement or simply a dampening of the seasonal temperature variations as a result of the enclosure and heating of the area near the gauges. At present, it appears that the readings may be fluctuating around a new base value that is somewhat lower than the original zero point established when the area was subjected to the normal air temperature variations. Given the new base line, the readings do not appear to suggest a net closure of the gap. Figure 61 is a composite record of all the G-1 gauges with the A, C, and D gauges adjusted to coincide with the G-1B reading. In this figure, the similarity of the variations with time can be observed--further indicating the affect of temperature rather than rock movements which might be expected to differ depending on the location and orientation of the gauge.

Figures 62-64 present shear versus normal displacements with time of the three locations where both shear and normal displacements are monitored (G-2, G-3, G-4). These figures are meant to depict the trace of a point on the reactor containment with time (facing the reactor containment from the outside). In the case of G-2A versus G-1A, it is clear that most of the movement has been normal to the reactor containment (i.e., the gap has been opening and closing with seasonal temperature variations). Measurements at G-3 indicate both normal and shear movement with almost no net displacement with time. Installations of G-4 depict gap closure and shear displacement to the right and show some small net movement. When the orientation and position of this gauge is con-

sidered, it can be determined that the net movement is almost directly west. It should be noted, however, that the G-4 gauges were installed in Feburary 1983, and it may be too early to determine if there really is a net movement.

In January 1983, one gap gauge was mounted vertically on the reactor containment building with the reference plate set on the SE electrical tunnel tie-in. The purpose of this installation was to monitor the effect of the rewatering of the reactor excavation. In a sense, with the gauge mounted on the reactor, the instrument is monitoring the relative position of the base of the excavation (elevation 163 feet) with respect to the electrical tunnel (elevation 214.5 feet). While it initially appeared that the gauge was recording a swelling of the rock mass between elevations 163 and 214.5 feet, it now appears that, in fact, the seasonal temperature changes are the most dominant effect being recorded. The first year record shows a net gap closure (zone expansion), but, at this time, it is difficult to determine if this is just a temperature variation or if the trend will continue.

PIEZOMETERS

Table 2 presents an update of the results of the monitoring of the piezometers from January 1983 through March 1984. This data documents the rise in water levels at the beginning of 1983 in the shaft and reactor excavation and the subsequent lowering of the water level in the reactor excavation near the end of June of the same year.

Table 1

INSTRUMENTATION

Instrument	Location (Plant Grid Coordinates)	Elevation (ft)	Date of First Reading	Reading Frequency	Status
Stressmeters					
OC-1	5610.91S 1896.30W	198 - 196	Sept. 1977	Monthly	Discontinued July 1982
OC-2	2599.45S 1877.52E	159 - 157	Sept. 1977	Monthly	Discontinued July 1982
OC-5	357.00N 281.50W	141	July 1977	Monthly	Destroyed Dec. 1979
OC-7	351.92N 295.00W	141	July 1977	Monthly	Failed Sept. 1980
Inclinometers					
I-1	523.01S 382.77W	Top, 260 Bottom, 196	Mar. 1977	Monthly	Discontinued May 1982
I-2	226.17N 392.92W	Top, 253 Bottom, 200	Mar. 1977	Monthly	Discontinued June 1981
I-3	318.42N 439.75W	Top, 250 Bottom, 103	Mar. 1977	Monthly	Ongoing
I-4	603.76S 535.77W	Top, 263 Bottom, 183	Mar. 1977	Monthly	Discontinued May 1982
SI-1	332.42N 254.79W	Top, 220 Bottom, 74	Dec. 1979	Monthly	Destroyed below el 146 in Feb. 1980
SI-2	338.67N 366.83W	Top, 246 Bottom, 93	Jan. 1980	Monthly	Ongoing
SI-3	334.17N 310.83W	Top, 232 Bottom, 78	Jan. 1980	Monthly	Discontinued March 1983
SI-4	334.00N 300.00W	Top, 232 Bottom, 72	Jan. 1980	Monthly	Discontinued March 1983

Table 1 (continued)

Instrument	Location (Plant Grid Coordinates)	Elevation (ft)	Date of First Reading	Reading Frequency	Status
SI-5	360.17N 300.00W	Top, 232 Bottom, 71	Jan. 1980	Monthly	Discontinued March 1983
SI-6	395.00N 329.92W	Top, 246 Bottom, 70	Jan. 1980	Monthly	Ongoing
SI-7	342.5N 265.5W	Top, 220 Bottom, 71	Jan. 1980	Monthly	Blocked at el 158 in Jan. 1980
SI-8	355.79N 261.82W	Top, 216 Bottom, 72	Nov. 1981	Monthly	Ongoing
SI-9	355.34N 252.0W	Top, 216 Bottom, 74	Nov. 1981	Monthly	Ongoing
SI-10	379.8N 252.0W	Top, 242 Bottom, 76	Nov. 1981	Monthly	Ongoing
SI-20	7.26N 113.85E	Top, 248 Bottom, 53	Nov. 1981	Monthly	Ongoing
SI-21	62.0N 138.0E	Top, 246 Bottom, 56	Nov. 1981	Monthly	Ongoing
SI-22	15.59N 230.0E	Top, 250 Bottom, 60	Nov. 1981	Monthly	Ongoing
SI-23	59.93S 80.23W	Top, 203 Bottom, 51	Nov. 1981	Monthly	Ongoing
803	191.1N 6.8E	Top, 243 Bottom, 117	May 1980	Monthly	Discontinued June 1983
805	55.7N 318.7E	Top, 246 Bottom, 88	May 1980	Monthly	Ongoing
806	73.1N 468.4E	Top, 249 Bottom, -37	June 1980	Monthly	Ongoing
810	87.3S 707.7E	Top, 247 Bottom, -37	May 1980	Monthly	Ongoing

Table 1 (continued)

Instrument	Location (Plant Grid Coordinates)	Elevation (ft)	Date of First Reading	Reading Frequency	Status
820	298N 50E	Top, 238 Bottom, 52	Nov. 1981	Monthly	Ongoing
821	263N 106E	Top, 240 Bottom, 52	Nov. 1981	Monthly	Ongoing
RS-2	1057.3S 493.7E	Top, 250 Bottom, 172	June 1980	Monthly	Discontinued April 1983
Extensometers					
MPX-1	344.90N 353.54W	221, 216, 211 201, 171, 141	June 1977 Aug. 1981	Monthly	Discontinued Aug. 1981
MPX-2	166.53N 55.63E	245, 235, 225 205, 165, 125	Sept. 1977 June 1981	Monthly	Discontinued June 1981
EX-1	335.08N 367.86W	247, 227, 213 196, 172, 130 97	Nov. 1979	Monthly	Ongoing
EX-2	339.08N 310.58W	232, 213, 196 172, 130, 110 72	Dec. 1979	Monthly	Discontinued February 1984
EX-3	330.42N 229.92W	232, 213, 196 172, 113, 72	Dec. 1979	Monthly	Discontinued February 1984
Ex-4	360.92N 304.08W	232, 213, 196 172,113	Dec. 1979	Monthly	Discontinued March 1984
EX-5	346.96N 261.64W	220, 213, 196 172, 132, 110 72	Oct. 1981	Monthly	Ongoing
EX-6	348.0N 252.78W	220, 218, 196 172, 132, 110 72	Oct. 1981	Monthly	Ongoing
Ex-20	2.16N 113.94E	252, 237, 222 202, 177, 156 127, 92, 54	Oct. 1981	Monthly	Ongoing

Table 1 (continued)

Instrument	Location (Plant Grid Coordinates)	Elevation (ft)	Date of First Reading	Reading Frequency	Status
HEX-1	54.2N 88.4E	(Horizontal depths) 10, 20, 40 60, 112, 150	Oct. 1981	Monthly	Ongoing
HEX-2	240.0N 54.5E	246.0(Gnd Elev) 44,55,70,86 96,129(anchor distances from head)	Dec. 1982	Monthly	Ongoing
Piezometers					
PI-1	332.50N 265.50W	A - 131 B - 181	Nov. 1979	Monthly	Ongoing
PI-2	335.25N 372.53W	A - 160 B - 190	Nov. 1979	Monthly	Ongoing
PI-3	332.33N 304.92W	A - 130 B - 181	Nov. 1979	Monthly	Discontinued March 1983
PI-4	415.83N 355.00W	A - 161 B - 194	Nov. 1979	Monthly	Ongoing
PI-5	355.0N 225.0W	A - 123 B - 202	Nov. 1981	Monthly	Ongoing
PI-20	5.53N 117.63E	157	Nov. 1981	Monthly	Ongoing
PI-21	4.37N 229.87E	156	Nov. 1981	Monthly	Ongoing

Table 1 (continued)

Table 1 (continued)

Instrument	Location (Plant Grid Coordinates)	Elevation (ft)	Date of First Reading	Reading Frequency	Status
G1-A	47.5N 73.0E	214.5	May 1982	Monthly	Ongoing
G1-B	63.5S 64.5E	214.5	Nov. 1981	Monthly	Ongoing
G1-C	56.0S 69.0W	214.5	Dec. 1982	Monthly	Ongoing
G1-D	32.0N 82.0W	210.0	Dec. 1982	Monthly	Ongoing
G2-A	63.0N 60.0E	214.5	May 1982	Monthly	Ongoing
G2-B	72S 49E	214.5	Nov. 1981	Monthly	Ongoing
G3	115.0S 62.0W	262.0	Dec. 1982	Monthly	Ongoing
G4	69.0N 54.0W	207.5	Feb. 1983	Monthly	Ongoing
G5-A	131N 6E	217.75	Nov. 1981	Monthly	Ongoing
G5-B	125S 9W	217.75	Nov. 1981	Monthly	Ongoing
G6	128S 62W	214.5	Nov. 1981	Monthly	Ongoing
GV1	65.0S 63.0E	214.5 214.5	Jan. 1983	Monthly	Ongoing

TABLE 2

PIEZOMETER DATA

DATE	INSTRUMENT	SENSOR	WATER LEVEL (ft.)	SENSOR ELEVATION (ft.)
01/06/83	PI-1	A	177.14	
		B	---	
01/24/83	PI-1	A	207.36	
		B	207.07	
02/08/83	PI-1	A	208.28	
		B	209.61	
02/21/83	PI-1	A	211.05	
		B	211.22	
03/09/83	PI-1	A	203.67	
		B	207.99	
04/06/83	PI-1	A	216.59	
		B	215.84	
04/29/83	PI-1	A	206.21	
		B	210.99	
06/15/83	PI-1	A	208.98	
		B	209.61	
07/12/83	PI-1	A	205.29	
		B	206.84	A = 131.0
08/15/83	PI-1	A	205.75	
		B	210.99	B = 181.0
09/13/83	PI-1	A	210.82	
		B	210.99	
10/21/83	PI-1	A	206.44	
		B	209.84	
11/18/83	PI-1	A	209.90	
		B	212.84	
12/27/83	PI-1	A	216.82	
		B	217.91	
01/24/84	PI-1	A	210.59	
		B	218.37	
02/15/84	PI-1	A	203.21	
		B	217.22	
03/21/84	PI-1	A	201.82	
		B	215.61	

Note: --- Water level is below sensor level

TABLE 2

DATE	INSTRUMENT	SENSOR	WATER LEVEL (ft.)	SENSOR ELEVATION (ft.)
01/06/83	PI-2	A	175.92	
		B	205.42	
01/24/83	PI-2	A	204.99	
		B	216.72	
02/08/83	PI-2	A	207.29	
		B	218.11	
02/21/83	PI-2	A	208.22	
		B	219.49	
03/09/83	PI-2	A	208.91	
		B	223.41	
03/24/83	PI-2	A	208.91	
		B	219.95	A = 160.0
04/06/83	PI-2	A	215.83	
		B	221.80	B = 189.5
04/29/83	PI-2	A	208.45	
		B	219.03	
07/12/83	PI-2	A	202.91	
		B	216.26	
08/15/83	PI-2	A	203.83	
		B	219.03	
09/13/83	PI-2	A	205.22	
		B	217.65	
10/21/83	PI-2	A	204.29	
		B	216.72	
11/22/83	PI-2	A	206.37	
		B	220.88	
12/27/83	PI-2	A	211.22	
		B	222.26	
01/24/84	PI-2	A	209.83	
		B	220.88	
02/15/84	PI-2	A	205.45	
		B	223.64	

Note: --- Water level is below sensor level

TABLE 2

DATE	INSTRUMENT	SENSOR	WATER LEVEL (ft.)	SENSOR ELEVATION (ft.)
01/06/83	PI-3	A	174.99	
		B	---	
01/24/83	PI-3	A	205.44	
		B	207.76	
02/08/83	PI-3	A	208.90	A = 130.0
		B	210.76	
02/21/83	PI-3	A	210.51	B = 181.0
		B	212.38	
03/09/83	PI-3	A	208.44	
		B	211.22	
03/24/83	PI-3	A	204.29	
		B	207.76	
01/06/83	PI-4	A	192.11	
		B	196.31	
01/24/83	PI-4	A	210.79	
		B	209.00	
02/08/83	PI-4	A	213.33	
		B	212.23	
02/21/83	PI-4	A	214.25	
		B	213.61	
03/09/83	PI-4	A	217.94	
		B	215.92	
03/24/83	PI-4	A	213.10	
		B	211.07	
04/06/83	PI-4	A	218.41	
		B	217.76	
04/29/83	PI-4	A	212.64	
		B	214.30	
06/15/83	PI-4	A	213.10	A = 160.5
		B	211.99	
07/12/83	PI-4	A	208.02	B = 194.0
		B	209.69	
08/15/83	PI-4	A	210.79	
		B	214.76	

Note: --- Water level is below sensor level

TABLE 2

DATE	INSTRUMENT	SENSOR	WATER LEVEL (ft.)	SENSOR ELEVATION (ft.)
09/13/83	PI-4	A	212.18	
		B	213.38	
10/21/83	PI-4	A	209.87	A = 160.5
		B	212.69	
				B = 194.0
10/18/83	PI-4	A	211.72	
		B	216.15	
02/15/84	PI-4	A	210.33	
		B	221.22	
01/06/83	PI-5	A	177.61	
		B	210.31	
01/24/83	PI-5	A	206.67	
		B	214.92	
02/08/83	PI-5	A	208.06	
		B	216.30	
02/21/83	PI-5	A	209.44	
		B	217.69	
03/09/83	PI-5	A	207.83	
		B	217.00	
03/24/83	PI-5	A	205.98	
		B	214.92	
04/06/83	PI-5	A	216.36	
		B	221.61	
04/29/83	PI-5	A	207.60	
		B	219.07	
06/15/83	PI-5	A	208.98	A = 122.7
		B	217.69	
07/12/83	PI-5	A	203.45	B = 202.0
		B	216.76	
08/15/83	PI-5	A	204.83	
		B	219.99	
09/13/83	PI-5	A	205.29	
		B	215.84	
10/26/83	PI-5	A	200.91	
		B	216.53	

Note: --- Water level is below sensor level

TABLE 2

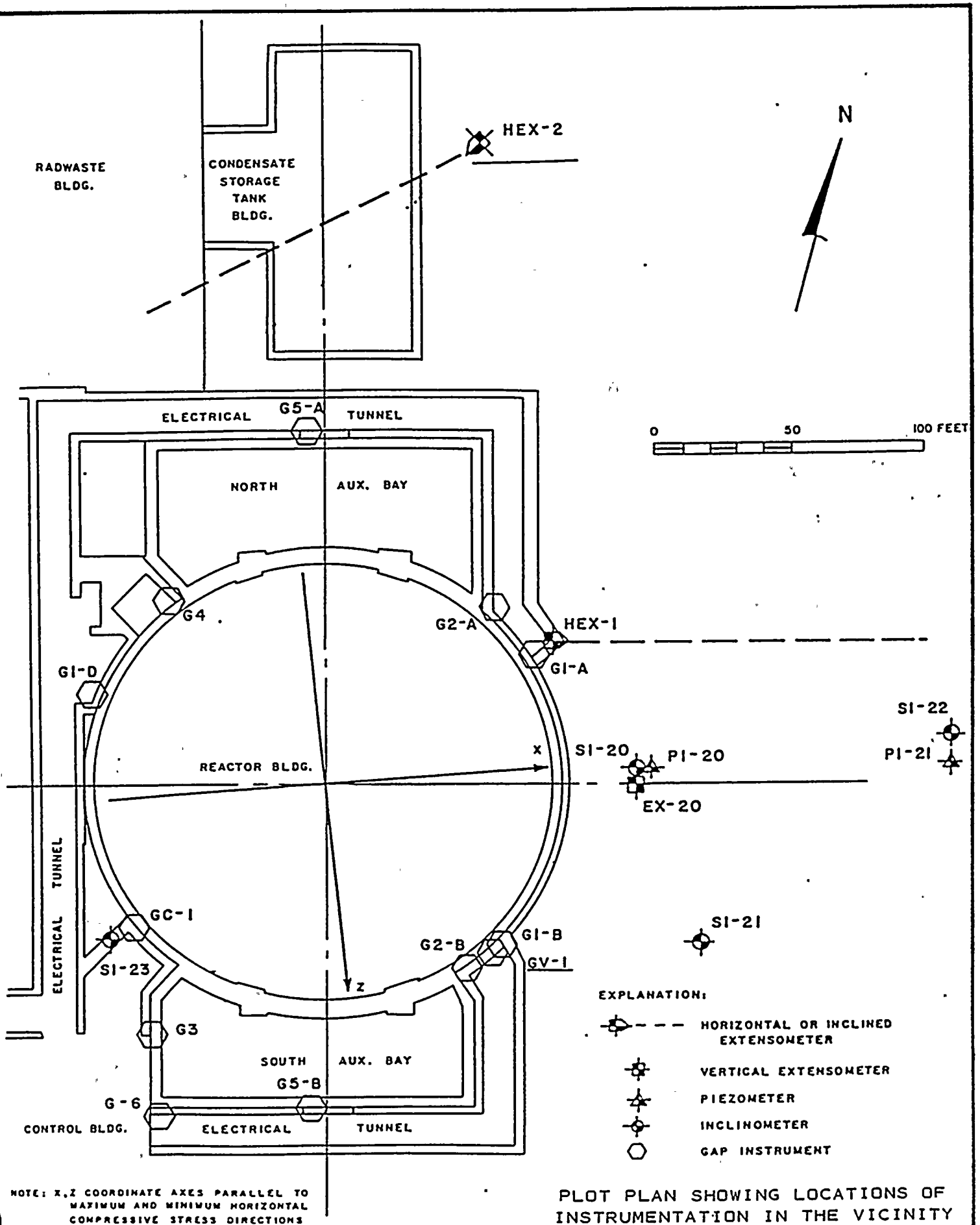
DATE	INSTRUMENT	SENSOR	WATER LEVEL (ft.)	SENSOR ELEVATION (ft.)
11/18/83	PI-5	A	207.37	
		B	220.69	
12/27/83	PI-5	A	213.60	
		B	224.61	A = 122.7
				B = 202.0
01/24/84	PI-5	A	209.67	
		B	224.38	
02/15/84	PI-5	A	204.14	
		B	225.76	
01/06/83	PI-20		172.98	
01/24/83	PI-20		178.06	
02/08/83	PI-20		177.82	
02/21/83	PI-20		177.59	
03/09/83	PI-20		211.97	
03/24/83	PI-20		210.58	
04/06/83	PI-20		212.20	
04/29/83	PI-20		212.89	
06/15/83	PI-20		213.35	
07/12/83	PI-20		179.21	156.6
08/15/83	PI-20		179.21	
09/13/83	PI-20		176.90	
10/21/83	PI-20		177.36	
10/26/83	PI-20		173.44	
11/18/83	PI-20		177.36	
01/24/84	PI-20		178.75	
02/22/84	PI-20		176.90	

Note: --- Water level is below sensor level

TABLE 2

DATE	INSTRUMENT	WATER LEVEL (ft.)	SENSOR ELEVATION (ft.)
02/16/83	PI-21	183.48	
02/21/83	PI-21	183.48	
04/06/83	PI-21	212.09	
04/29/83	PI-21	213.01	155.8
07/12/83	PI-21	183.02	
08/15/83	PI-21	182.56	

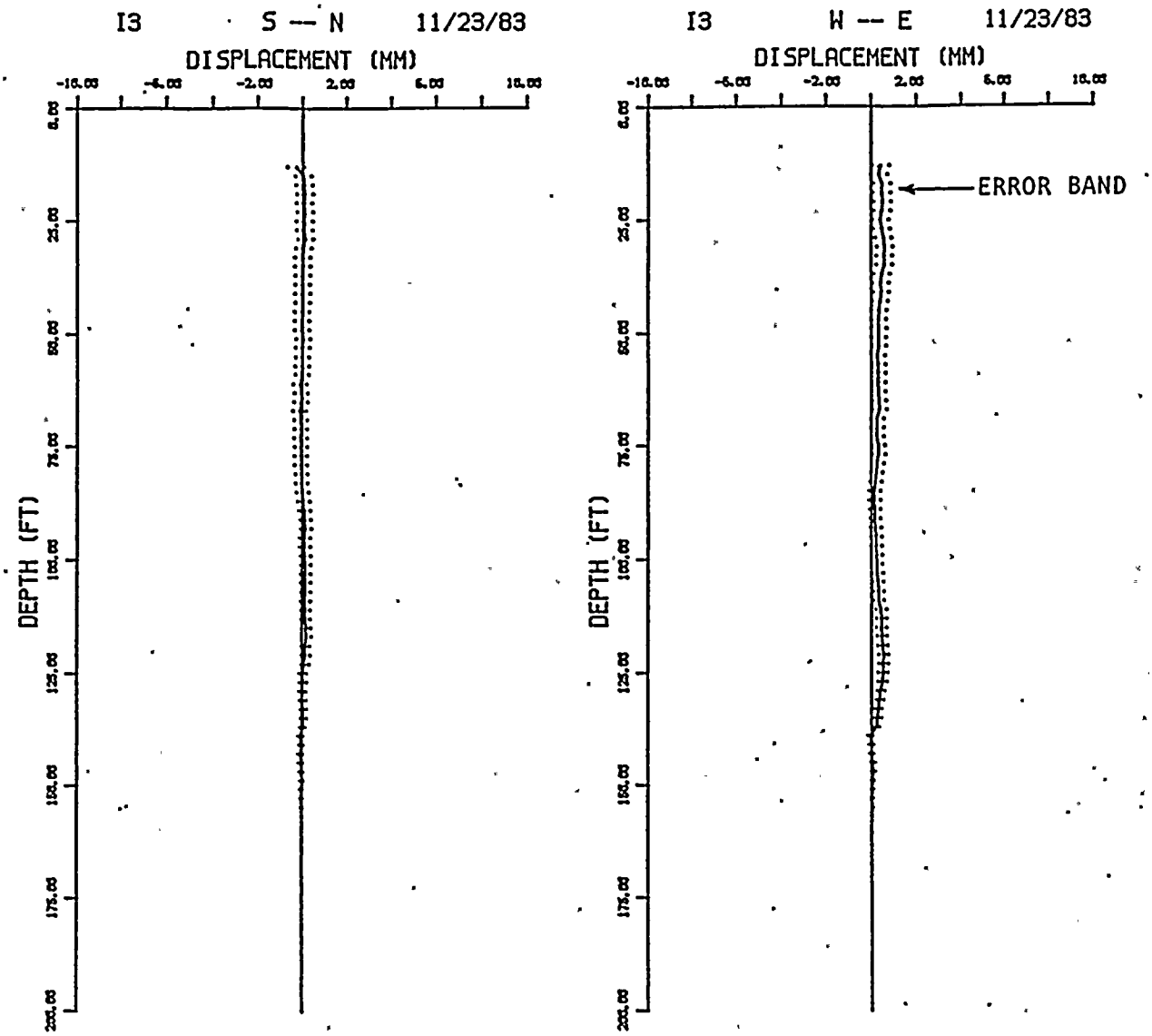
Note: --- Water level is below sensor level



NOTE: X,Z COORDINATE AXES PARALLEL TO MAXIMUM AND MINIMUM HORIZONTAL COMPRESSIVE STRESS DIRECTIONS AROUND REACTOR EXCAVATION.

PLOT PLAN SHOWING LOCATIONS OF INSTRUMENTATION IN THE VICINITY OF THE REACTOR COMPLEX AREA

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

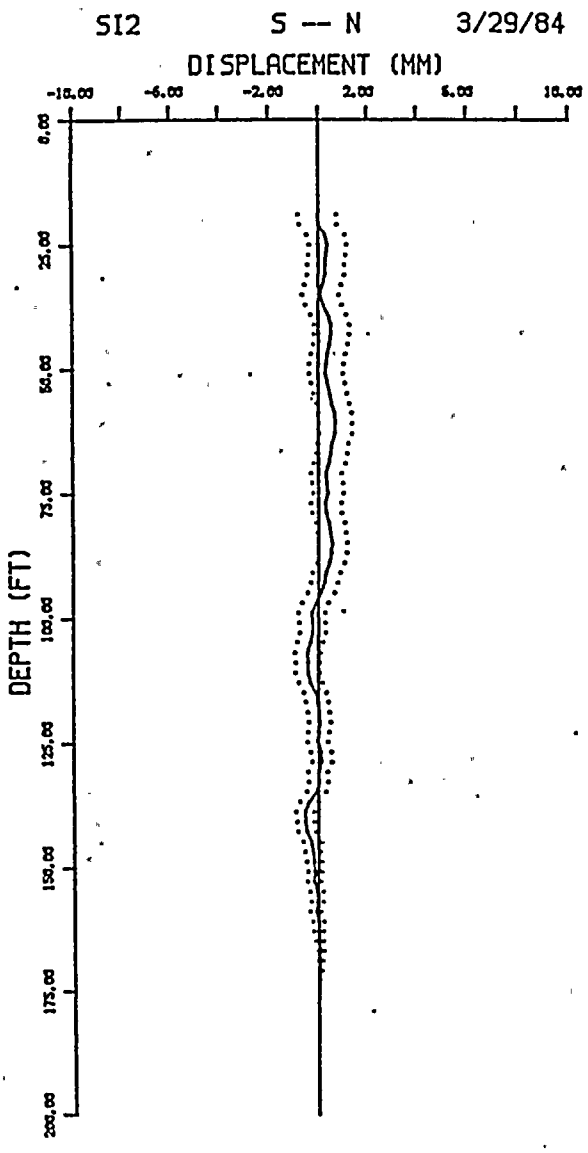


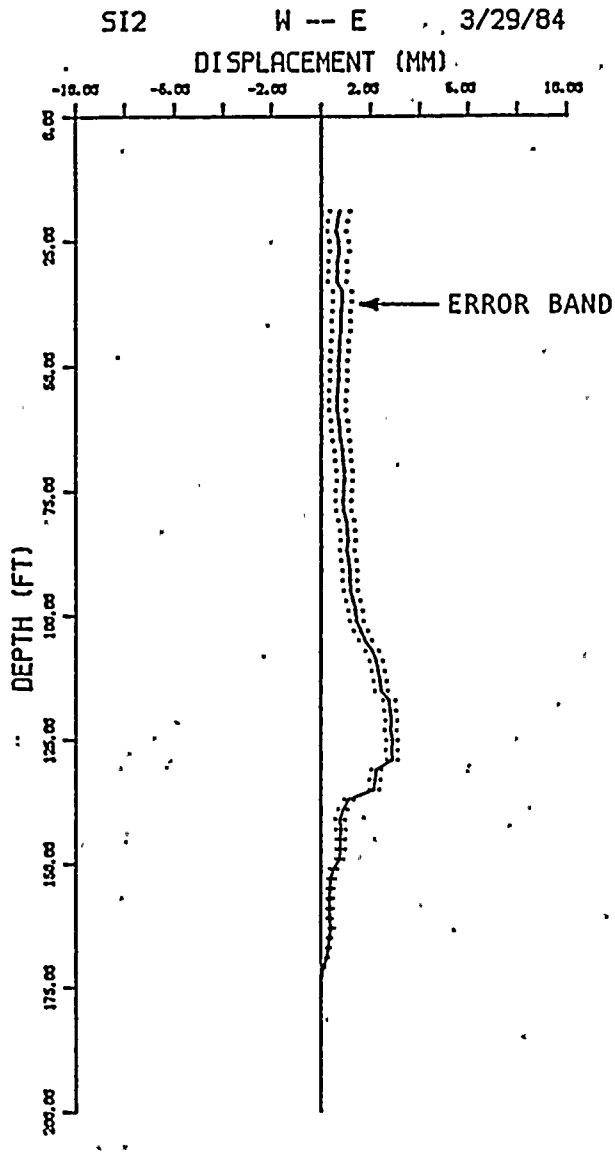
INCLINOMETER I-3

DISPLACEMENT vs. DEPTH PLOTS

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 4



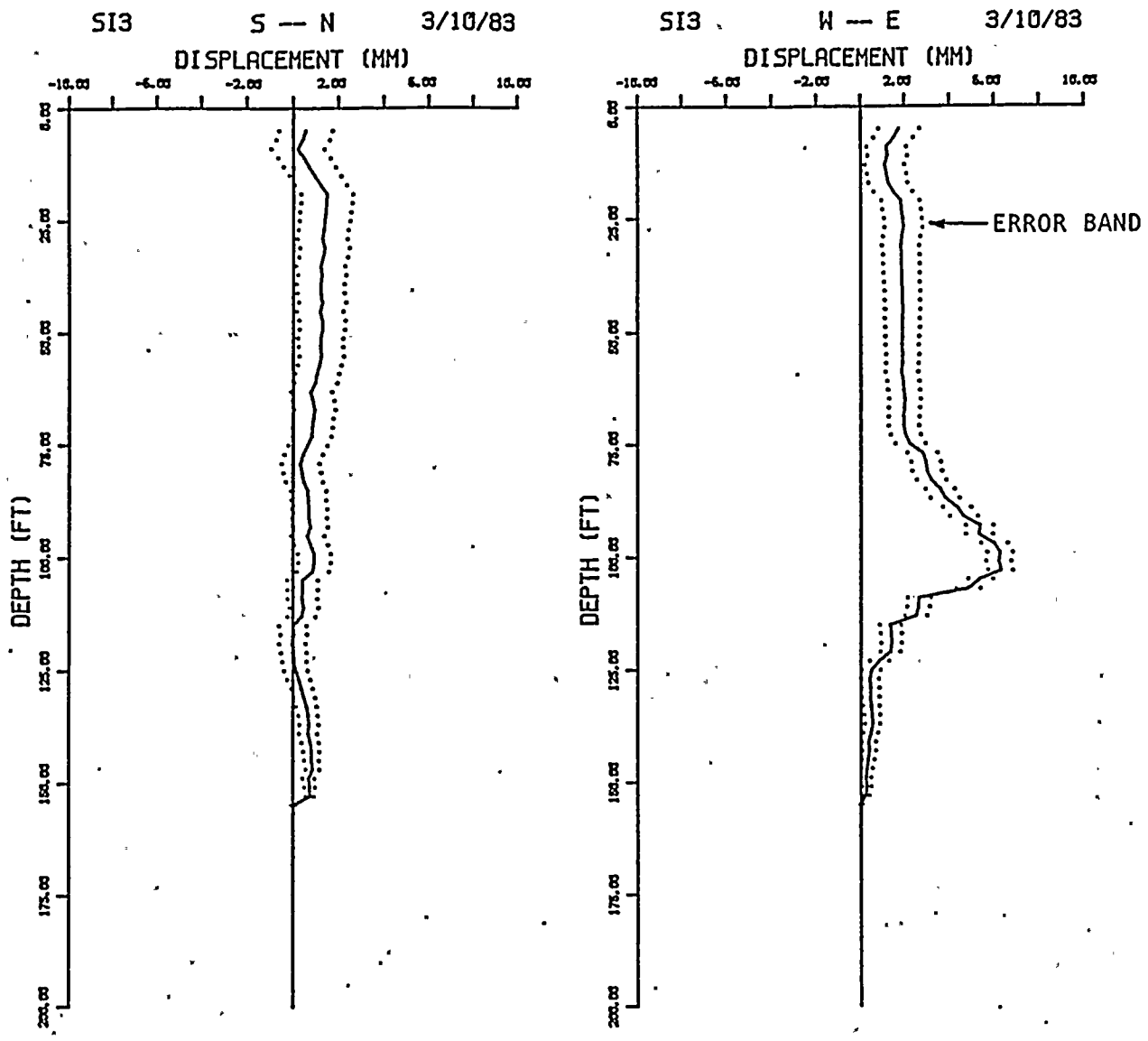


INCLINOMETER SI-2

DISPLACEMENT vs. DEPTH PLOTS

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 5

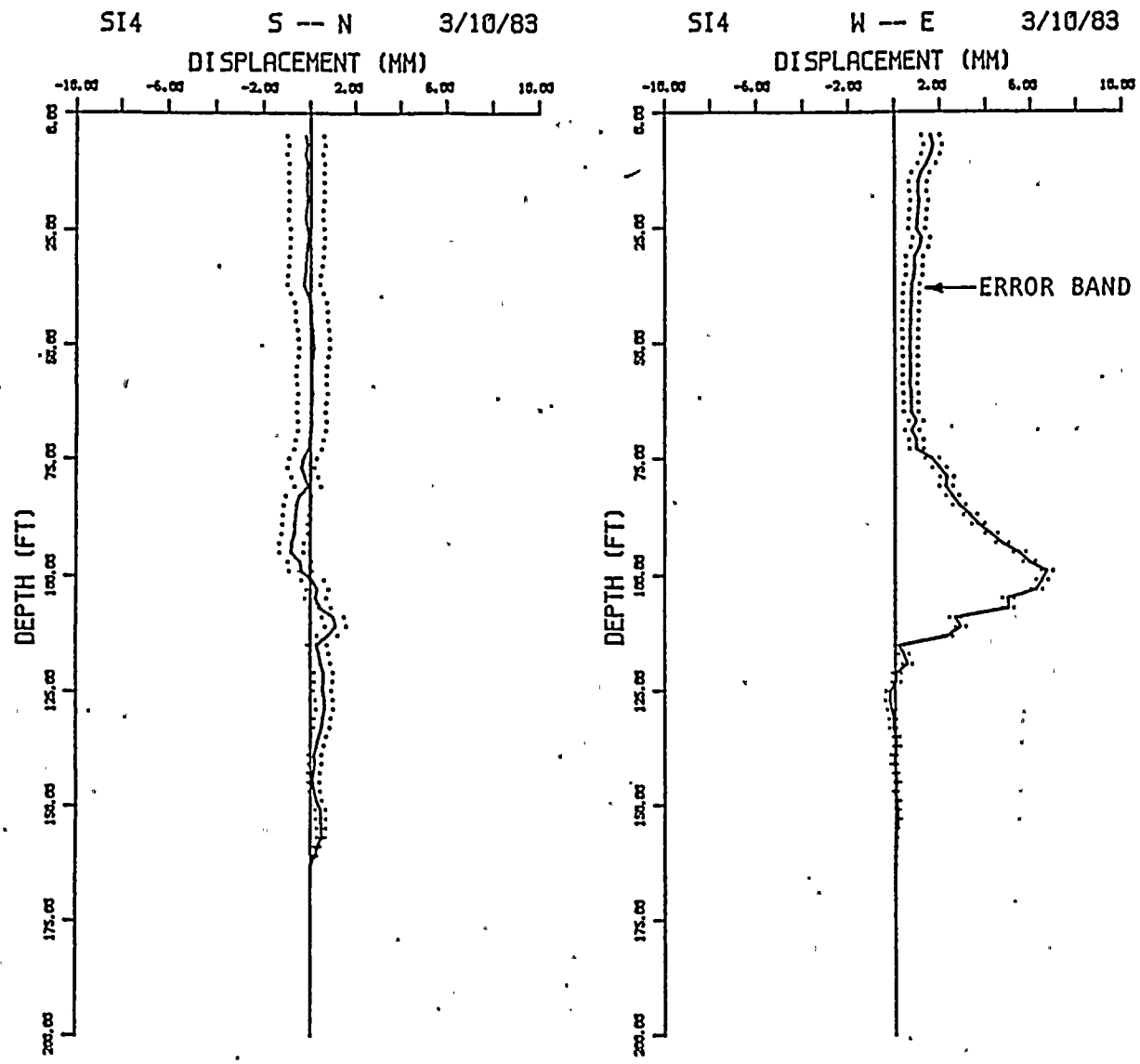


INCLINOMETER SI-3

DISPLACEMENT vs. DEPTH PLOTS

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 6

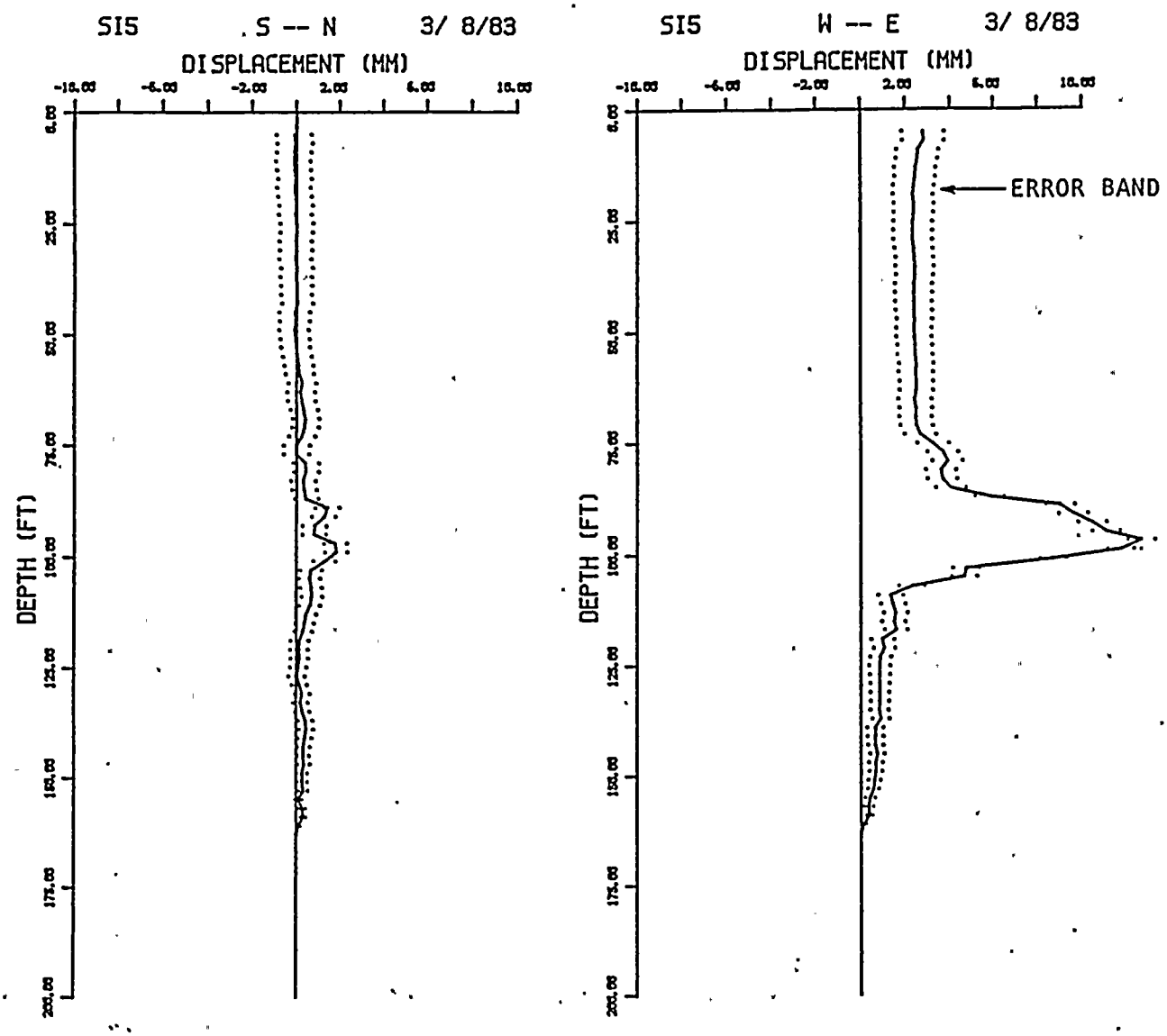


INCLINOMETER SI-4

DISPLACEMENT vs. DEPTH PLOTS

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 7

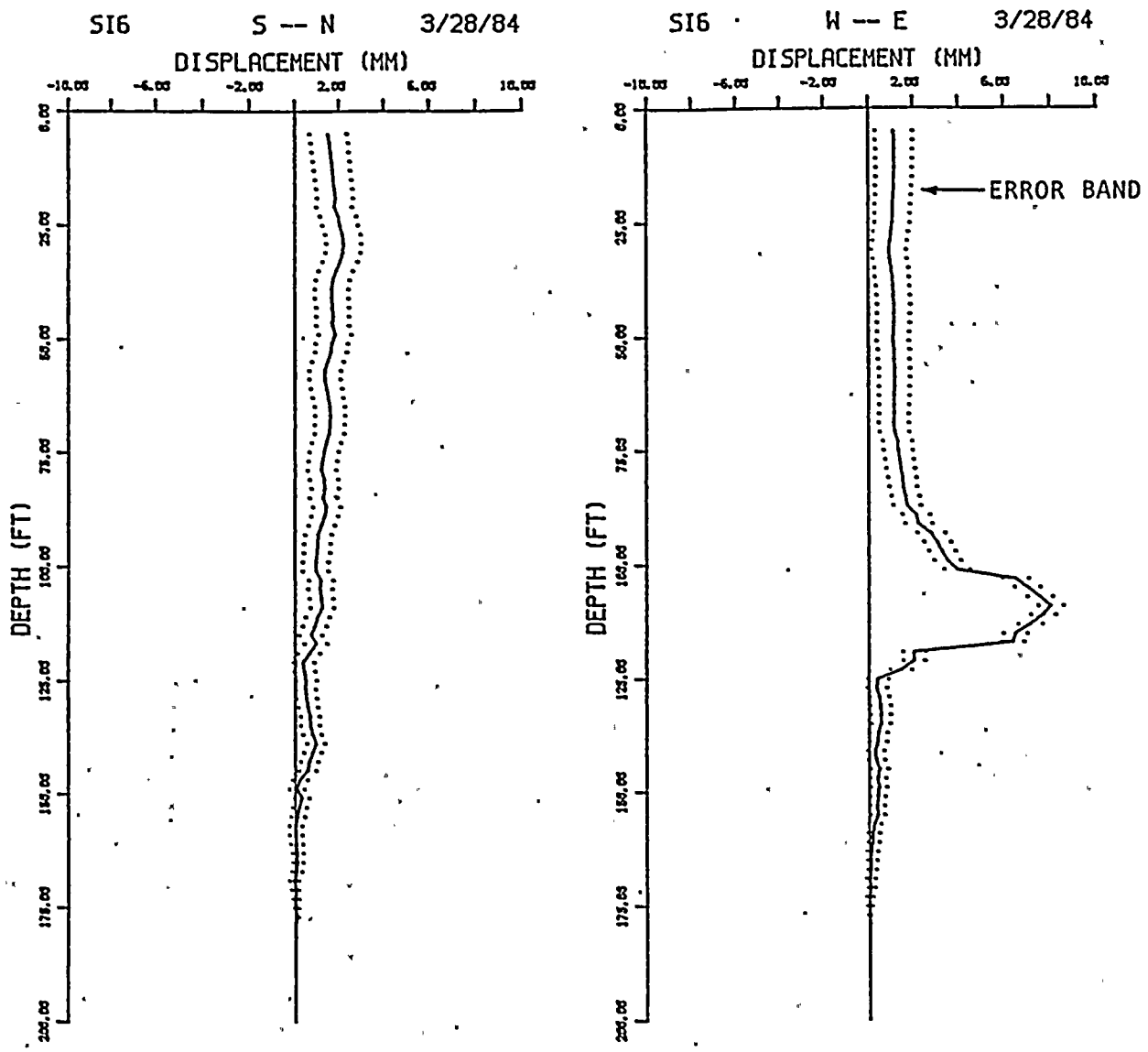


INCLINOMETER SI-5

DISPLACEMENT vs. DEPTH PLOTS

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

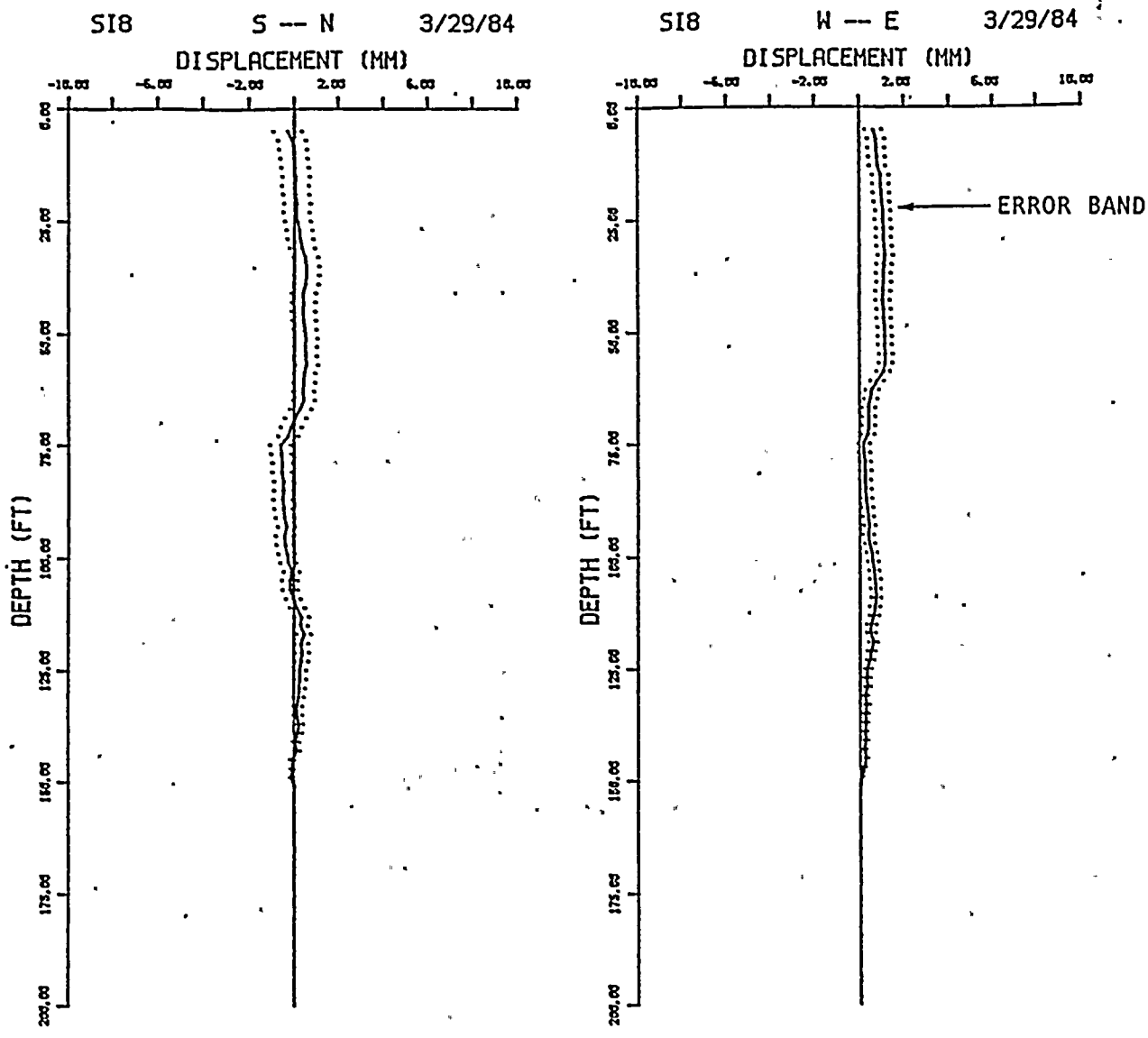
FIGURE 8



INCLINOMETER SI-6
DISPLACEMENT vs. DEPTH PLOTS

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 9

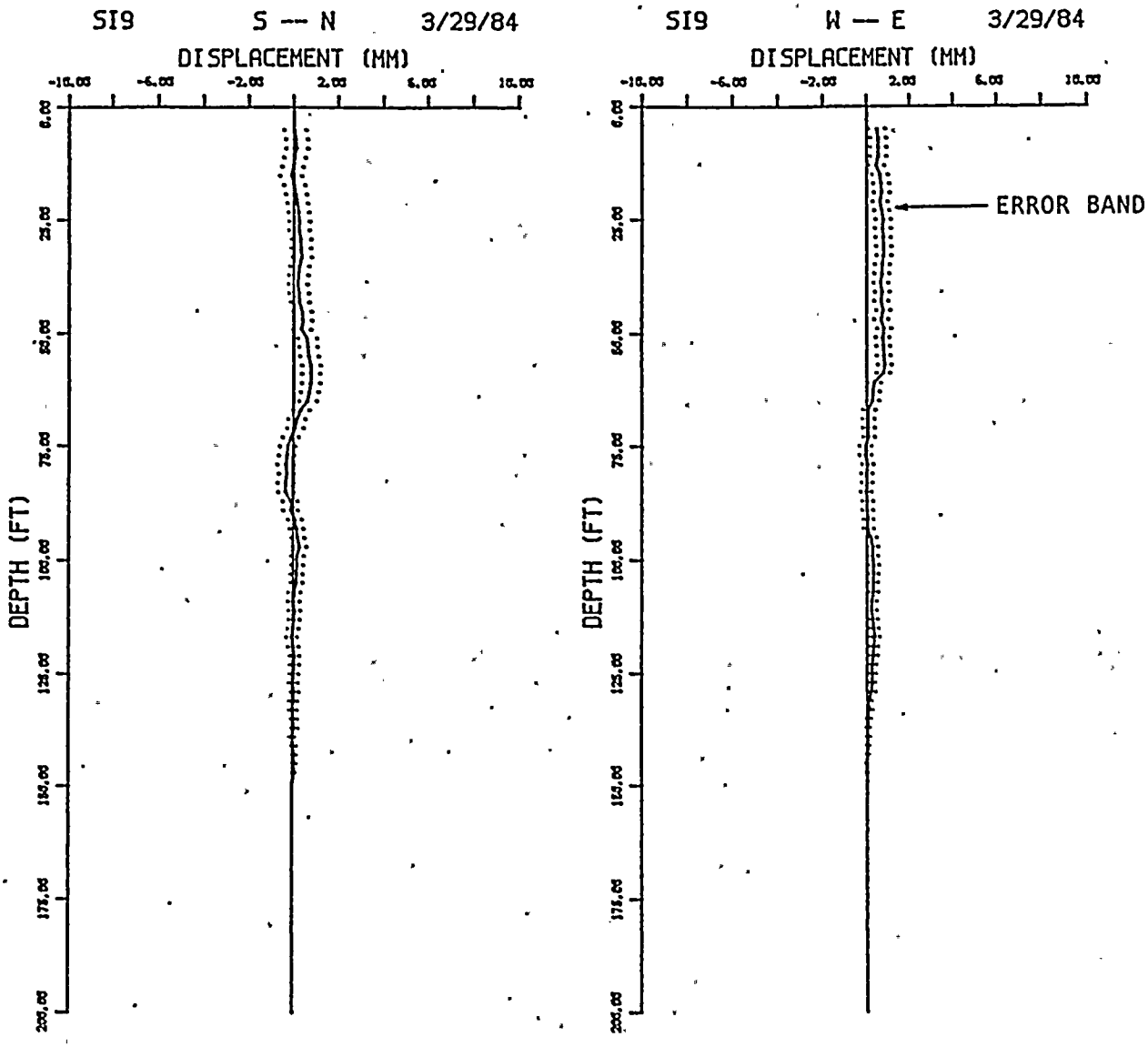


INCLINOMETER SI-8

DISPLACEMENT vs. DEPTH PLOTS

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 10

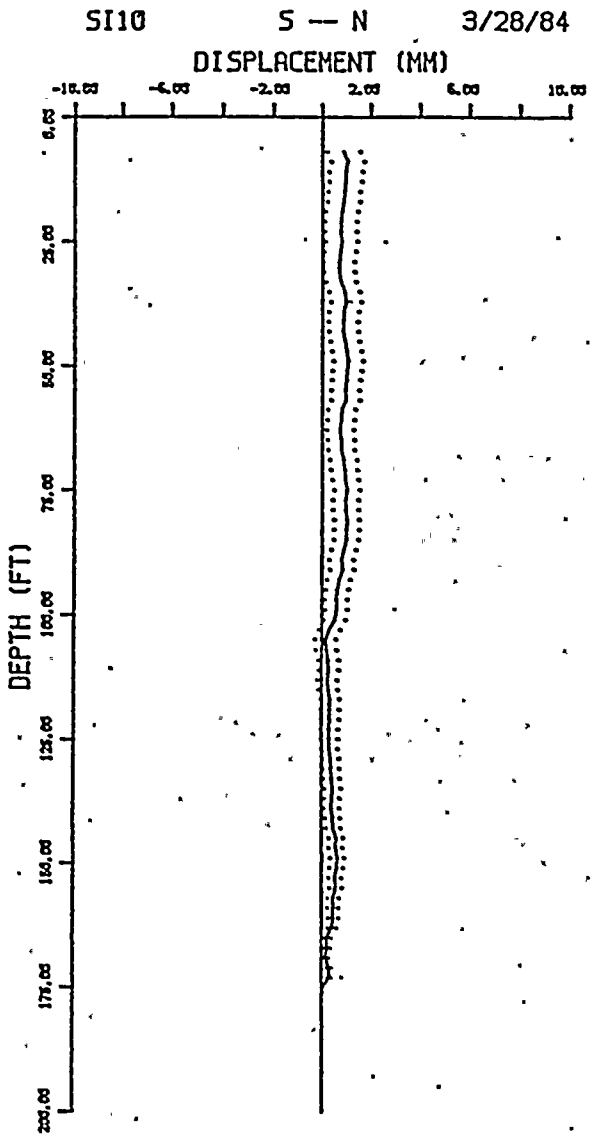


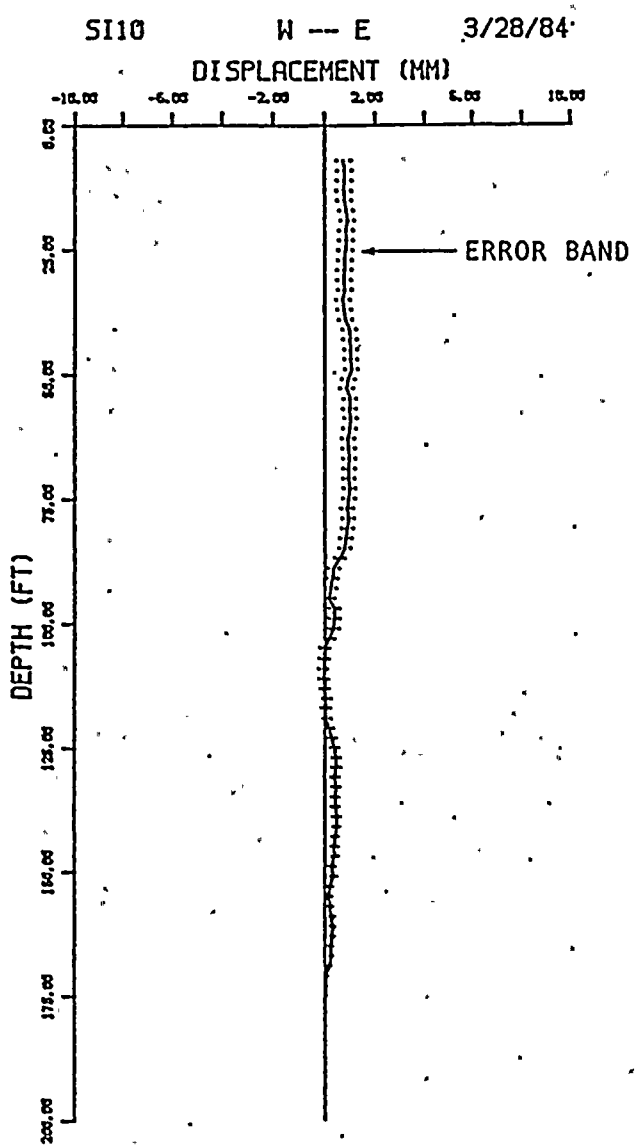
INCLINOMETER SI-9

DISPLACEMENT vs. DEPTH PLOTS

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 11



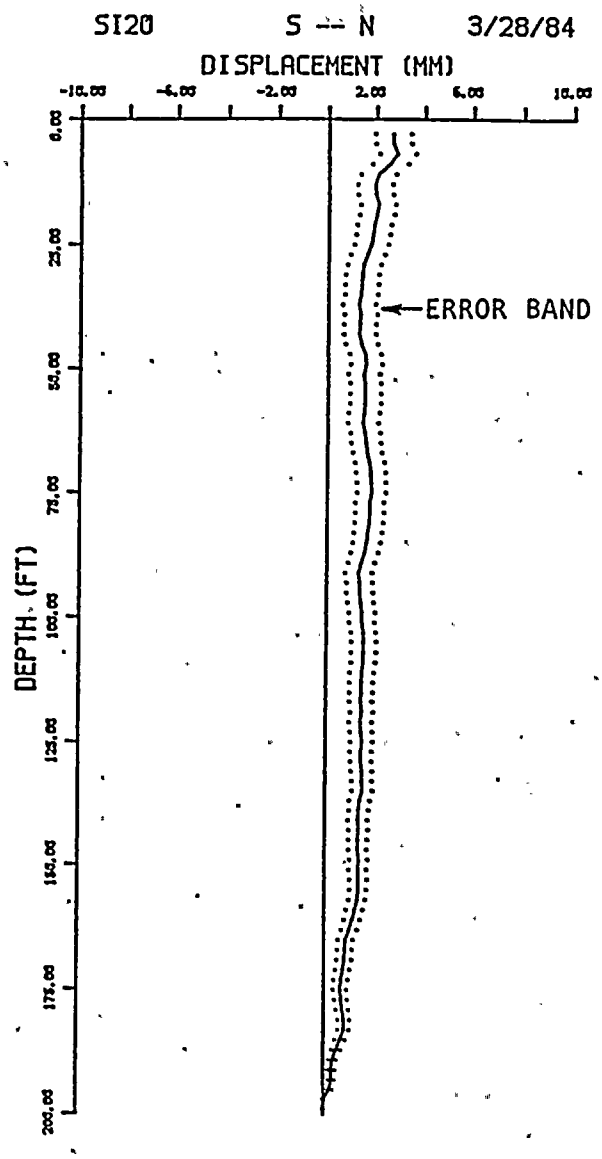


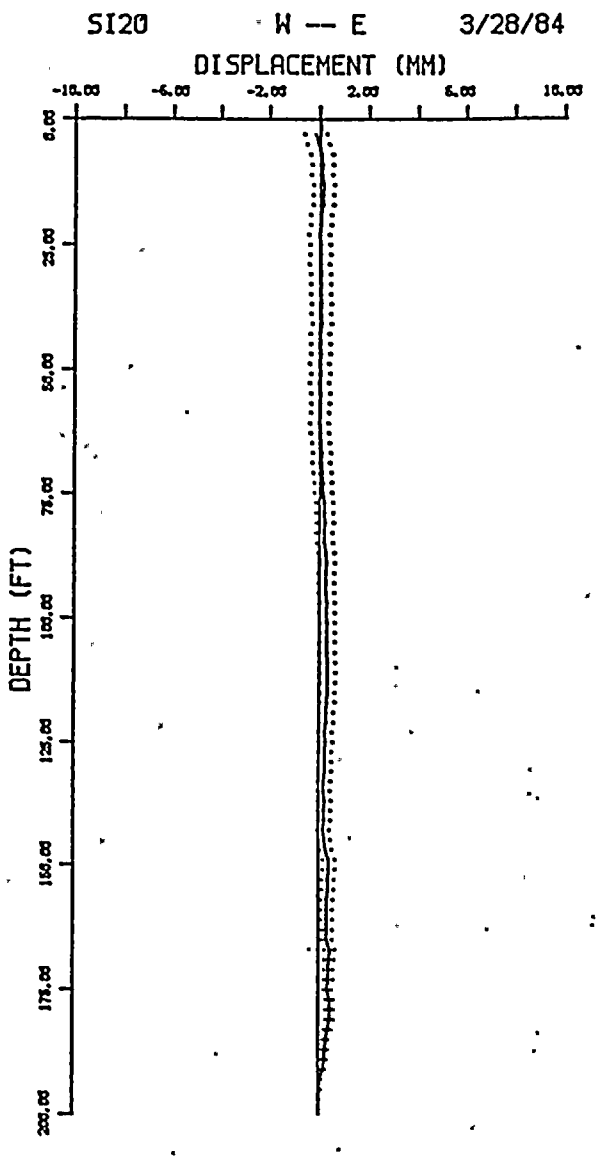
INCLINOMETER SI-10

DISPLACEMENT vs. DEPTH PLOTS

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 12



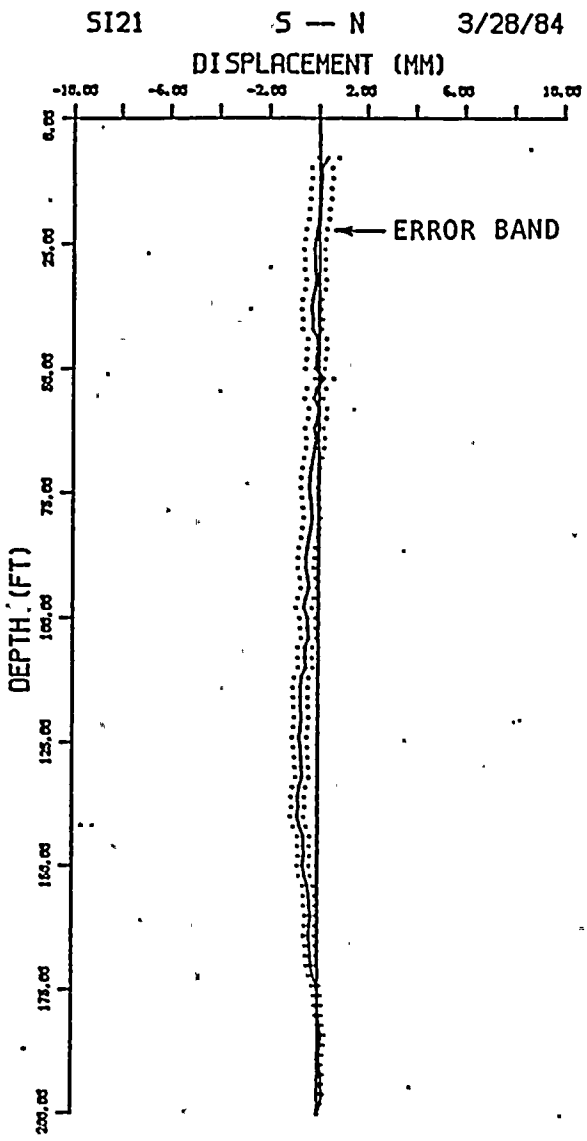


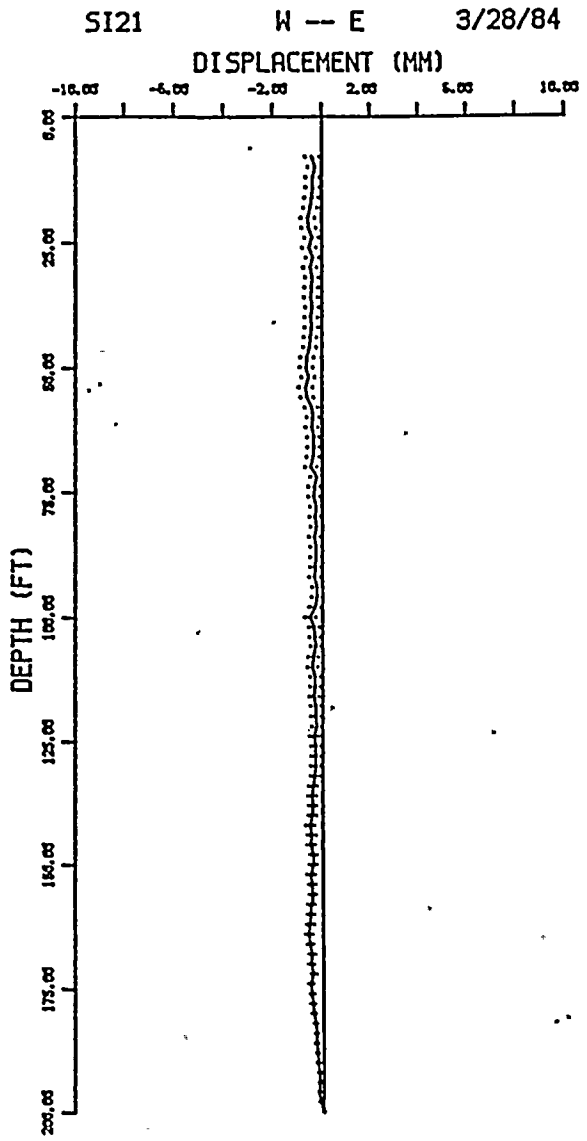
INCLINOMETER SI-20

DISPLACEMENT vs. DEPTH PLOTS

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 13



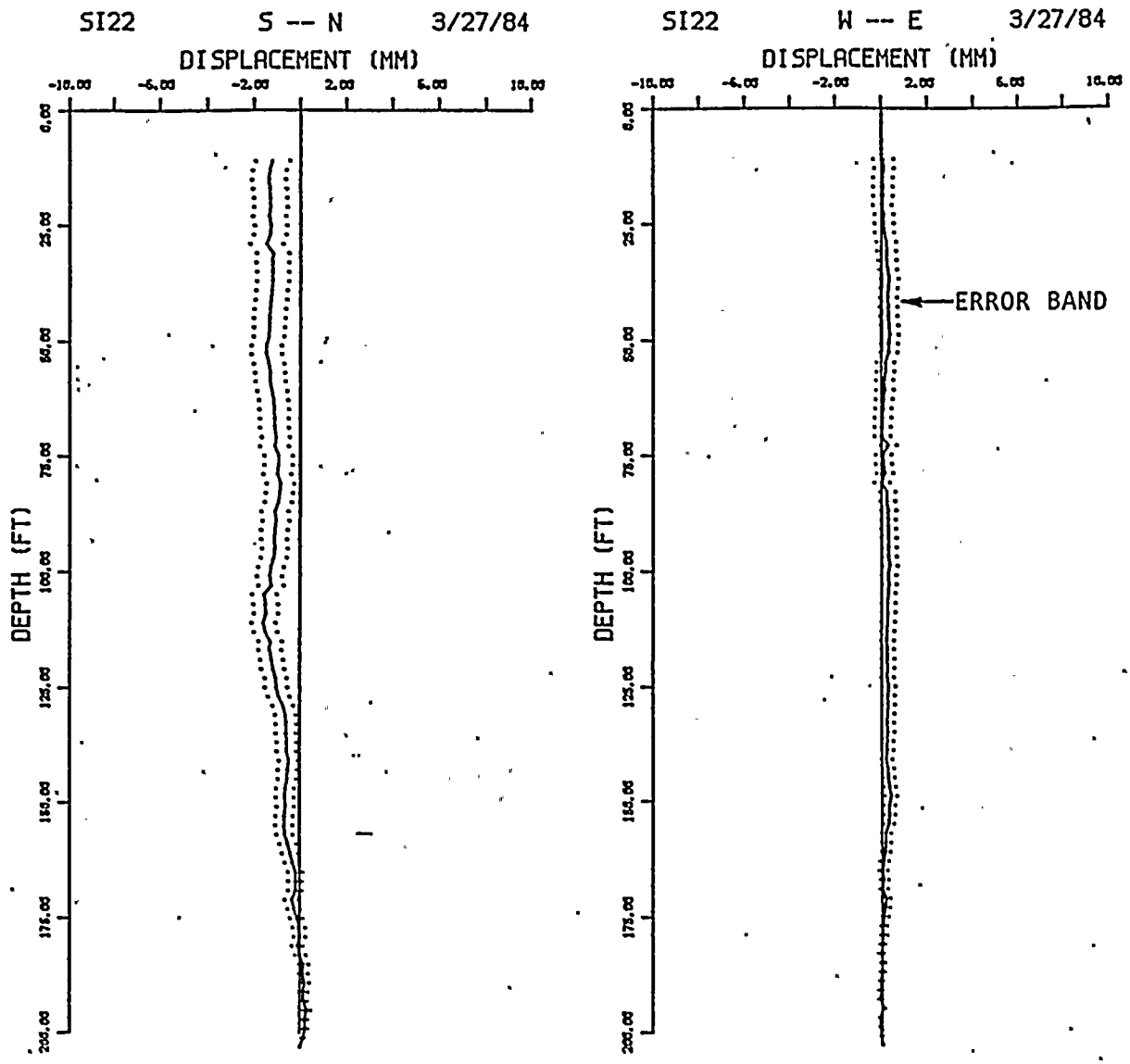


INCLINOMETER SI-21

DISPLACEMENT vs. DEPTH PLOTS

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 14

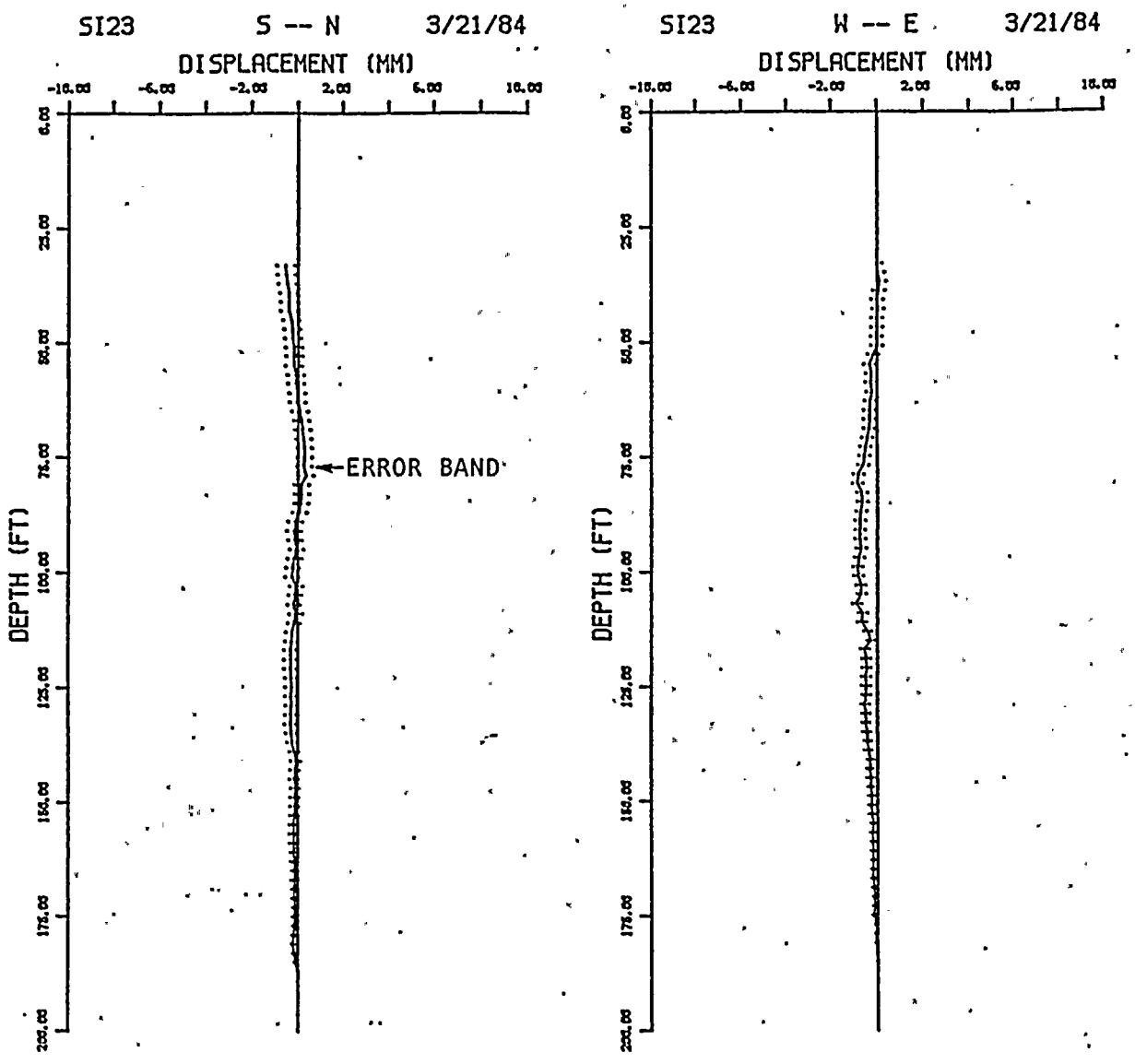


INCLINOMETER SI-22

DISPLACEMENT vs. DEPTH PLOTS

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 15

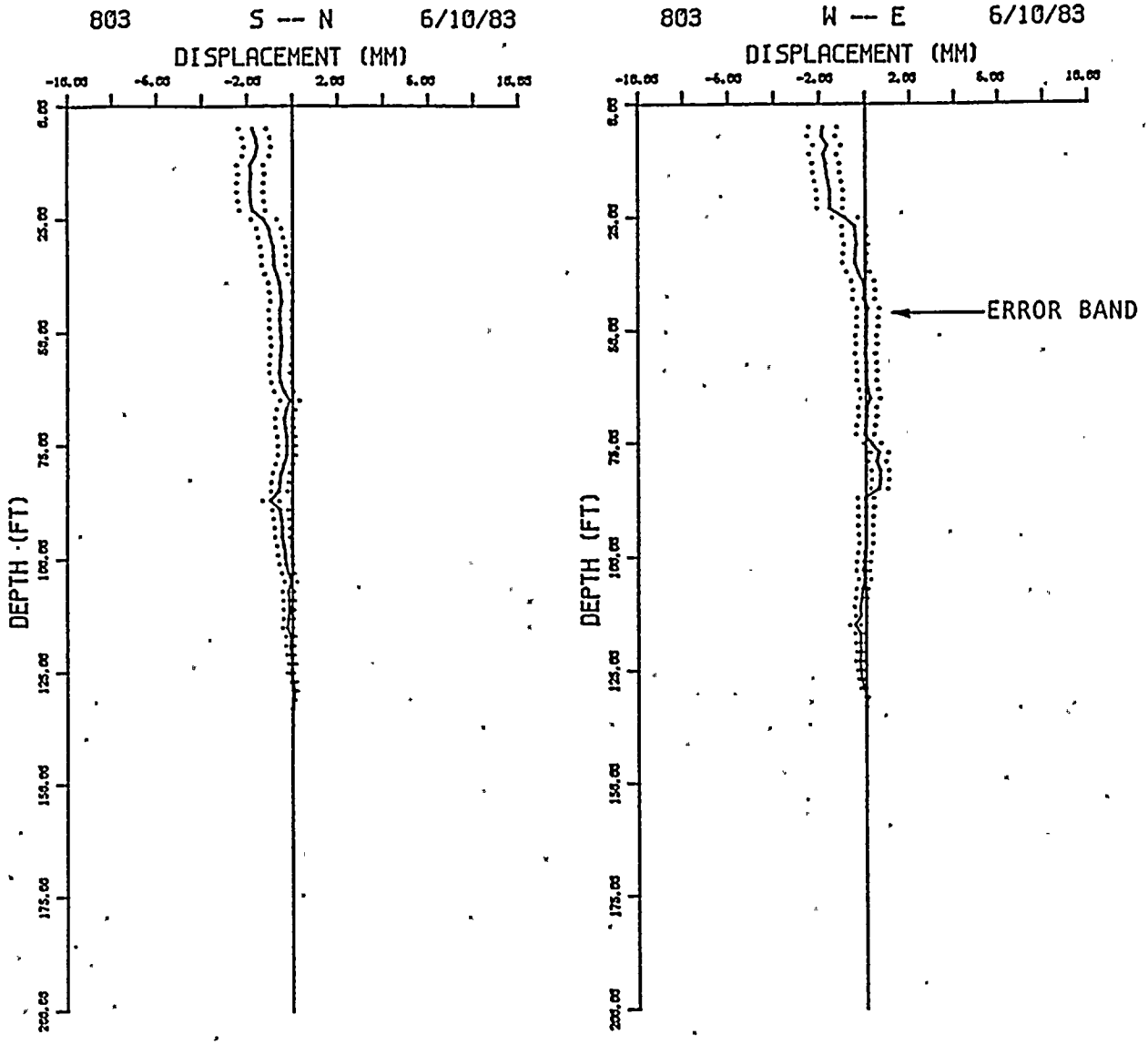


INCLINOMETER SI-23

DISPLACEMENT vs. DEPTH PLOTS

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 16

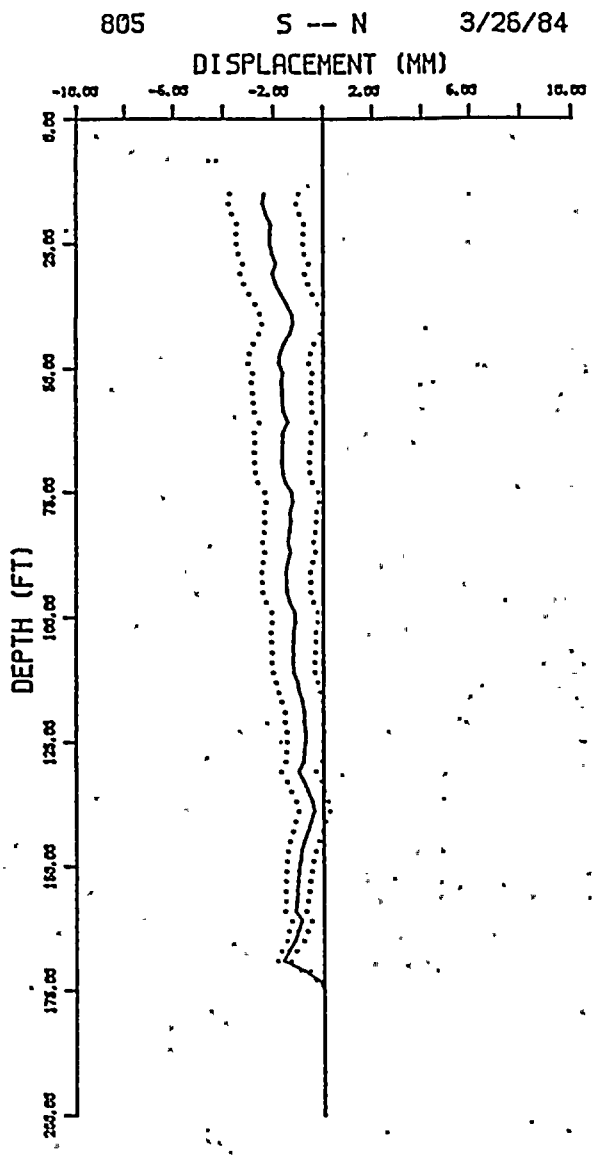


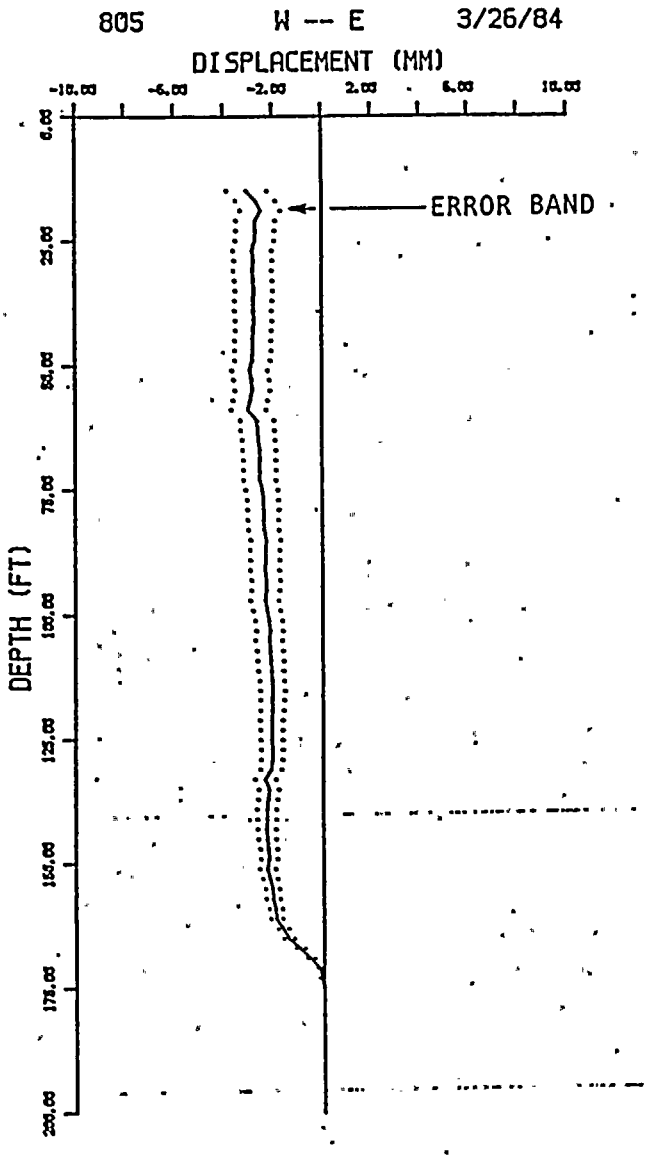
INCLINOMETER 803

DISPLACEMENT vs. DEPTH PLOTS

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 17



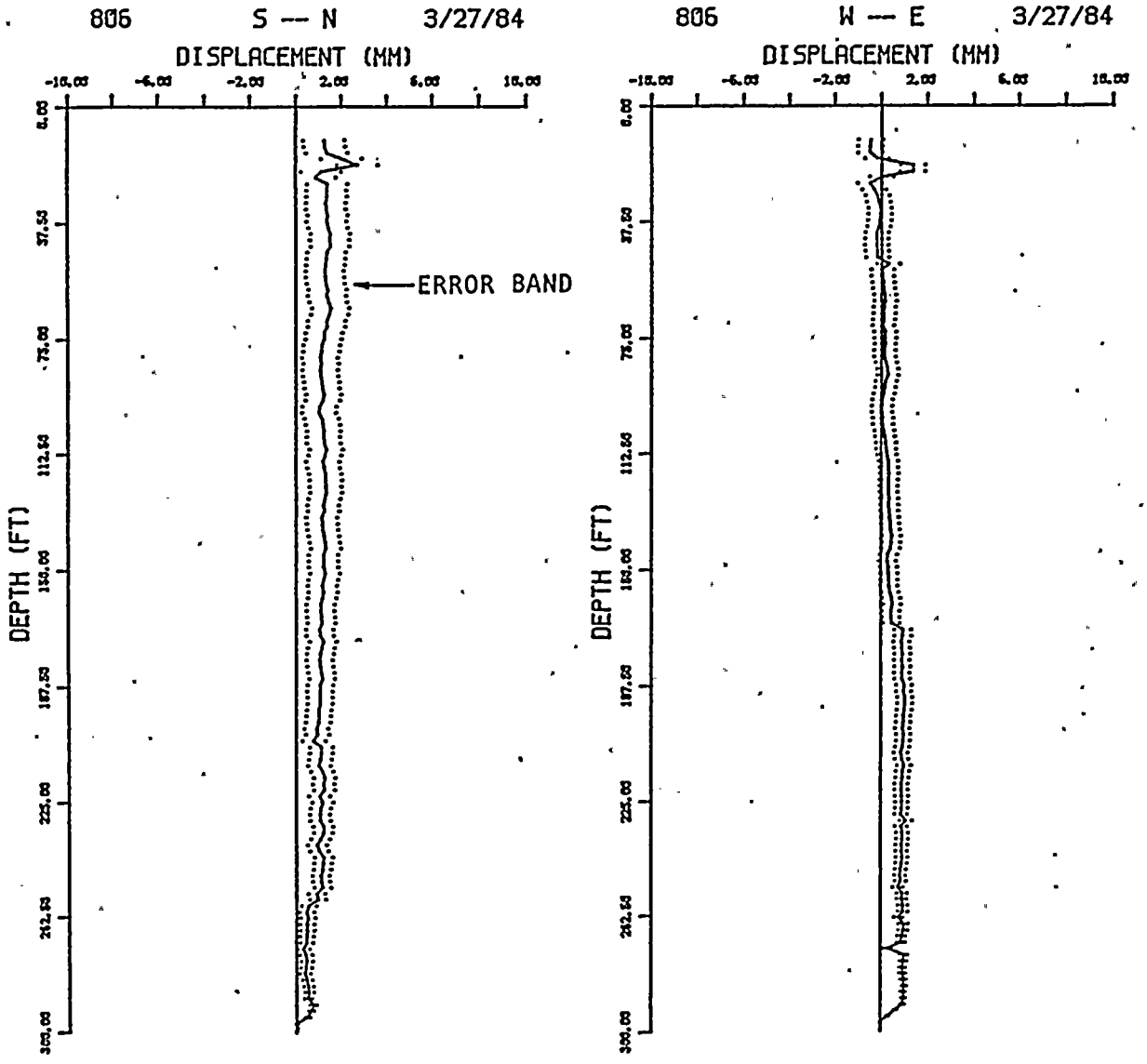


INCLINOMETER 805

DISPLACEMENT vs. DEPTH PLOTS

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 18

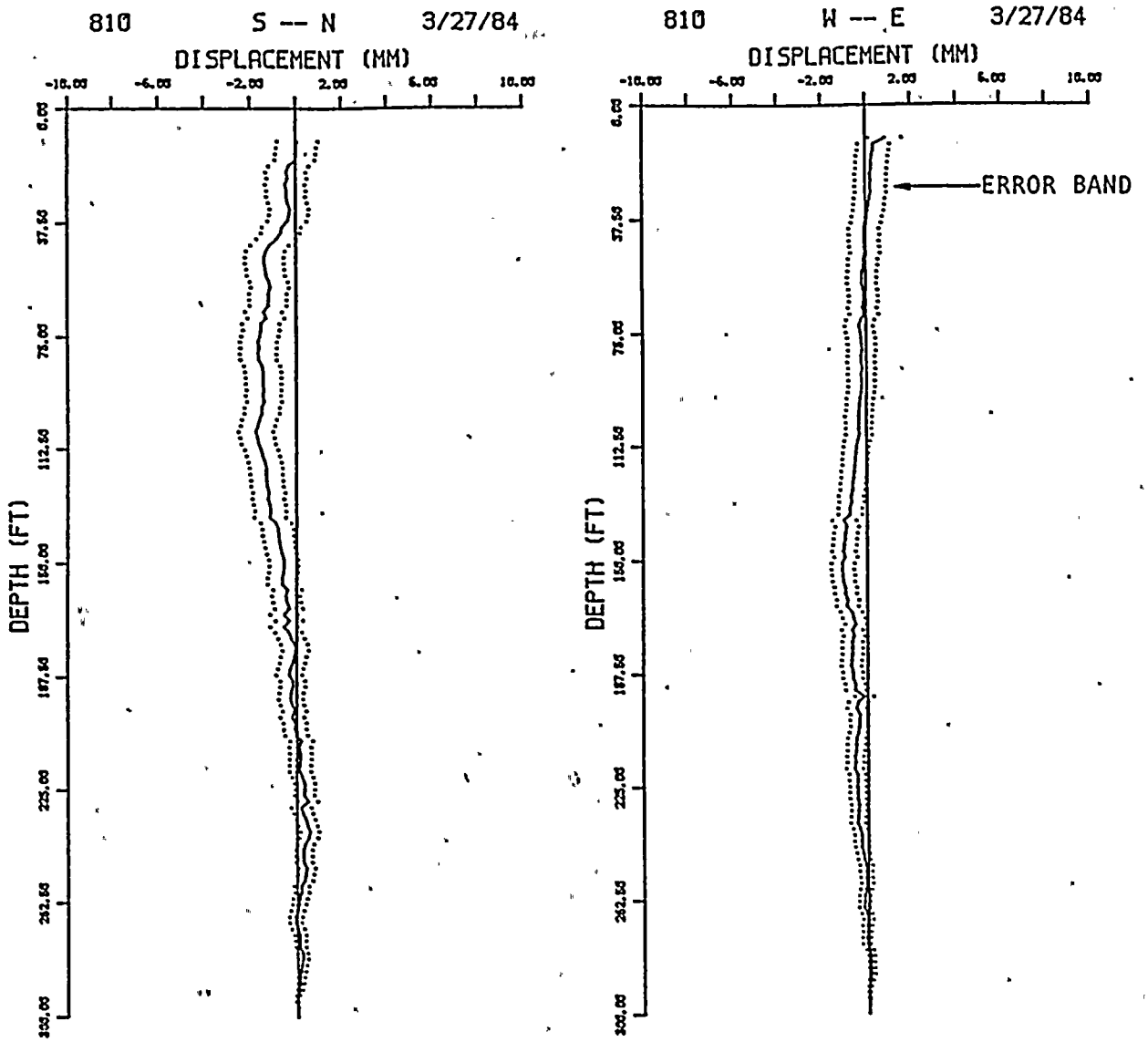


INCLINOMETER 806

DISPLACEMENT vs. DEPTH PLOTS

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 19

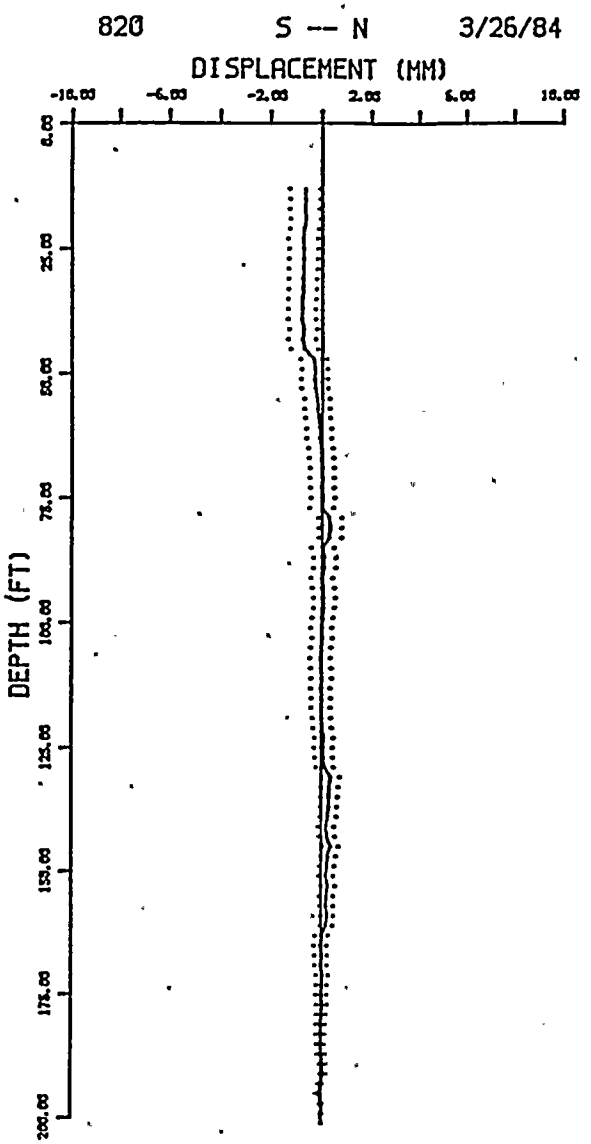


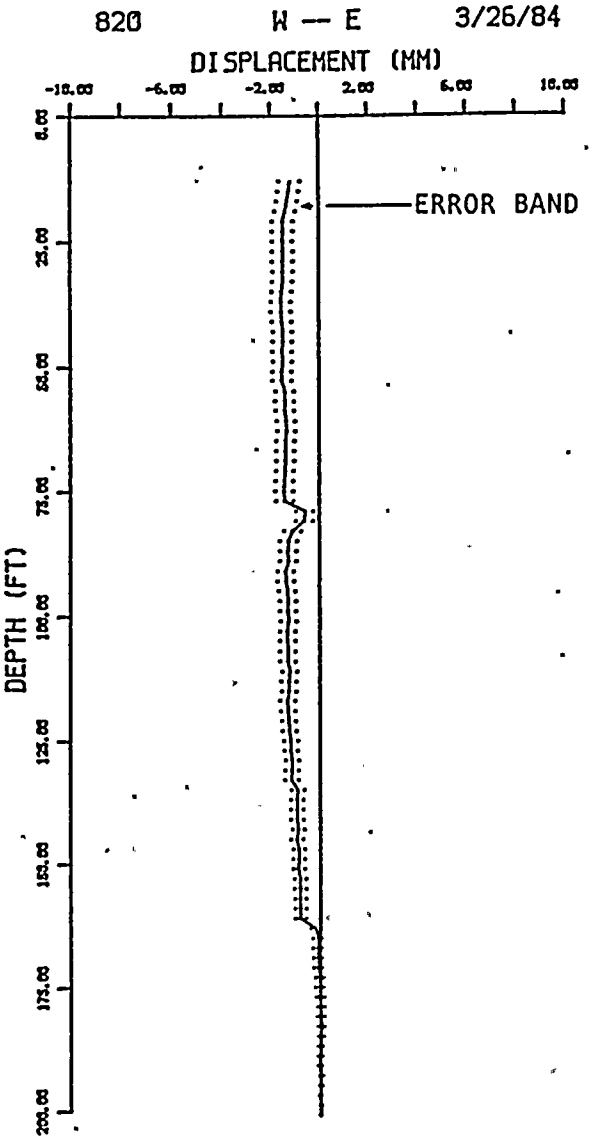
INCLINOMETER 810

DISPLACEMENT vs. DEPTH PLOTS

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 20



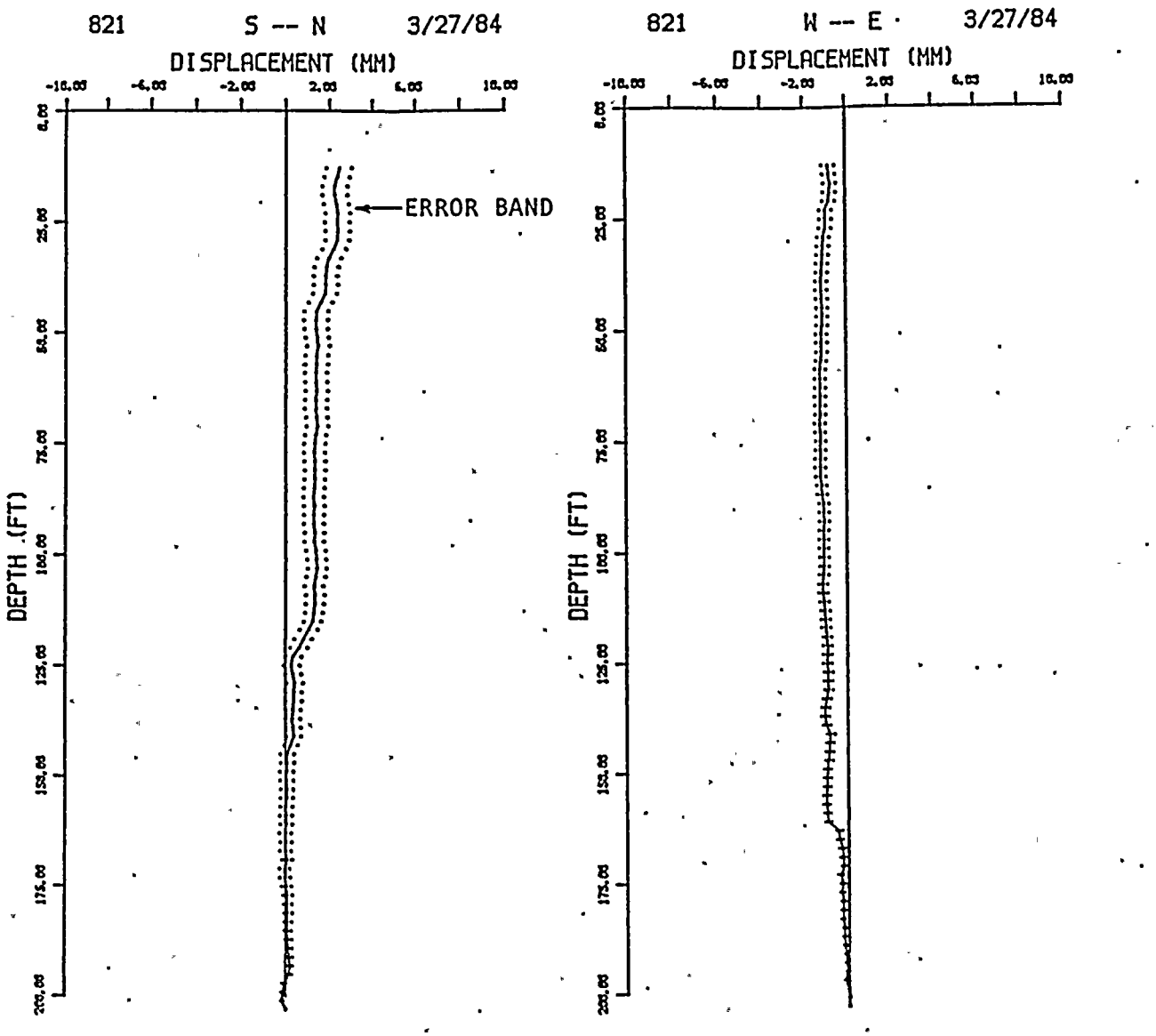


INCLINOMETER 820

DISPLACEMENT--vs. DEPTH PLOTS

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 21

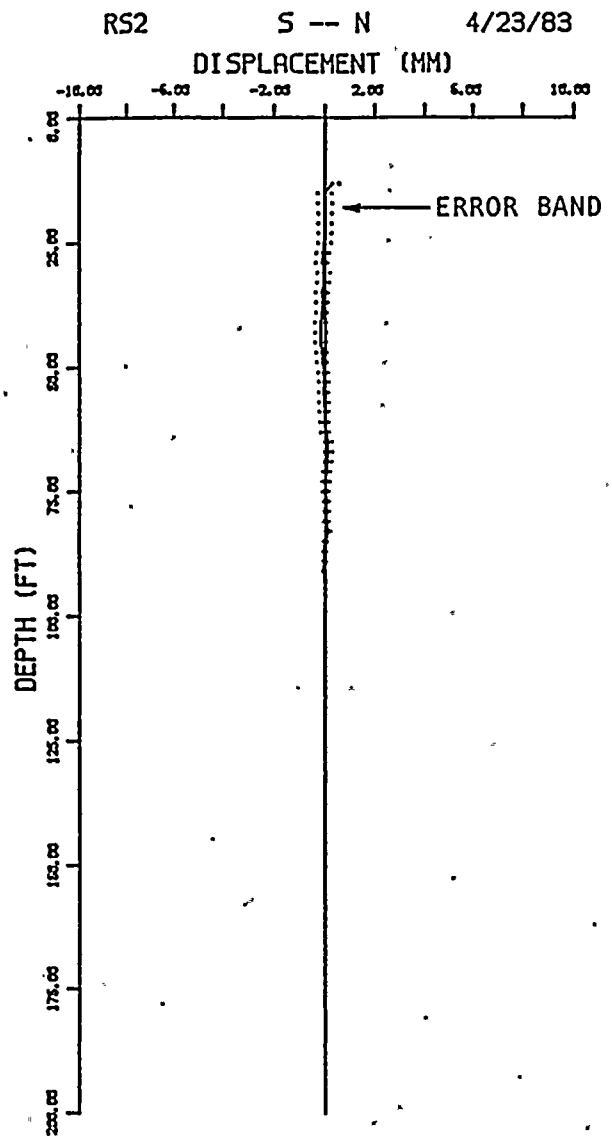


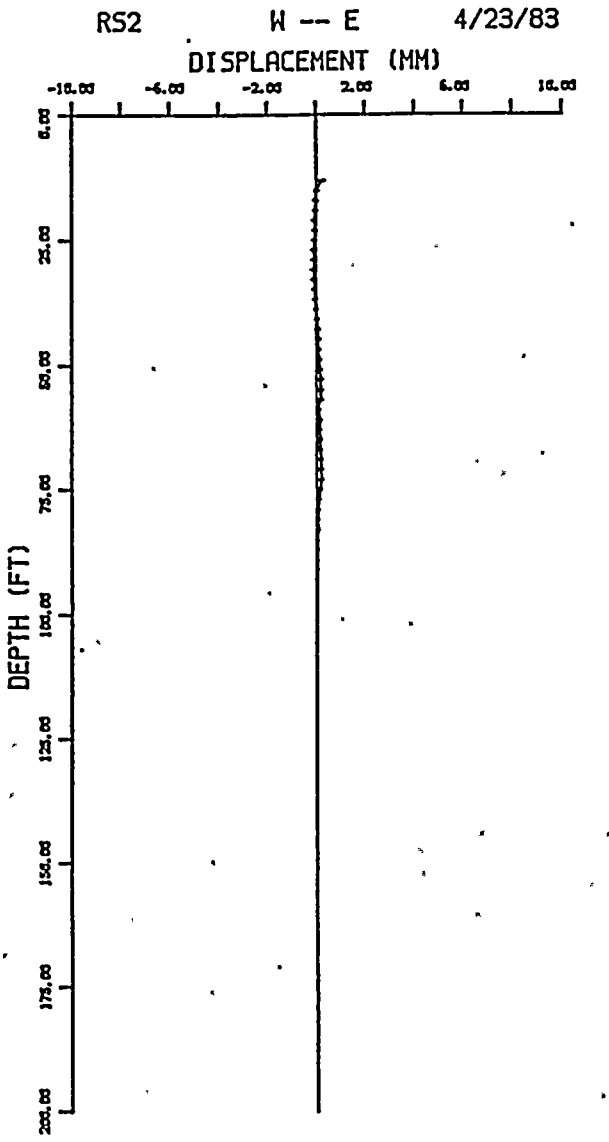
INCLINOMETER 821

DISPLACEMENT vs. DEPTH PLOTS

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 22



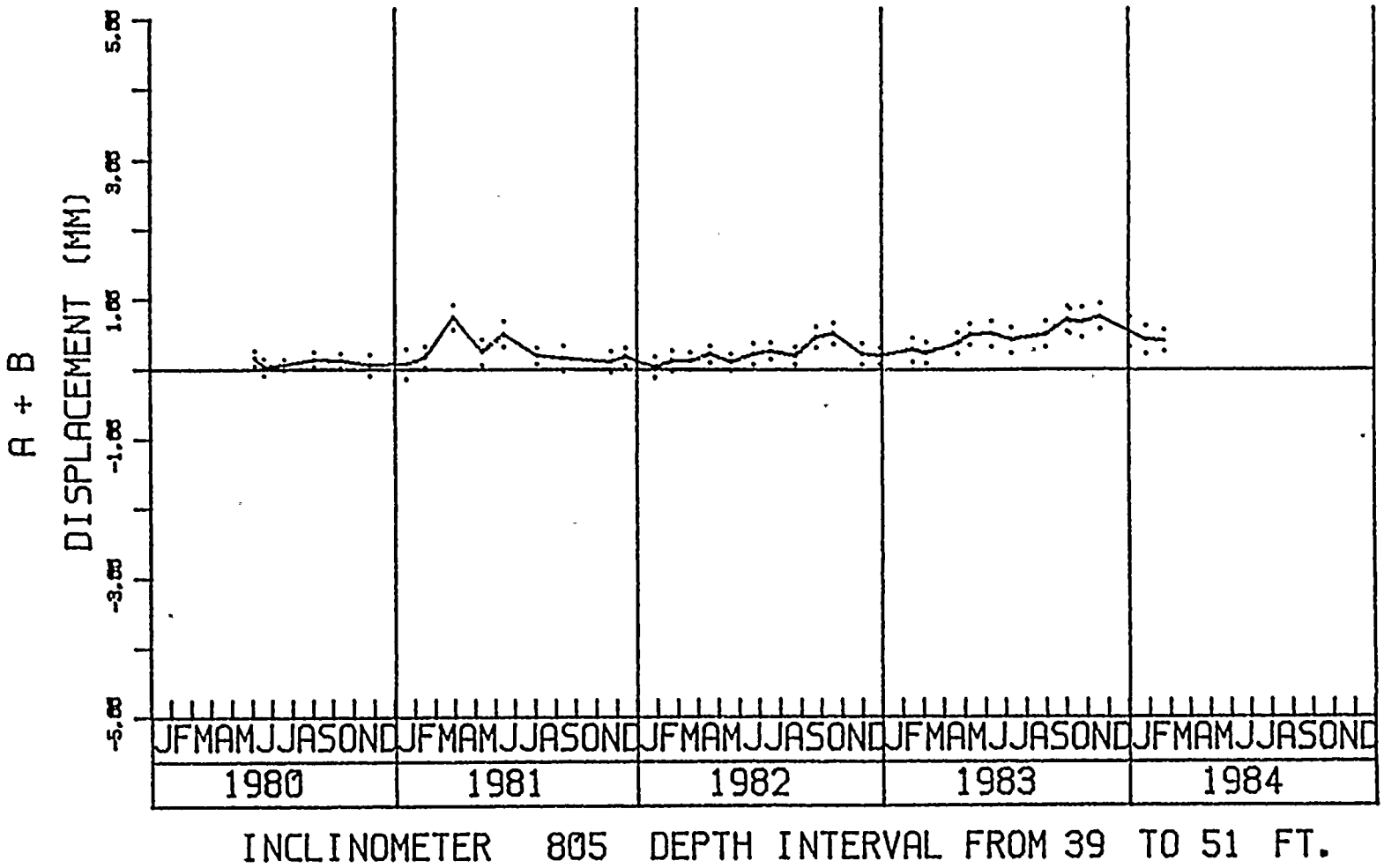


INCLINOMETER RS-2

DISPLACEMENT vs. DEPTH PLOTS

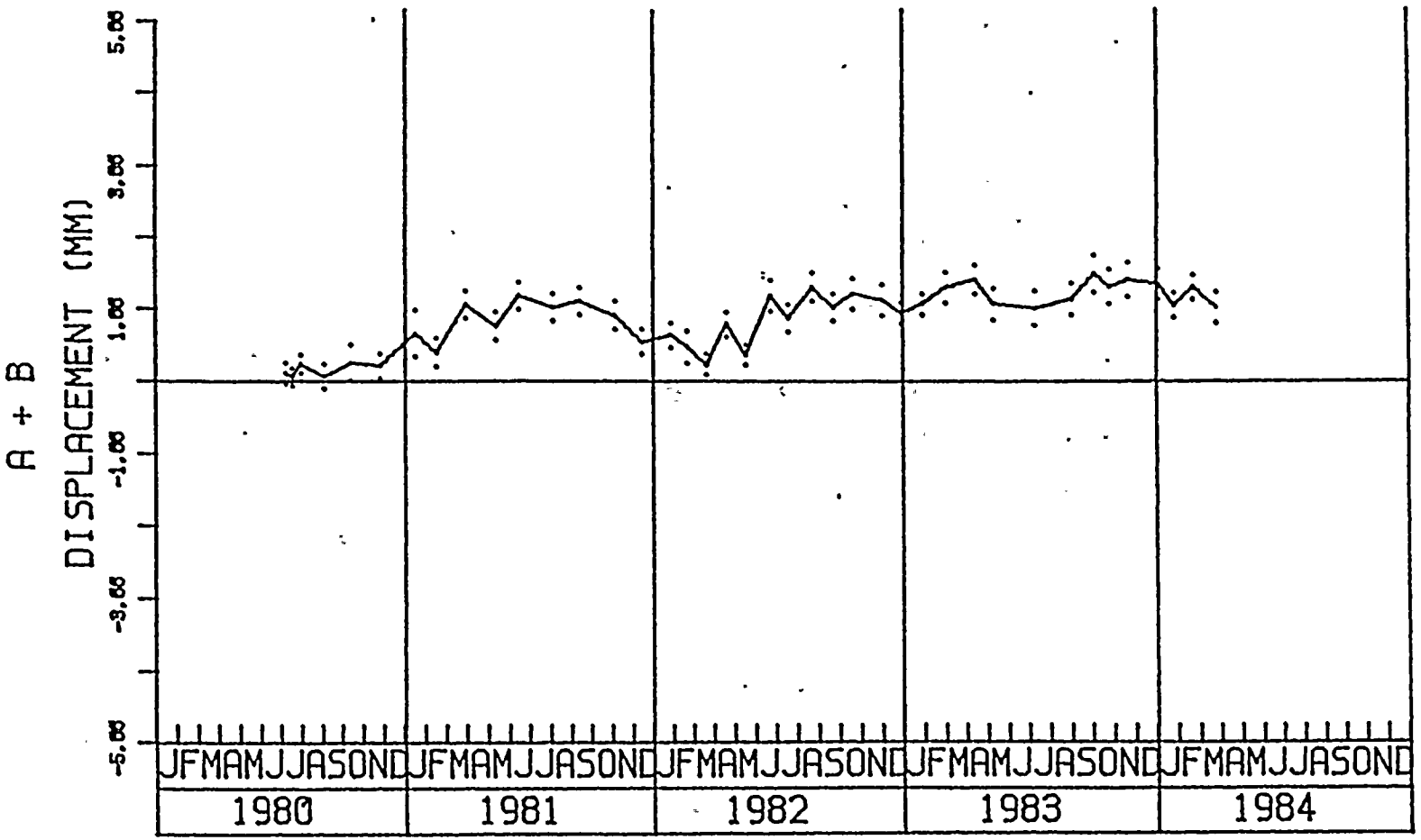
NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 23



NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

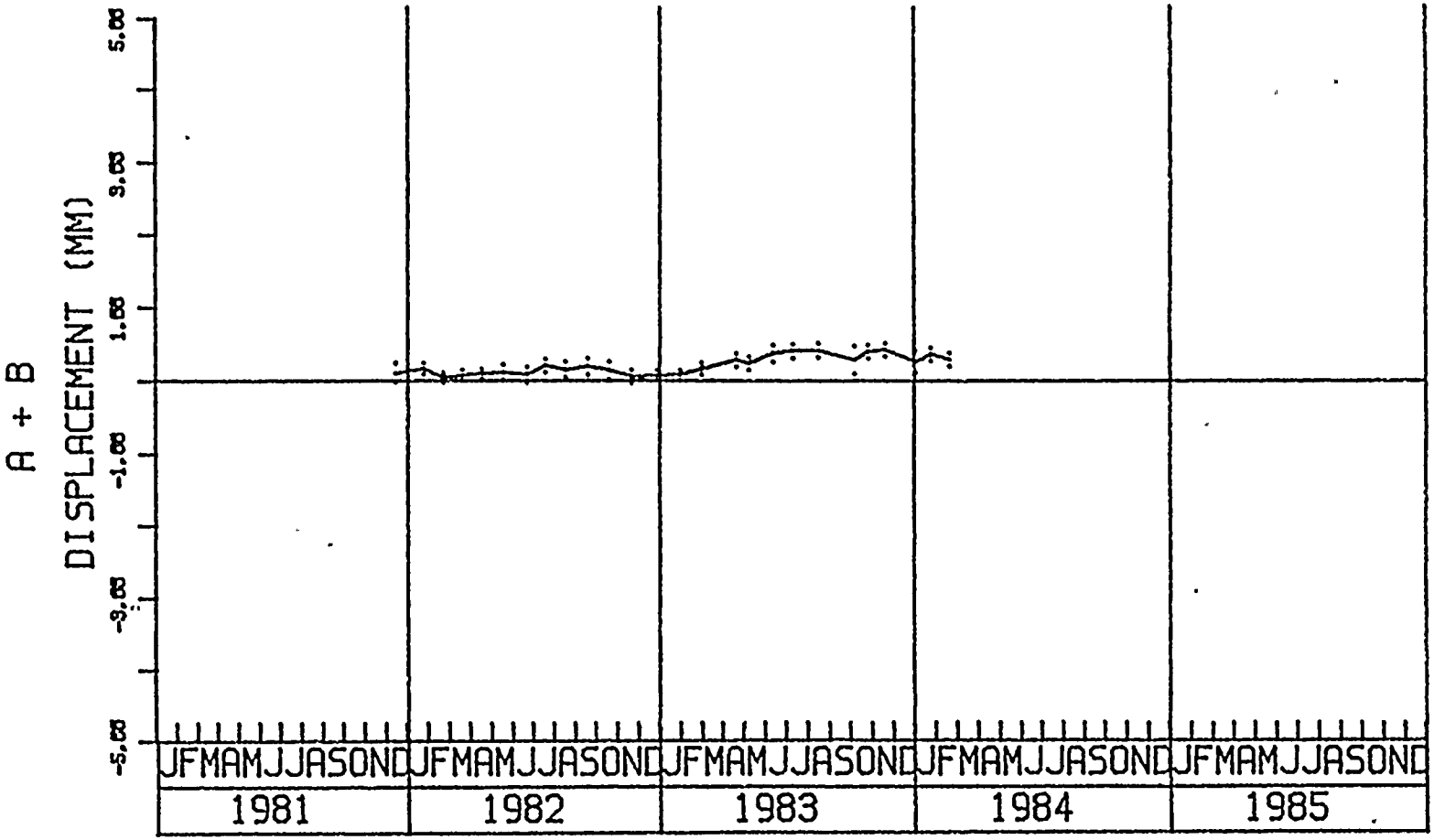
FIGURE 24



INCLINOMETER 810 DEPTH INTERVAL FROM 37 TO 49 FT.

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

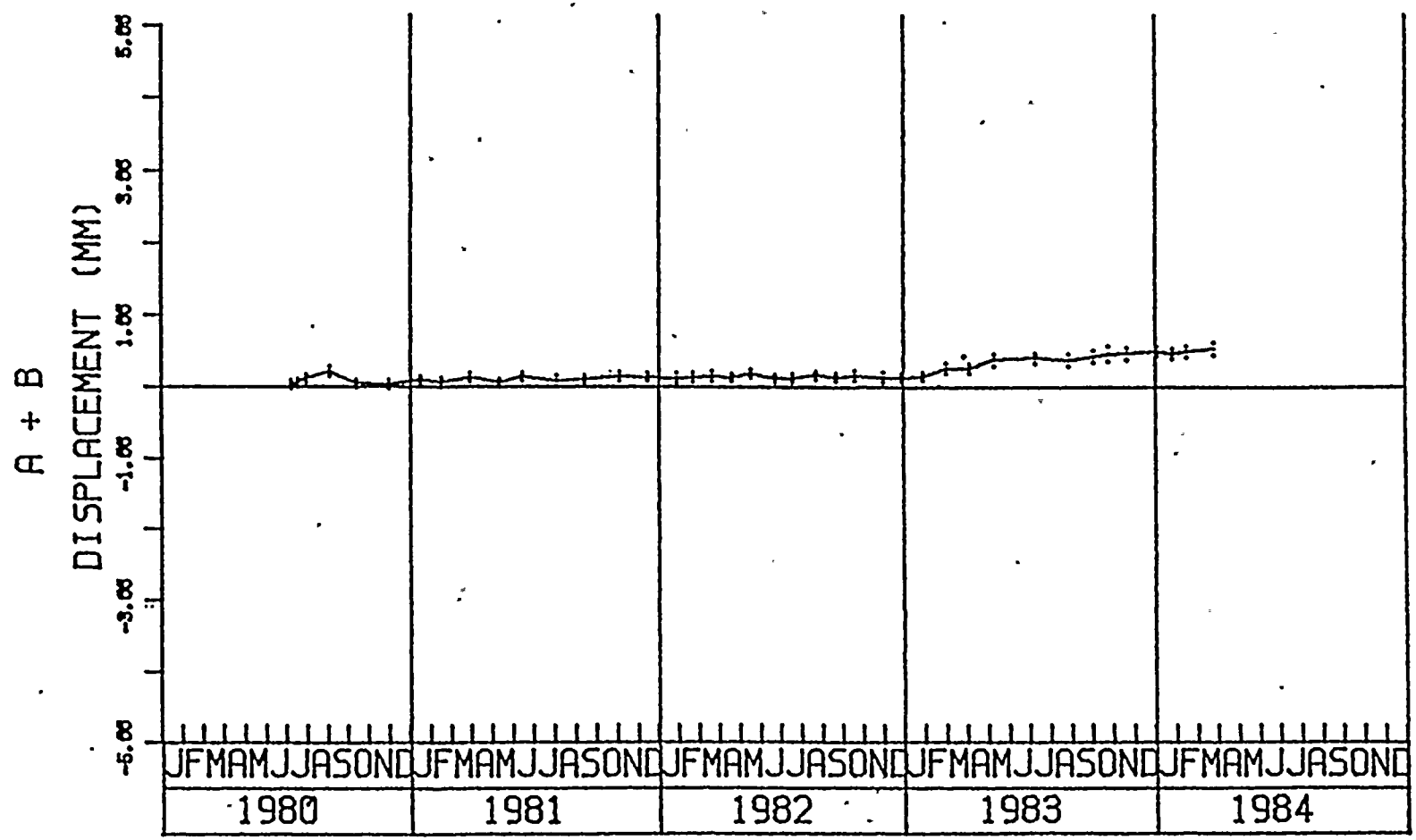
FIGURE 25



INCLINOMETER 821 DEPTH INTERVAL FROM 39 TO 45 FT.

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

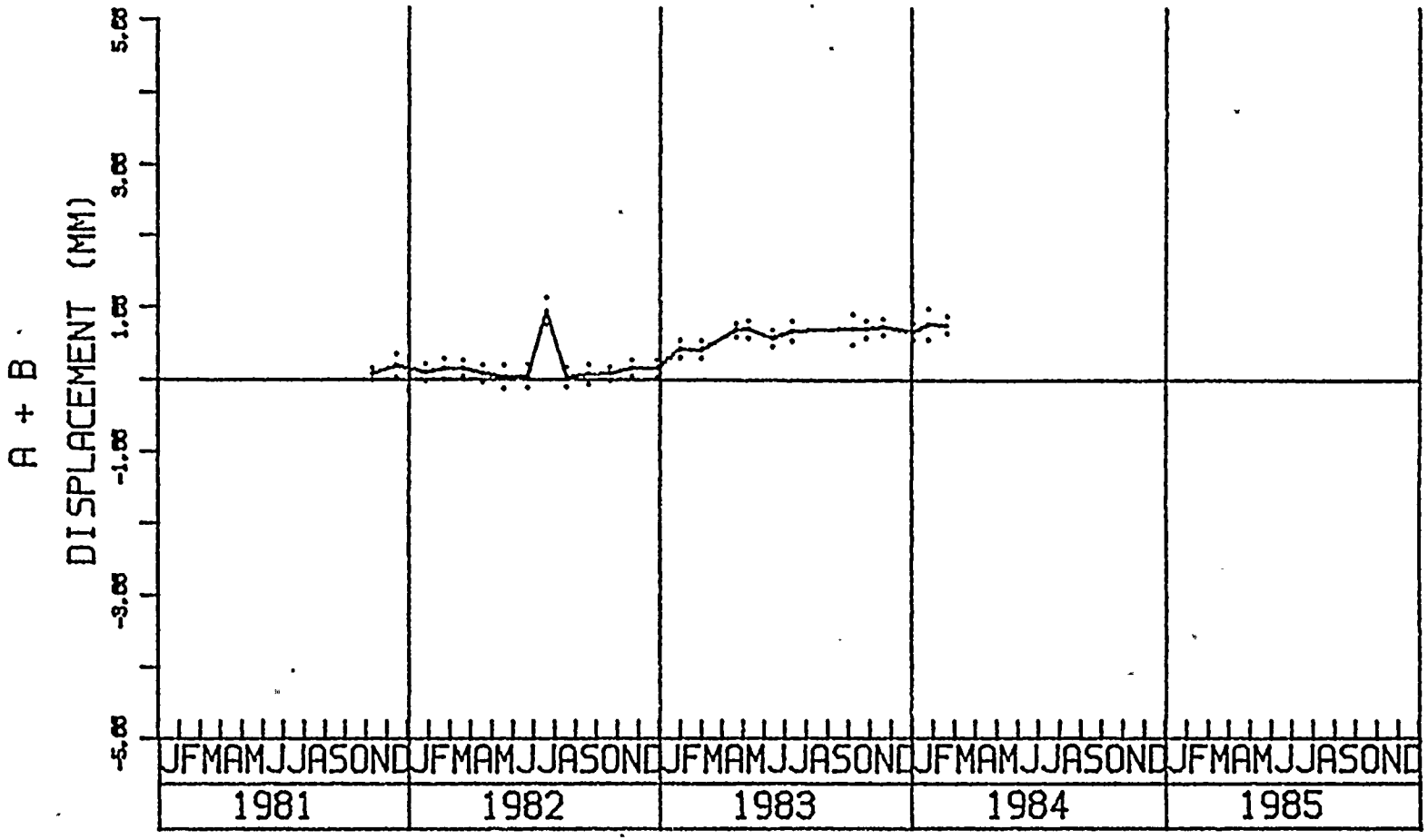
FIGURE 26



INCLINOMETER 806 DEPTH INTERVAL FROM 165 TO 169 FT.

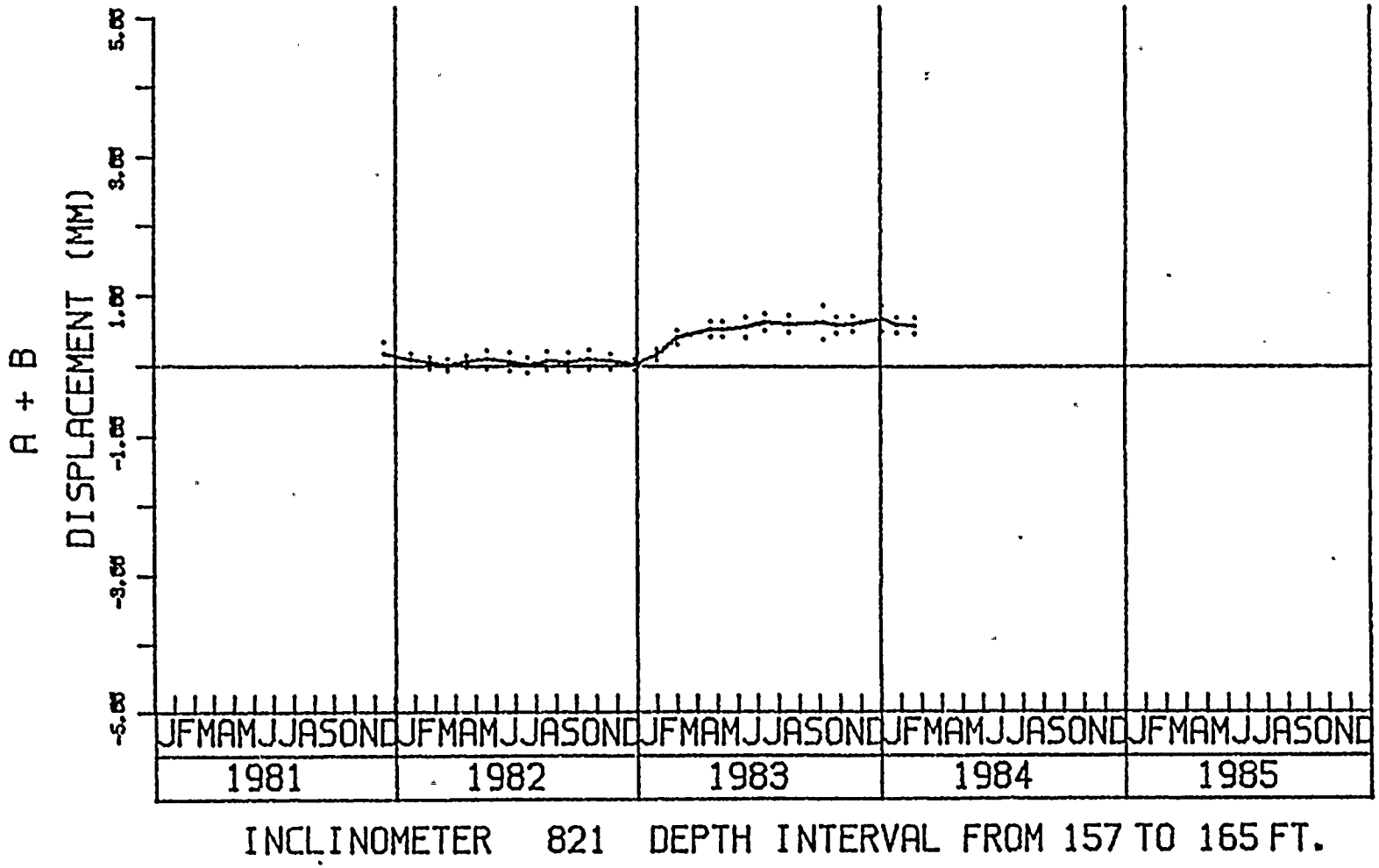
NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 27



NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

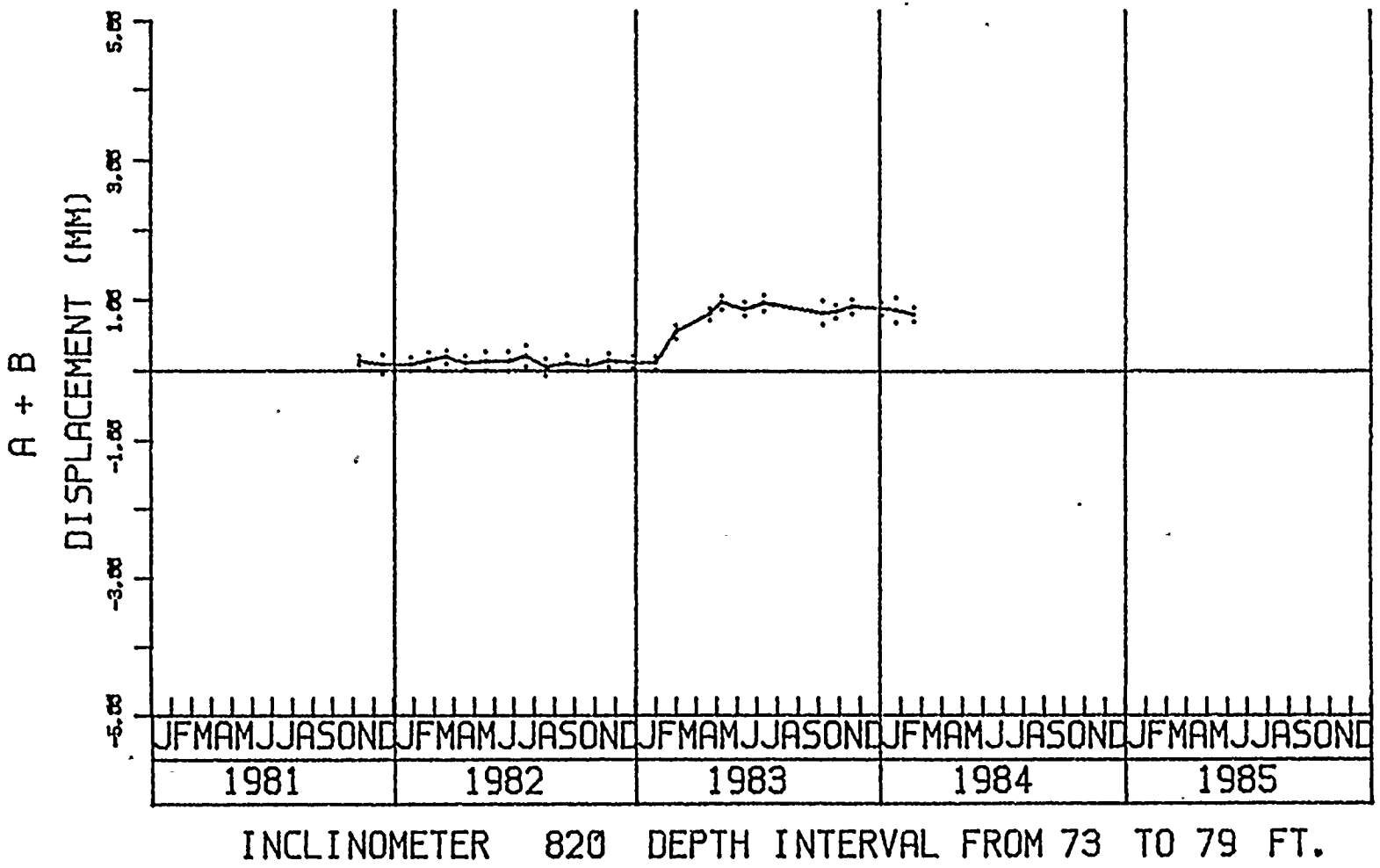
FIGURE 28



INCLINOMETER 821 DEPTH INTERVAL FROM 157 TO 165 FT.

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

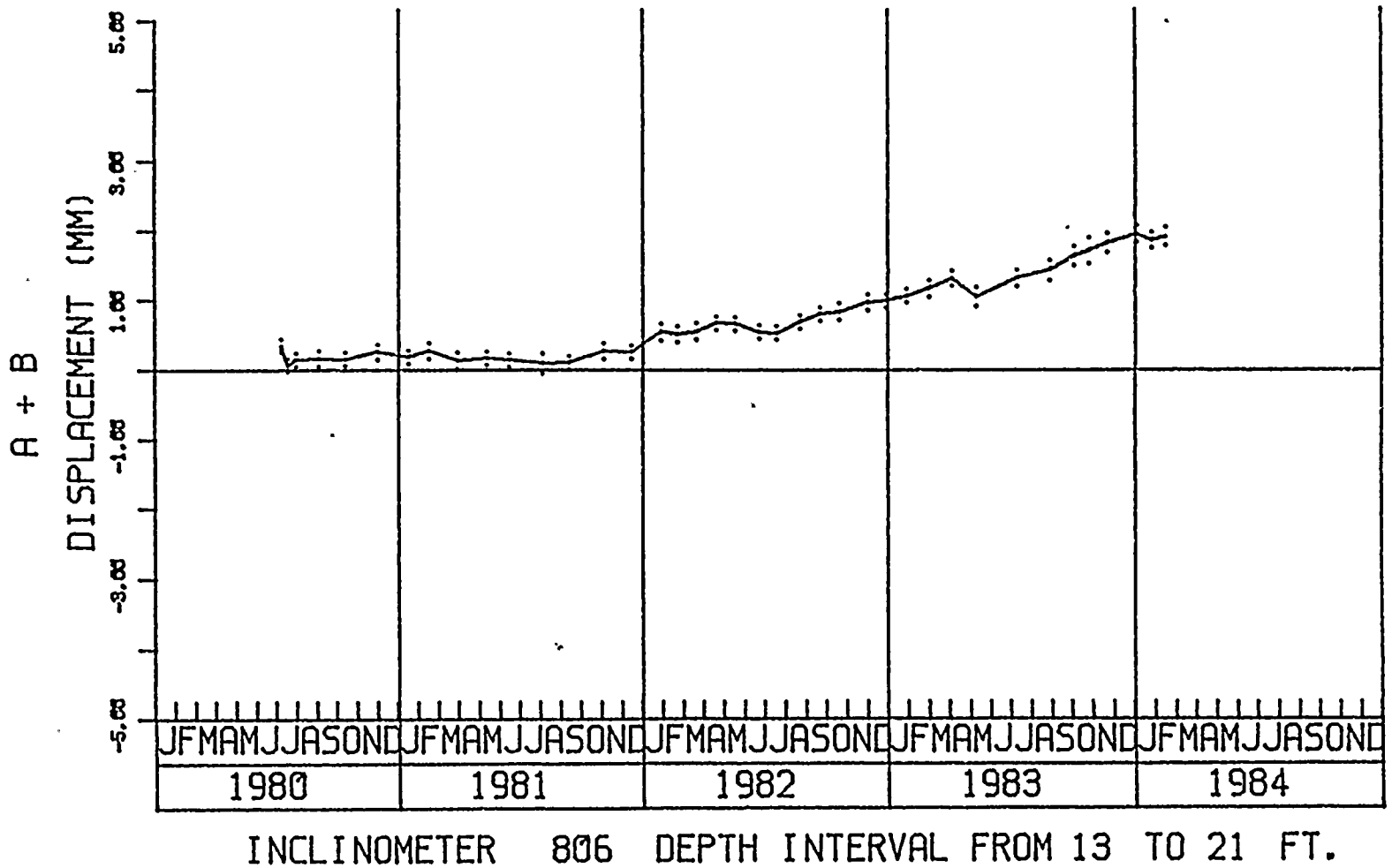
FIGURE 29



INCLINOMETER 820 DEPTH INTERVAL FROM 73 TO 79 FT.

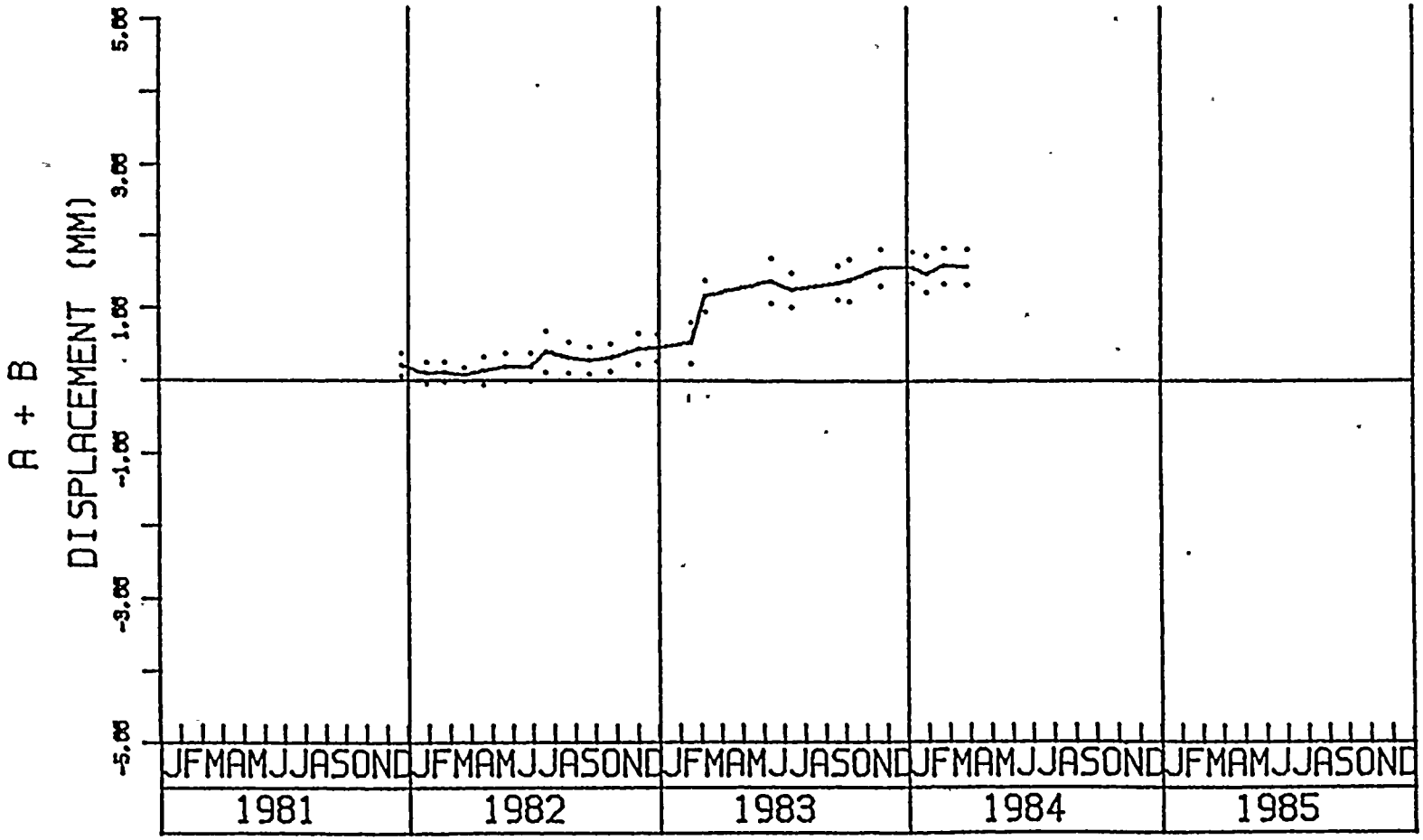
NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 30



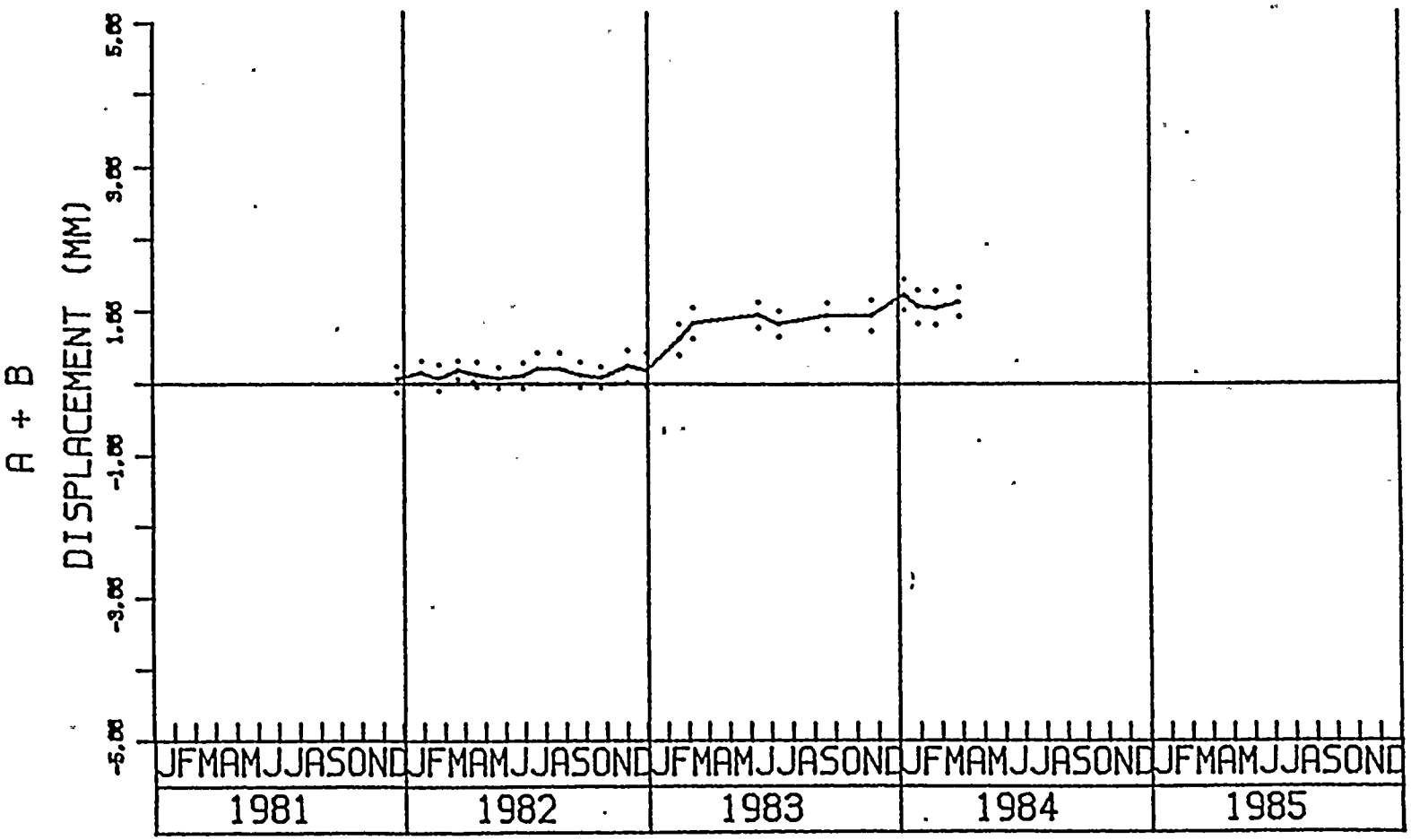
NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 31



NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

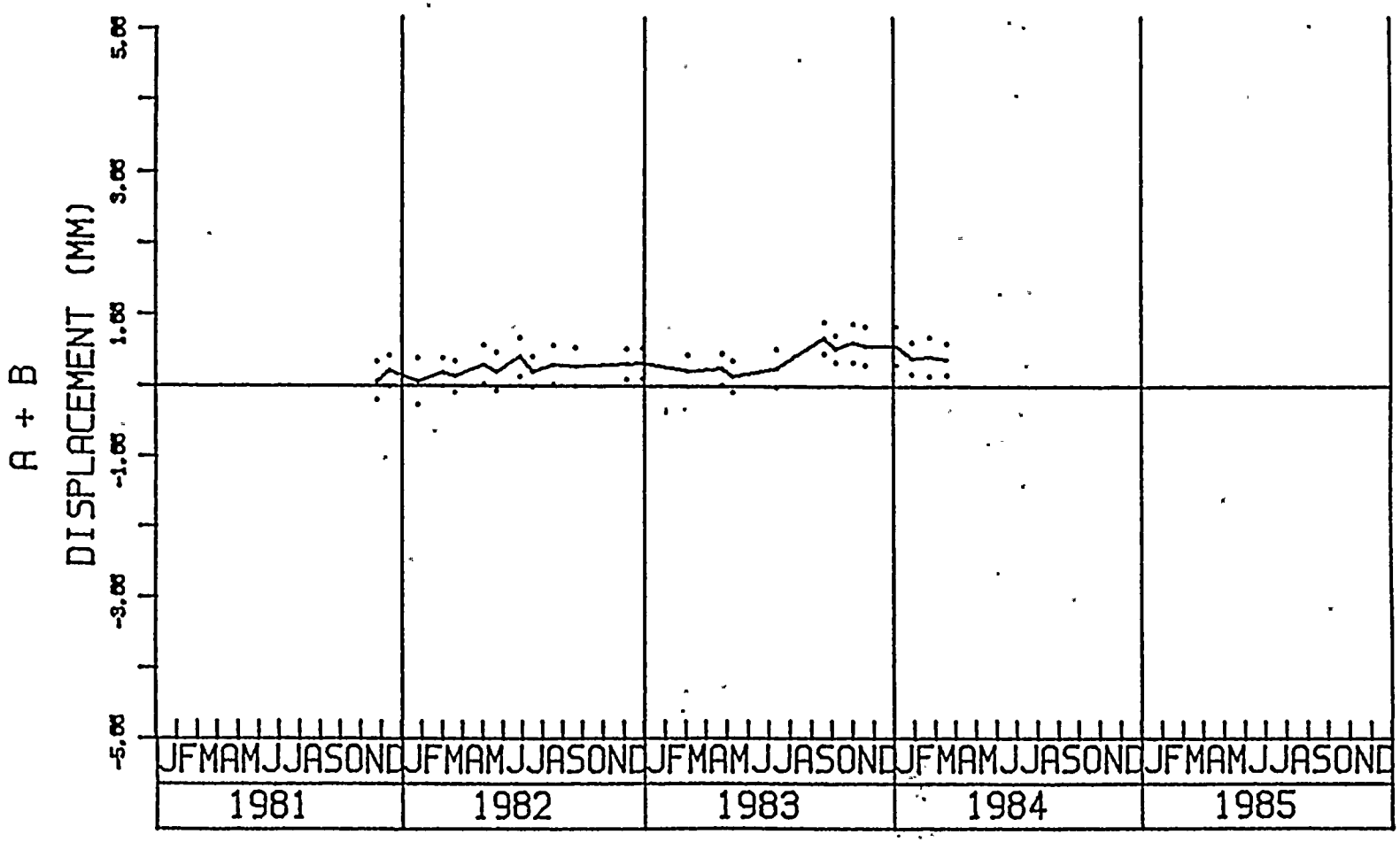
FIGURE 32



INCLINOMETER SI9 DEPTH INTERVAL FROM 63 TO 79 FT.

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

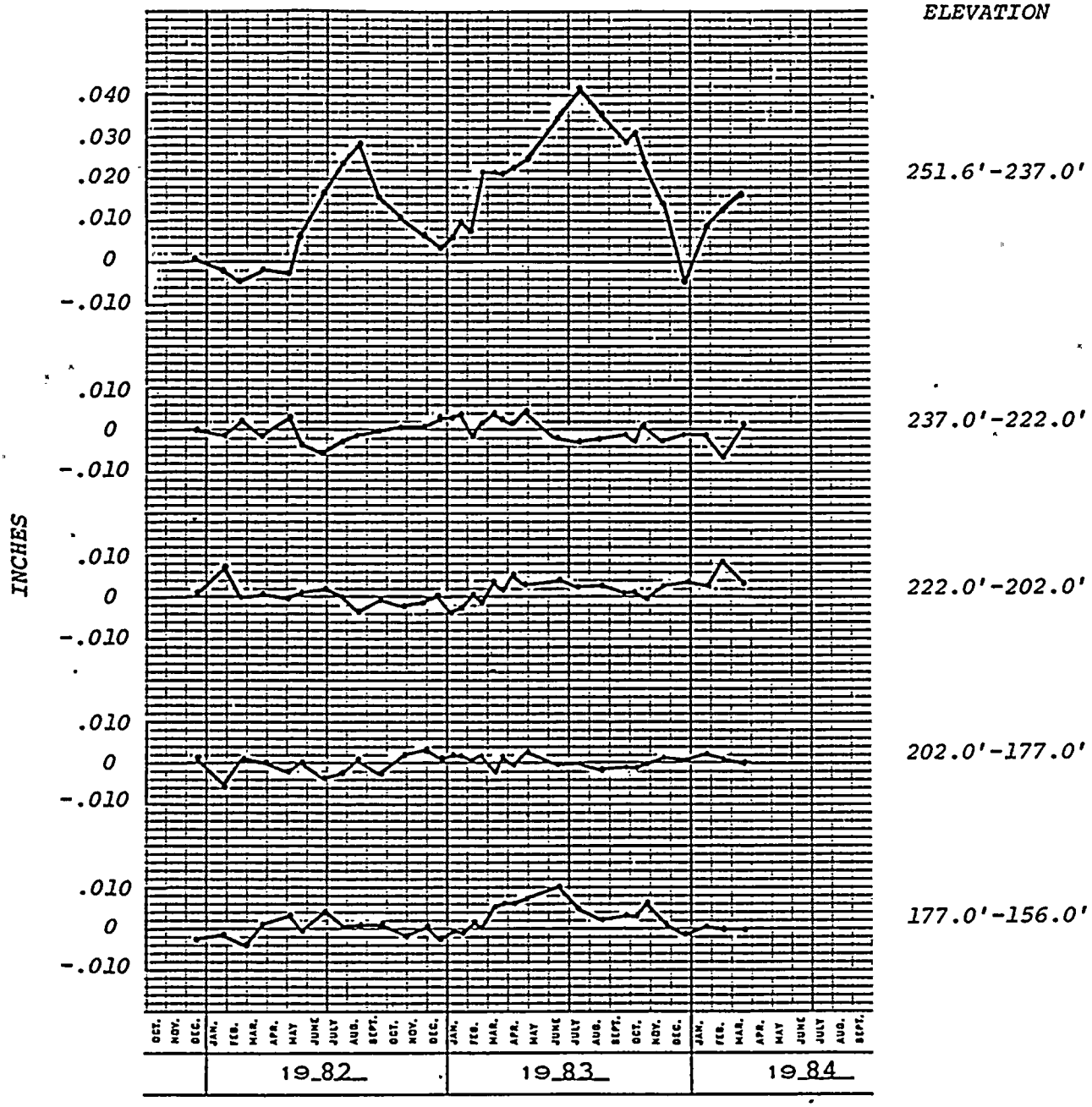
FIGURE 33



INCLINOMETER SI23 DEPTH INTERVAL FROM 99 TO 133 FT.

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

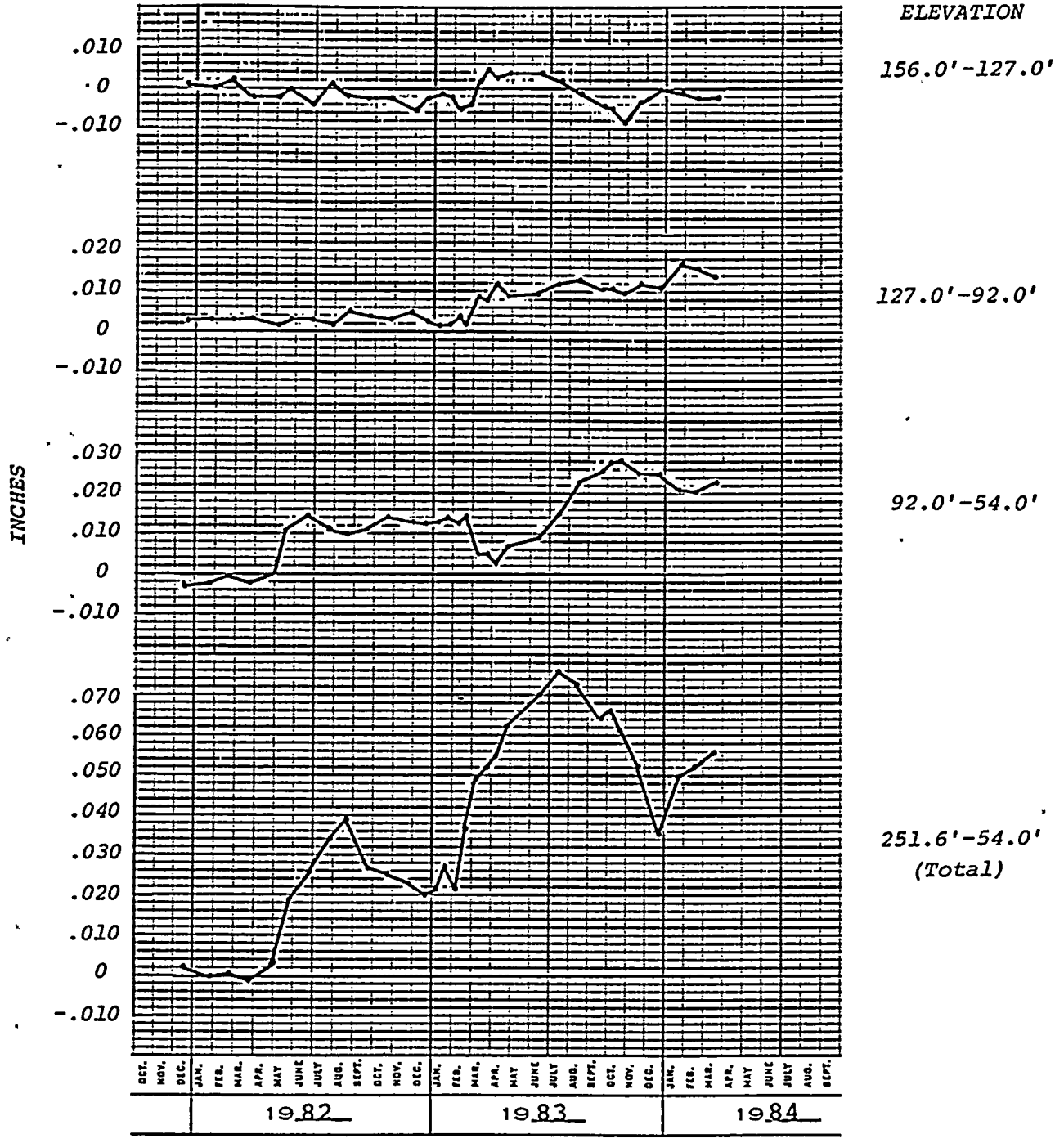
FIGURE 34



EXTENSOMETER EX-20

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

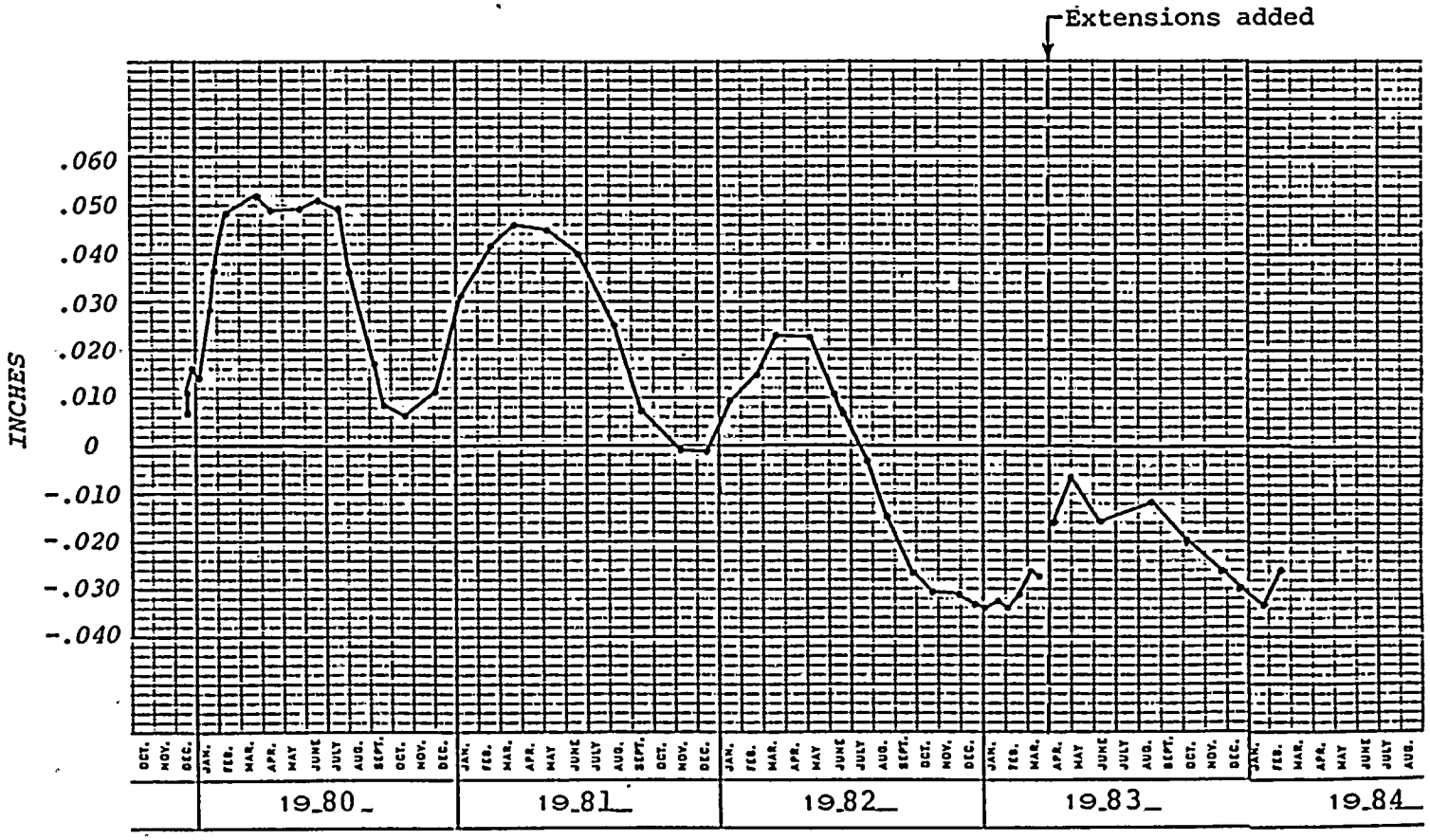
FIGURE 35A



EXTENSOMETER EX-20

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

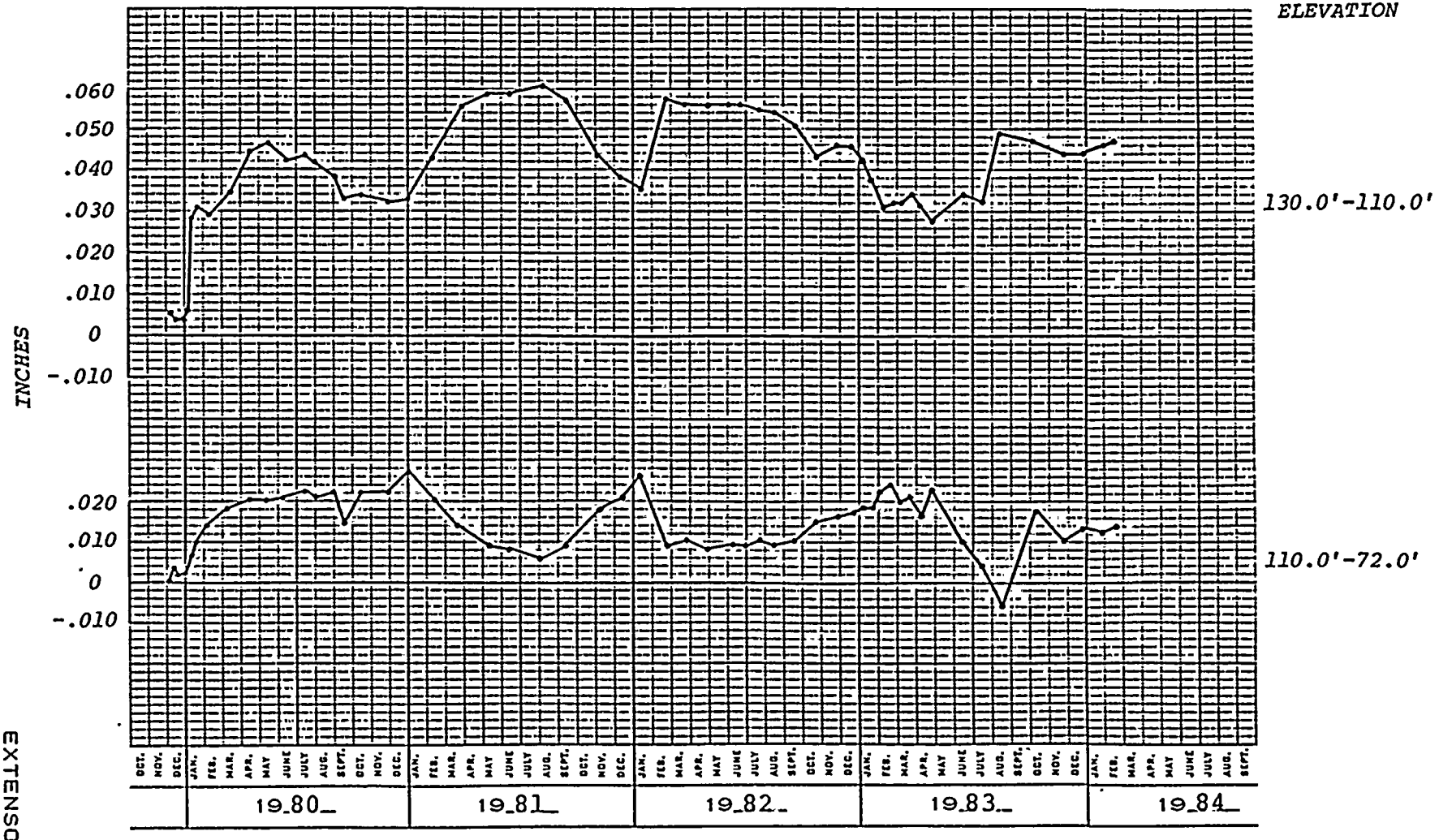
FIGURE 35B



EXTENSOMETER EX-2

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

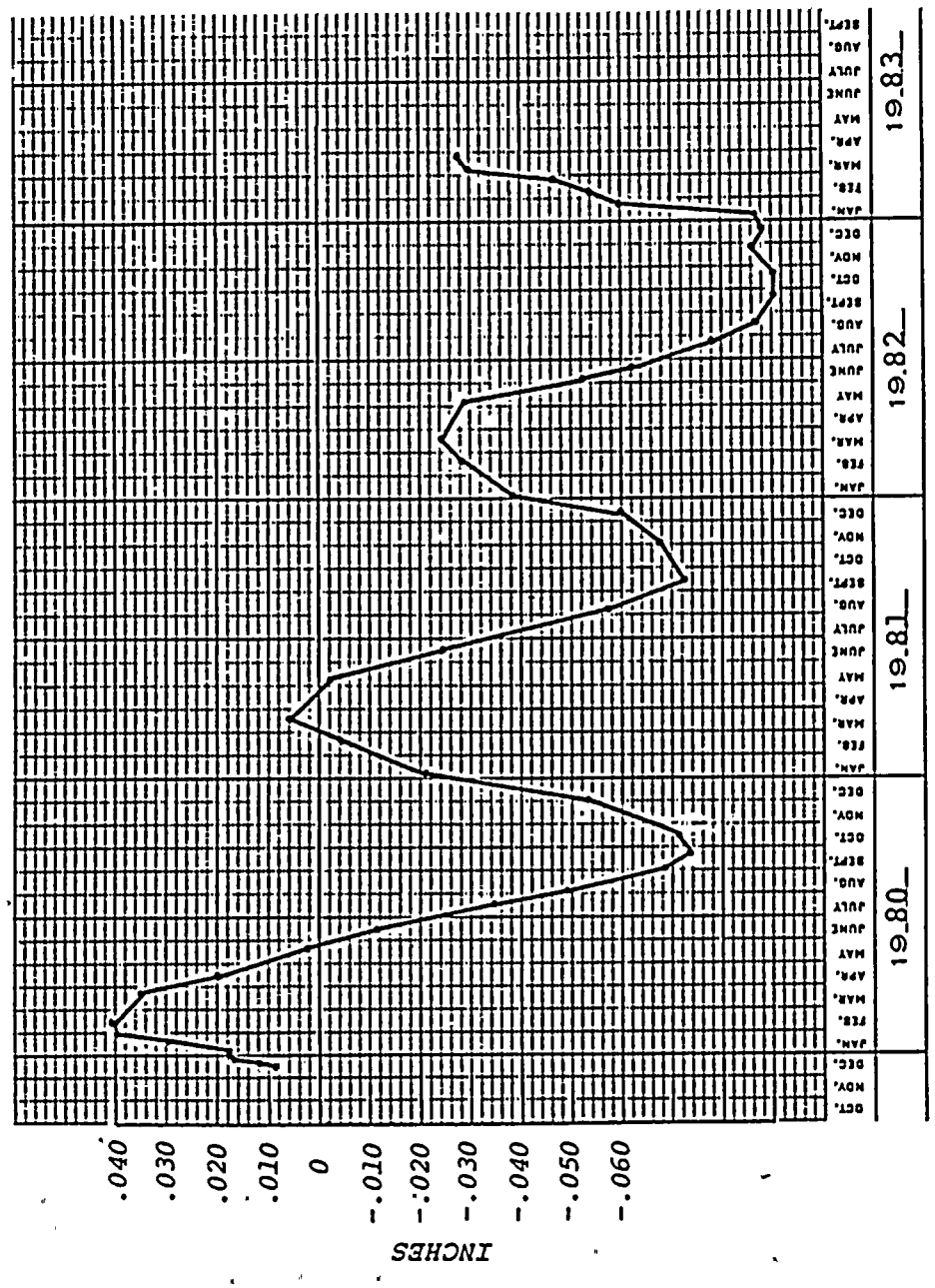
FIGURE 37B



EXTENSOMETER EX-3

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

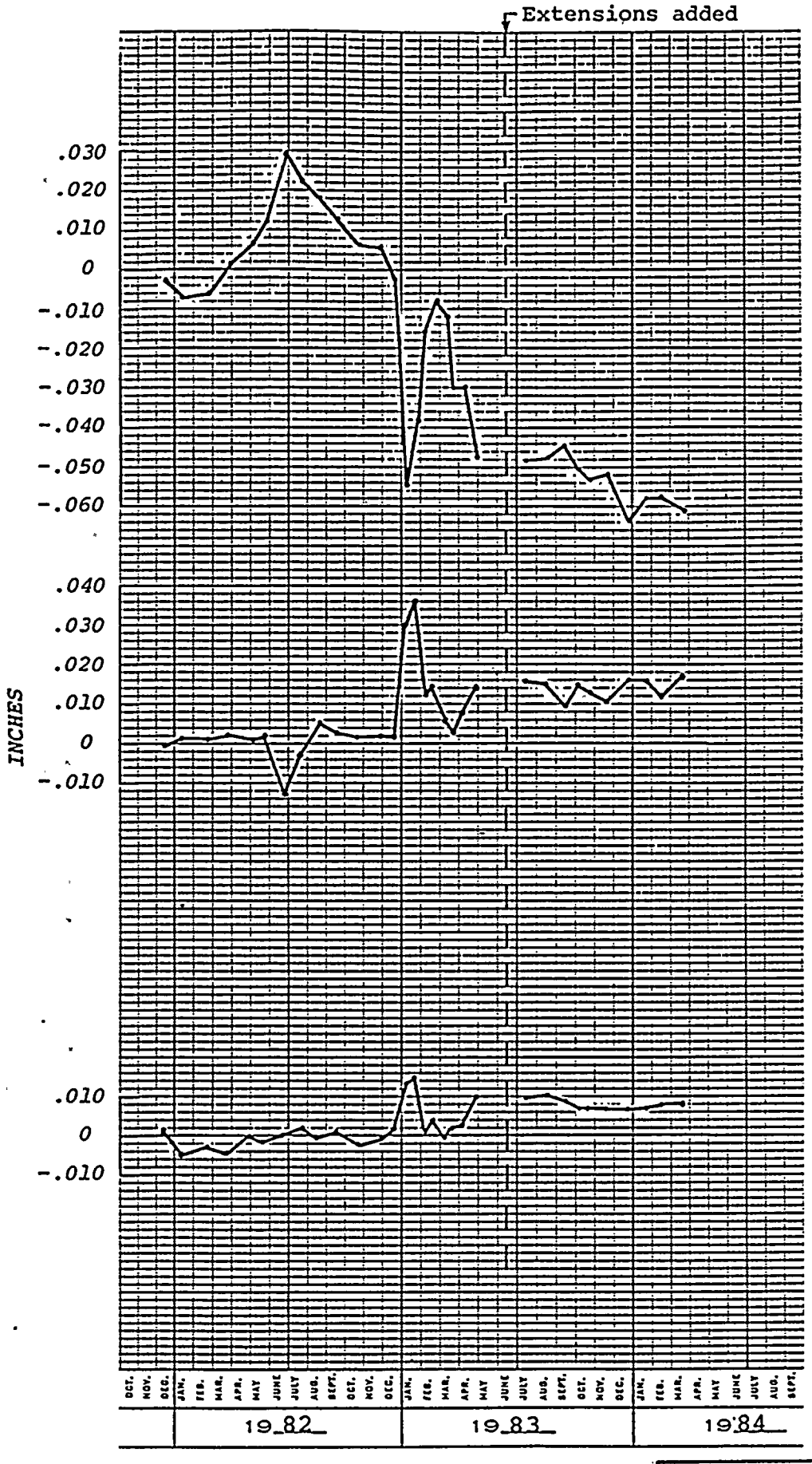
FIGURE 38B



EXTENSOMETER EX-4

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

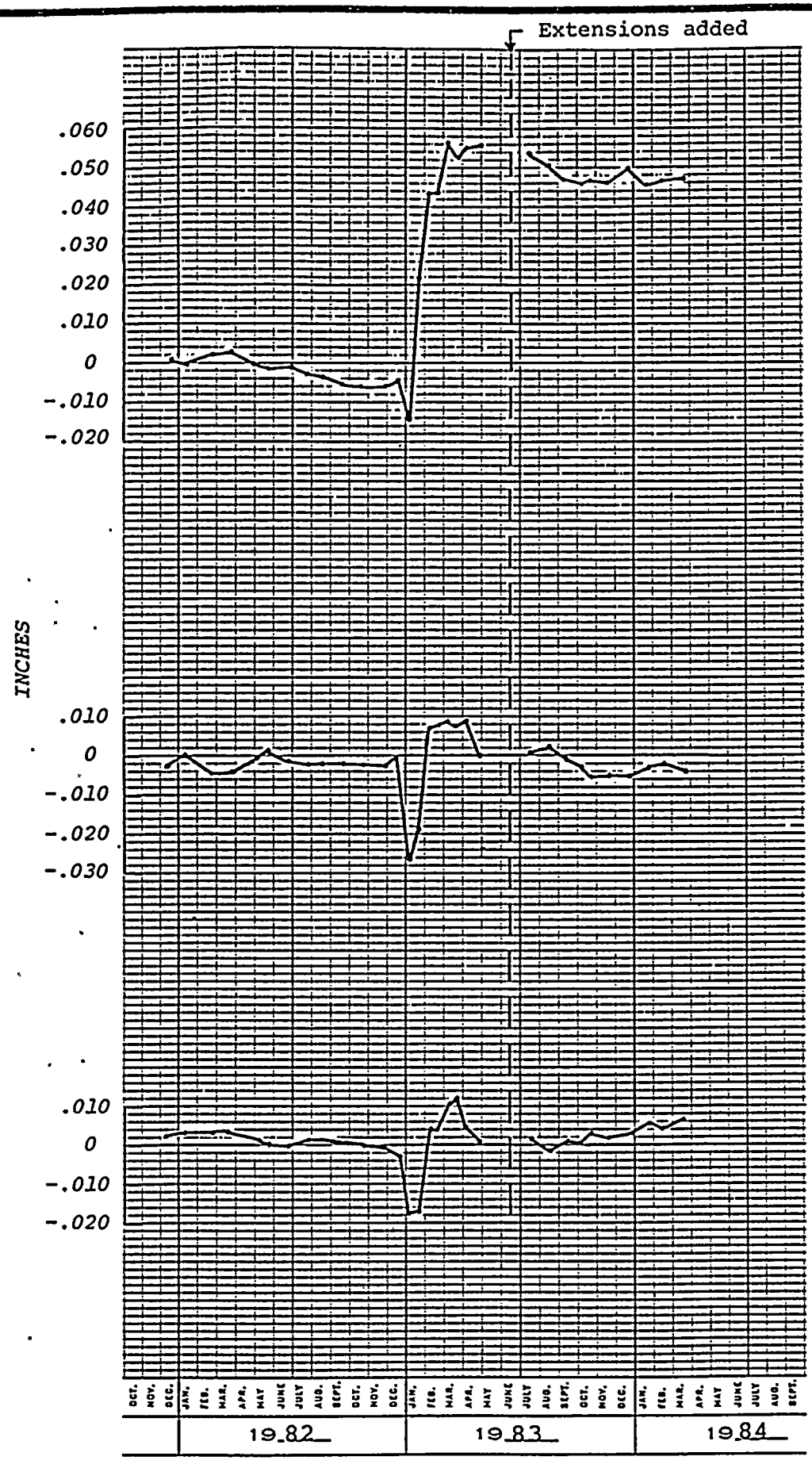
FIGURE 39B



EXTENSOMETER EX-5

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

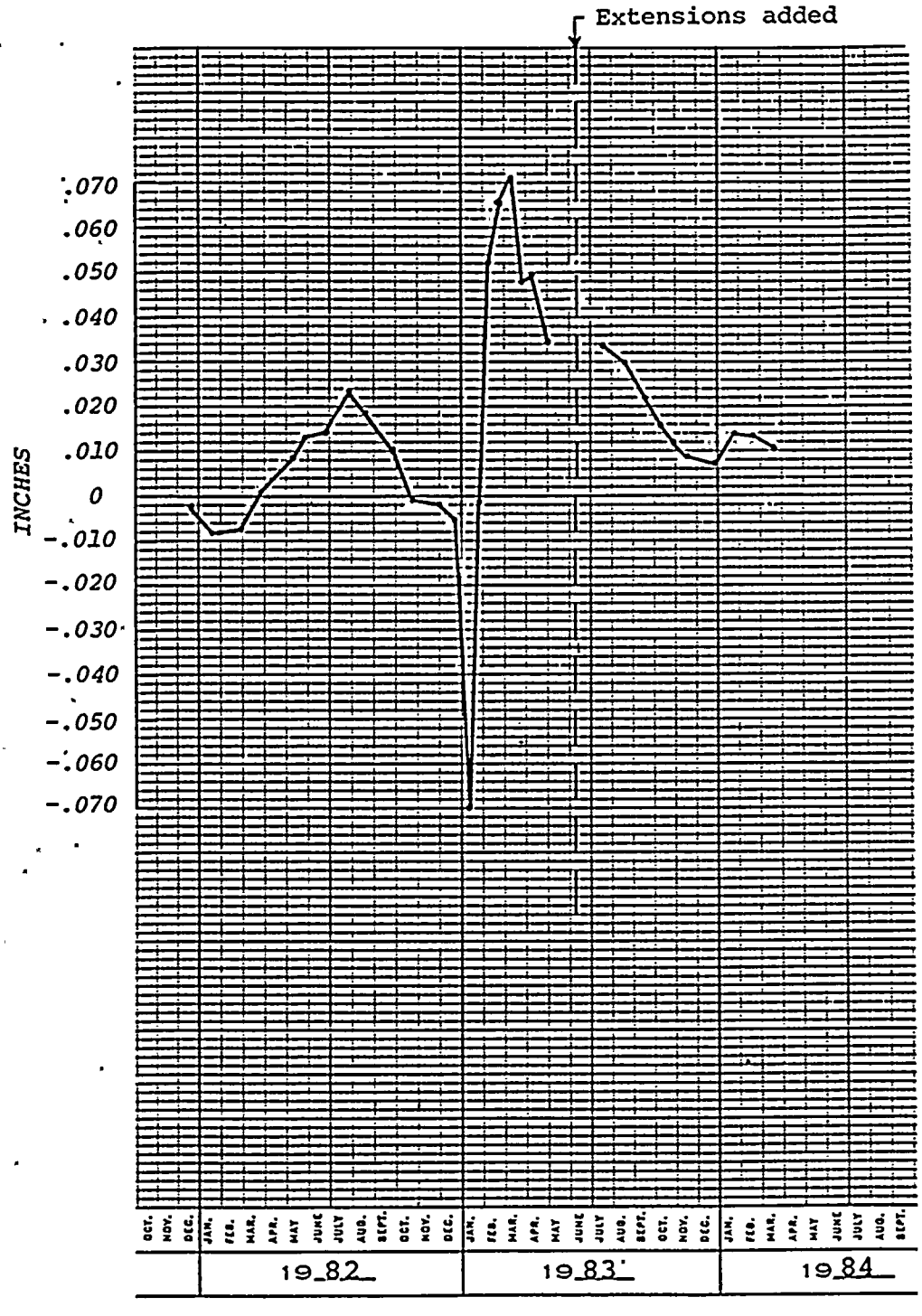
FIGURE 40A



EXTENSOMETER EX-5

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

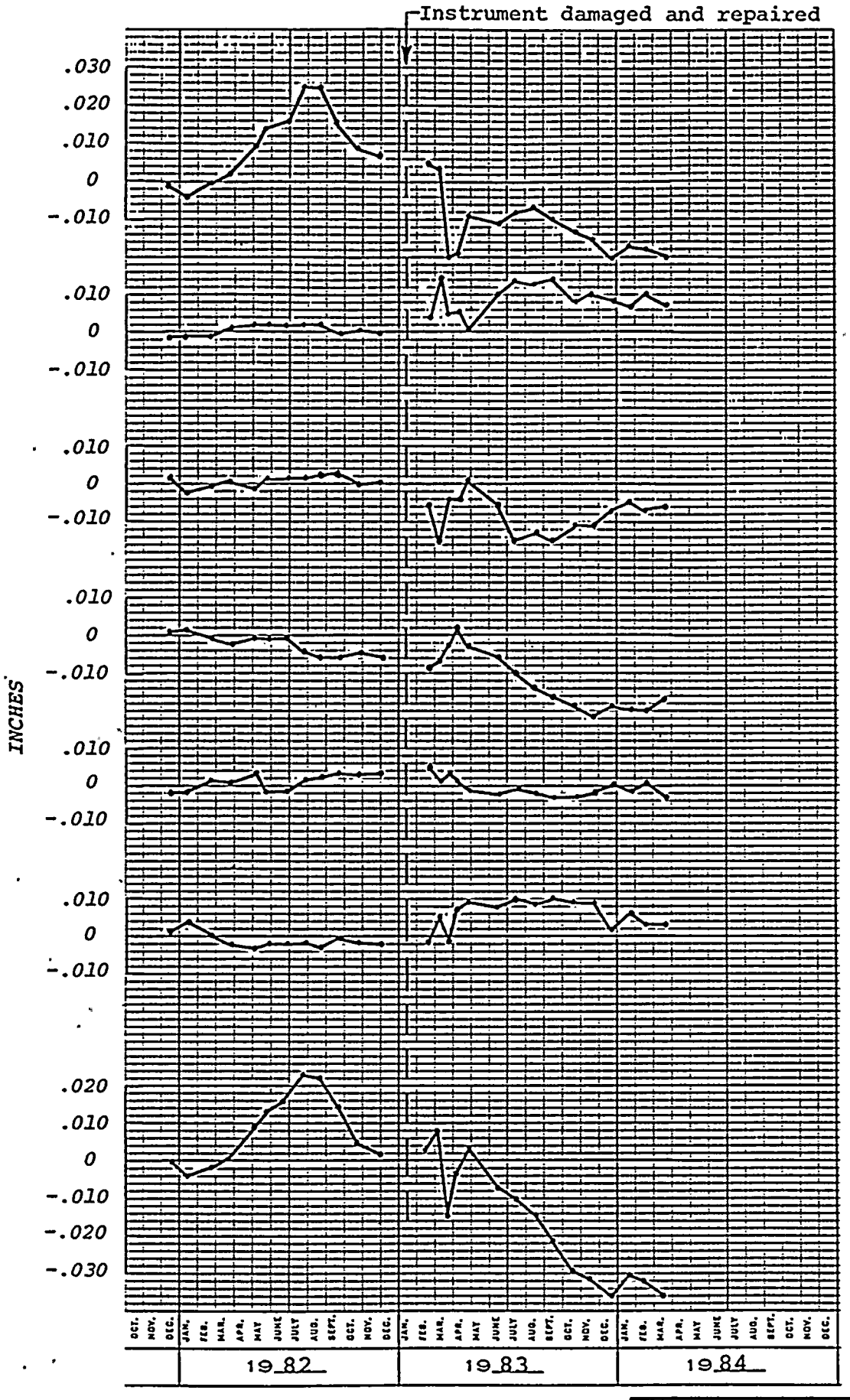
FIGURE 40B



EXTENSOMETER EX-5

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

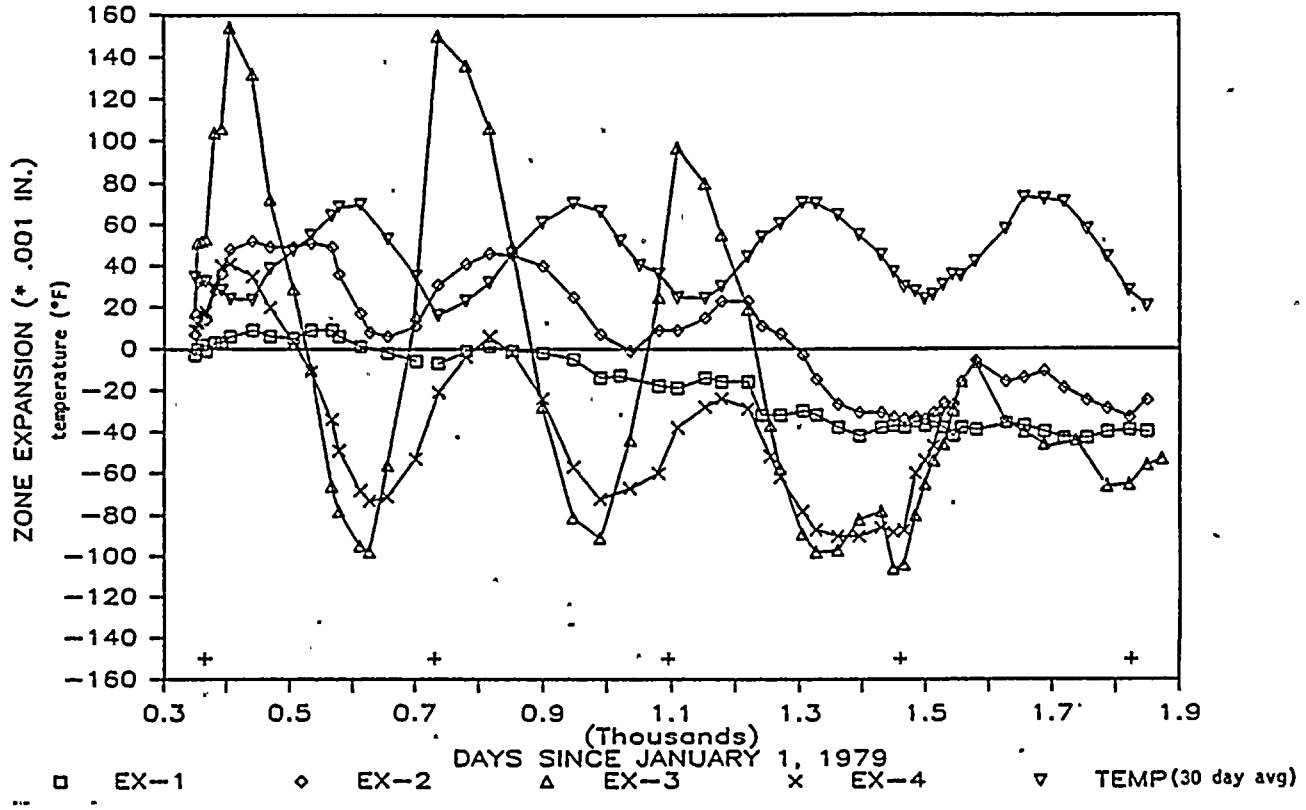
FIGURE 40C



EXTENSOMETER EX-6

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 41

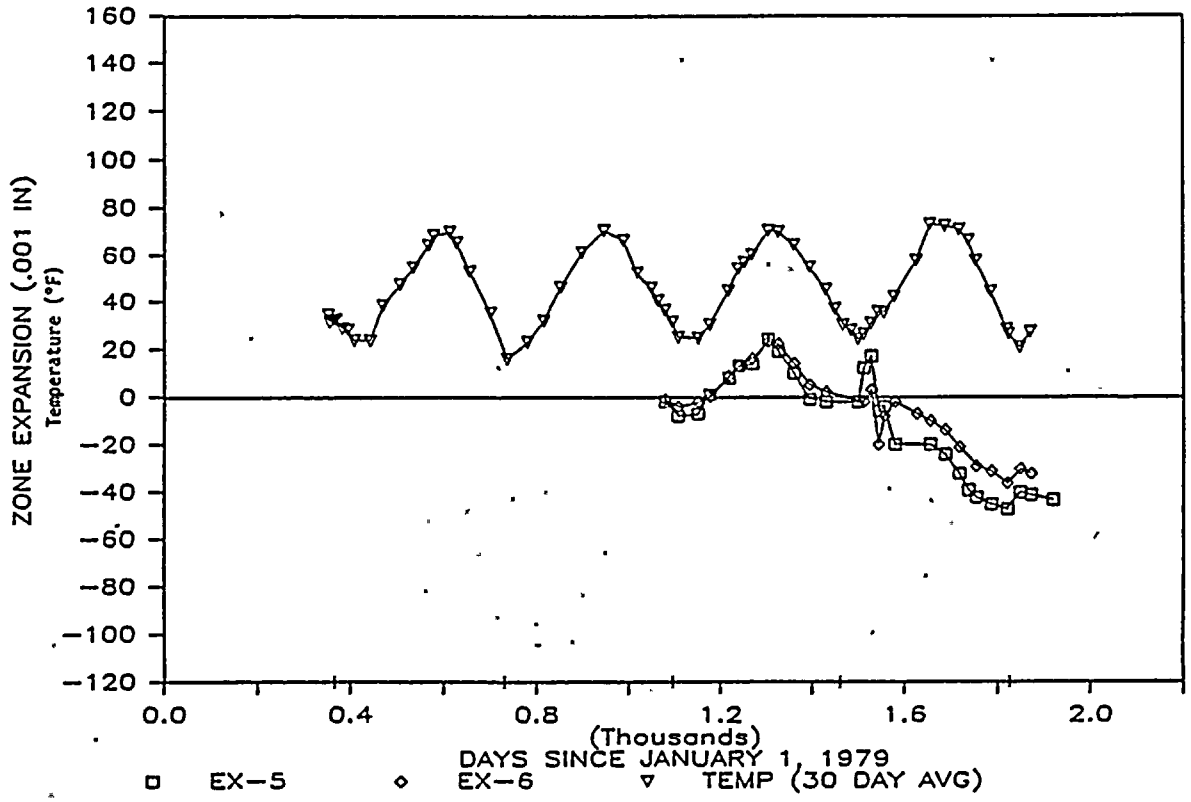


TOTAL DISPLACEMENTS

EXTENSOMETERS

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 42

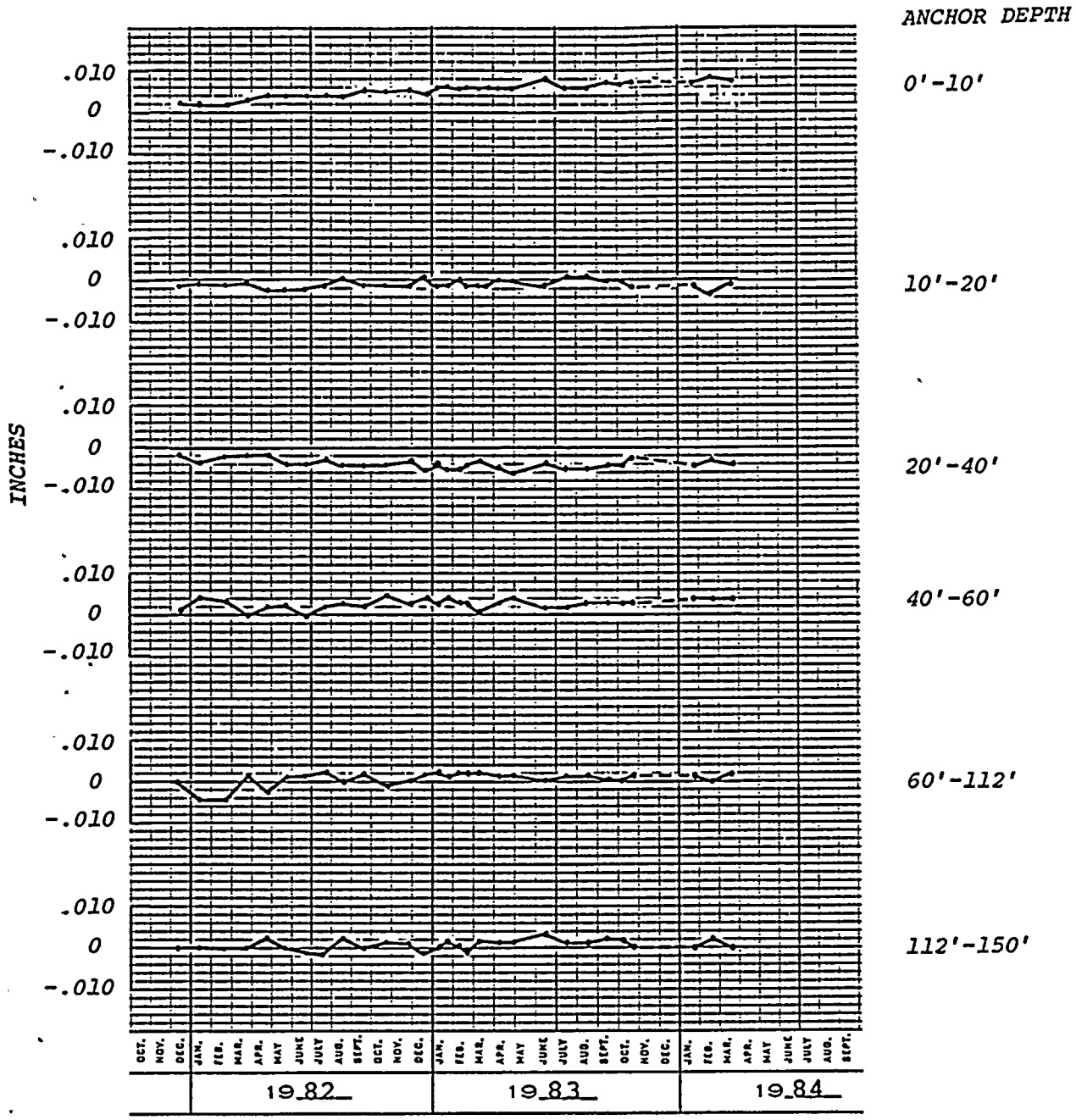


TOTAL DISPLACEMENTS

EX−5 AND EX−6 ZONE 224'−73'

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 43

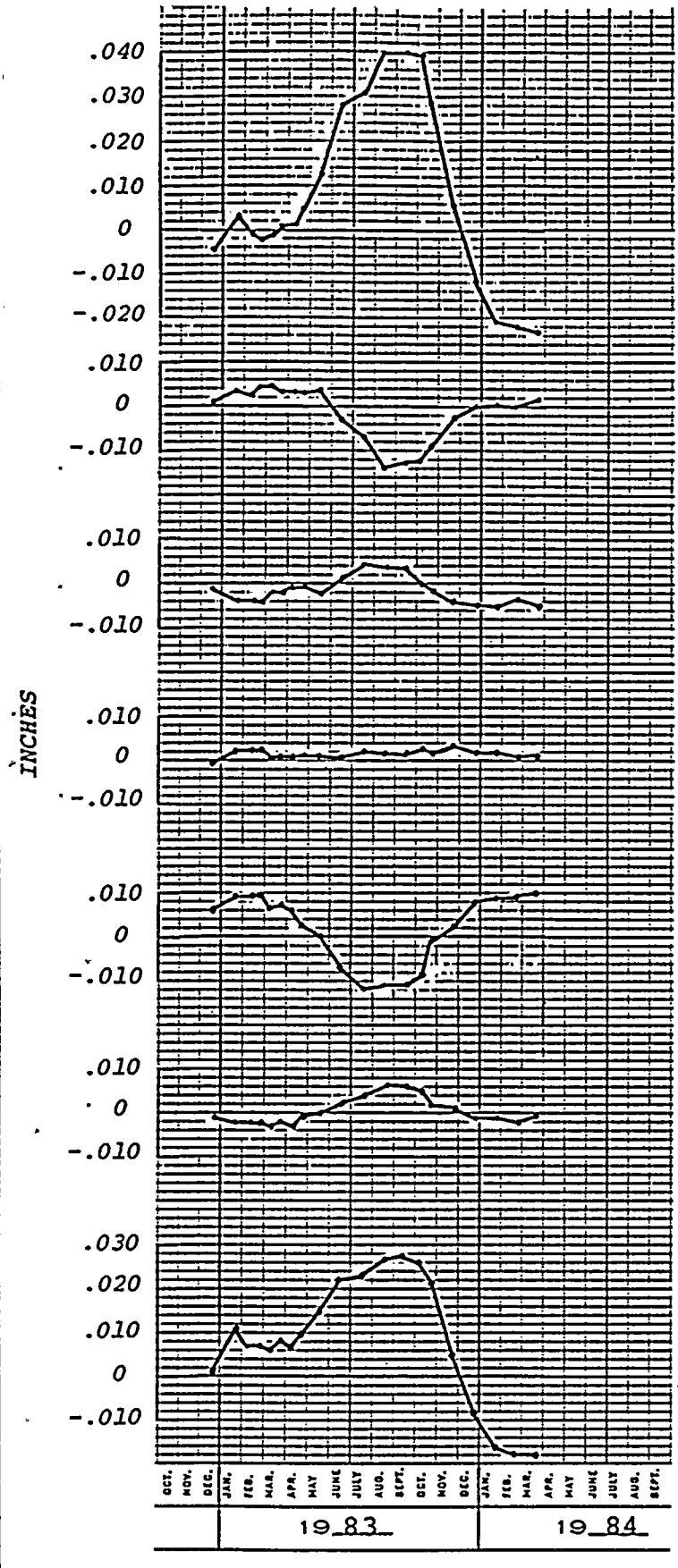


EXTENSOMETER HEX-1

SONIC PROBE

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 44

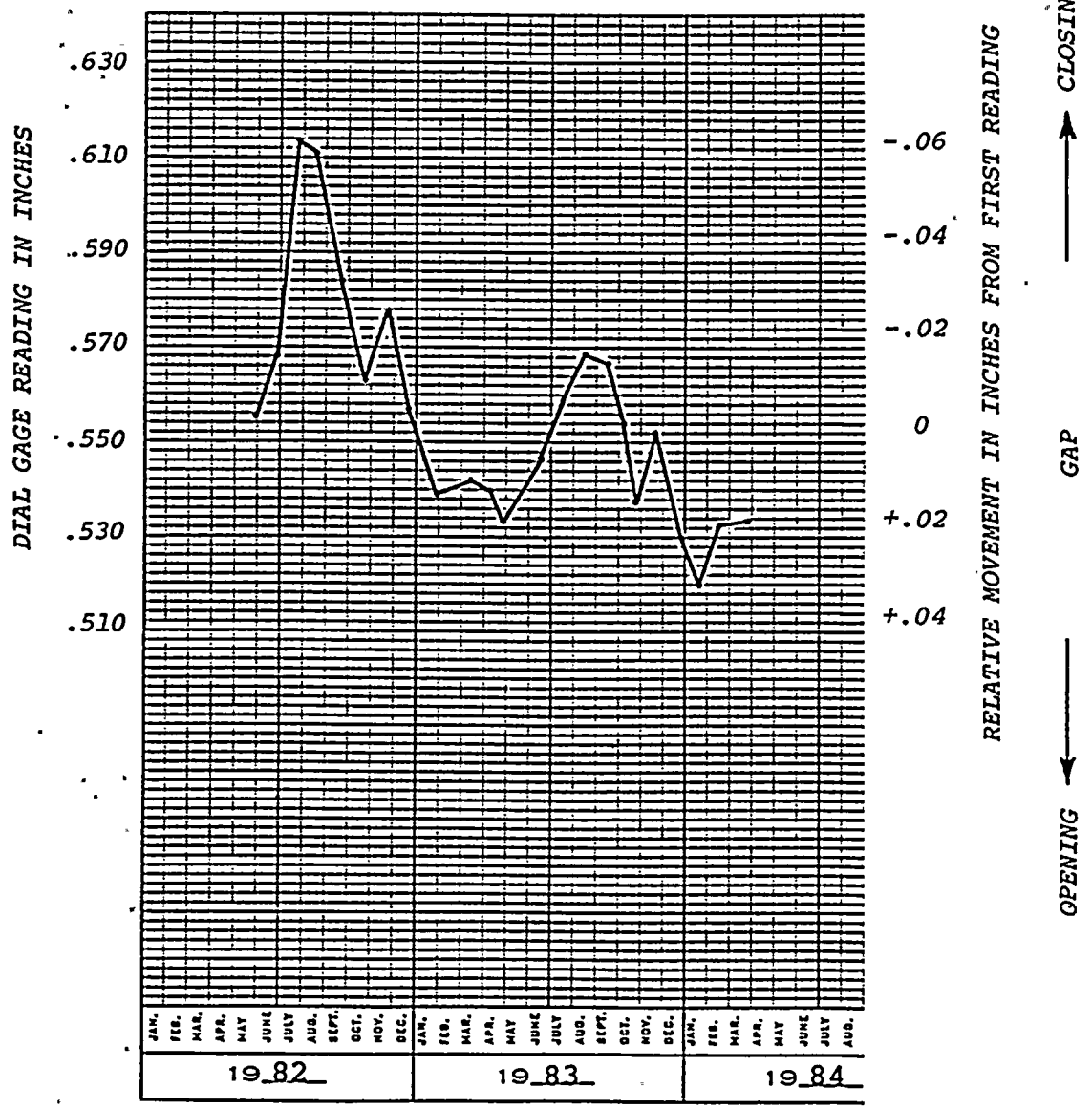


ELEVATION	ANCHOR DEPTH
246.0'-232.0'	0.0'-45.0'
232.0'-230.0'	45.0'-52.5'
230.0'-226.0'	52.5'-70.5'
226.0'-222.0'	70.5'-84.0'
222.0'-220.0'	84.0'-91.0'
220.0'-208.0'	91.0'-132.0'
246.0'-208.0' (Total)	0.0'-132.0'

EXTENSOMETER HEX-2
DCDT'S

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

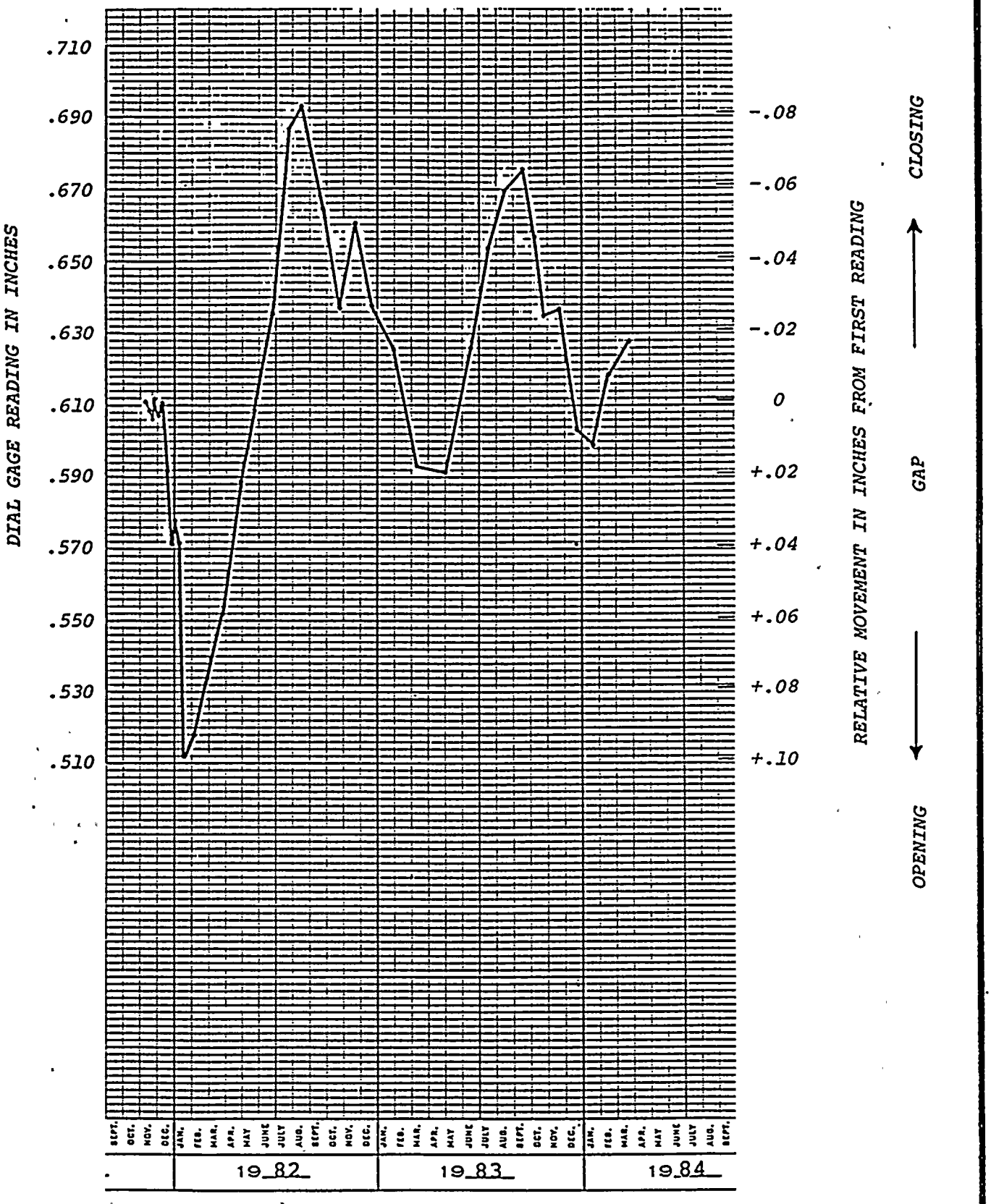
FIGURE 45



GAP GAGE G1A

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

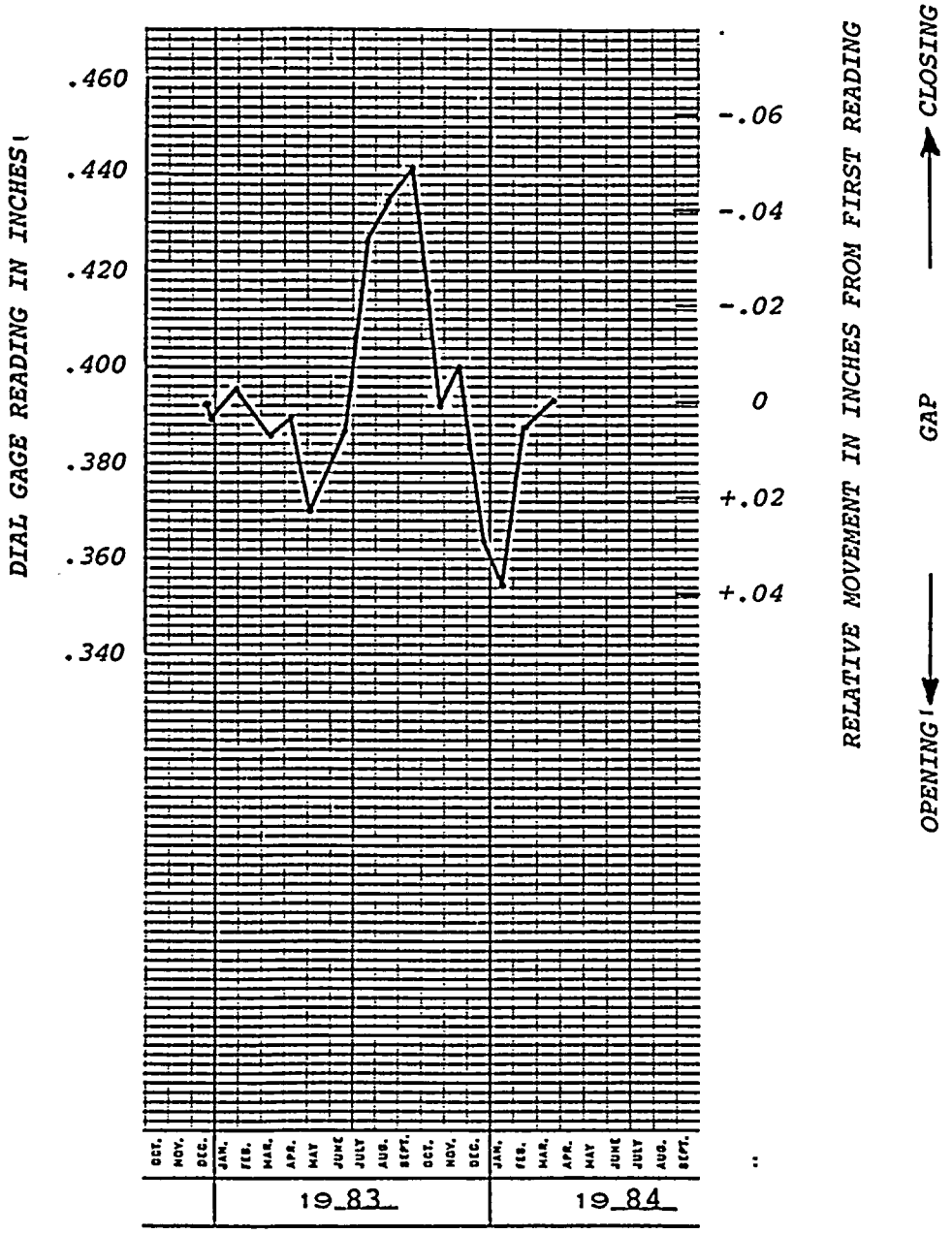
FIGURE 46



GAP GAGE G1B

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

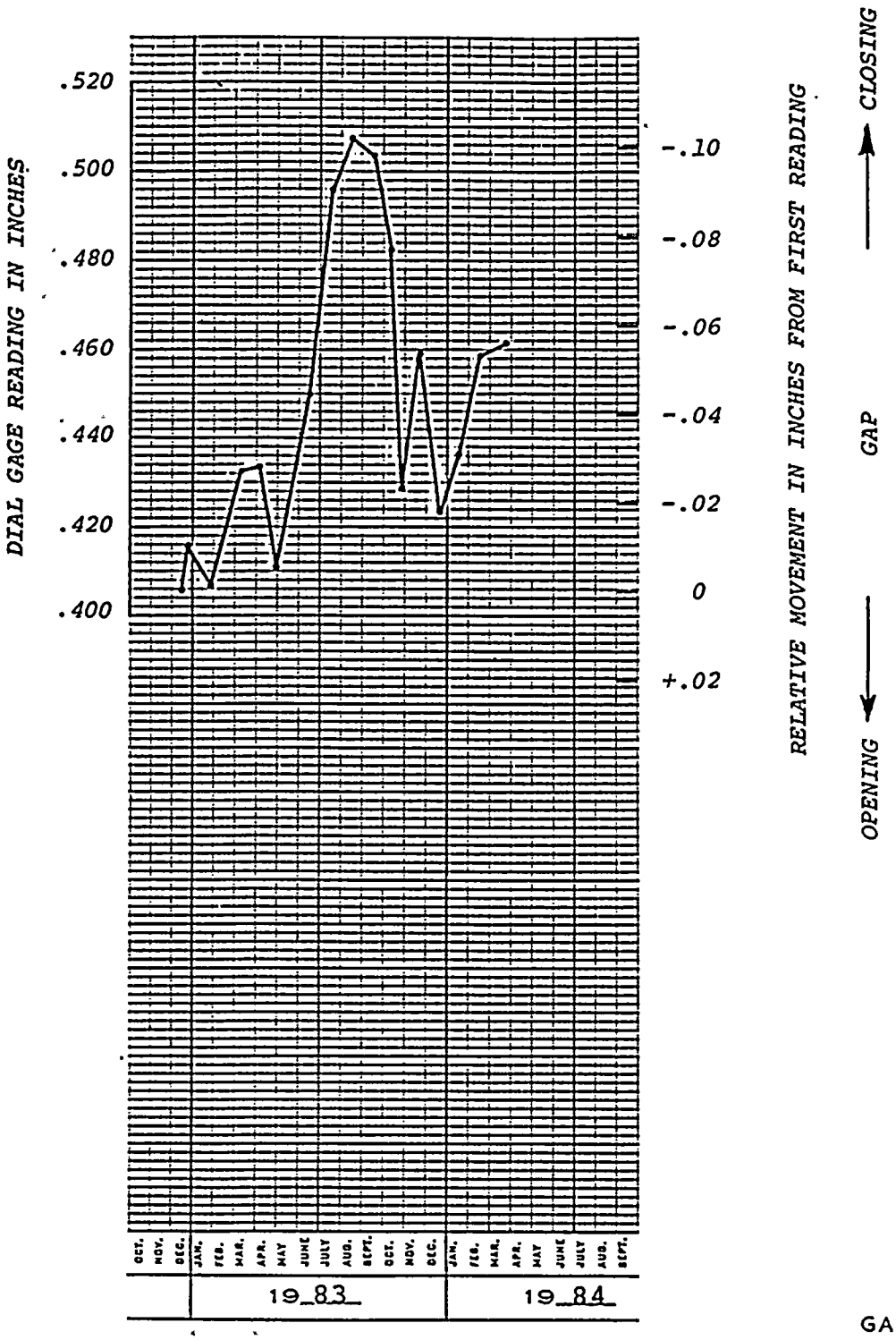
FIGURE 47



GAP GAGE G1C

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

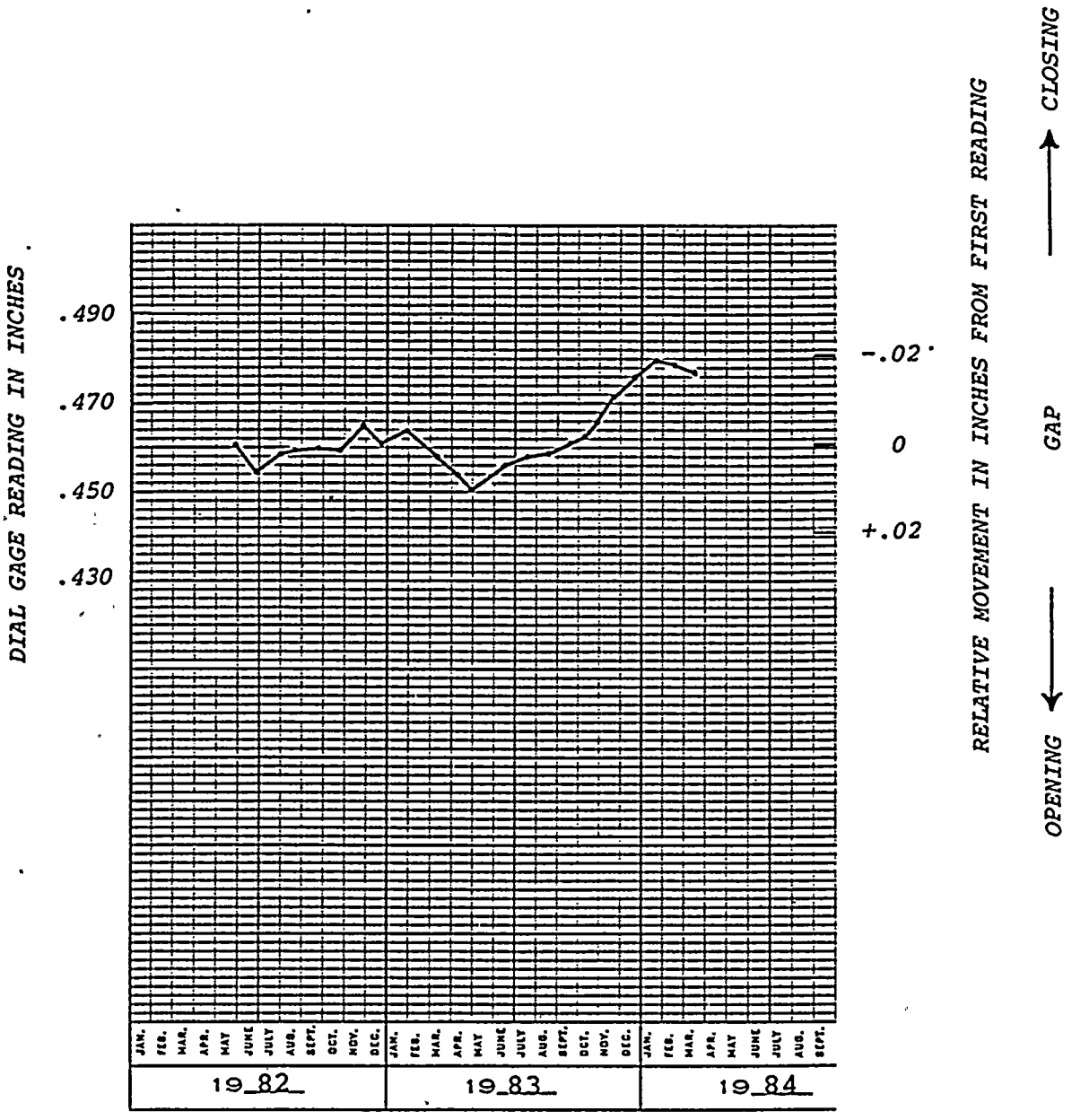
FIGURE 48



GAP GAGE, G1D

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

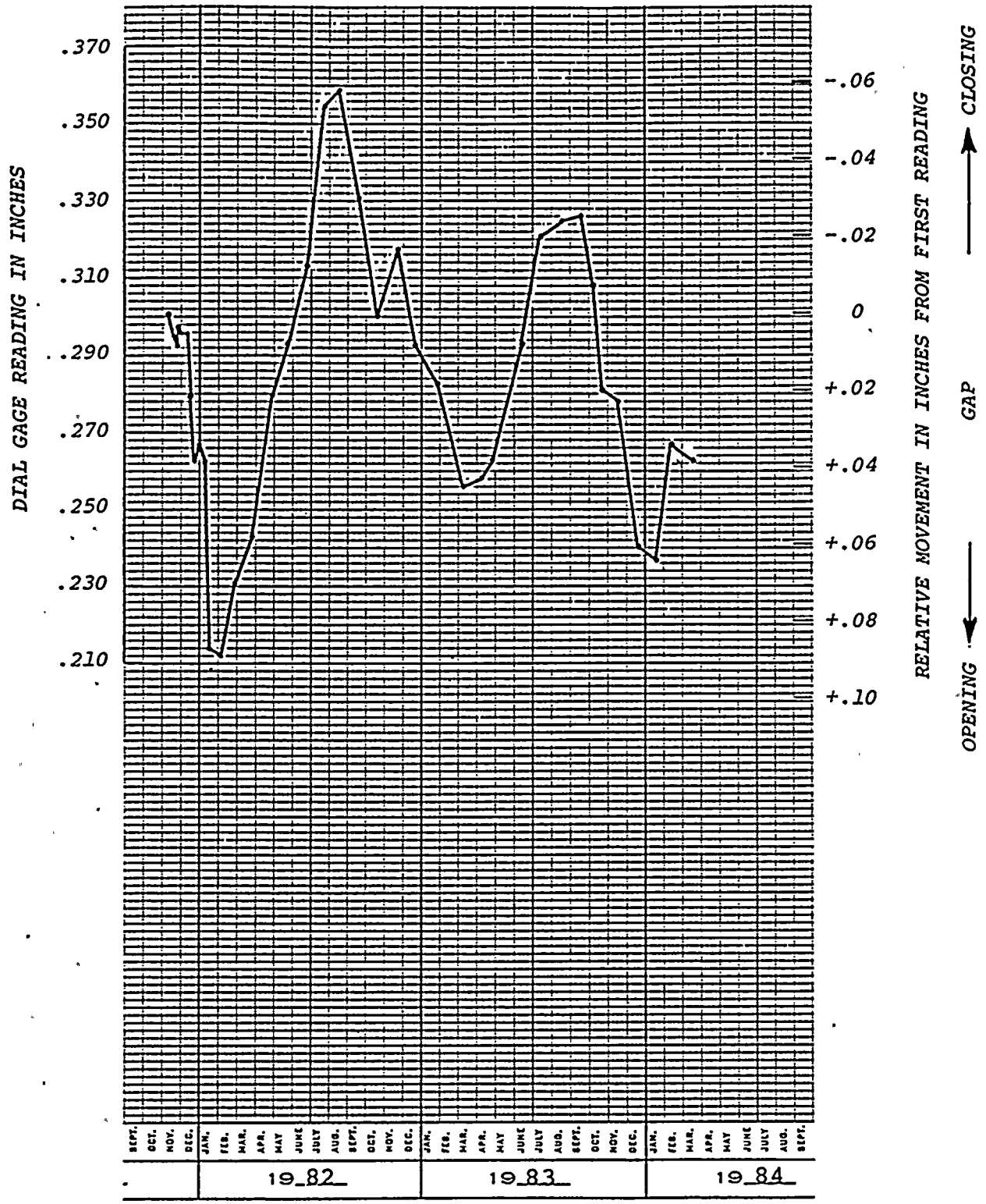
FIGURE 49



GAP GAGE G2A

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

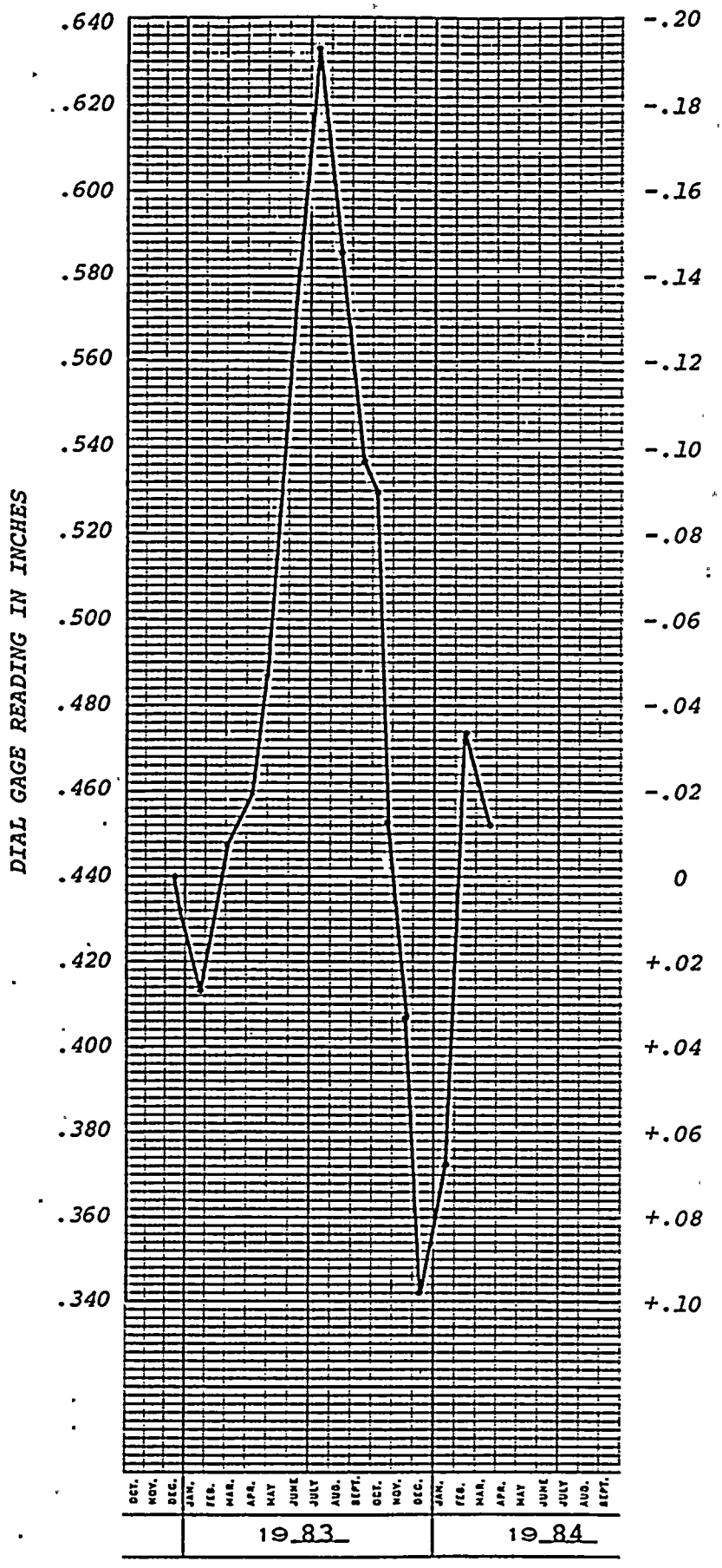
FIGURE 50



GAP GAGE G2B

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

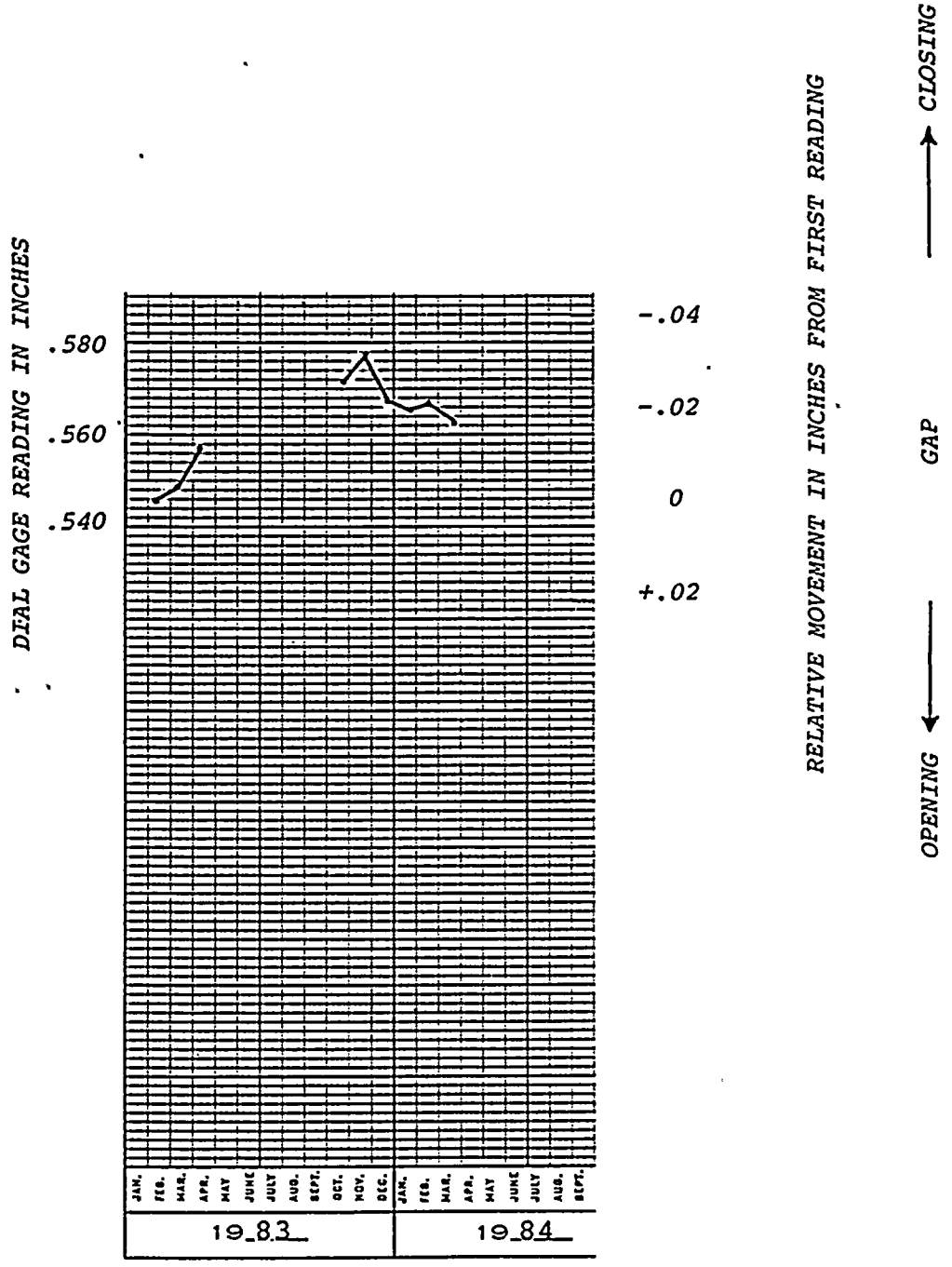
FIGURE 51



GAP GAGE G3 NORMAL

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

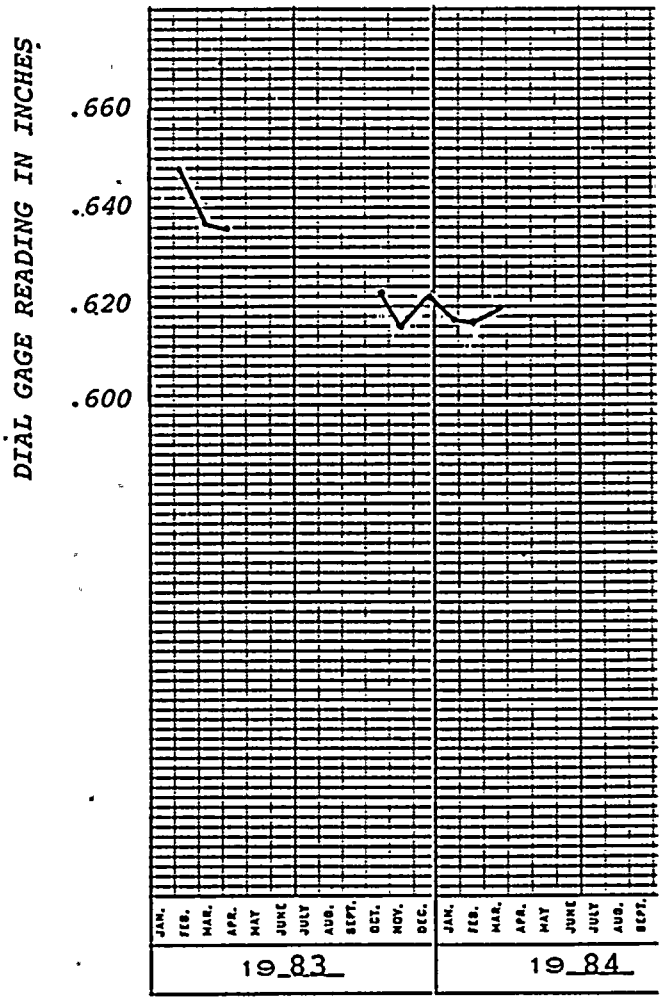
FIGURE 52



GAP GAGE G4 NORMAL

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

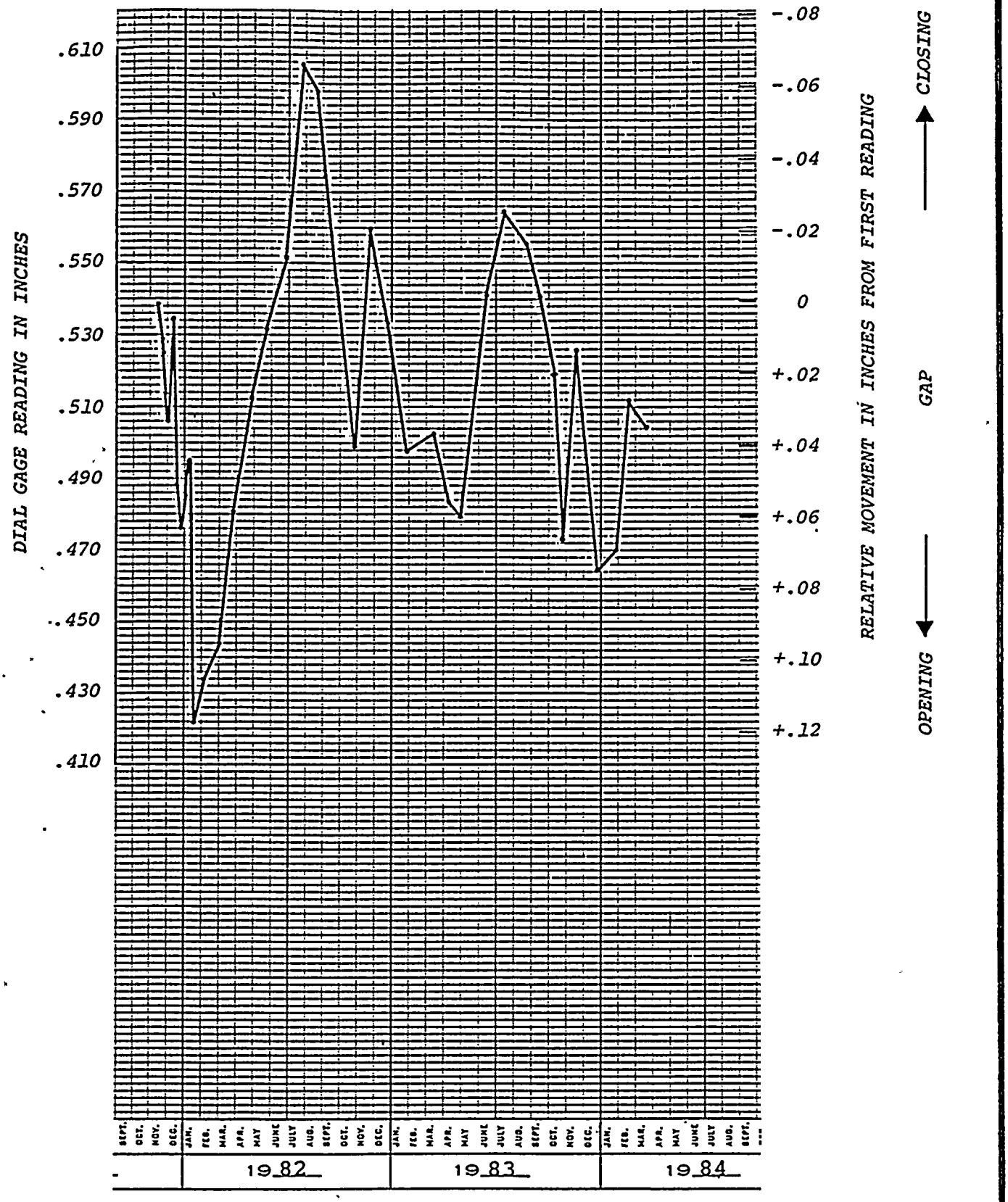
FIGURE 54



GAP GAGE G4, SHEAR

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

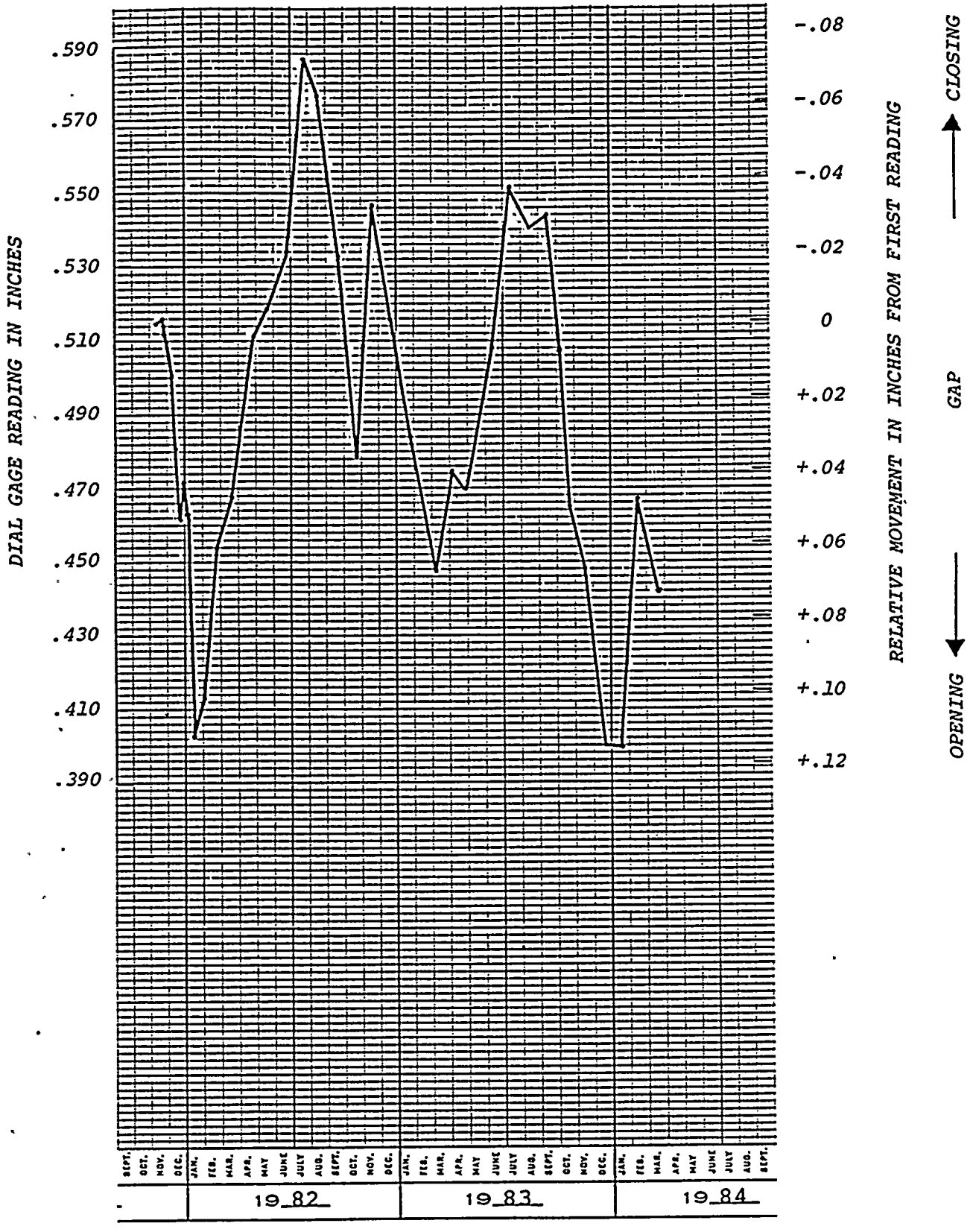
FIGURE 55



GAP GAGE G5A

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

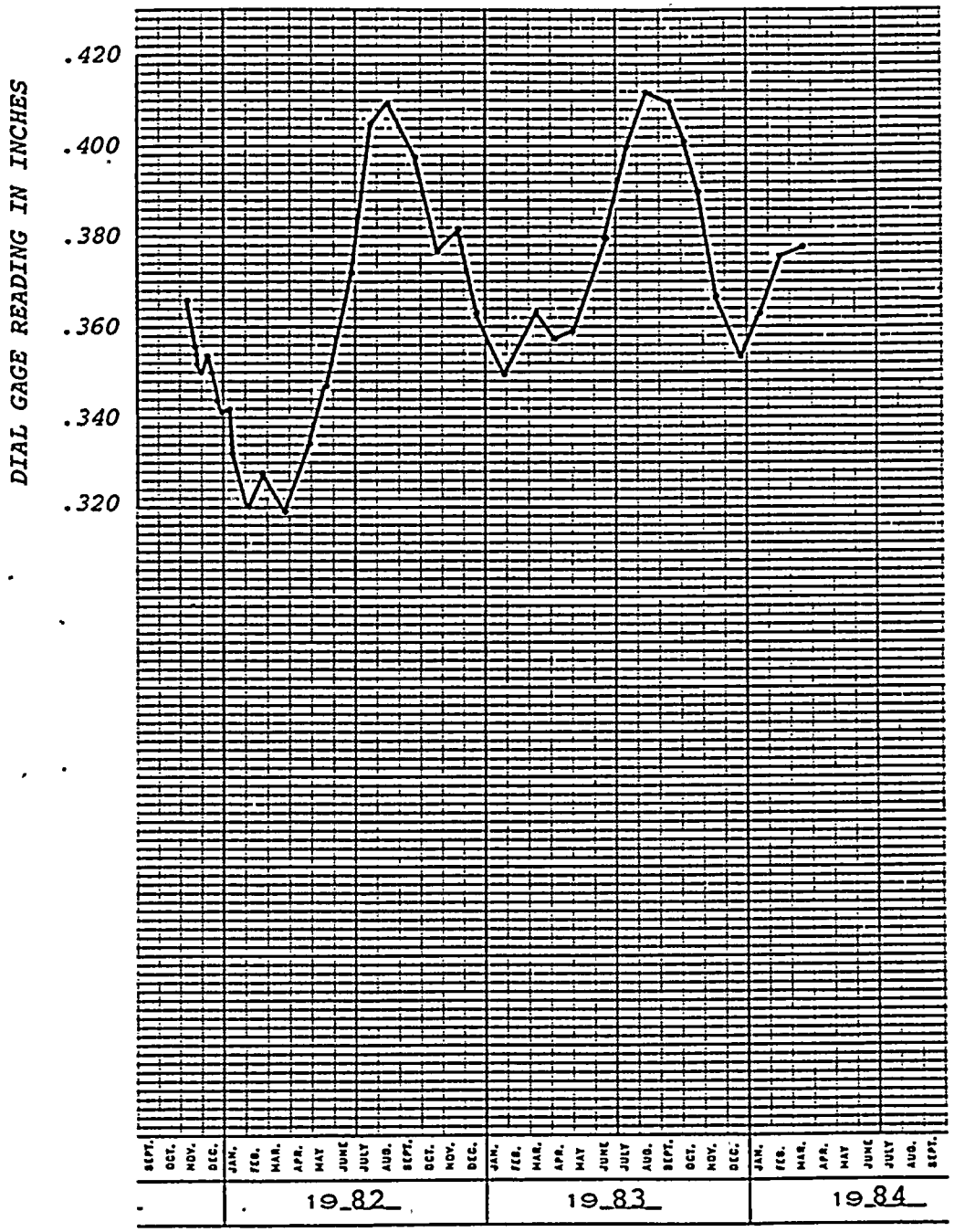
FIGURE 56



GAP GAGE G5B

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

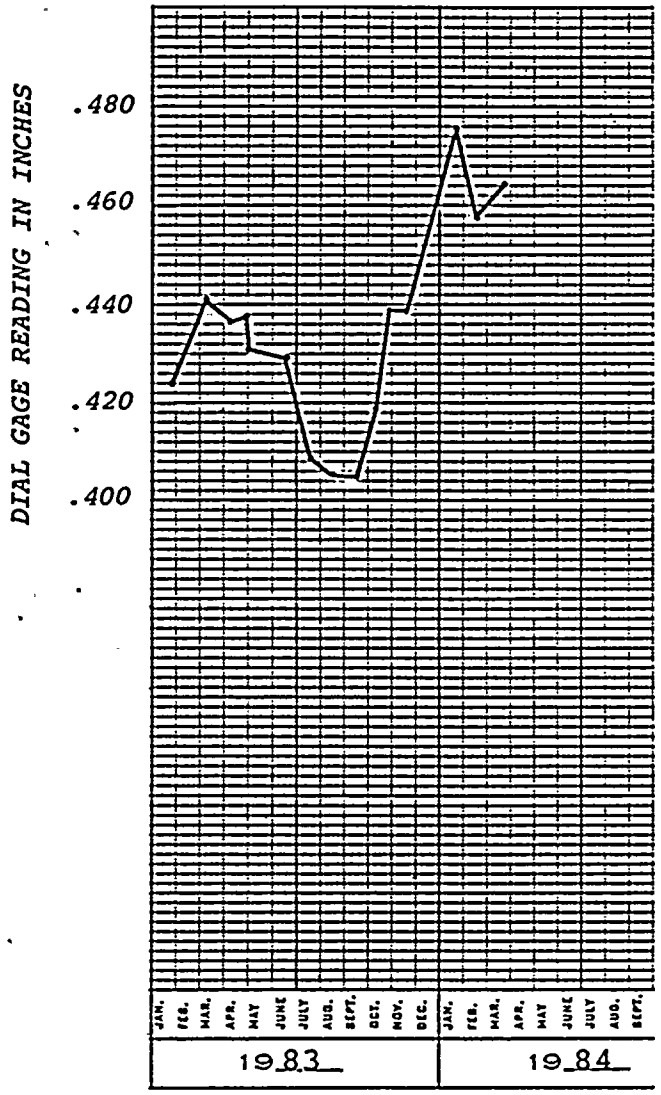
FIGURE 57



GAP GAGE G6

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

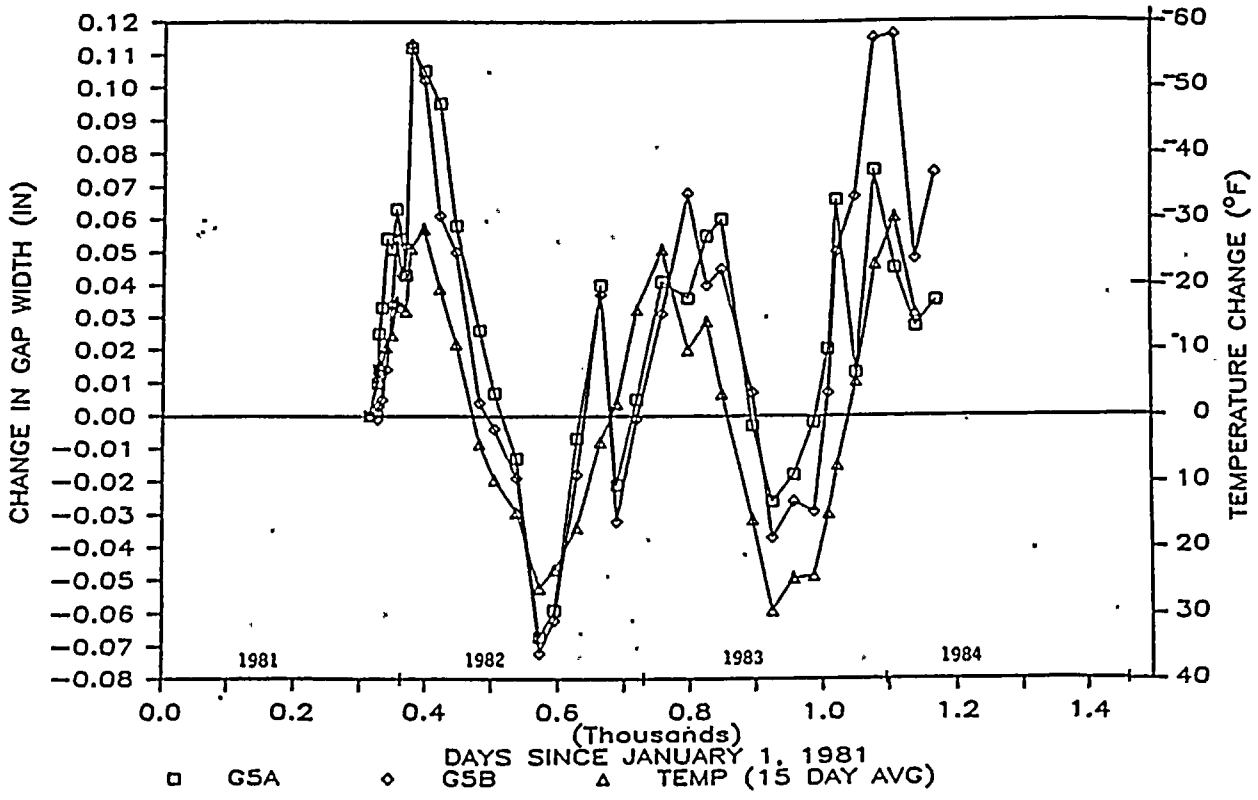
FIGURE 58



GAP GAGE GV-1

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 59

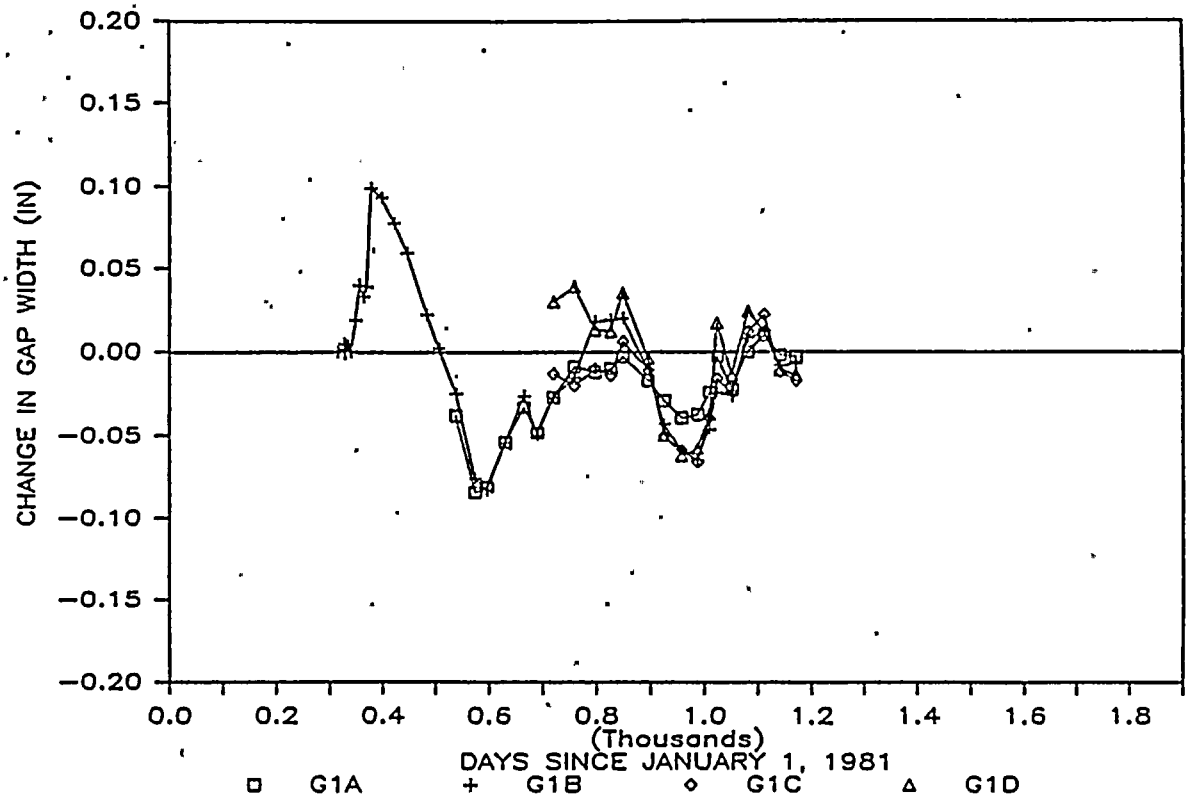


GAP AND TEMPERATURE VS. TIME

GAP GAGES G5A & G5B

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 60

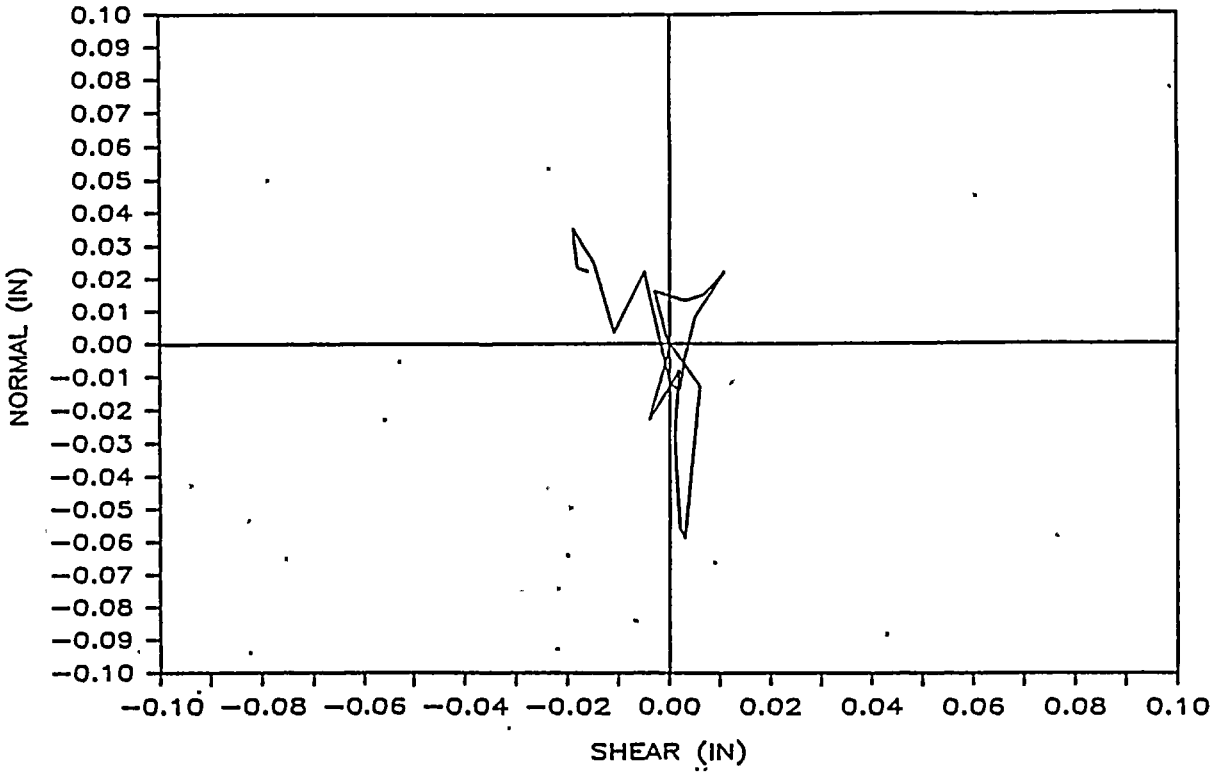


GAP CHANGE VS. TIME

G1A G1B G1C G1D

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 61

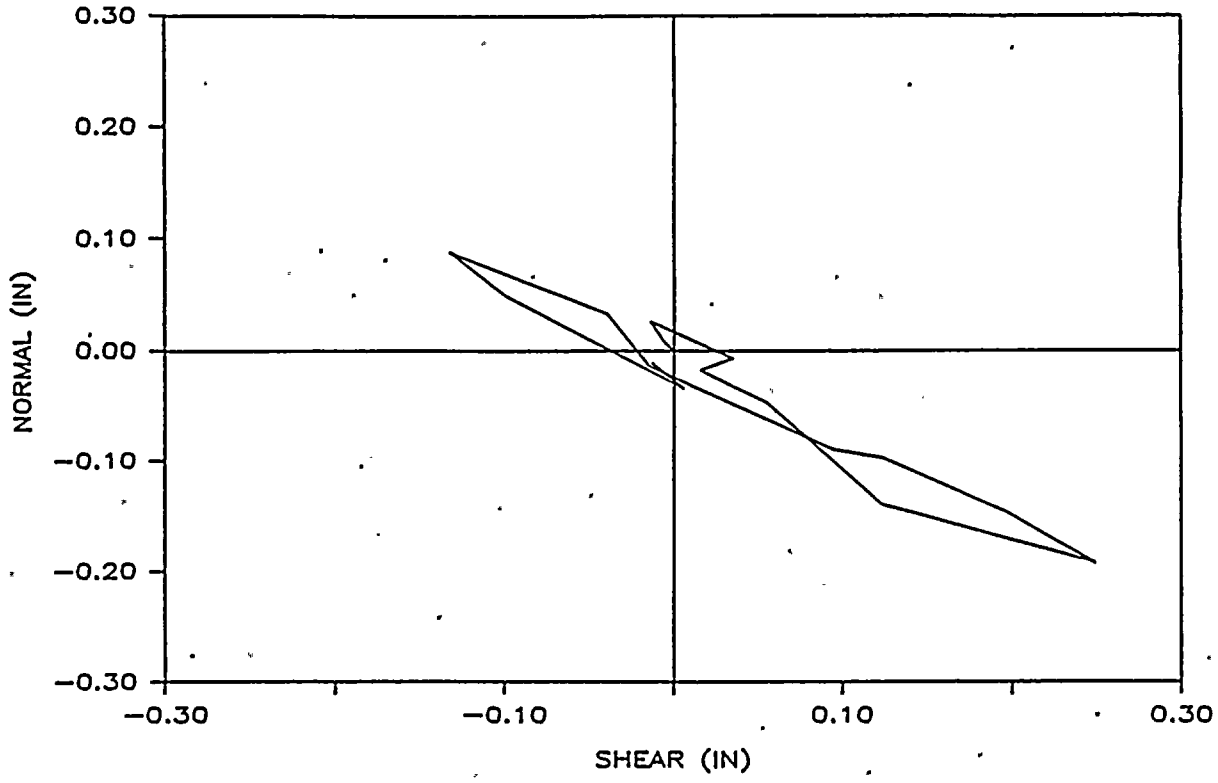


NORMAL VS SHEAR DISPLACEMENTS

GAP GAGES G2A & G1A

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 62

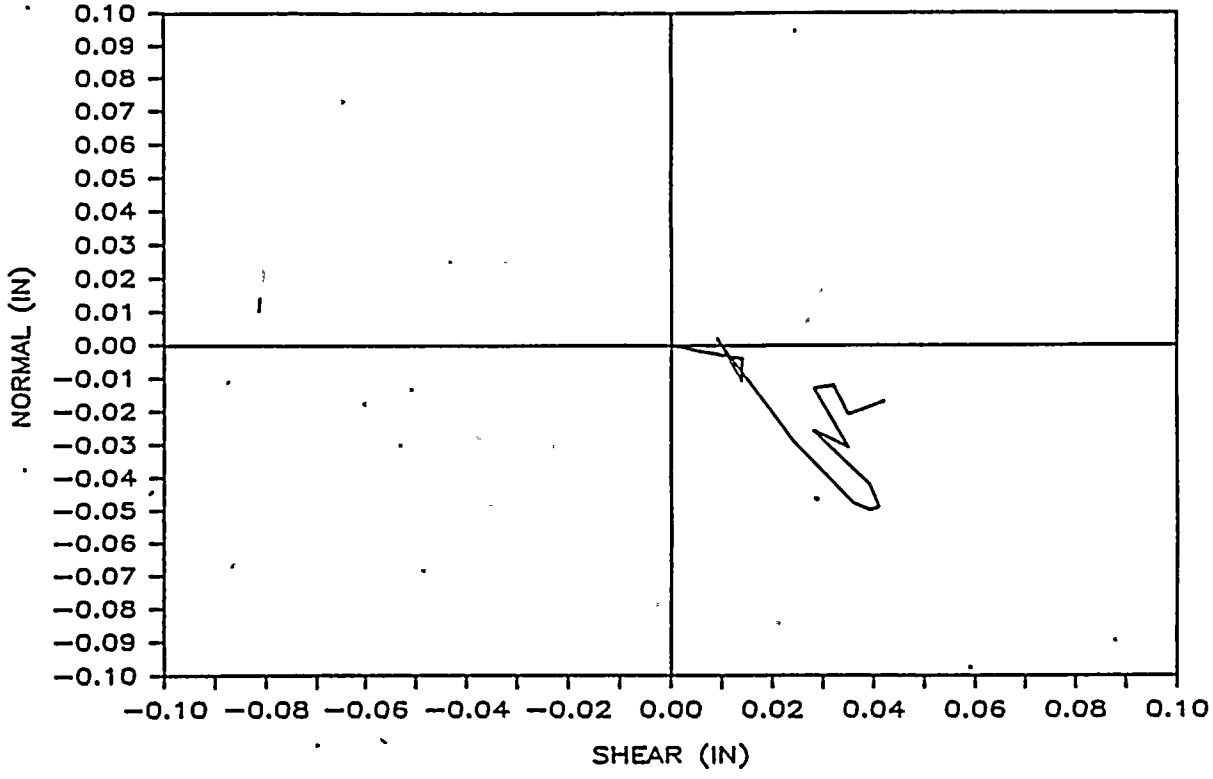


NORMAL VS SHEAR DISPLACEMENTS

GAP GAGE G3

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 63



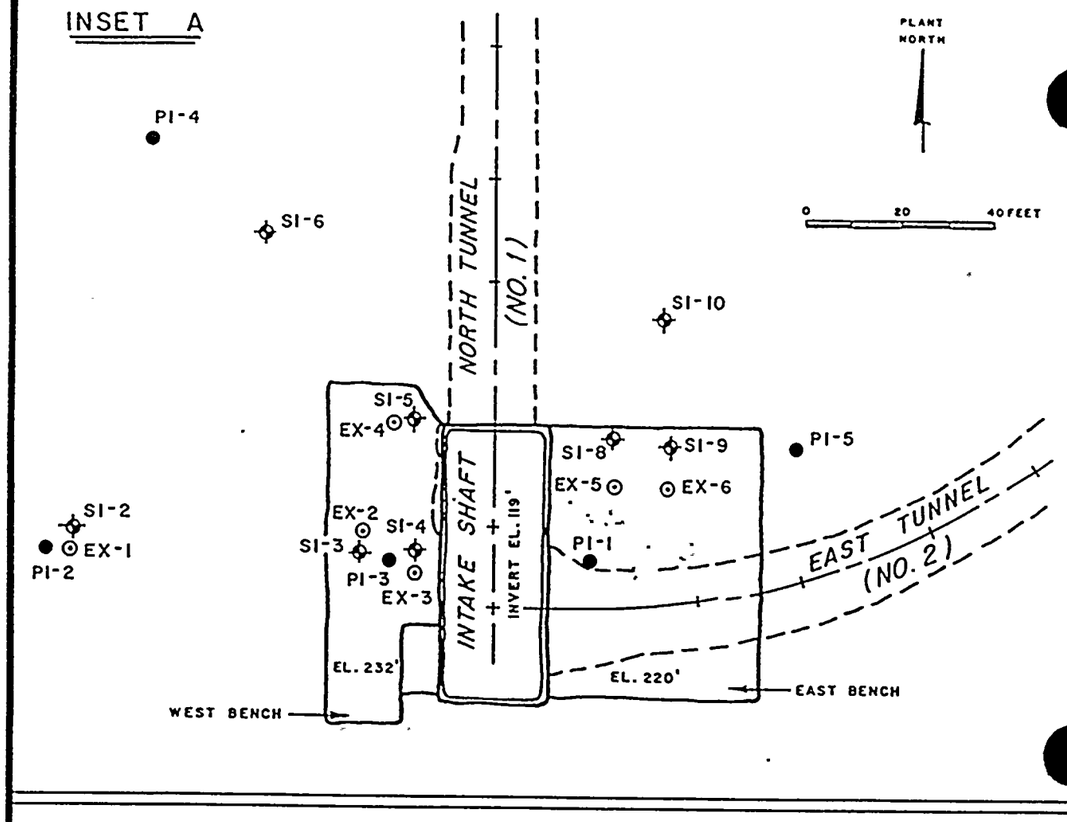
NORMAL VS SHEAR DISPLACEMENTS

GAP GAGE G4

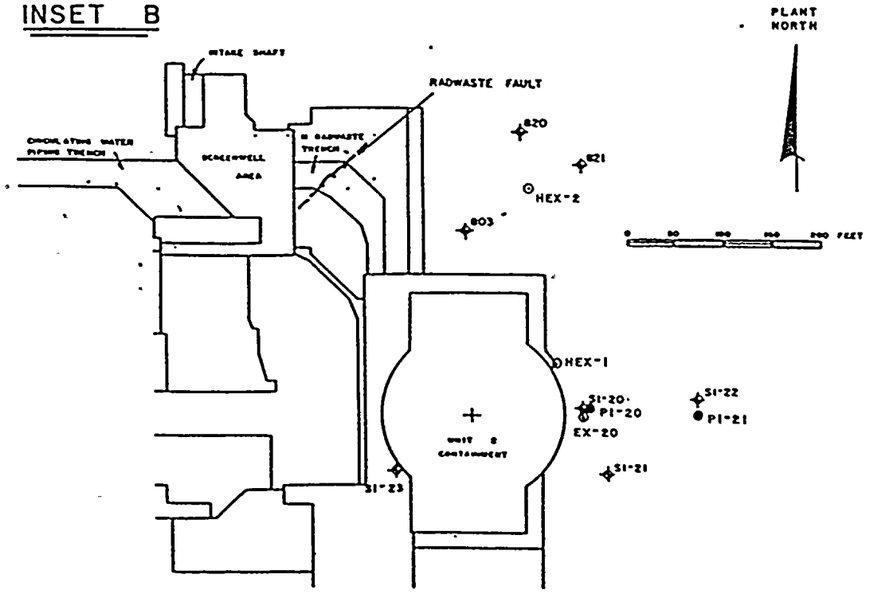
NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

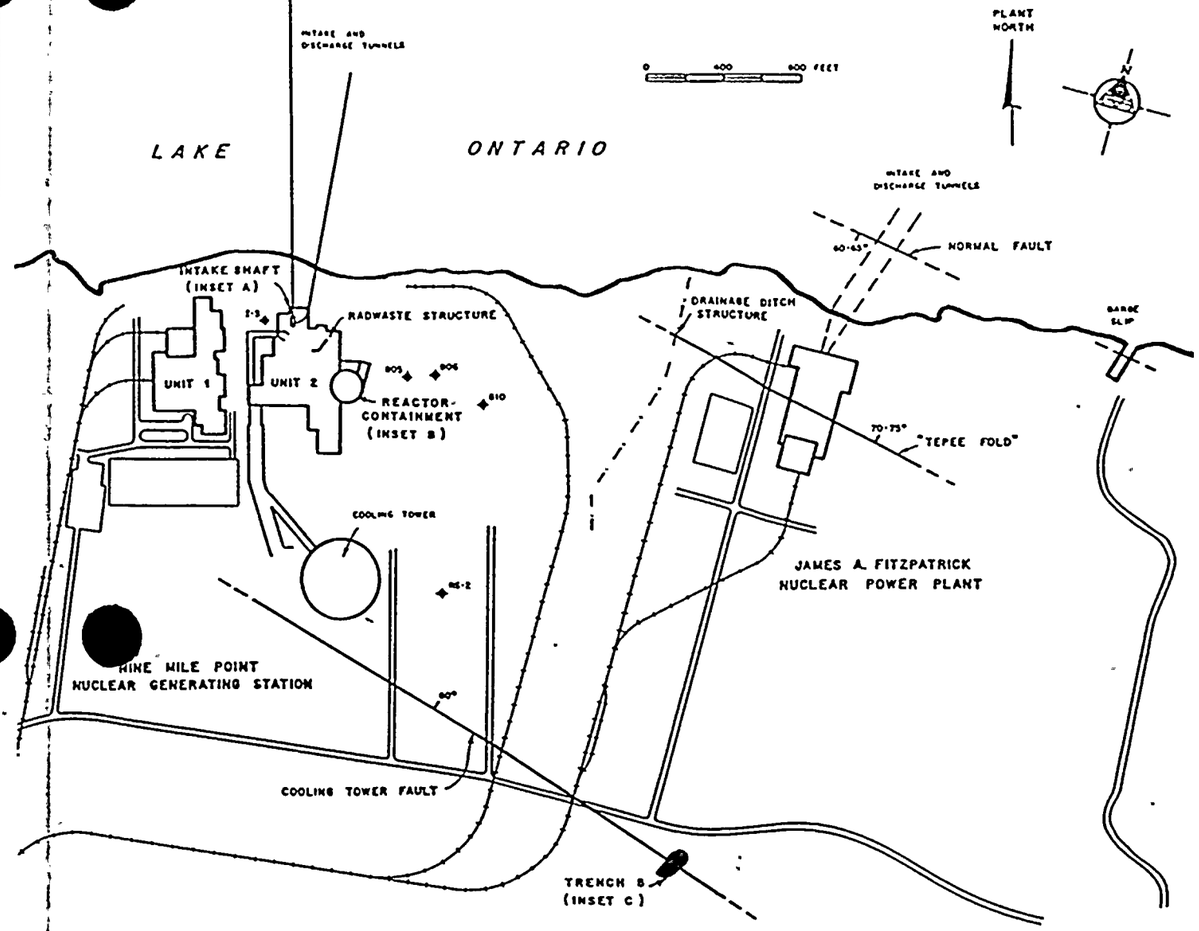
FIGURE 64

INSET A



INSET B





EXPLANATION:

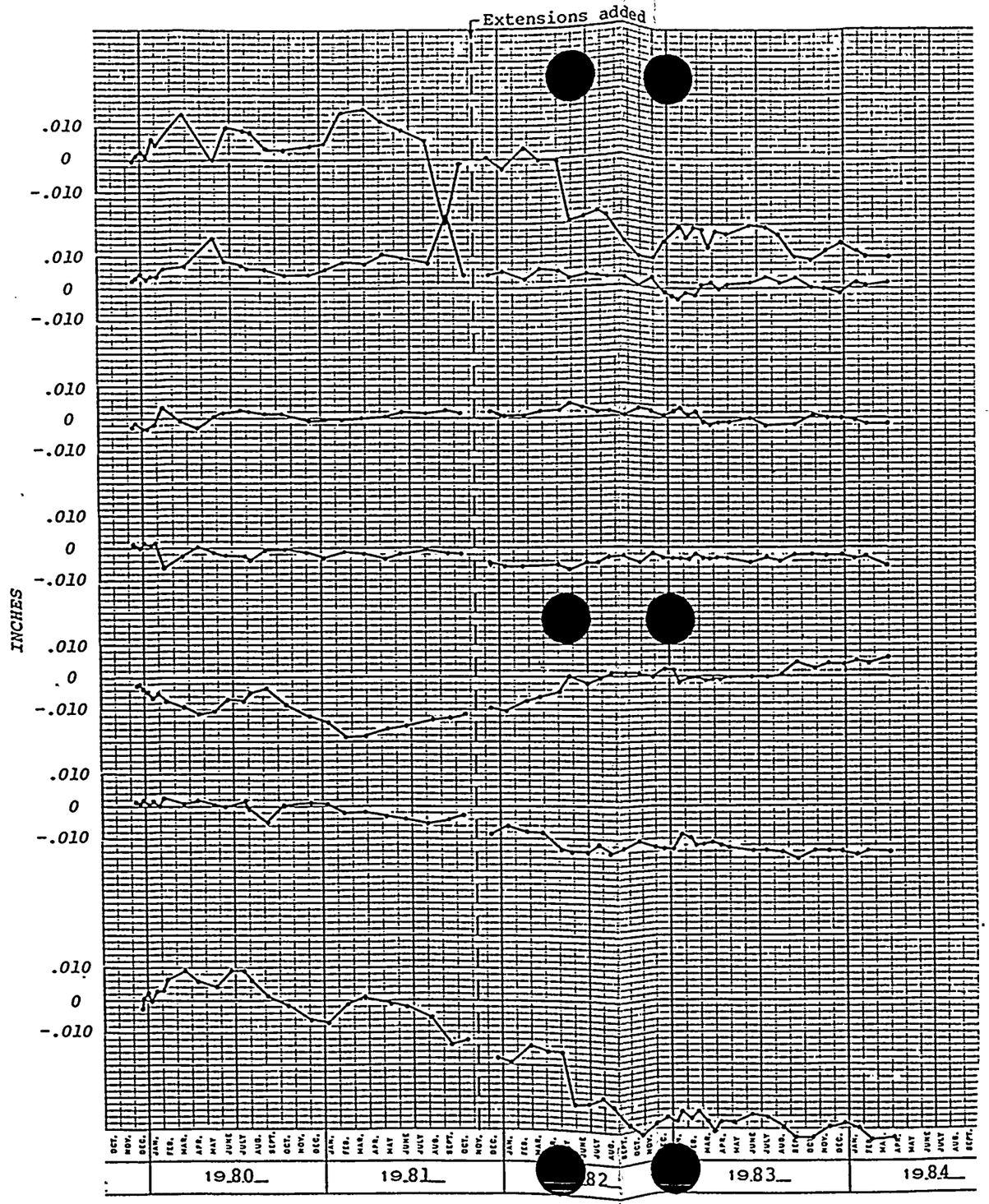
- INCLINOMETER LOCATION
- EXTENSOMETER LOCATION
- PIEZOMETER LOCATION

PLOT PLAN OF INSTRUMENTATION
AT NINE MILE POINT UNIT 2

8406040164-01

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 1.



ELEVATION

261.0'-227.0'

227.0'-213.0'

213.0'-196.0'

196.0'-172.0'

172.0'-130.0'

130.0'-97.0'

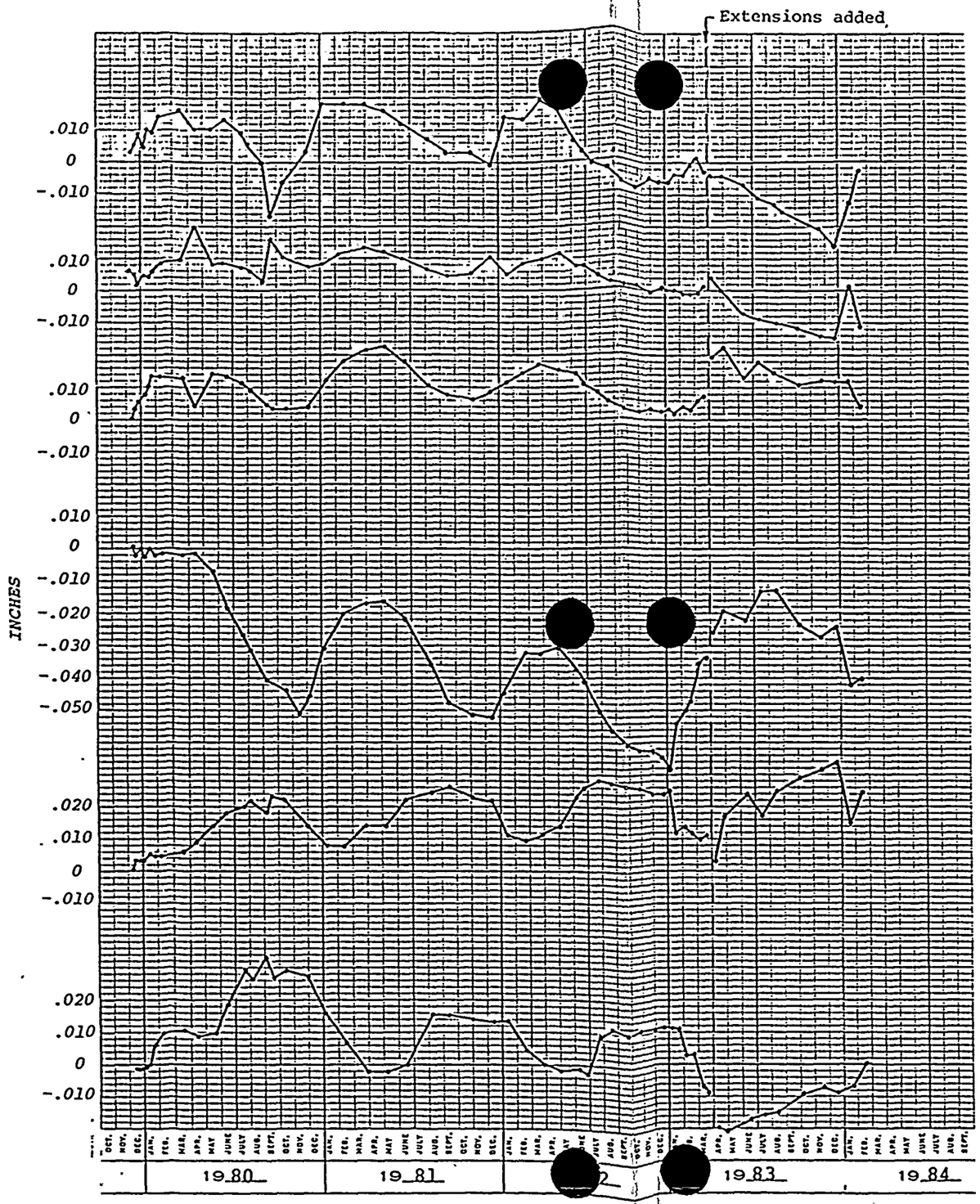
261.0'-97.0'
(Total)

8406040164-02

EXTENSOMETER EX-1

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 36



ELEVATION

235.0'-213.0'

213.0'-196.0'

196.0'-172.0'

172.0'-130.0'

130.0'-110.0'

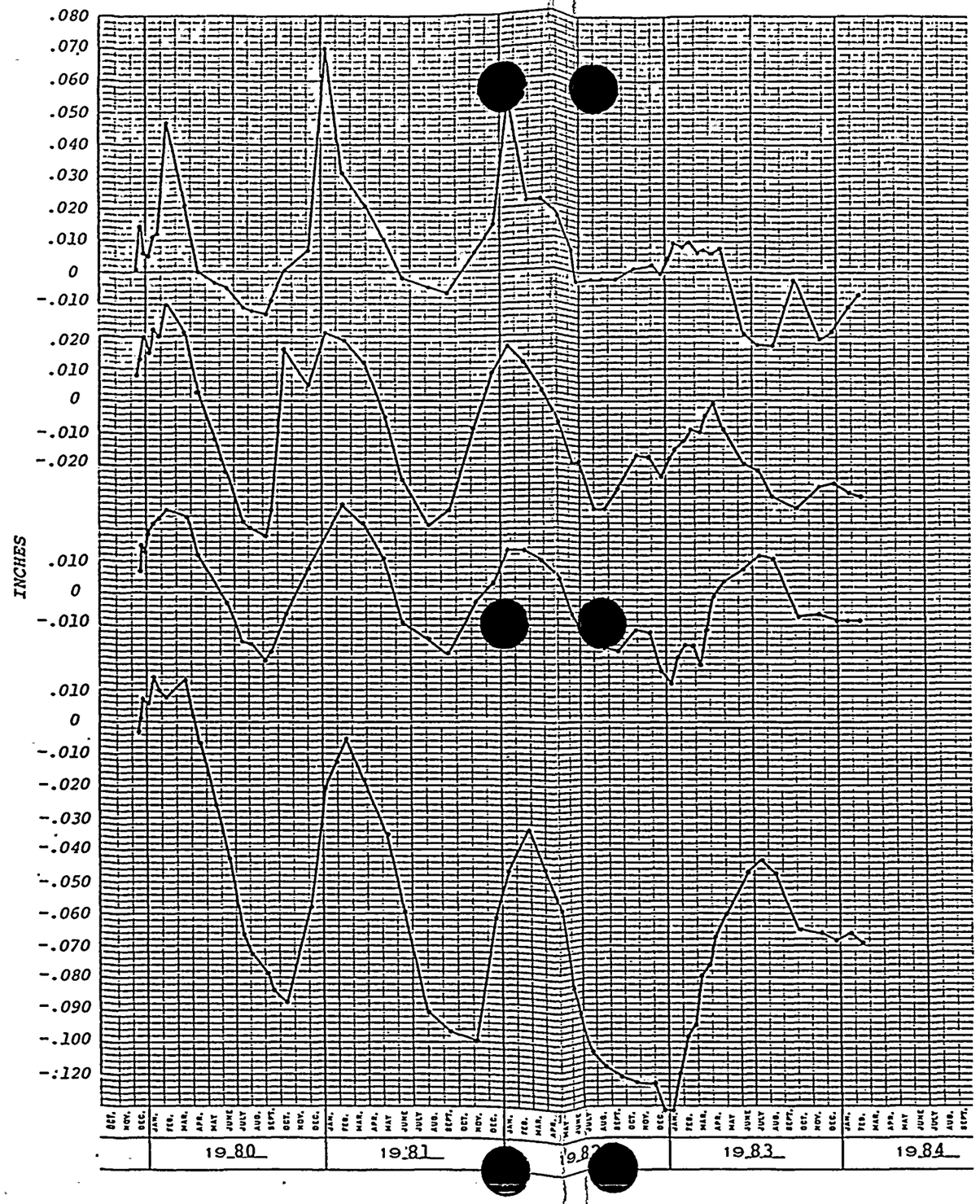
110.0'-73.0'

8406040164-03

EXTENSOMETER EX-2

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 37A



ELEVATION

235.0'-213.0'

213.0'-196.0'

196.0'-172.0'

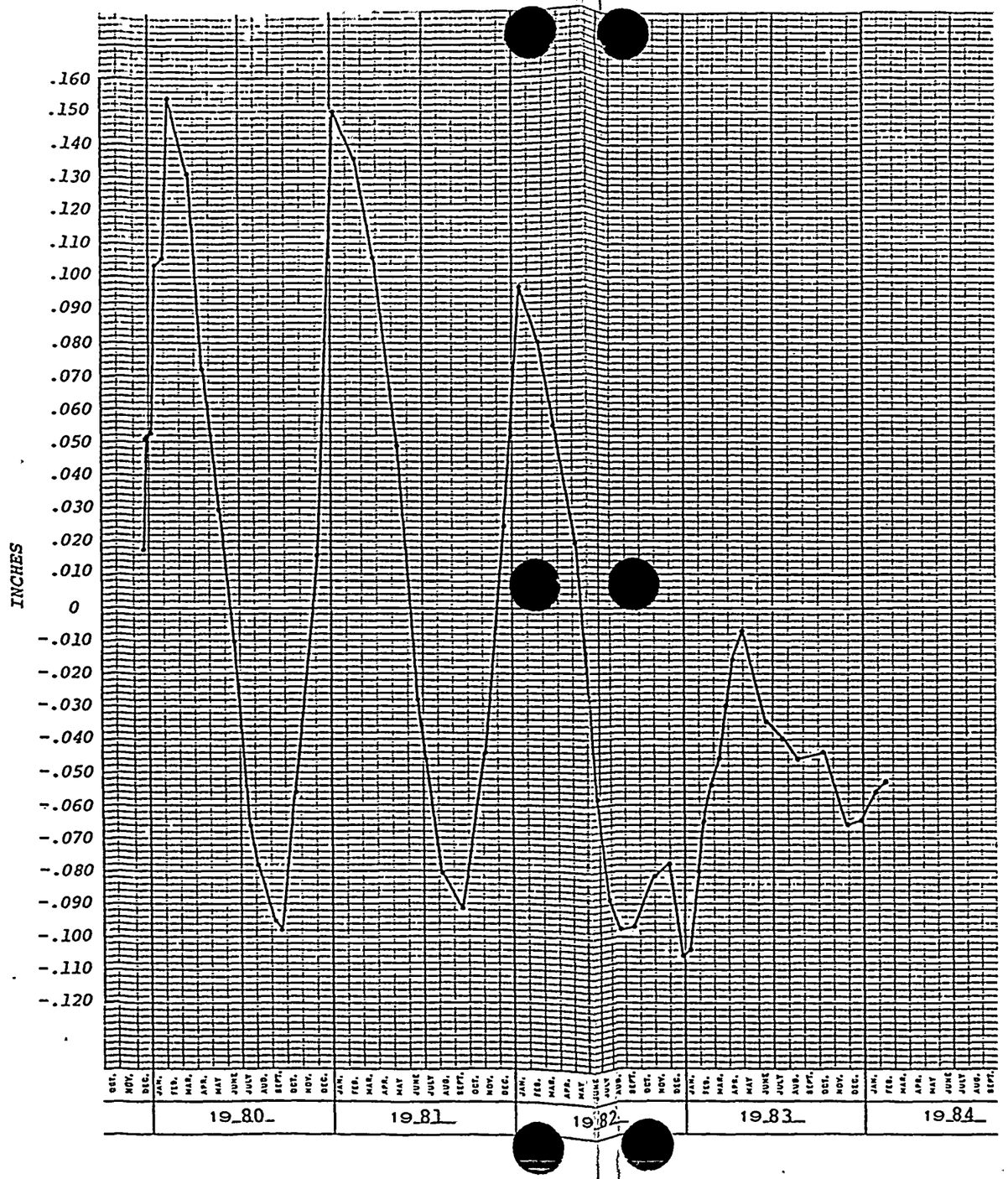
172.0'-130.0'

8406040164-04

EXTENSOMETER EX-3

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 38A



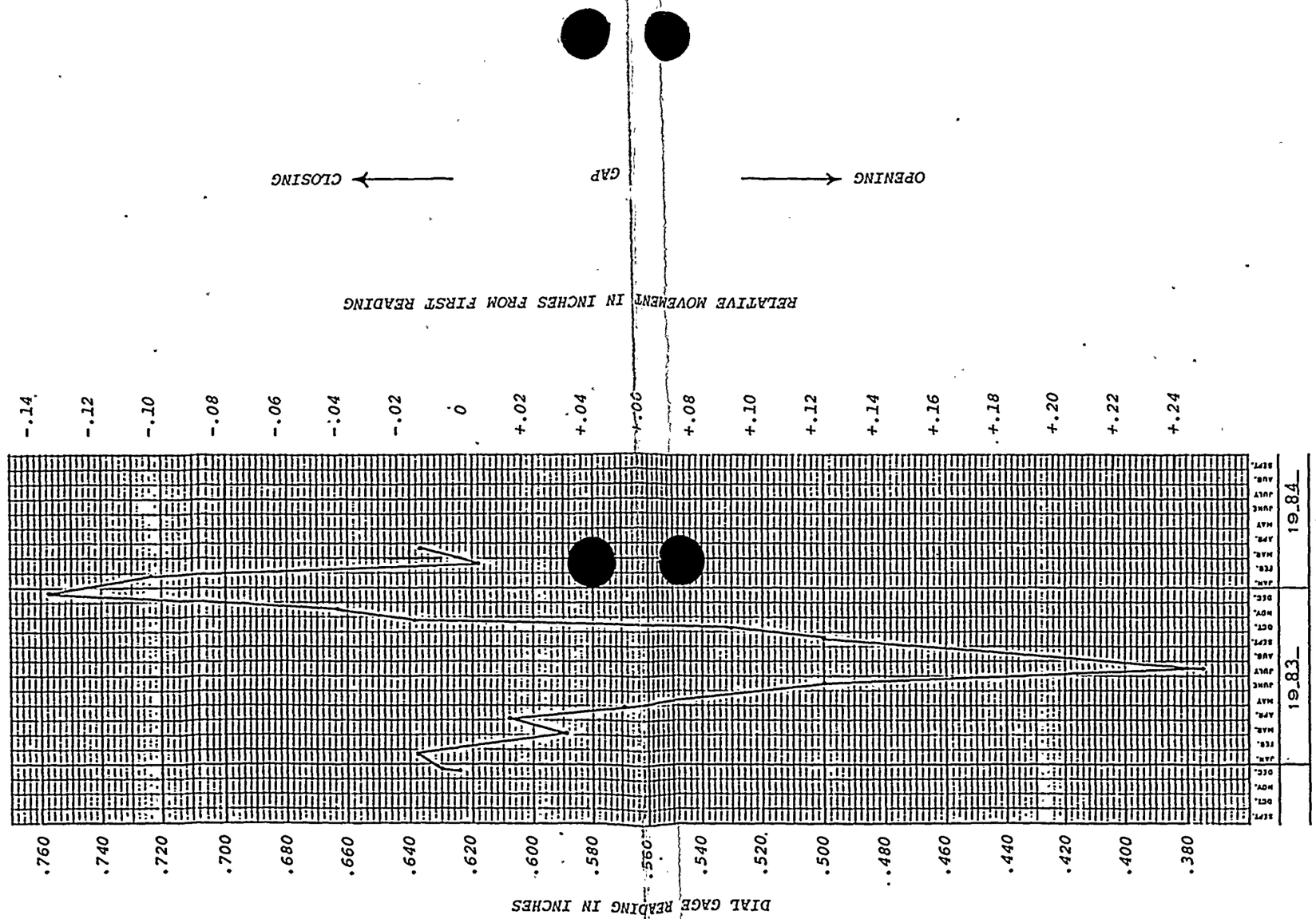
ELEVATION

235.0'-72.0'
(Total)

EXTENSOMETER EX-3

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 38C



TI APERTURE CARD

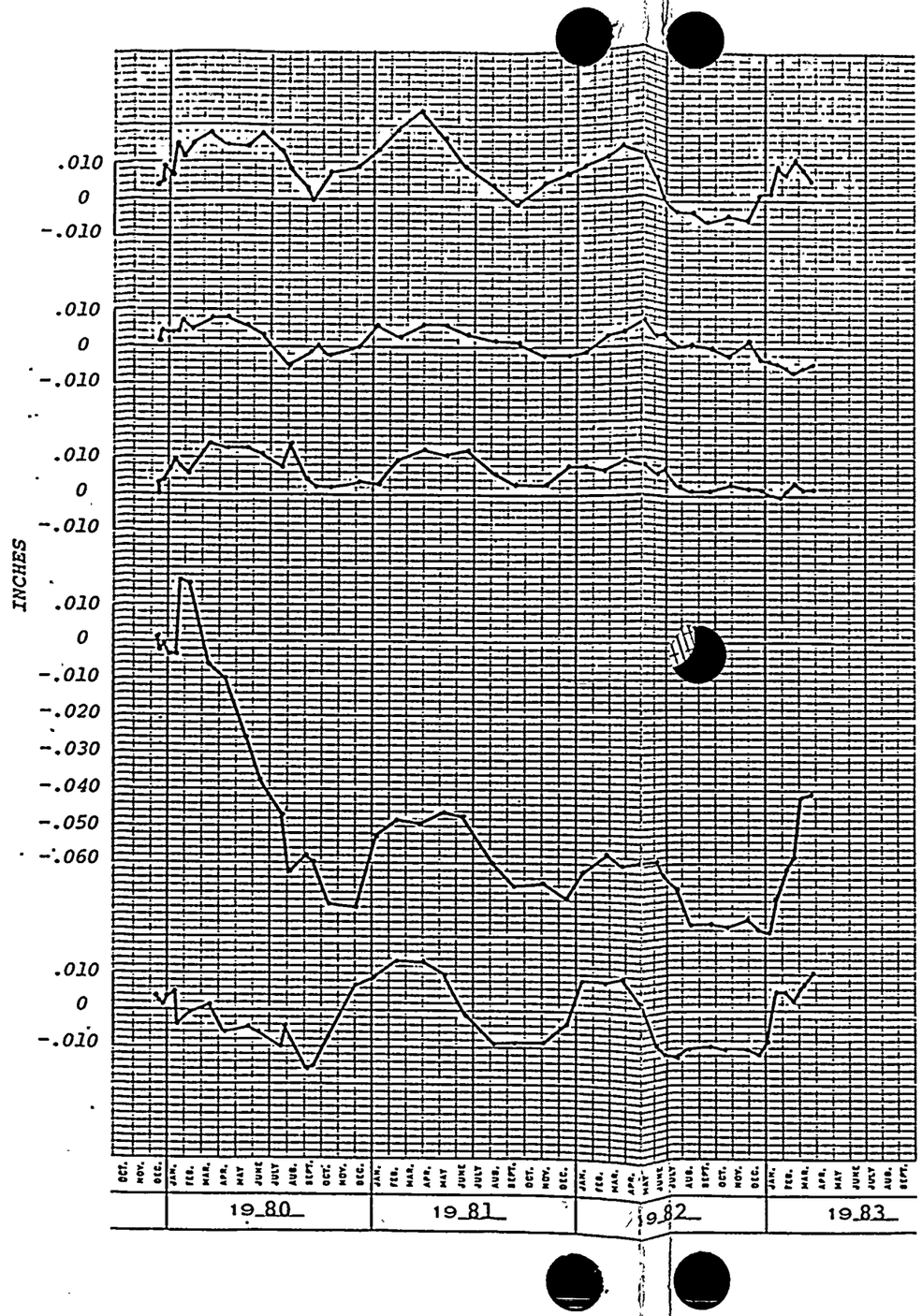
Also Available On Aperture Card

8406040164-06

GAP GAGE G3 SHEAR

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 53



ELEVATION

232.0'-213.0'

213.0'-196.0'

196.0'-172.0'

172.0'-130.0'

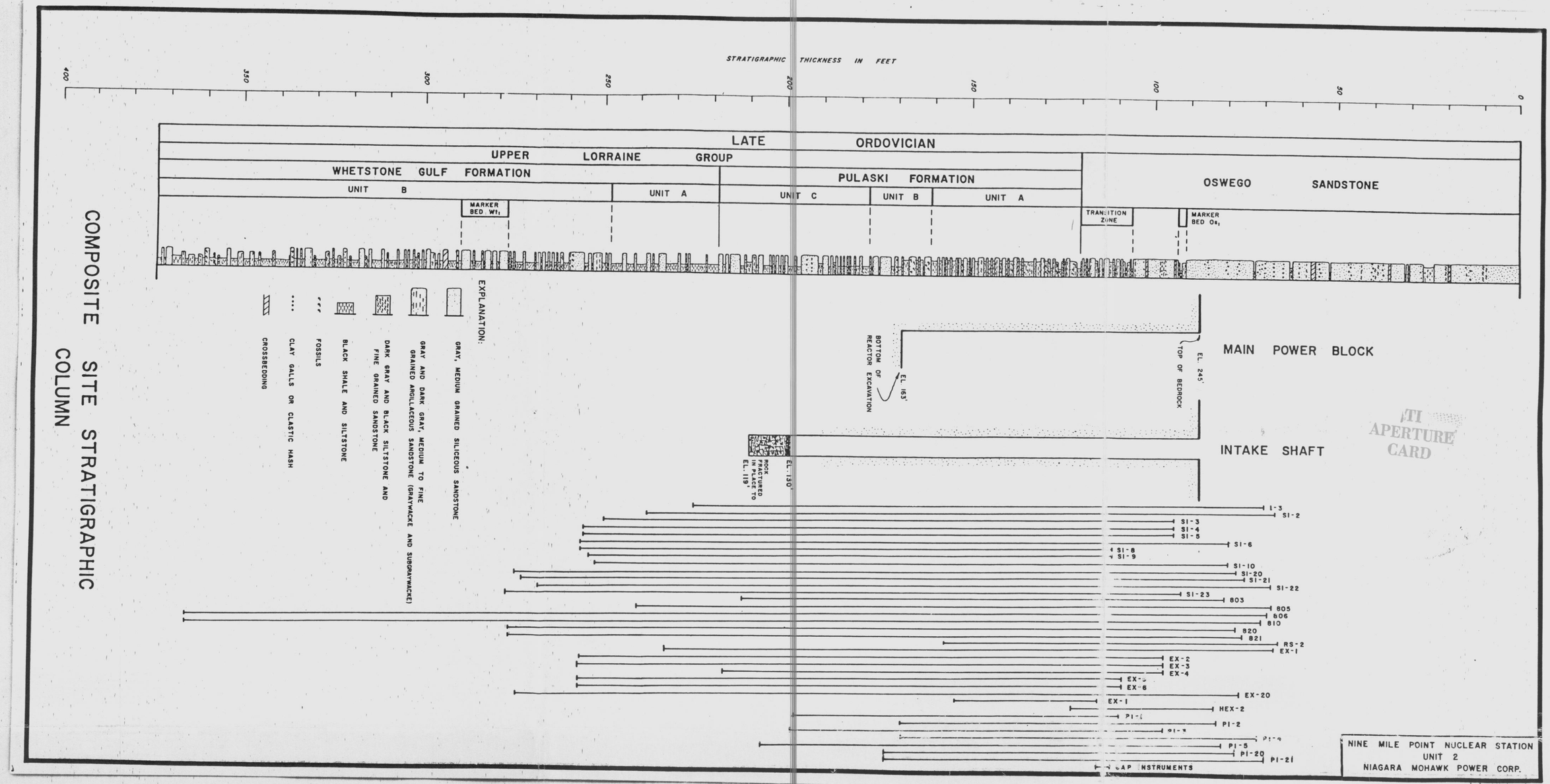
130.0'-113.0'

8406040164-07

EXTENSOMETER EX-4

NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 39A



NINE MILE POINT NUCLEAR STATION
UNIT 2
NIAGARA MOHAWK POWER CORP.

FIGURE 3

8406040164-08 D