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Radiation level decay in the U-line

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EP&S DIVISION TECHNICAL NOTE

No. 106

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Introduction

Shortly after the removal of the wide band horns from the FEB tunnel on February 2, 1984, we began measuring, at roughly weekly intervals, the radiation levels at several specific locations in and around the area of the "inner tunnel". The motivation for this was to measure the absolute levels and to determine the rate which the steel and concrete structure was cooling down. This, we hoped, would give us a better estimate for the accumulated dose that people removing the steel would receive and show what benefits would be gained by waiting longer.

The Measurement

The instrument used to make this measurement was the XETEX 302B Digital Exposure Ratemeter. Health physics has three of these instruments on hand for use in routine monitoring. Some initial confusion was encountered with the first sets of readings simply because we did not at first realize the need for tighter control of the measuring instruments. Initially no attempt was made to identify which instrument was which. Unfortunately the basic accuracy of this particular unit is only ±15% and so trying to make a decay rate measurement of something on the order of months (we were taking samples once a week) is understandably difficult. The readings on the instrument itself vary ±10% from sample to sample and, from time to time, instruments are sent for "recalibration" where unknown adjustments are made.

Once these problems became apparent, we decided to "reserve" one instrument (XETEX 203B S/N 11057) for the purpose of making the measurements. Two months have now passed and a consistent set of readings taken; the results are presented below.

The Results

Figure 1 shows a schematic view of the tunnel area where the measurements were taken. Locations (2), (3), and (5) were selected for plotting on the graph as representative of the decay of the iron and concrete "inner tunnel" since this is the material that is being considered for removal. The table contains the data for all nine locations, as well as data taken with a second XETEX instrument. This second instrument, while identified by number, was not controlled as was the first instrument.

Readings from the location (2), (3) and (5), when fitted to an exponential, show an average half life of around 97 days. While it appears to still be decaying at roughly that rate, we must be aware that in time the presence of other longer half life products may become apparent making predictions using a half life of 97 days the "most optimistic" case.

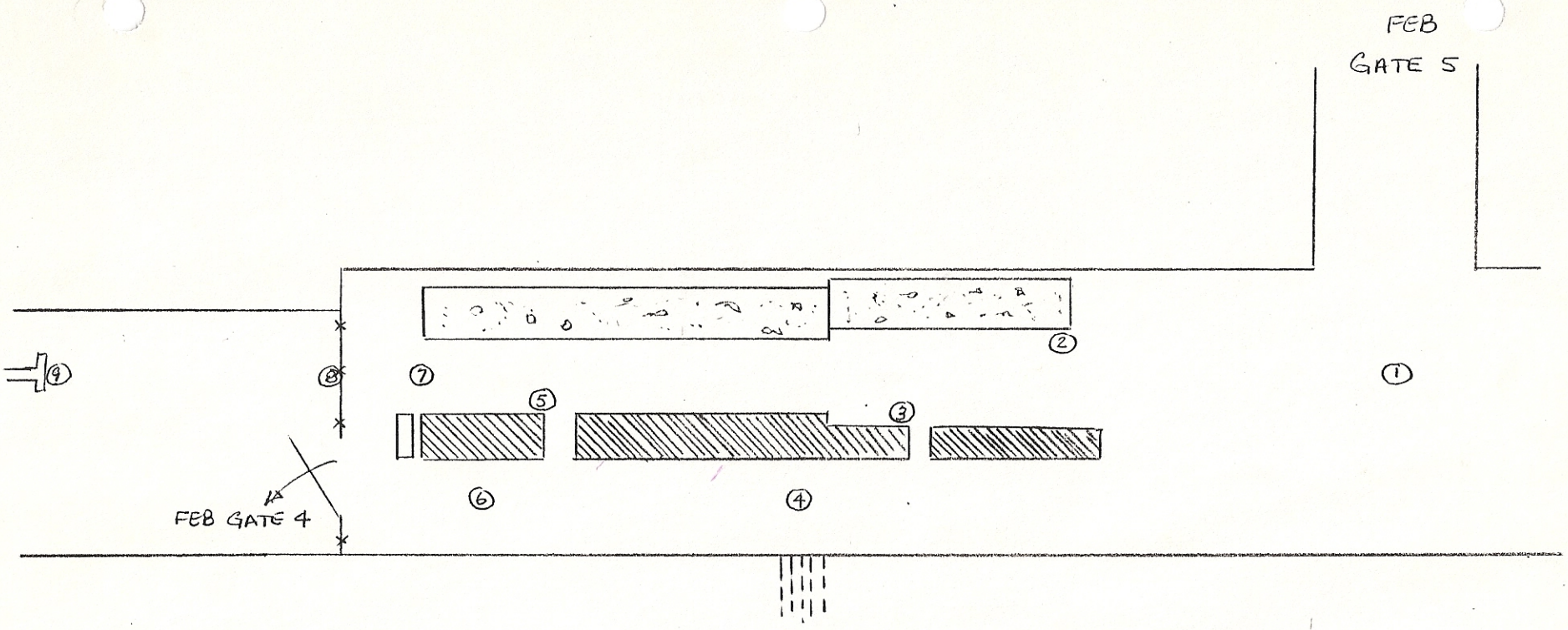
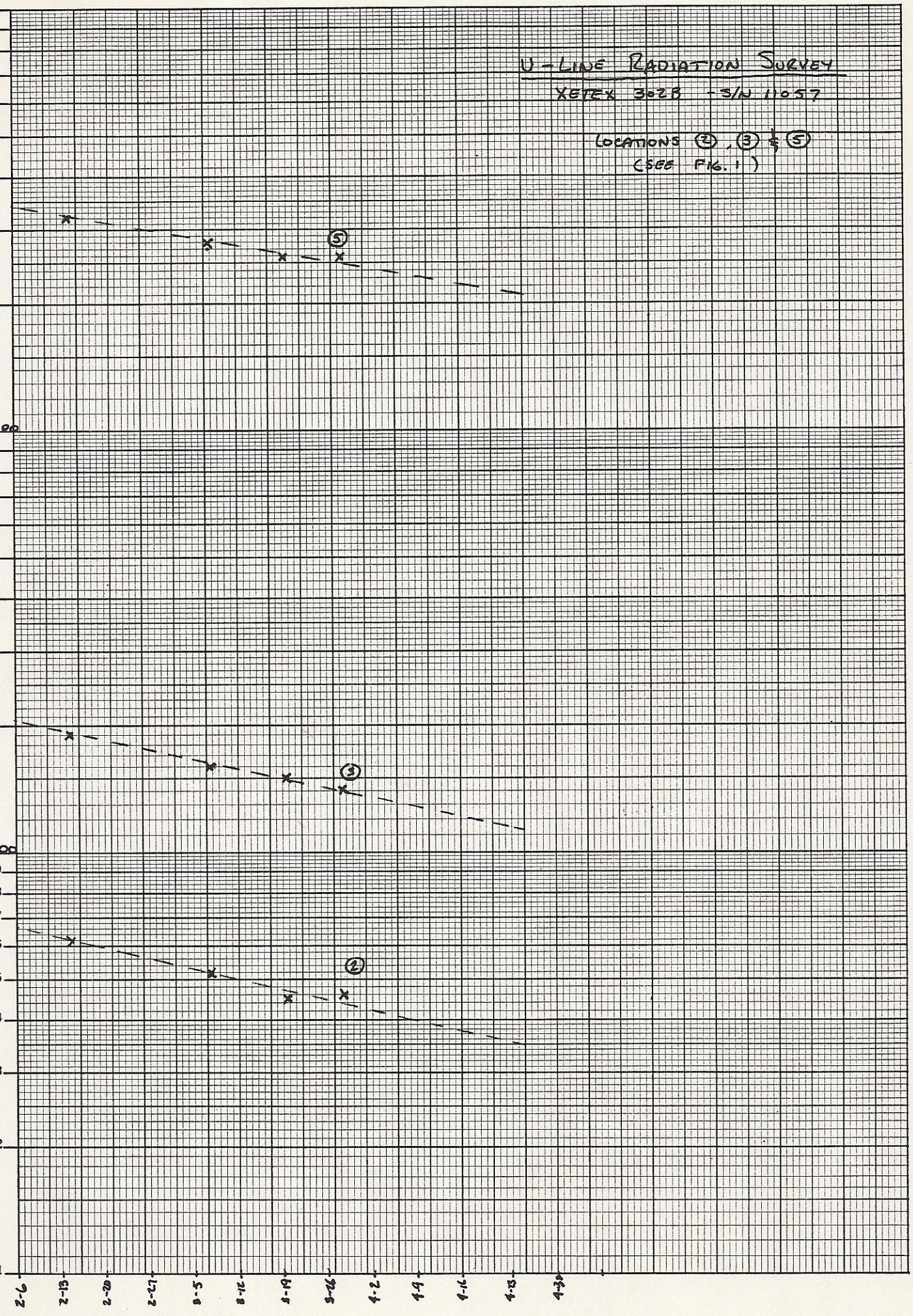


FIGURE 1 - SCHEMATIC VIEW OF HORN "INNER" TUNNEL, THE CIRCLED NUMBERS INDICATE THE MEASUREMENT POINTS.

U-LINE RADIATION SURVEY

XETEX 3028 - S/N 11057

LOCATIONS ②, ③ & ⑤
(SEE FIG. 1)



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4-10-84

FEB Radiation Survey Data

Taken with XETEX 302B Instr. – S/N 11057

(Readings in MR/HR unless otherwise noted)

Location	2-14-84	3-7-84	3-19-84	3-28-84
1	60	50	50	40
2	610	510	450	460
3	1.90R	1.61R	1.50R	1.43R
4	60	50	60	50
5	32.0R	28.0R	25.8R	25.8R
6	310	250	280	260
7	3.9R	3.1R	3.0R	2.90R
8 *	400	360	350	360
9 *	140	170	140	120

FEB Radiation Survey Data

Taken with XETEX 302B Instr – No. 88044

Location	2-6-84	2-21-84	3-19-84	3-28-84
1	70	70	50	60
2	950	710	540	500
3	3.0R	2.3R	2.4R	2.05R
4	80	60	50	50
5	50R	43R	32.0R	31.0R
6	400	310	250	280
7	4.9R	6.8R	3.8R	4.10R
8 *	450	450	430	370
9 *	200	150	140	130

* Iron curtain closed during these readings.

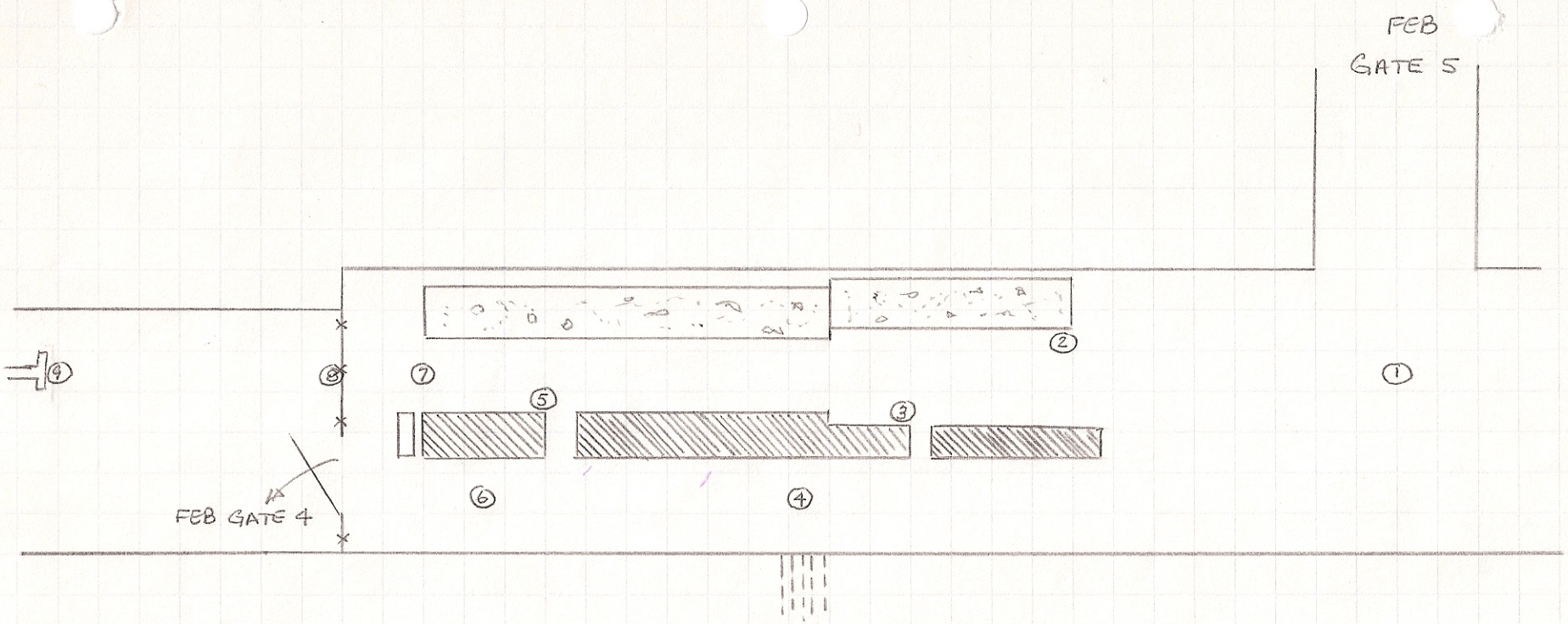
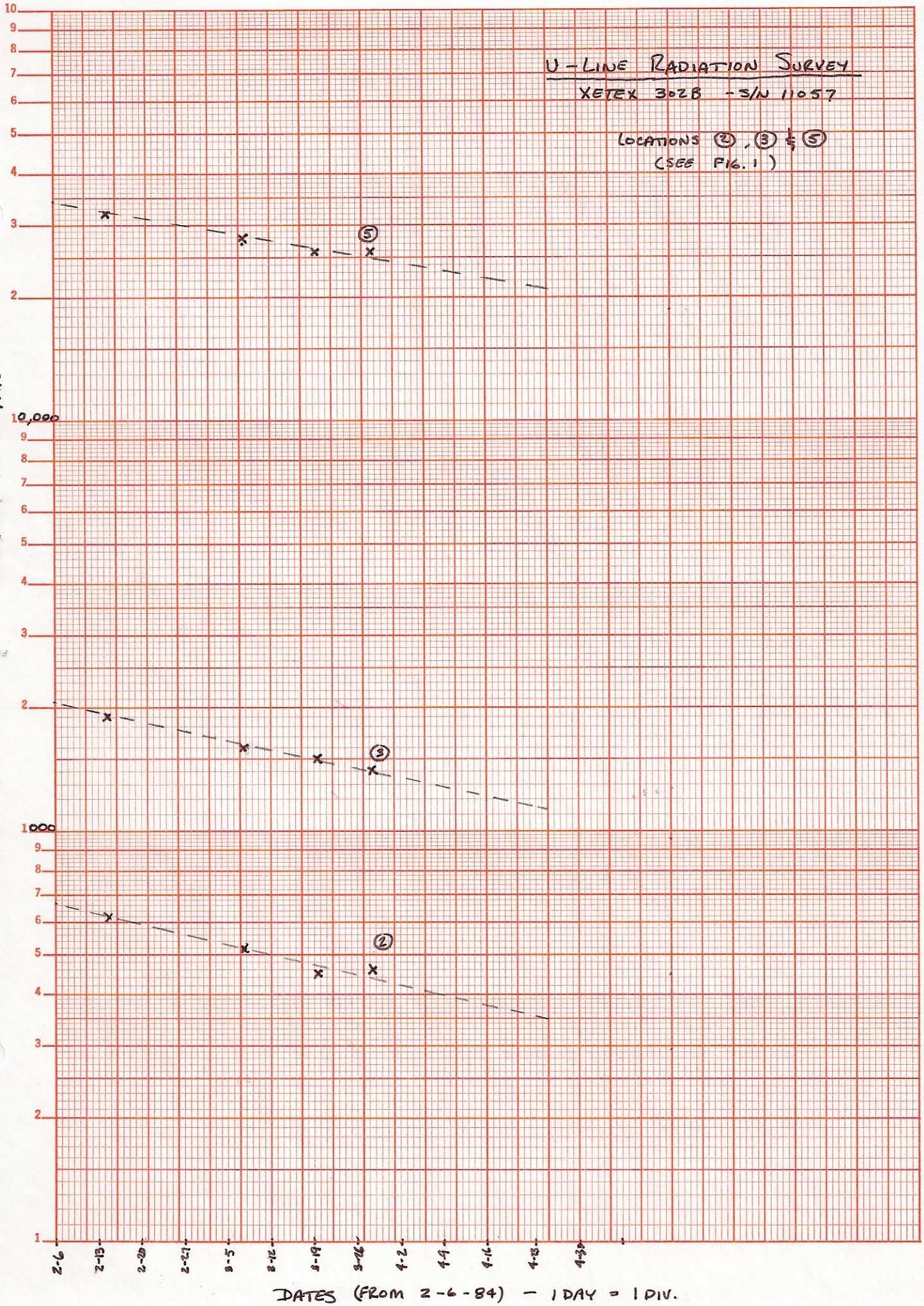


FIGURE 1 - SCHEMATIC VIEW OF HORN "INNER" TUNNEL, THE CIRCLED NUMBERS INDICATE THE MEASUREMENT POINTS.

U-LINE RADIATION SURVEY

XETEX 302B -S/N 11057

LOCATIONS ②, ③ & ⑤
(SEE FIG. 1)



4-10-84

FEB Radiation Survey Data

Taken with XETEX 302B Instr. – S/N 11057

(Readings in MR/HR unless otherwise noted)

Location	2-14-84	3-7-84	3-19-84	3-28-84
1	60	50	50	40
2	610	510	450	460
3	1.90R	1.61R	1.50R	1.43R
4	60	50	60	50
5	32.0R	28.0R	25.8R	25.8R
6	310	250	280	260
7	3.9R	3.1R	3.0R	2.90R
8 *	400	360	350	360
9 *	140	170	140	120

FEB Radiation Survey Data

Taken with XETEX 302B Instr – No. 88044

Location	2-6-84	2-21-84	3-19-84	3-28-84
1	70	70	50	60
2	950	710	540	500
3	3.0R	2.3R	2.4R	2.05R
4	80	60	50	50
5	50R	43R	32.0R	31.0R
6	400	310	250	280
7	4.9R	6.8R	3.8R	4.10R
8 *	450	450	430	370
9 *	200	150	140	130

* Iron curtain closed during these readings.