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RADIOLOGICAL CONDITIONS IMMEDIATELY FOLLOWING THE 9/29/65 PRTR INCIDENT(a)

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DISCLAIMER

(a) This paper is based on work performed under United States Atomic Energy Commission Contract AT(45-1)-1830. Permission to publish is gratefully acknowledged.

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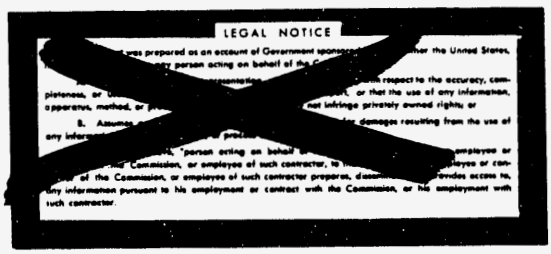
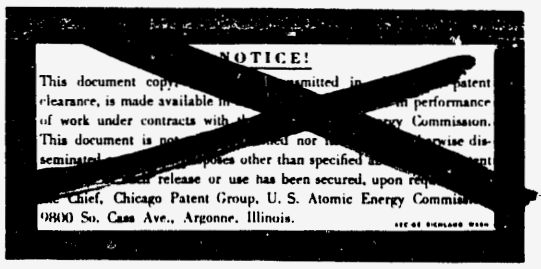
INTRODUCTION

On September 29, 1965, radioactive contamination was released to the containment vessel and several reactor systems of PRTR when approximately 700 grams of fuel material was lost from a ruptured fuel rod. The containment vessel immediately went into ventilation containment and remained in this condition for approximately 19 hours. During this period, one brief personnel entry was made to collect an air sample. A complete radiological survey of operating areas was made about six hours after restoration of ventilation. This report summarizes the radiological conditions observed immediately following the incident until controlled shutdown of the reactor was achieved and the situation was controlled.

SUMMARY

A summary is presented of the radiological conditions observed inside and outside the PRTR containment vessel following the fuel rod and pressure tube ruptures of September 29, 1965. No attempt is made to discuss the data, only to preserve it for future reference and use.





TIONS OUTSIDE THE 309 BUILDING (PRTR)

At 0645 on 9/29/65, approximately one and one-half hours after the incident, a s of check points were established on or near the road which encircles the 309 Building. rs of exposure rates were performed hourly at these check points. The locations of points are given in Figure 1. The results of surveys performed at various intervals iven in Table 1. By 0300 on 9/30/65, the exposure rate at each check point was less mR/hour. (Note: The PRTR came out of containment at 0034 on 9/30/65 and established flow at 0210.) The exposure rates decreased with an apparent half-life of approximatel urs. No surface contamination was detected on the ground or vehicles in the vicinity PRTR.

TIONS INSIDE SERVICE BUILDING AND M & M WING

. Exposure Rates and Surface Contamination

The Radiation Monitor on duty at the time of the incident measured exposure rates of 30 mR/hour and 200 mR/hour in the control room and maintenance shop, respectively, at approximately 0530. The exposure rates in the Rupture Loop Annex Equipment Room were noted as being normal. The exposure rate at Manhole #2 was 200 mR/hour. Check points were established at the step-off pad and control room at 0815 and measurements were made at about half hour intervals until 0800 on 9/30/65. Other check points were established at 1515 on 9/29/65 in the M & M Wing and Service Building. The locations of the check points and the results of the initial surveys are given in Figure 2 and Table 2, respectively. The measured exposure rates decreased with an apparent half-life of 4.5 hours. No surface contamination was detected in the building outside of established Radiation Zones.

. Airborne Contamination

Initial air samples collected in the control room by the Radiation Monitor on duty approximately one hour after the incident indicated an air concentration of $\sim 1 \times 10^{-6}$ μCi/cc of beta-gamma particulate contamination. Air samples were collected at one-half hour intervals starting at 0730 in the control room. The results of the air samples are presented in Figure 3. The radioactivity on the air samples decayed with an apparent half-life of 20 minutes. The initial air samples from the Rupture Loop Annex and Storage Basin indicated an air concentration of 3.1×10^{-7} μCi/cc and 2.2×10^{-8} μCi/cc respectively at 1445 on 9/29/65.

IONS INSIDE THE CONTAINMENT VESSEL

. Exposure Rates

The only indications of external exposure rates in the containment vessel, until a personnel entry was made at 1900 on 9/29/65, were RAM chamber recordings. The highest reading was obtained from a RAM chamber located in the Reactor Hall

on the steam drum enclosure. The readings from this chamber are plotted in Figure 4. An entry to the Reactor Hall was made at 1900 on 9/29/65. The exposure rate measured during this entry was 15 rad/hour including 4R/hour. The gamma component of this measurement agrees closely with the RAM chamber indication at 1900 hours. All other RAM chamber indications were below those of the chamber located in the Reactor Hall. Exposure rate measurements were obtained during personnel entries to various areas of the containment vessel to perform necessary functions. The time of the measurements and the results are given in Figure 5-11 and represent the first measurements taken at the indicated locations following the incident.

2. Surface Contamination

The first sample of smearable surface contamination was taken from the Reactor Hall floor at 2140 on 9/30/65. The radiation level measured from the sample was 80 mrad/hour and the radionuclides identified included ^{131}I, ^{133}I, ^{132}Te, ^{99}Mo and ^{140}La. A complete survey of the containment vessel was completed on 10/4/65. The levels of smearable contamination are given in Table 3. The major contaminants identified in the samples included those given above and ^{141}Ce, ^{136}Cs, and possibly ^{95}Zr - ^{95}Nb and ^{103}Ru.

3. Airborne Contamination

Four samples of the airborne iodine contamination in the Reactor Hall were collected while the vessel was in containment. Additional samples were collected after the vessel was taken out of containment. The results of airborne iodine samples are given in Table 4, for the period of time between the event and the morning of 10/1/65.

The apparent discrepancies between the results of the samples collected at 0700 and 1700 on 9/29/65 and the samples collected at 1900 on 9/29/65 may be explained by the fact that the first two samples were collected remotely from the Reactor Hall and the third sample was collected in the Reactor Hall during a personnel entry while the reactor was still in containment.

Filter samples of airborne beta-gamma contamination were collected in the Reactor Hall after the vessel was taken out of containment. The results of these samples are summarized in Table 5.

Samples of possible airborne tritium contamination were collected on 9/30/65 and 10/1/65. The results of these samples indicated a tritium concentration of 2×10^{-6} μCi/cc and 8×10^{-7} μCi/cc respectively which represent normal levels at the locations sampled.

TABLE 1

MEASURED EXPOSURE RATES AT
CHECK POINTS ESTABLISHED OUTSIDE THE PRTR

(Refer to Figure 1)

Units of mR/hr

DATE	TIME	#1-SE CORNER OF 300 FENCE	#2-SW CORNER OF OF 308	#3-ROAD BETWEEN 308 & 309	#4 ROAD NEAR DUMP CONDENSER	#5-ROAD S OF 309	#6-ROAD AT 318	#7 RLT-2 HOLD UP TANK
9/29/65	0645	22	26	40	70	40	5	
	0800	18	20	35	45	30	4	
	0910	16	17	37	42	15	2	
	0950	13	13	30	35	12	<1	
	1100	11	11	26	29	10	<1	10
	1200	9	9	22	24	8	<1	7
	1300	8	8	19	21	7	<1	7
	1400	6	6	15	19	6	<1	6
	1500	6	6	14	16	5	<1	4
	1600	5	5	12	15	5	<1	4
	1700	4	4	11	13	4	<1	4
	1800	4	4	11	12	4	<1	3
	1900	4	4	10	11	3	<1	3
	2000	3	3	9	10	3	<1	3
	2100	3	3	8	9	3	<1	2
	2200	3	3	7	8	2	<1	2
	2300	2	2	6	7	2	<1	2
	2400	2	2	5	6	2	<1	<1
9/30/65	0100	2	2	4	4	4	<1	<1
	0200	1	1	1	1	1	<1	<1
	0300	<1	<1	<1	<1	<1	<1	<1
	0400	<1	<1	<1	<1	<1	<1	<1
	0500	<1	<1	<1	<1	<1	<1	<1
	0600	<1	<1	<1	<1	<1	<1	<1
	0700	<1	<1	<1	<1	<1	<1	<1

Note: All measurements after 0910, 9/29/65, made using same CP meter at same location.

TABLE 2

MEASURED EXPOSURE RATES AT
CHECK POINTS ESTABLISHED INSIDE THE PRTR

(Refer to Figure 2)

DATE	TIME	1	2	3	4	5	6	7	8	9
9/29/65	0815	20	45							
	0850	18	40							
	0950	14	33							
	1023	14	30							
	1052	12	24							
	1125	11	22							
	1210	9	20							
	1300	9	20							
	1415	6	13							
	1445	5	12							
	1515			1	5	8	1	2	8	
	1600	4	10	1	3	7	1	5	9	
	1630	4	9							
	1700	4	9	1	4	7	2	4	7	
	1730	3	8							210
	1800	2	7	1	2	5	1	3	5	
	1900	1	6							
	2000	1	5	<1	2	5	<1	3	5	
	2100	1	5							
	2200		5							
	2230			<1	1	3	<1	1	3	120
	2300	1	5							
	2400	1	5	<1	<1	<1	<1	<1	<1	100
9/30/65	0100	<1	3							
	0130	<1	3	<1	<1	<1	<1	<1	<1	33
	0200	<1	3							
	0230									7
	0300	<1	2							
	0400	<1	<1							
	0800	<1	<1	<1	<1	<1	<1	<1	<1	< 1

TABLE 3

SMEARABLE CONTAMINATION LEVELS
IN THE CONTAINMENT VESSEL ON 10/4/65

Location	Radiation Level from Smearable Contamination
Reactor Hall Floor	25 mrad/hour including 2 mR/hour
Reactor Hall Walls	2500 c/m
-11 ft. C-Cell floor	40 mrad/hour including 3 mR/hour
-21 ft. C-Cell floor	130 mrad/hour including 3 mR/hour
Stairwell Walls	5000 c/m
-32 ft. C-Cell floor	500 mrad/hour including 13 mR/hour
-32 ft. B-Cell floor	160 mrad/hour including 4 mR/hour
-32 ft. A-Cell floor	34 rad/hour including 1.2 R/hour

TABLE 4

AIRBORNE IODINE CONCENTRATIONS IN THE REACTOR HALL

SAMPLING DATE AND TIME		^{131}I	^{133}I	^{135}I
9/29/65	0700	3×10^{-5}	3×10^{-4}	7×10^{-4}
9/29/65	1430	6×10^{-5}	3×10^{-4}	--
9/29/65	1700	3×10^{-5}	2×10^{-4}	6×10^{-5}
9/29/65	1900	5×10^{-5}*	2×10^{-4}*	1×10^{-4}*
9/30/65	2030	4×10^{-8}	1×10^{-7}	--
10/1/65	0525	9×10^{-9}	1×10^{-8}	--

* Average of two samples.

Note: Results for 9/29/65 were taken while the reactor was still in containment.

TABLE 5

AIRBORNE CONCENTRATION OF GROSS BETA-GAMMA EMITTING RADIONUCLIDES

SAMPLING DATE AND TIME		CONCENTRATION - μCi/cc
9/30/65	0630	2×10^{-5}
10/1/65	0900	9×10^{-7}
10/2/65	0915	7×10^{-7}
10/3/65	1100	2×10^{-7}

FIGURE 1

Location of Check Points Outside the PRTR

Refer to Table 1 for results

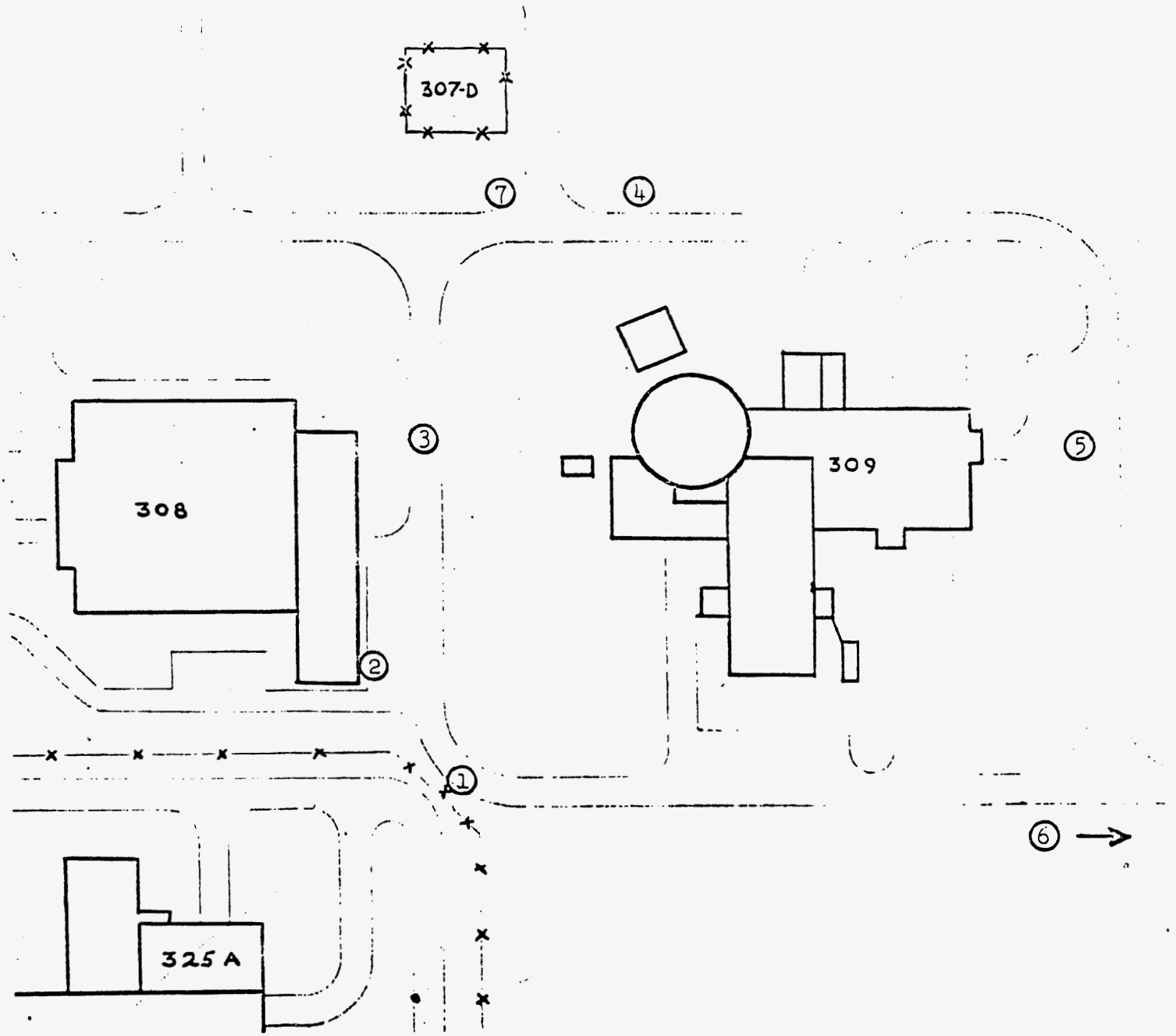
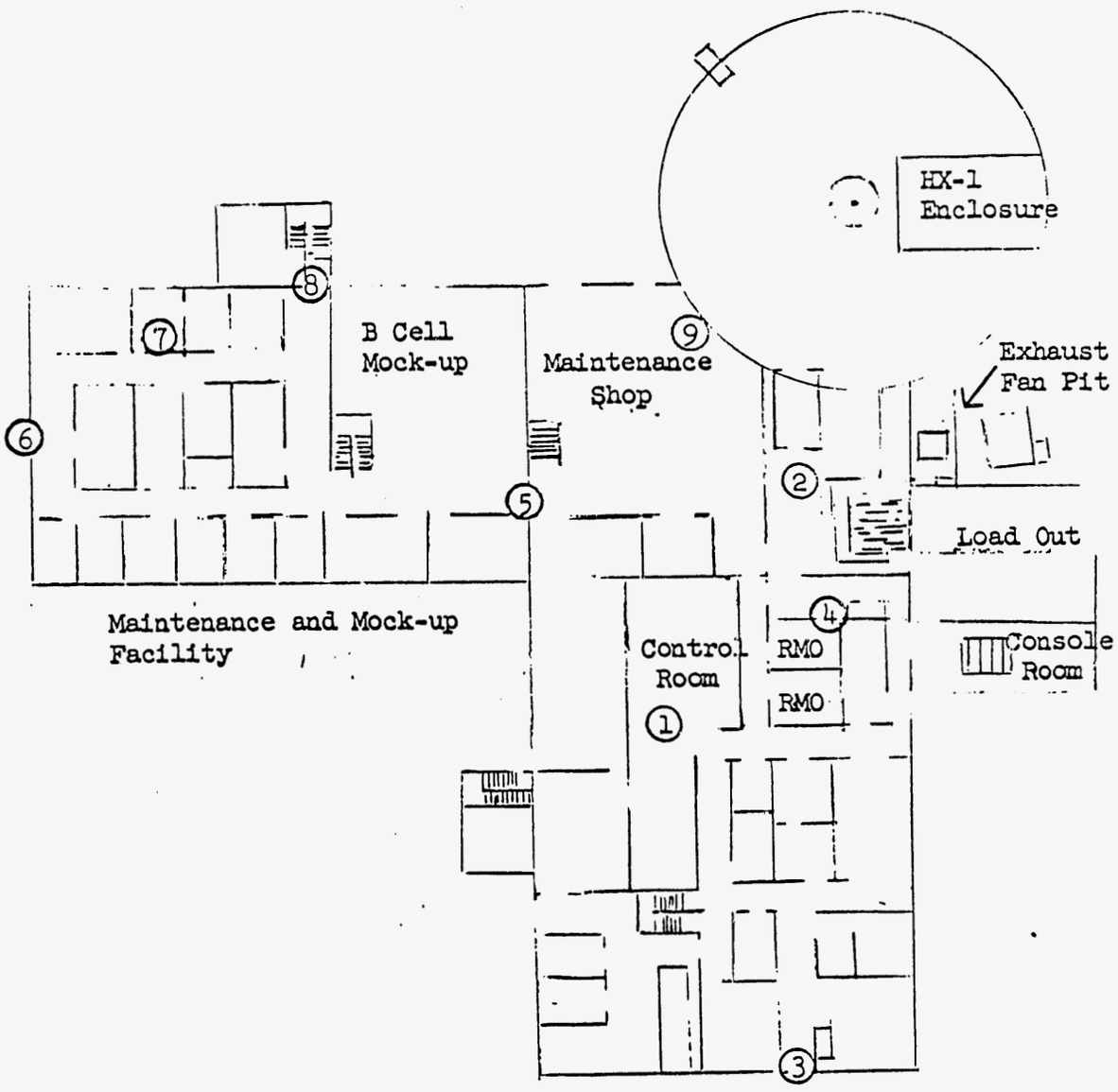


FIGURE 2

Location of Check Points Inside the PRTR

Refer to Table 2 for results



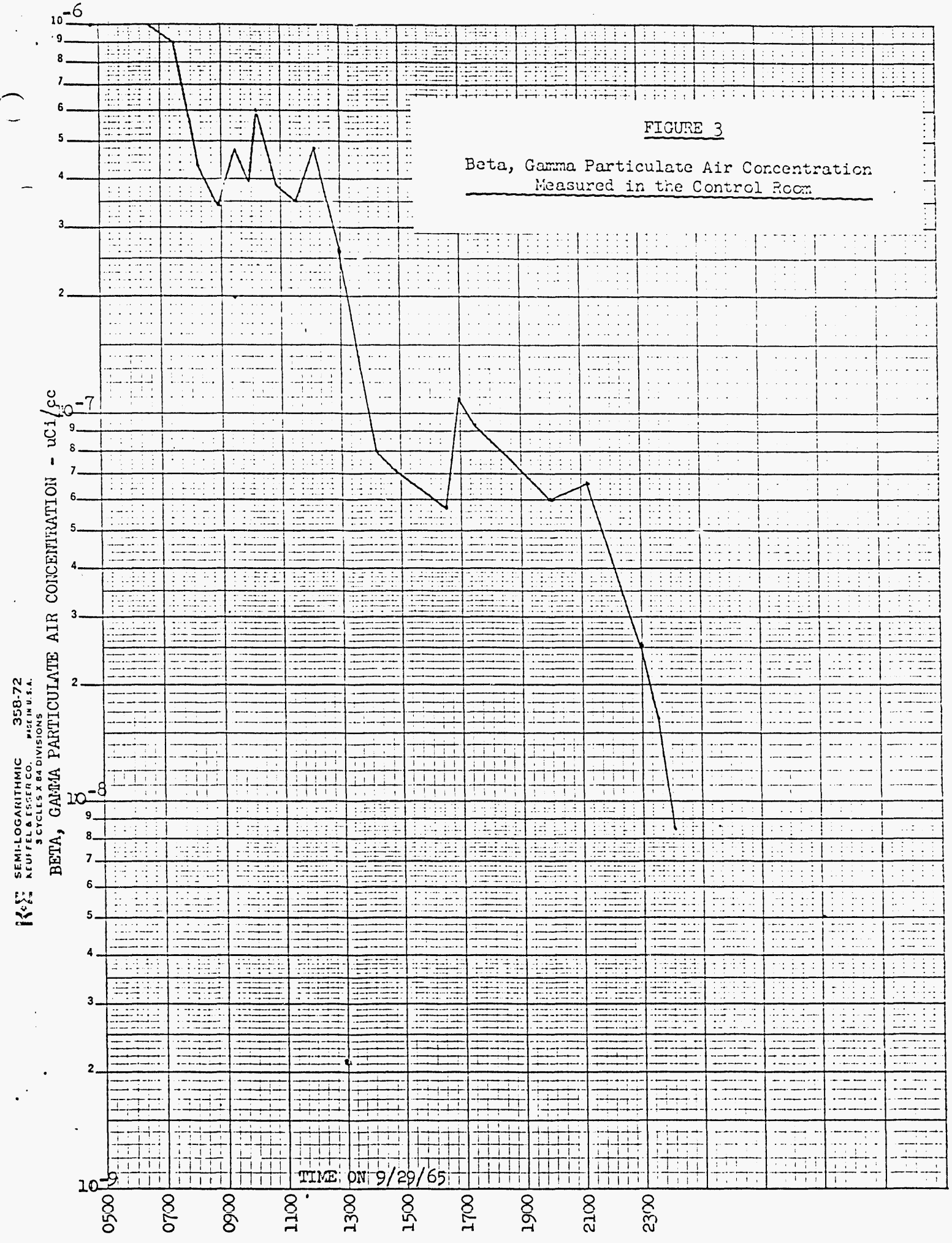


FIGURE 3
Beta, Gamma Particulate Air Concentration
Measured in the Control Room
BETA, GAMMA PARTICULATE AIR CONCENTRATION - uCi/cc
TIME ON 9/29/65
0500
0700
0900
1100
1300
1500
1700
1900
2100
2300
SEMI-LOGARITHMIC 358-72
KEUFFEL & ESSER CO. MADE IN U.S.A.
3 CYCLES X 84 DIVISIONS

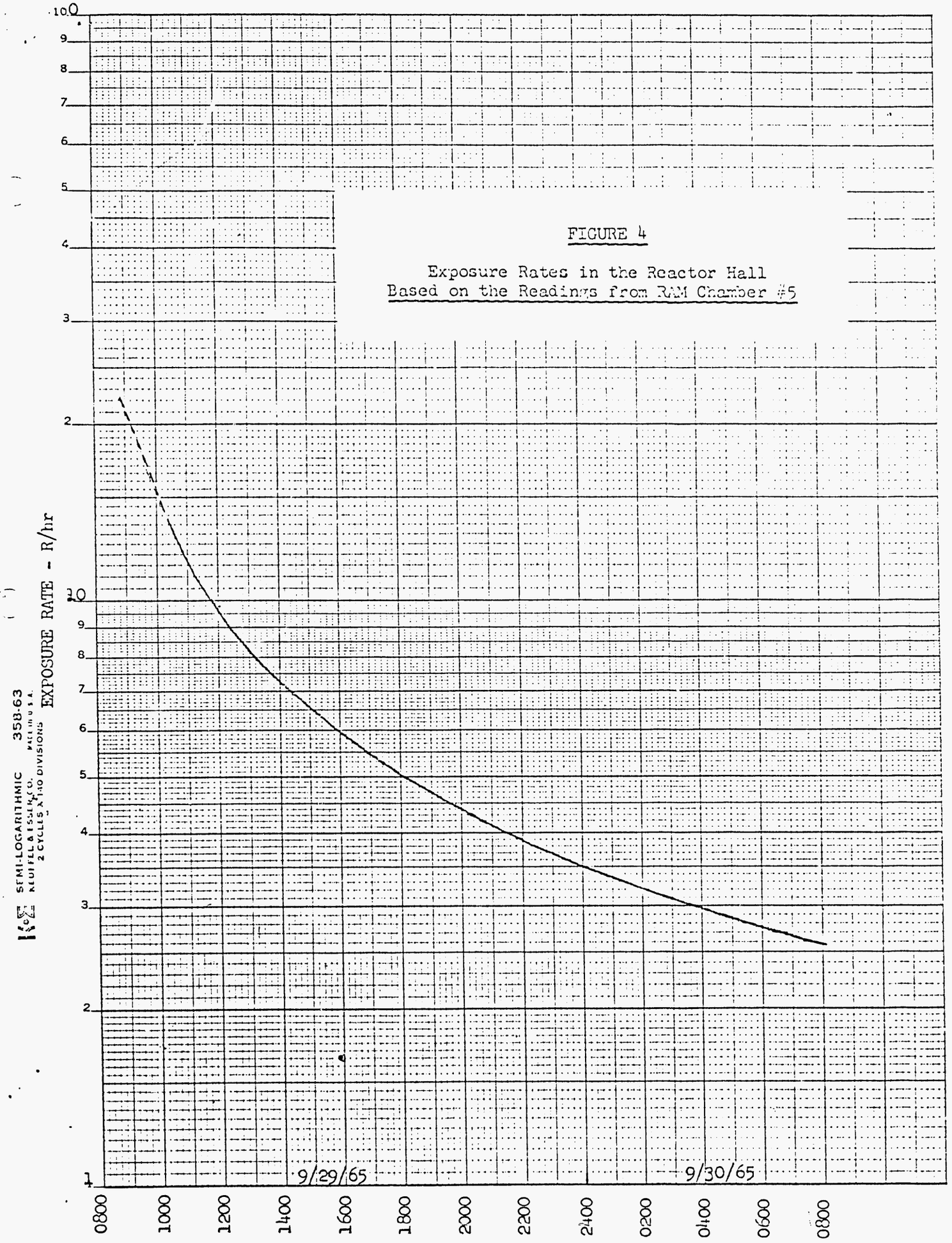


FIGURE 4
Exposure Rates in the Reactor Hall
Based on the Readings from RAM Chamber #5
EXPOSURE RATE - R/hr
100
9
8
7
6
5
4
3
2
10
9
8
7
6
5
4
3
2
1
9/29/65
9/30/65
0800
1000
1200
1400
1600
1800
2000
2200
2400
0200
0400
0600
0800
SEMI-LOGARITHMIC 358-63
KEUFFEL & ESSER CO.
2 CYCLES X 140 DIVISIONS

FIGURE 5

Initial Exposure Rate Measurements Taken
in the Reactor Hall Following the Incident

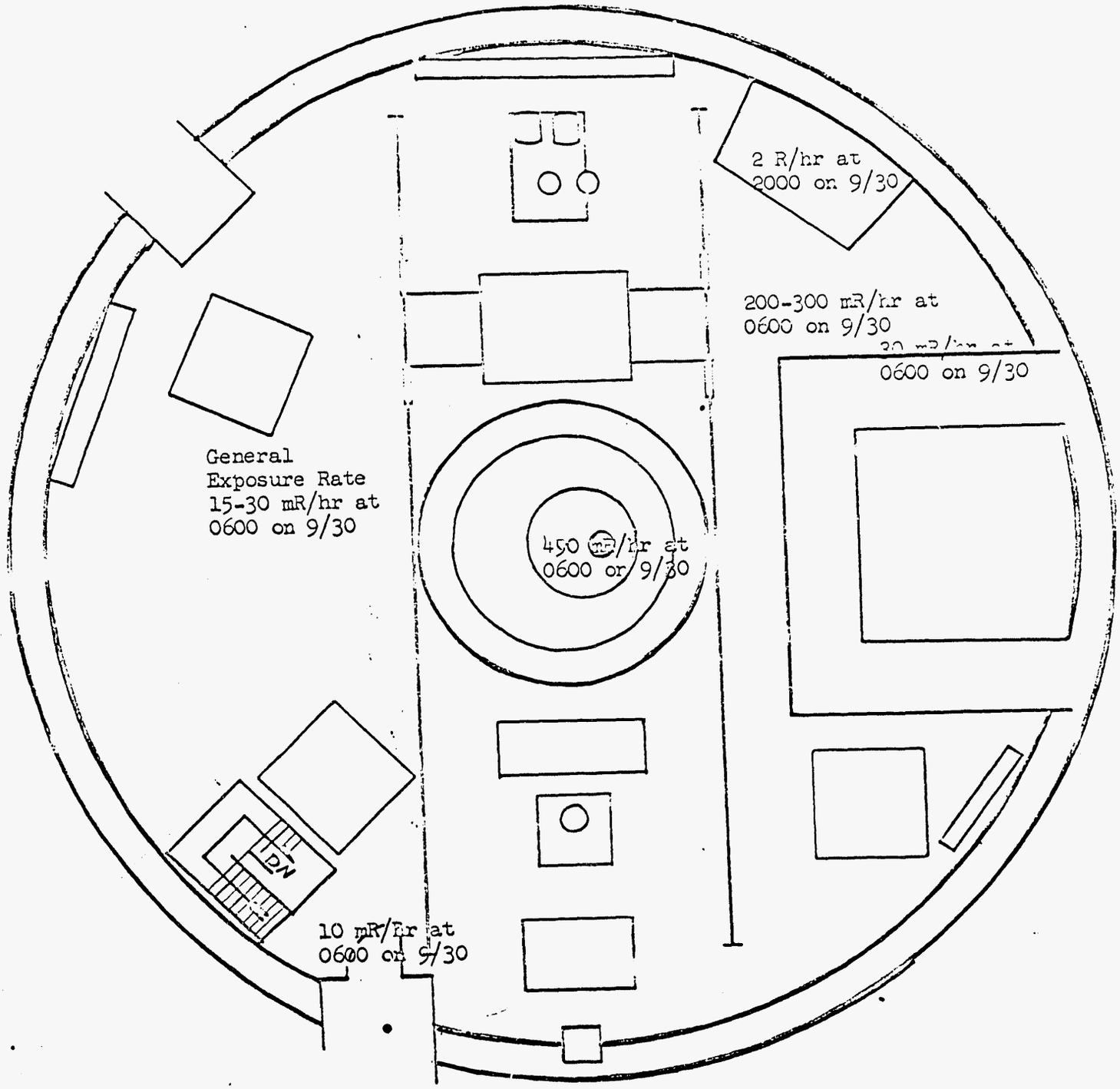


FIGURE 6

Initial Exposure Rate Measurements
Taken in the -11 ft. Level of "C" Cell Following the Incident

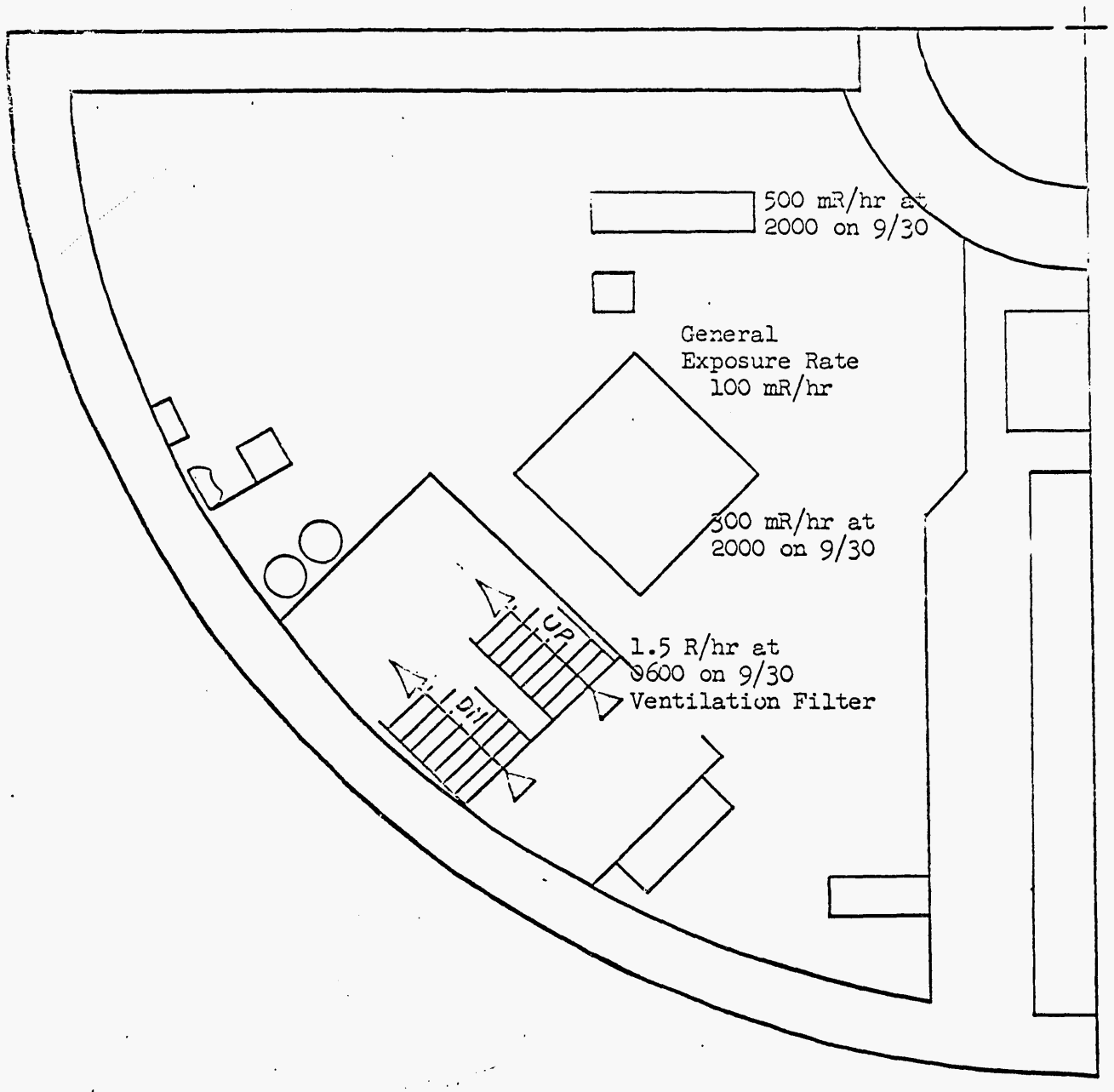


FIGURE 7

Initial Exposure Rate Measurements
Taken in the -21 ft. Level of "C" Cell Following the Incident

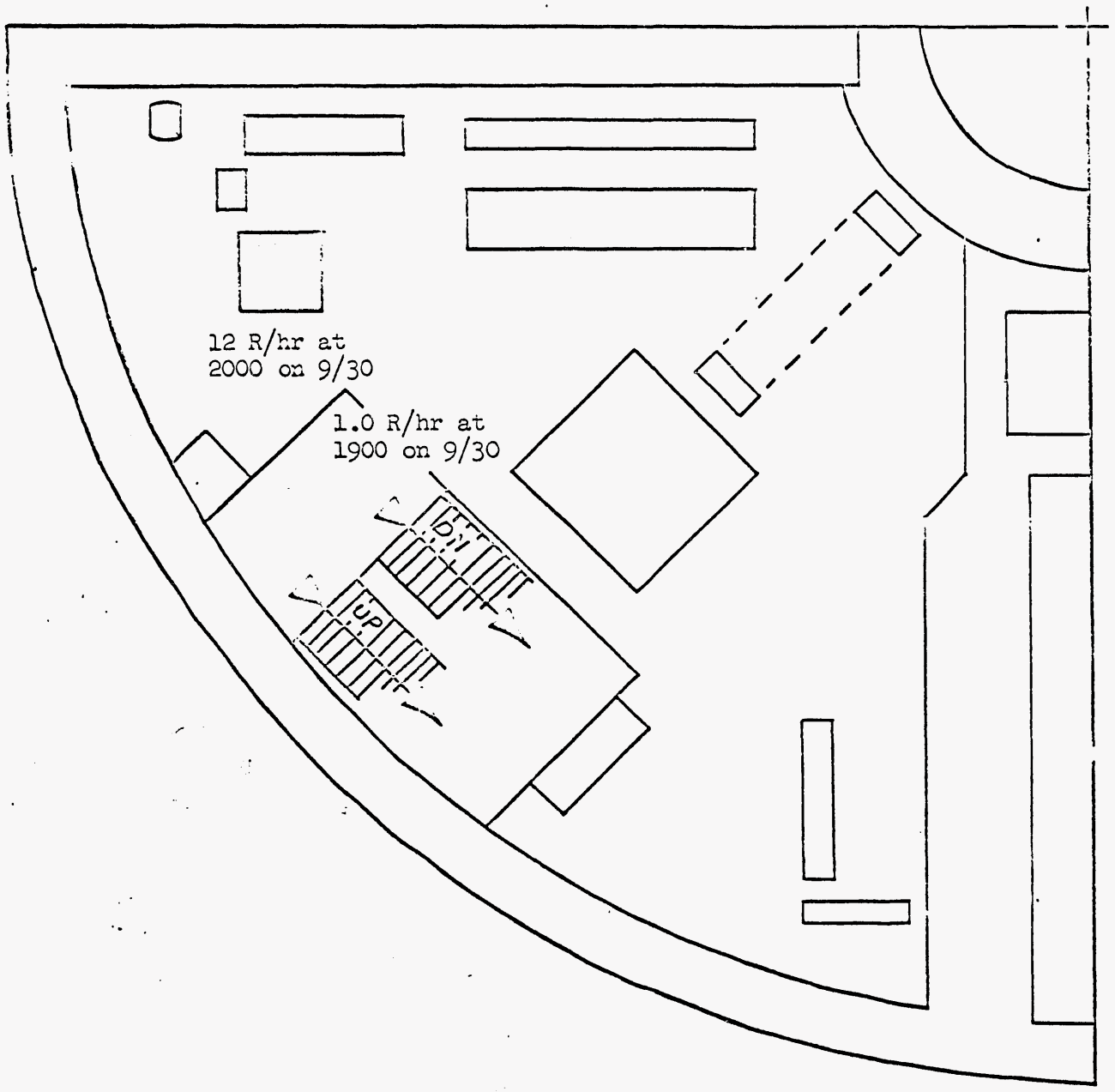


FIGURE 8

Initial Exposure Rate Measurements
Taken in the -32 ft. Level of "C" Cell Following the Incident

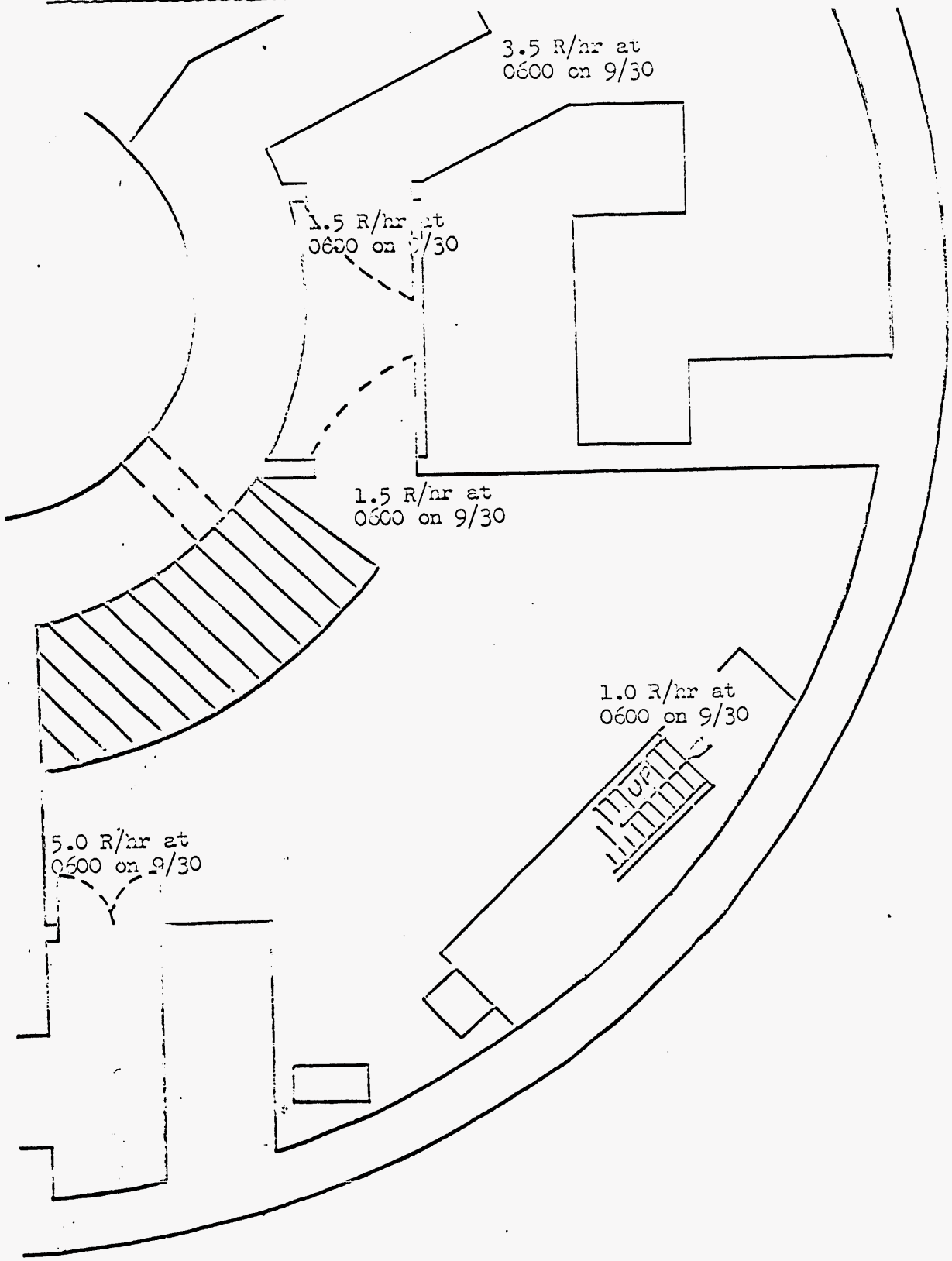


FIGURE 9

Initial Exposure Rate Measurements Taken in the -32 ft. Level of "A" Cell Following the Incident

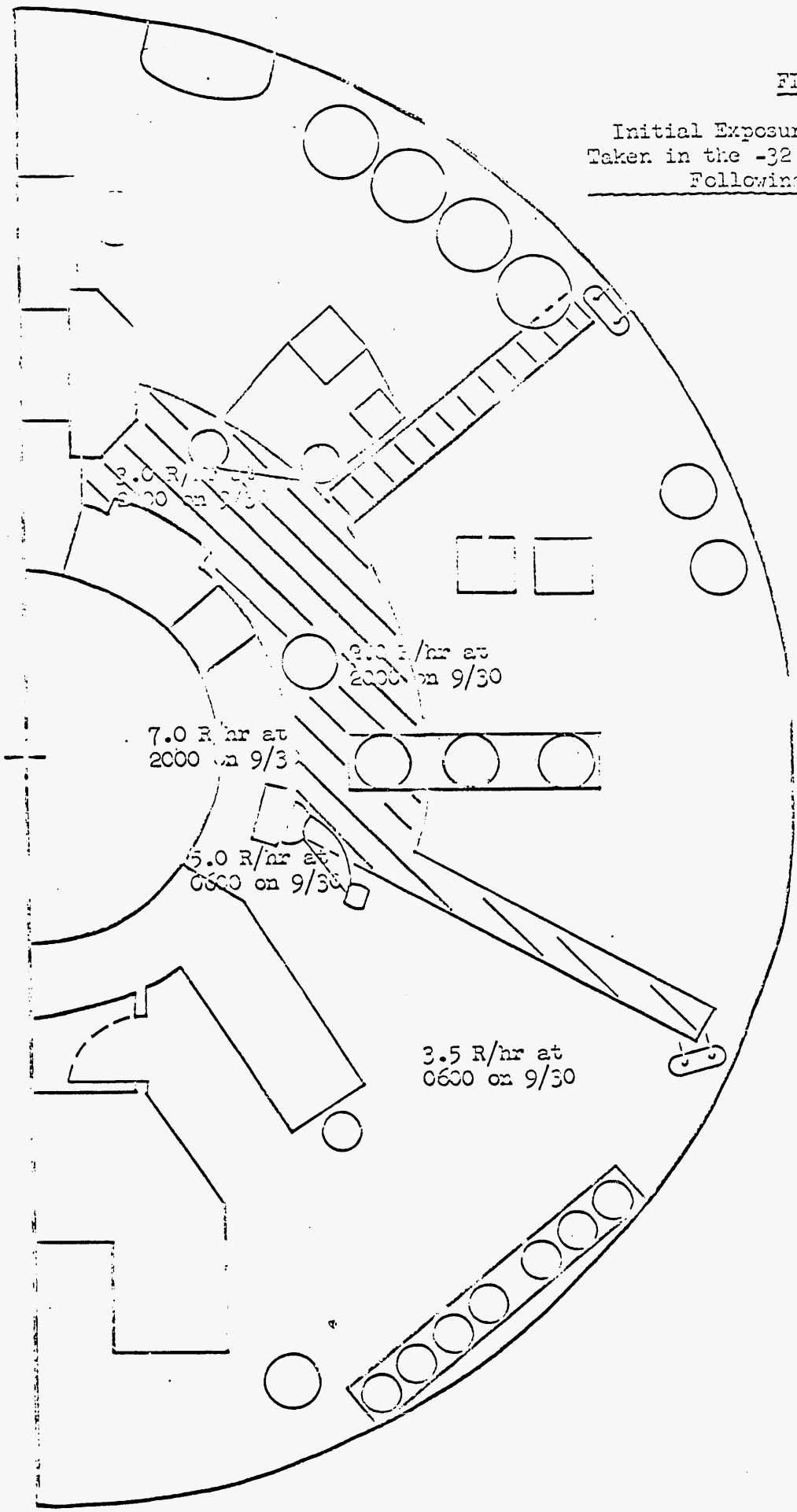


FIGURE 10

Initial Exposure Rate Measurements Taken in the -19 ft. & -21 ft. Levels of "A" Cell Following the Incident

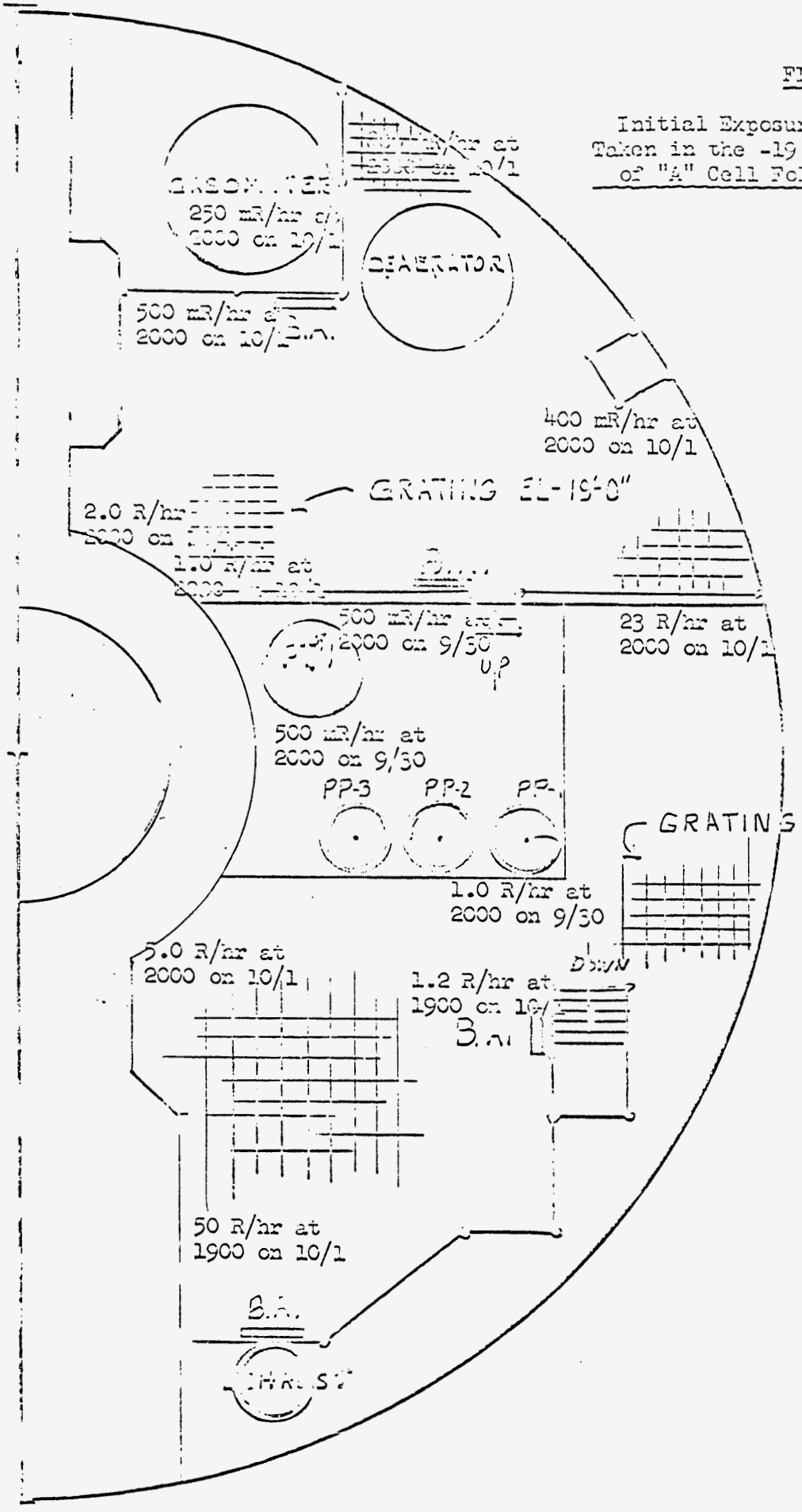
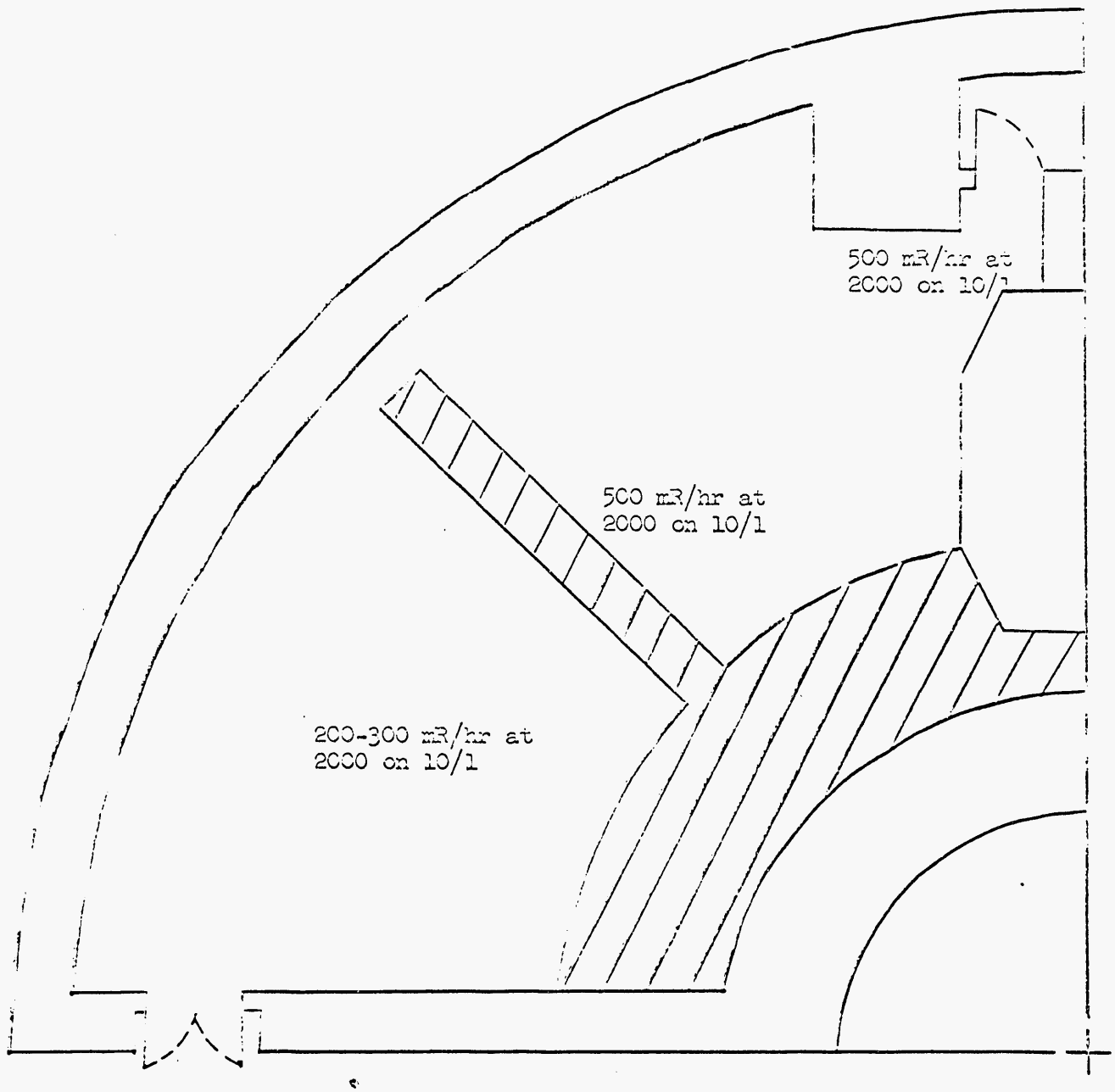


FIGURE 11

Initial Exposure Rate Measurements
Taken in "B" Cell Following the Incident



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