DAILY IUE PEAK RADIATION LEVELS

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Each day the IUE satellite passes through the outer Van Allen radiation belts during the US2 shift. The particles trapped in the radiation belts cause increased fogging on the cameras during the time of this passage. The radiation background thus limits the length of the exposures that can be obtained during the second US shift. This communication is a continuation of the work reported by Taylor and Imhoff (1986, NASA IUE Newsletter No. 29, p. 31) and earlier articles.

The IUE Observatory monitors the peak radiation levels which are encountered each day. These levels are recorded as a voltage on the Flux Particle Monitor (FPM). The readings may be converted to an equivalent exposure rate for the most sensitive portions of the camera by:

$$\text{fogging rate (DN/hour)} = K * 10^{FPM}$$

where K=1.0 for the SWP camera, K=1.3 for the LWP, and K=0.7 for the LWR camera at its reduced UVC voltage. Thus, when FPM=2.0 volts the fogging occurs at a rate of 100 DN/hr for the SWP camera, 130 DN/hr for the LWP, and 70 DN/hr for the LWR.

The radiation background typically peaks during US2. Figure 1 depicts the radiation variations over US1 and US2 for three recent shifts. These shifts took place within a time interval of five days, and illustrate how rapidly dramatic changes in the radiation conditions can occur. Note that the radiation rises fairly early in US1 for two of the three days. This behavior has been the predominant trend for the last several months.

Figures 2 and 3 depict the daily variation of the peak FPM for 1986 and 1987, respectively. Occasional variations in phase with solar rotation and solar activity levels may be seen. The number of days in each month that the radiation peaked at specific levels is given in Tables 1 through 3.

Figure 4 depicts the radiation fluctuations over the last ten years. High radiation days are defined as any day in which the radiation peaks at 2.4 volts or above. During low radiation days the radiation peaks below 1.7 volts. The number of high and low radiation days per month is plotted against the month. The months begin with March 1978 and extend to April 1988, and the axis is labelled in years. The peak in low radiation seen in the first years of the IUE mission is due to the solar maximum, and should be seen again within the next few years.

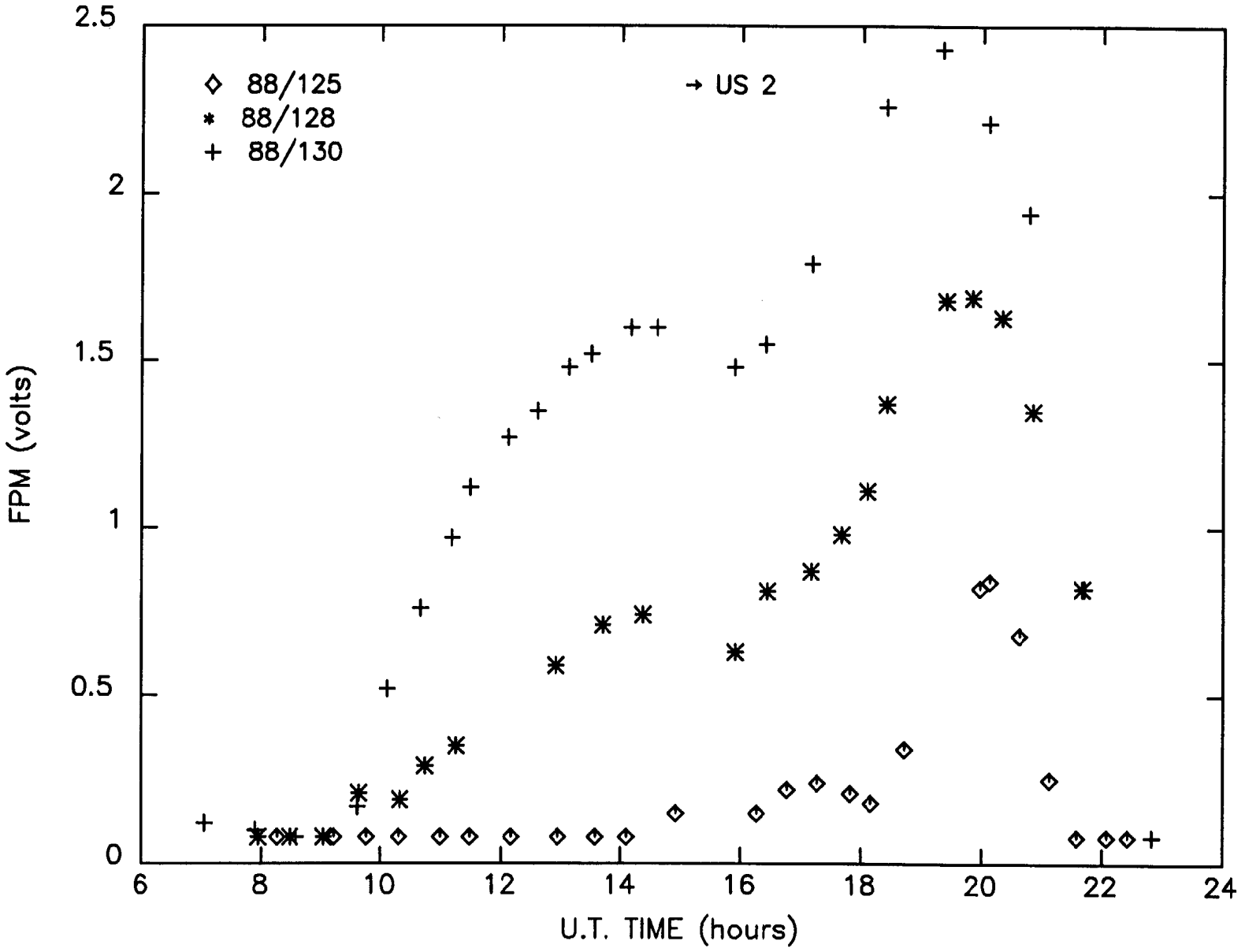

◇ 88/125
* 88/128
+ 88/130
→ US 2
FPM (volts)
U.T. TIME (hours)
0
0.5
1
1.5
2
2.5
6
8
10
12
14
16
18
20
22
24

FIGURE 1

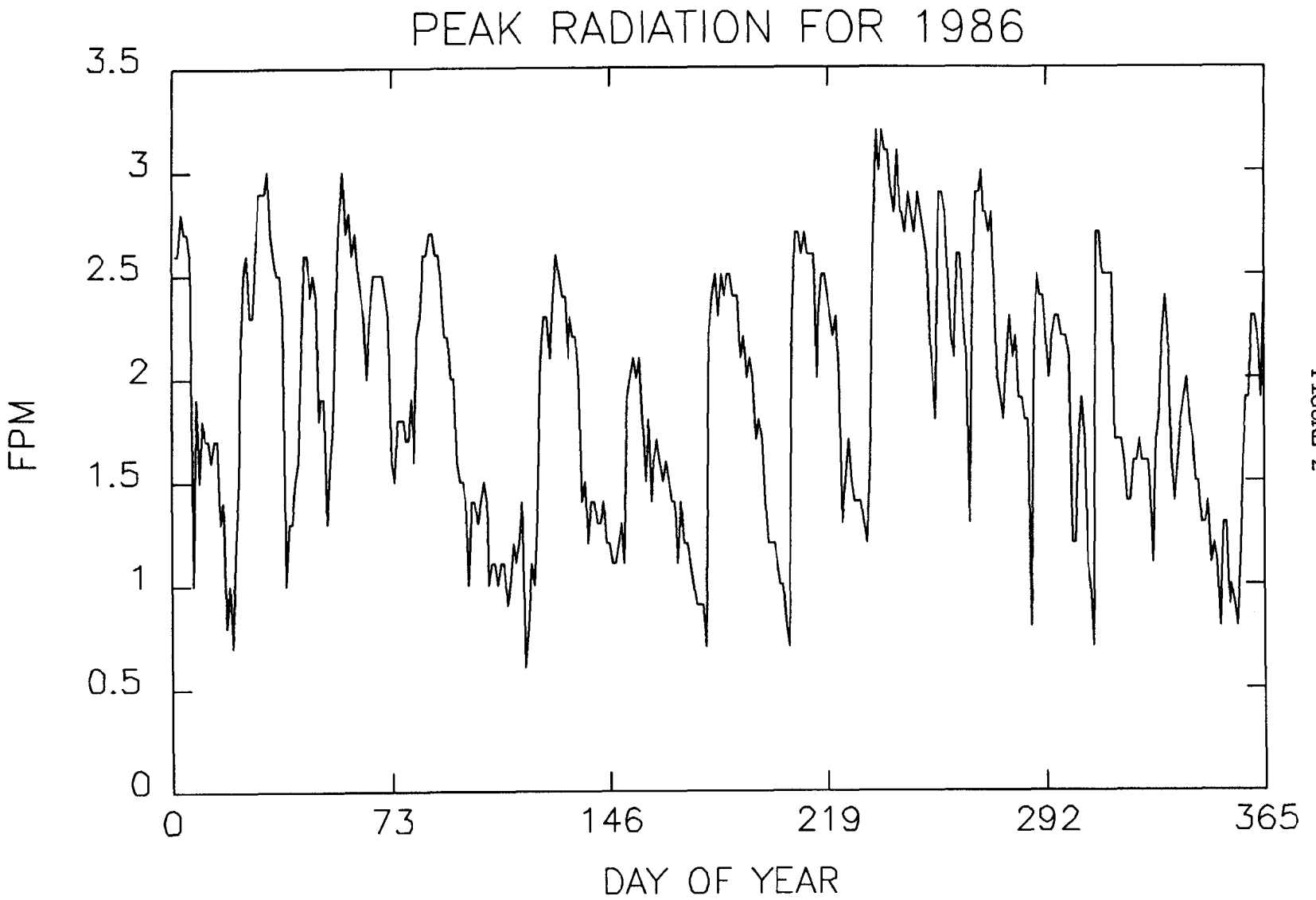

PEAK RADIATION FOR 1986
FPM
3.5
3
2.5
2
1.5
1
0.5
0
0
73
146
219
292
365
DAY OF YEAR

FIGURE 2

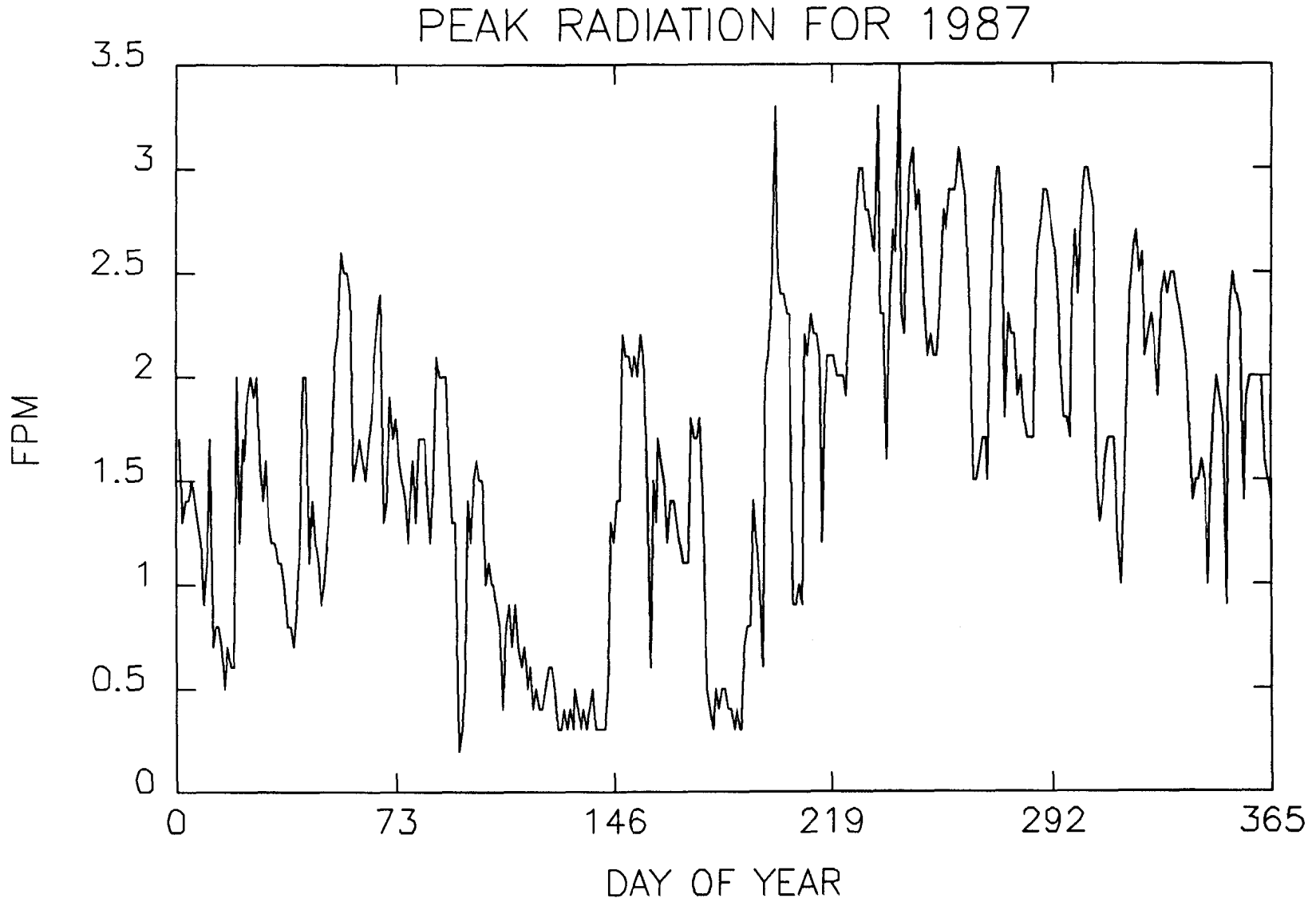

PEAK RADIATION FOR 1987
FPM
3.5
3
2.5
2
1.5
1
0.5
0
0
73
146
219
292
365
DAY OF YEAR

FIGURE 3

TABLE 1

NUMBER OF DAYS REACHING PEAK RADIATION LEVELS

PEAK MONITOR READING	1986 JAN	FEB	MAR	APR	MAY	JUNE	MAXIMUM FOGGING RATE (DN/HOUR) K=1
FPM<1.0	2	0	0	3	0	4	< 10
1.0<=FPM<1.7	8	7	3	23	17	15	10-50
1.7<=FPM<2.0	6	4	6	0	0	4	50-100
2.0<=FPM<2.4	3	2	6	4	9	5	100-250
2.4<=FPM<2.8	6	11	16	0	5	2	250-500
2.8<=FPM<3.0	6	2	0	0	0	0	500-1000
FPM>=3.0	0	2	0	0	0	0	> 1000

PEAK MONITOR READING	1986 JUL	AUG	SEP	OCT	NOV	DEC	TOTAL FOR YEAR	MAXIMUM FOGGING RATE (DN/HOUR) K=1
FPM<1.0	2	0	0	1	1	4	17	< 10
1.0<=FPM<1.7	7	9	1	2	13	15	120	10-50
1.7<=FPM<2.0	3	1	1	8	7	7	47	50-100
2.0<=FPM<2.4	7	6	6	15	2	4	69	100-250
2.4<=FPM<2.8	12	6	9	4	7	1	79	250-500
2.8<=FPM<3.0	0	3	12	1	0	0	24	500-1000
FPM>=3.0	0	6	1	0	0	0	9	> 1000

TABLE 2

NUMBER OF DAYS REACHING PEAK RADIATION LEVELS

PEAK MONITOR READING	1987 JAN	FEB	MAR	APR	MAY	JUNE	MAXIMUM FOGGING RATE (DN/HOUR) K=1
FPM<1.0	9	5	0	17	24	6	< 10
1.0<=FPM<1.7	14	15	15	13	4	14	10-50
1.7<=FPM<2.0	5	0	9	0	0	5	50-100
2.0<=FPM<2.4	3	4	1	0	3	5	100-250
2.4<=FPM<2.8	0	4	1	0	0	0	250-500
2.8<=FPM<3.0	0	0	0	0	0	0	500-1000
FPM>=3.0	0	0	0	0	0	0	> 1000

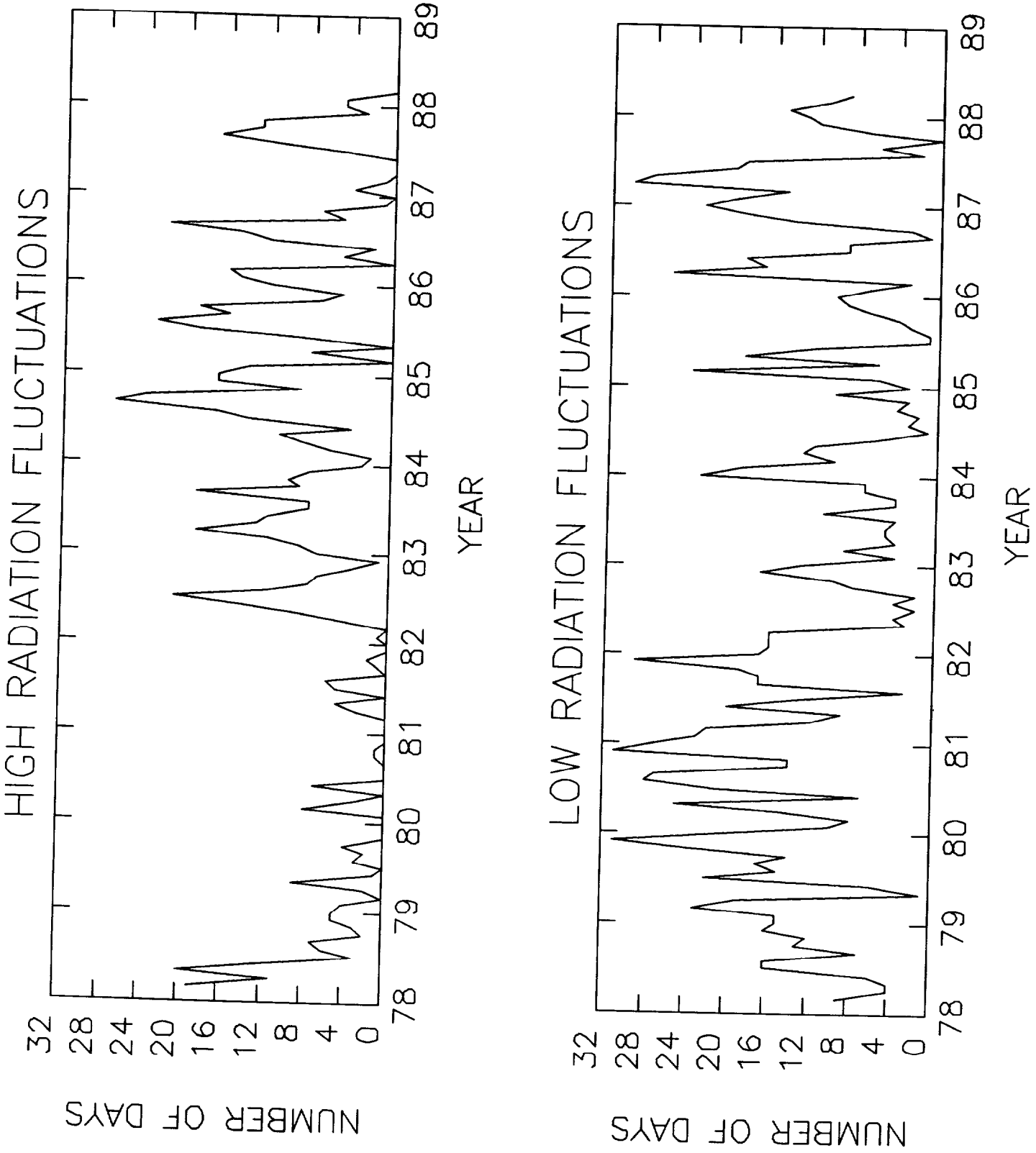
PEAK MONITOR READING	1987 JUL	AUG	SEP	OCT	NOV	DEC	TOTAL FOR YEAR	MAXIMUM FOGGING RATE (DN/HOUR) K=1
FPM<1.0	15	0	0	0	0	1	77	< 10
1.0<=FPM<1.7	4	2	6	0	7	11	105	10-50
1.7<=FPM<2.0	0	2	0	9	5	5	40	50-100
2.0<=FPM<2.4	7	15	7	5	5	11	71	100-250
2.4<=FPM<2.8	4	5	5	9	11	3	42	250-500
2.8<=FPM<3.0	0	3	8	4	2	0	17	500-1000
FPM>=3.0	1	4	4	4	0	0	13	> 1000

TABLE 3

NUMBER OF DAYS REACHING PEAK READIATION LEVELS

PEAK MONITOR READING	1988 JAN	FEB	MAR	APR	MAXIMUM FOGGING RATE (DN/HOUR) K=1
FPM<1.0	5	6	1	1	< 10
1.0<=FPM<1.7	8	9	10	8	10-50
1.7<=FPM<2.0	5	7	8	5	50-100
2.0<=FPM<2.4	8	2	12	16	100-250
2.4<=FPM<2.8	4	4	0	0	250-500
2.8<=FPM<3.0	0	1	0	0	500-1000
FPM>=3.0	1	0	0	0	> 1000

FIGURE 4


HIGH RADIATION FLUCTUATIONS
NUMBER OF DAYS
YEAR
LOW RADIATION FLUCTUATIONS
NUMBER OF DAYS
YEAR