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P.F.T.R. 622.

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PORTON FIELD TRIAL REPORT No. 622.

THE VULNERABILITY TO C.W. SPRAY ATTACK OF AN H.A. BATTERY

[S]

By

G.F. COLLINS

AUG 22 1966
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PORTON FIELD TRIAL REPORT No. 622.

DATE (11) 26th January, 1966, (13) 18A

(7)

The Vulnerability to C.W. Spray Attack of an H.A. Battery [57. (8)]

(1) A. H. ...

(10) G.F. Collins.

Programme 12/65

carried out 24 June 65.

INTRODUCTION

1. The trial reported here was one of the series being carried out at C.D.E.E. to determine the vulnerability of troops in the field to C.W. Spray attack. Whereas however in work reported hitherto the troops participating have been drawn from the Infantry (1, 2, 3), attention is now being turned to other branches of the Army, and the present Report deals with a trial involving an H.A. Battery. Unlike previous ones, this trial was arranged at very short notice, to take advantage of the brief presence of a Battery at Porton for another purpose; since there was choice neither of site nor of date, it was not possible to plan or execute the trial to yield as much information as would have been wished.

2. The experiment was intended to provide data relative to a spray attack with a persistent percutaneously acting C.W. agent, firstly on the degree of contamination of the men's clothing due to direct spray and secondly on their subsequent pick-up of contamination during operations in a contaminated environment. Unfortunately the second part of the programme had to be abandoned owing to rain. The troops were instructed to ignore the spraying and assessment proceedings, and no attempt was made on this occasion to study C.W. training methods.

3. Safety and convenience necessitated that delivery of the spray should be done with a helicopter instead of airburst shell or a high speed aircraft. This delivery means lacks tactical realism, but the resulting spray is similar to that produced by high speed aircraft.

EXPERIMENTAL

General

4. The situation selected for study was that obtaining when all equipment

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had been set up and a listening watch was being maintained. Under these conditions most of the troops would ordinarily be under some sort of cover, but for the purpose of the trial it was arranged that one team should be engaged in transferring a missile to its launcher at the time of spraying.

Site

5. The experiment was carried out on the Northern edge of Thorney Down Wood (GSGS 4620, Sheet 167, SV 203345). This site was chosen by the Battery Commander as being that most suitable for another purpose and unfortunately was not ideal for this trial: the ground fell away steeply to the north-west and was covered with bushes, which made difficult the placing of readily visible aiming marks, etc. The major items of equipment were located as shown in Fig. 1. The tactical control (TC), launcher Command post (LCP) and target illuminating radar (TIR) were under natural cover of trees and branches, and the two launchers were in the open. The administrative element and the vehicles were located upwind on the southern edge of the wood and were not included in the experiment.

Personnel

6. The number of men involved in the C.W. assessment was 40 and included a troop commander, troop sergeant major, launcher Command Post men (LCP) (6), Tactical Control (TC) area (8), Target Illuminating Radar (TIR) (5), launcher crews (13), REME (2), and drivers (4). (A complete battery would normally have two more such units, located about 5 miles away). Each man was provided with denim overalls (blouse and trousers) which had been specially laundered to facilitate subsequent analysis. These were worn over their normal clothing.

Sampling of Spray on the ground

7. Sampling envelopes were laid in a 5 yd x 5 yd grid pattern over areas 25 yd square, one around each of the emplacements, blanks being left in the patterns, wherever the presence of military equipment made the laying of an envelope impossible. Four rotary ground samplers were laid at representative positions in each of the areas. In addition 16 envelopes were laid at 20 yd intervals along the downwind 300 yd side of a 200 yd by 300 yd rectangle enclosing the emplacements, and 6 rotary ground samplers were distributed at 60 yd intervals along this line.

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The Spraying

8. The simulant C.W. agent was a mixture of diethylene glycol ($74\frac{1}{2}\%$) with water ($24\frac{1}{2}\%$) and uvitox SWN (1%); it was chosen because it is colourless, is harmless to men, and has no deleterious effect on paintwork.

9. The intention was to spray the 200 yd by 300 yd rectangle to a contamination density of 4 g/m^2 , which was the greatest that was possible with a single tankful (60 gallons) of liquid; the helicopter, a Whirlwind Mk.7, was to make 9 passes, 300 yd long, over the rectangle at intervals of 25 yds at a height of 50 ft and a speed of 60 kt. In fact only 6 passes were made; the unevenness of the ground and the presence of trees, which obscured the aiming marks, caused the pilot to overrun the rectangle and prematurely exhaust the tank; and, since the weather was very unsettled (see para 12), it was considered unwise to protract the trial by reloading the helicopter and completing the spraying with a second sortie.

Undressing of the Men

10. After the spraying the men were inspected and photographed under UV illumination, and the distribution of contamination on each was noted. Face swabs were taken from those on whose faces contamination had been detected. All the men then carefully removed their overalls, whilst standing on a tarpaulin, and packed them in separate polythene bags for transport to the analytical laboratory.

Analysis

11. The denim suits were washed individually in methylated spirit, and the washings were analysed for uvitox. The sampling envelopes in the 25 yd squares were bulked in the groups shown in Figs. 5 to 8 and analysed for uvitox; the envelopes on the 300 yd line were treated singly. The papers from the rotary ground samplers were subjected to visual counting and sizing.

RESULTS AND DISCUSSION

Weather

12. The weather at the time of spraying was cloudy with intermittent slight rain, which increased during the next hour. The mean wind was SW'ly, 4.27 m/sec (9.6 mi/hr.) at 2 m. and the ground temperature approximately 70°F . There was a slight temperature lapse: T.D. (4m. - 0.5m.) - 0.3°F .

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Contamination on the Ground

13. Owing to the fact that the number of spray runs made was less than intended, part of the target area received a considerably lower contamination density than desired. (This included the A1 launcher position, where a missile transfer was in progress at the time of spraying). Mean contamination densities obtained from the bulked envelope samples in the four occupied areas are shown in Figs. 5 to 8, and the results for the downwind line in Appendix I. The values range from 4.4 down to 0.01 g/m².

14. The drop size results obtained from the rotary ground samplers are recorded in Appendix II. They are only approximate, for the papers were damp generally, and had been very wet in places, so that many of the stains had become enlarged and indefinite. The quoted results, which are based on the least affected papers, give m.m.d.s ranging from 300 μ to 1000 μ .

Contamination on the Men

15. The amounts of charging extracted from the denim overalls are shown in Appendix III against positions of the wearers in the command structure. The results of face and hand swabbing are shown in Appendix IV. Photographs of some of the men taken under ultra-violet illumination are shown in Figs. 9 to 12, and details of the approximate distribution of contamination on the body are given in Appendix V.

16. The quantity of spray falling on a man is conveniently expressed as a contamination factor (m²), which is the ratio of the mass on the man (g) to the contamination density on the ground in his immediate vicinity (g/m²). Contamination factors for as many men as possible are listed in Appendix III. The mean value is 0.63 m² (95% confidence limits 0.43 and 0.82) with a standard deviation of 0.57. This mean has to be compared with the contamination factors for an infantry man digging in, 0.3 m²(4), a standing man, 0.2 m²(4), and a man lying prone, 0.67 m²(4). From the evidence of this trial it seems therefore that the attitude adopted by the members of an HA Battery on a listening watch approaches on the average more nearly that of a prone man than that of a standing man.

17. By means of an analysis of variance of the contamination factors listed in Appendix III it is possible to determine the effect, if any, of a man's military function on his attitude. This has been carried out on the five

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groups of men constituting the A1 launcher team, the B1 launcher team, the T.I.R. team, the L.C.P. and the T.C., and the conclusion is that the attitudes of the men do not vary significantly from group to group.

18. It would have been instructive to study the relative vulnerabilities of the various groups of men, i.e. to determine inter alia how much protection was enjoyed by those men who were located under trees during the spray "attack". Unfortunately this has not been possible, for such a study would have required the contamination density to be sensibly constant over the entire trial site, and this was not so - even approximately - in the present trial.

ACKNOWLEDGEMENTS

The co-operation of Maj. P.R. Ketley-Jackson and the Battery Commander, Officers, N.C.O.'s and men of 57 A-D Regt., R.A. is gratefully acknowledged.

C.D.E.E.
PORTON DOWN,
GFC/HC.

(Sgd.) R.A. Titt.,
Superintendent,
Munitions Research Division.

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2. J.N. Banfield, P.F.T.R. 608, 1963.
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4. H.J. Fish, Suffield Special Publication 6/60, 1960.

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APPENDIX I

Contamination Density on downwind edge of area.

Sampling Position	Contamination Density $\mu\text{g}/\text{m}^2$
Z1	0.77
Z2	0.58
Z3	0.82
Z4	0.35
Z5	0.33
Z6	0.23
Z7	0.22
Z8	0.08
Z9	0.04
Z10	0.11
Z11	0.04
Z12	0.03
Z13	0.02
Z14	0.01
Z15	0.06
Z16	0.07

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APPENDIX II

Drop size data.

Sampler No.	Drop size range (μ)	M.M.D. of bulked samples (μ)
A2-2	200-520	300
A2-5	280-520	
A4-2	200-280	
A4-5	200-450	
B2-2	200-330	1000
B2-5	280-450	
B5-3	200-1680	
B5-5	200-360	
C2-2	200-450	320
C2-5	200-450	
C4-5	200-520	
D2-2	200-1400	500
D2-5	Did not rotate	
D5-2	360-520	
D5-5	360-520	
Z1	200-520	360
Z4	200-450	
Z7	200-450	
Z10	200-520	
Z13	200-450	
Z16	200-680	

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APPENDIX III.

Contamination on the men.

Subject No.	Function	Dose (grams)	Contamination Density (μ/m^2)	Contamination factor "F" (m^2)
1	A.1 Launcher	0.090	0.185	0.49
2	"	0.100	"	0.54
3	"	0.070	"	0.38
4	"	0.040	"	0.22
5	"	0.060	"	0.32
6	"	0.090	"	0.49
7	"	< 0.030	"	< 0.16
8	"A" Troop Cdr.	0.360	1.16	0.31
9	"A" Troop s/m	< 0.030	0.068	< 0.44
11	B.1 Launcher	1.00	2.18	0.46
12	"	0.430	"	0.20
13	"	0.230	"	0.11
14	"	0.330	"	0.15
15	"	0.440	"	0.20
16	"	0.270	"	0.12
18	Driver/operator	< 0.030	Whereabouts not known	
21	L.C.P.	0.090	0.068	1.32
22	"	0.040	"	0.59
23	"	< 0.030	"	< 0.44
24	"	0.360	"	5.29
25	"	< 0.030	"	= 0.44
26	"	0.150	"	2.20
27	T.I.R.	0.040	1.16	0.34
28	"	0.800	"	0.69
29	"	0.110	"	0.09
30	"	0.620	"	0.53
31	"	0.410	"	0.35
42	Driver	< 0.030) Whereabouts not known.	
53	"	0.050		
56	"	< 0.030		
63	REME	0.120		
64	"	< 0.030		
81	T.C. Area	< 0.030	0.068	0.44
83	"	0.060	"	0.88
84	"	< 0.030	"	< 0.44
85	"	0.030	"	0.44
89	"	0.070	"	1.03
93	"	< 0.030	"	< 0.44
94	"	< 0.030	"	< 0.44
97	"	0.030	"	0.44

Contamination Factor "F"

quantity received by man (μ)
contamination density (μ/m^2).

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APPENDIX IV.

Results of face and hand swabbing.

Subject No.	Function	Contamination	
		Face (mg)	Hands (mg)
8	Troop Commander	0.9	*
11	} B1 Launcher	2.0	1.4
14		0.9	0.8
27	} T.I.R.	0.7	*
28		2.7	*
63	R.E.M.E.	0.7	*

* Hands not assessed.

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APPENDIX V.

Qualitative Distribution of Contamination on the Men

Site of body	Number of Men contaminated on site
Face	25 (out of 40)
Neck	13
Torso	22
Arms	11
Hands	24
Legs	20

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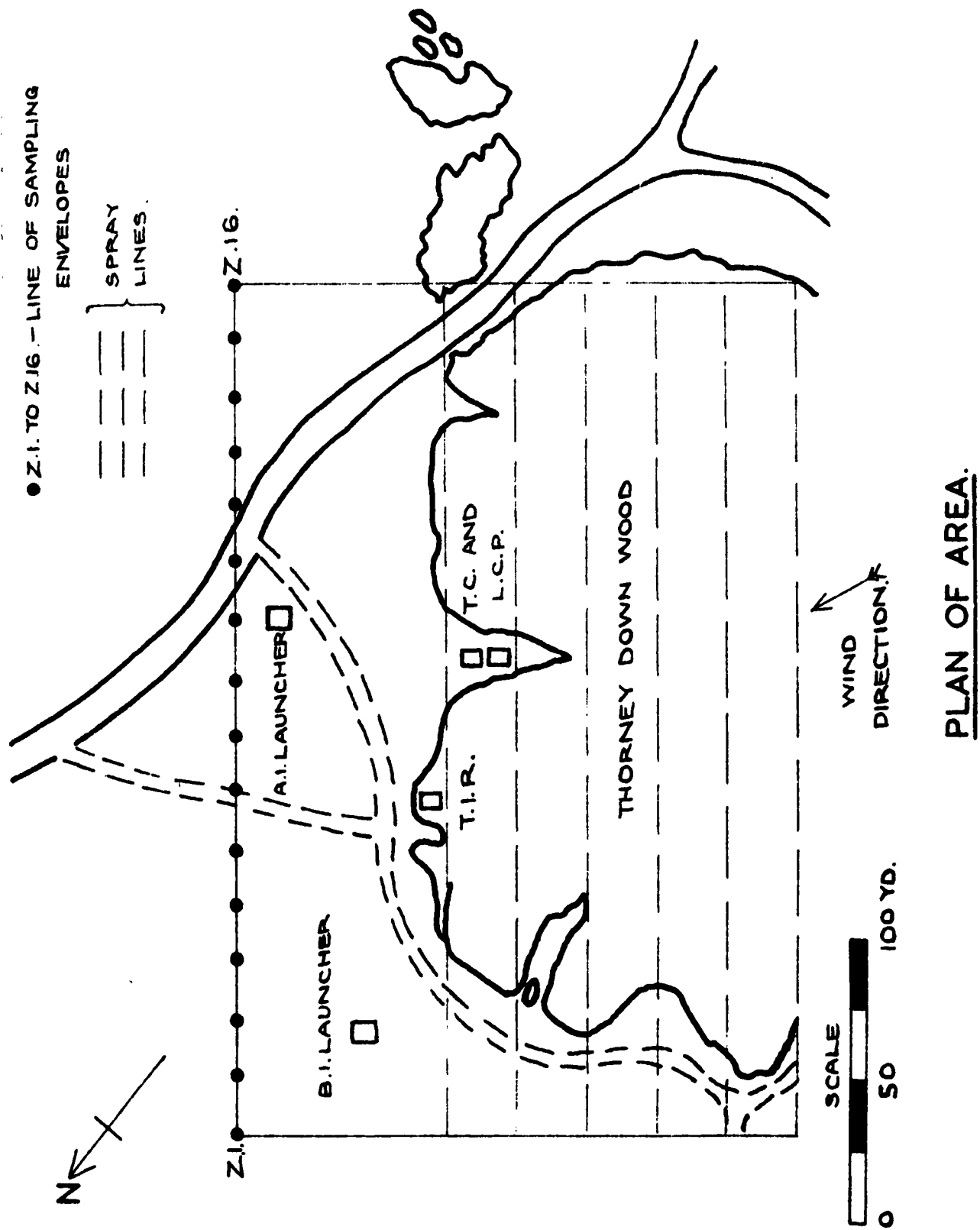
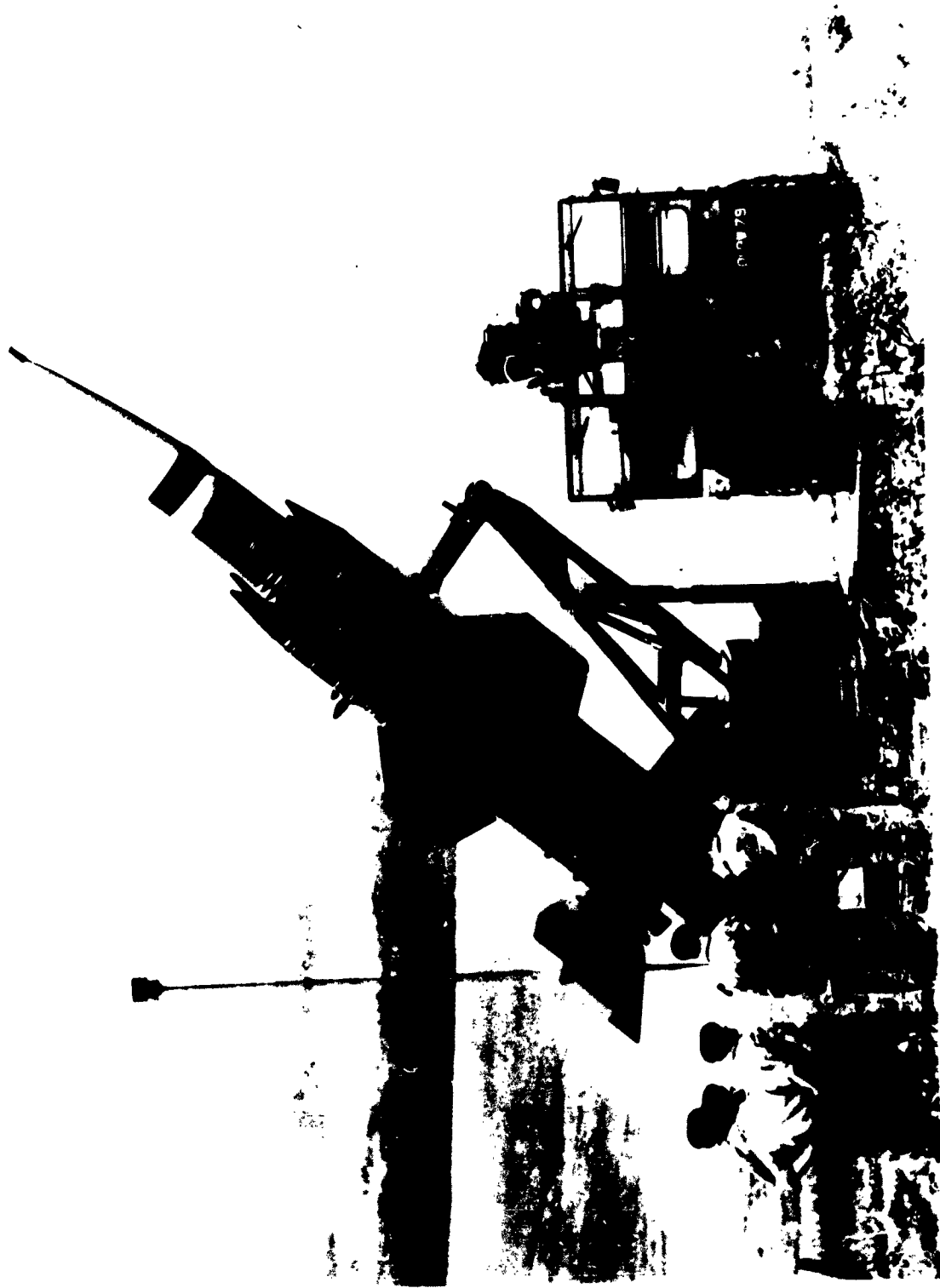


FIG. I.



A1 LAUNCHER DURING SPRAYING.

FIG 2



B1 LAUNCHER DURING SPRAYING.

Fig 3

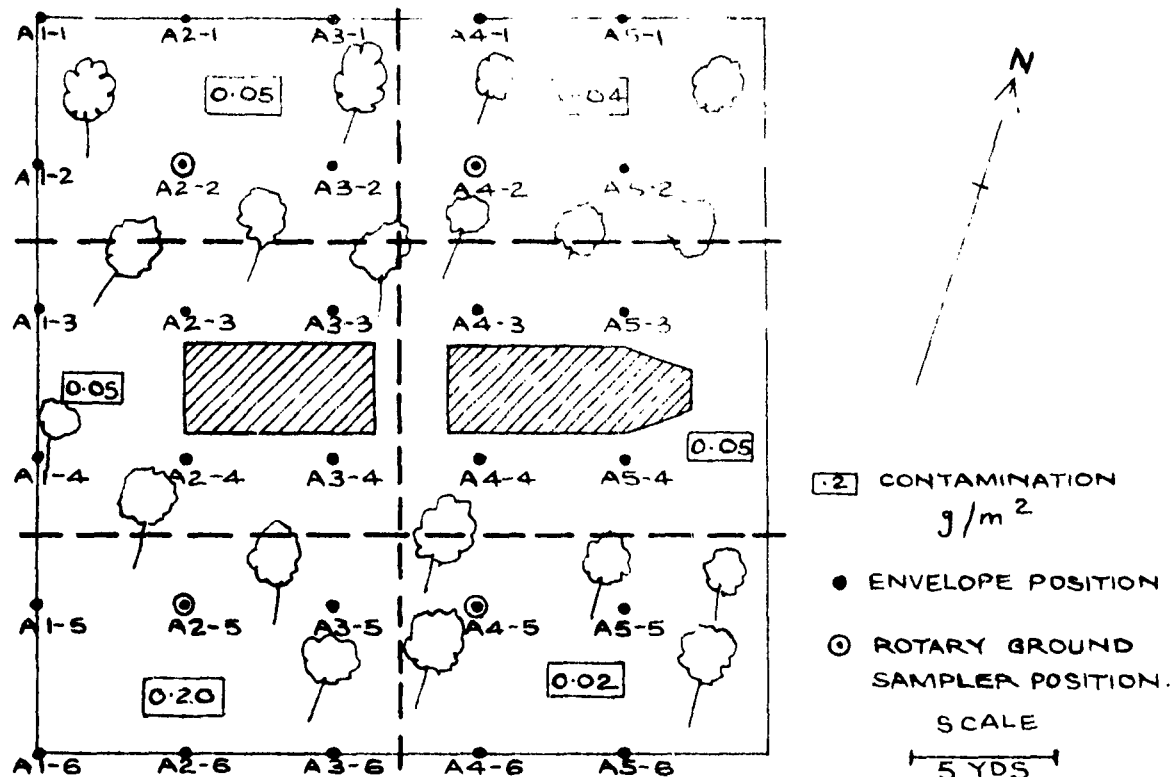
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Fig 4

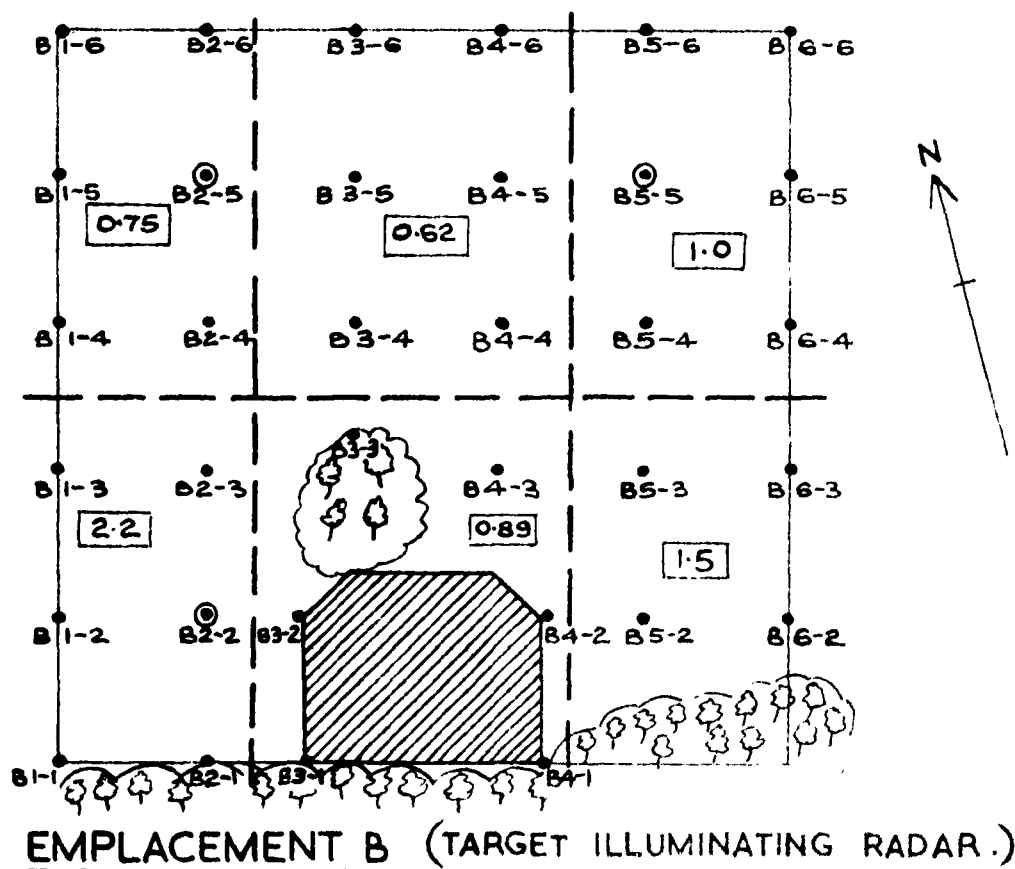
TIR DURING SPRAYING.

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EMPLACEMENT A (TACTICAL CONTROL AND LAUNCHER COMMAND POST.)

FIG. 5.



EMPLACEMENT B (TARGET ILLUMINATING RADAR.)

FIG. 6.

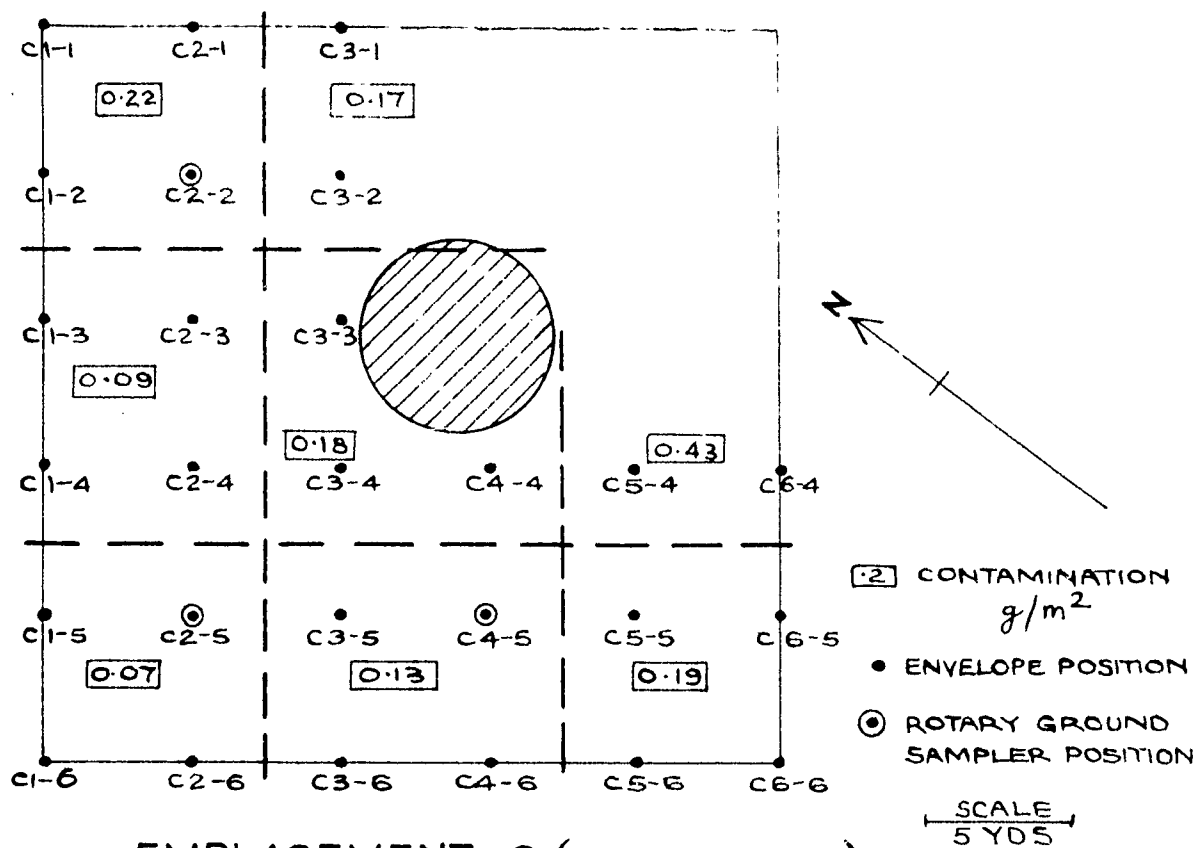


FIG. 7.

EMPLACEMENT C (AI LAUNCHER.)

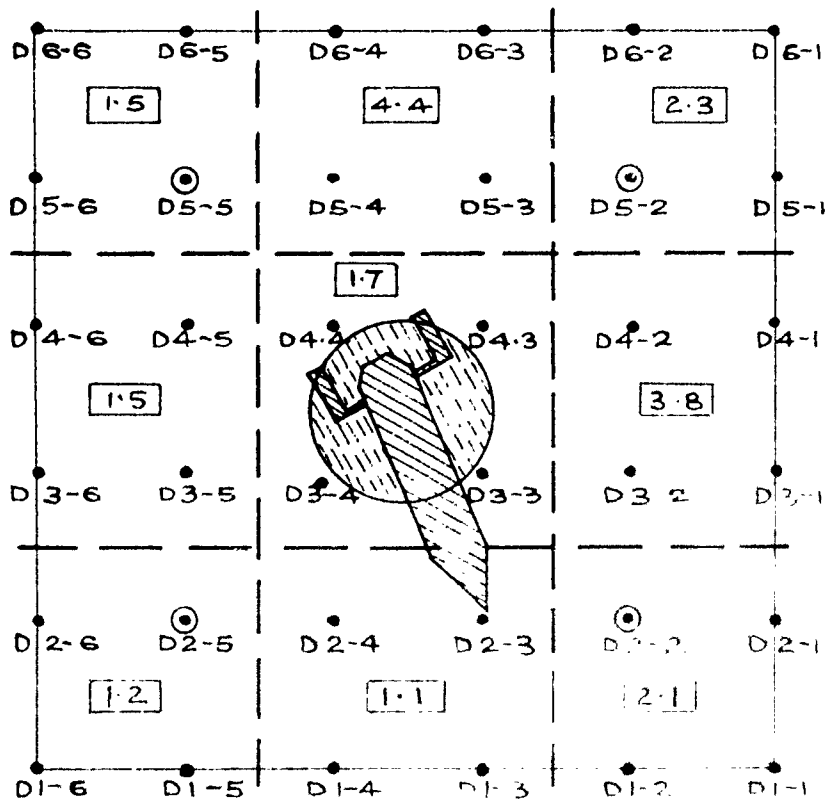


FIG. 8.

EMPLACEMENT D (BI LAUNCHER.)



FIG 9



FIG 10

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D.E.C. (25)

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D.R.C.I.

D.R.S.

M.R.F.

A.D./A.

A.D./C.R.

A.D./A.

S.D./D.R. (4)

S.P./B.

S./B.

S./B.

S./B.

S./B.

S./B.

S./B.

S./B.

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