ESS R 48

Dow Suffield Report Book

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HEAVY MUSTARD CONTAMINATION OF A SMALL AREA

SUMMARY

800 ppunds of Mustard in two 50 gallon drums was dispersed by means of a dynamite charge. The test was made under hot weather conditions.

It is concluded that this is not an effective method of setting up concentrations of mustard vapor, and that weathering quickly reduces any vapor danger to a minimum.

E.Ll. Davies

(E.Ll.Davies)
Chief Superintendent,
Experimental Station

TJ

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1946/1870

EXPERIMENTAL STATION, SUFFIELD, ALTA

SUFFIELD REPORT NO. 48

SERIAL NO. _____

30 December, 1942

HEAVY MUSTARD CONTAMINATION OF A SMALL AREA

OBJECT

The experiment was designed to assess the ground contamination, vapor danger, and persistence of mustard when a heavy contamination was dispersed by explosion.

PROCEDURE

Two 50 gallon oil drums, charged with approximately 800 pounds of dyed H.S.(U.S.) were blown up by seven sticks of dynamite charge placed below the drum.

Ground contamination was assessed by means of a layout of filter paper envelopes and sand trays. This consisted of tambourines arranged on 2.5 yard squares, as shown in figure 1, with the addition of 121 soup plates containing weighed quantities of sand placed centrally. Immediately after functioning, these plates were collected at all points where the contamination had obviously been too much for the tambourines to hold. They were weighed as quickly as possible. Vapour samples were taken at distances of 100, 200 and 400 yards from the source.

RESULTS

Results in tabular form are appended. Meteorological observations are given in Appendix 1, liquid contamination is given in Appendix 11, while vapour sampling is summarized in Appendix 111.

DISCUSSION

Assessment of ground contamination, while subject to some unavoidable errors due to heavy local contamination, has given the following approximate results.

(i) 30 square yards were contaminated to a degree of 1000 grams per square meter or higher.

(ii) 400 square yards were contaminated to a degree varying from 100 to 1000 grams per square meter.

(iii) 250 square yards were contaminated to a degree varying from 10 to 100 grams per square meter.

(iv) 1500 square yards were lightly contaminated (0.1 - 10 grams per square meter).

A chart of the results is shown in Fig. 1. It is seen that distribution is somewhat irregular, an effect due to the type of exploder used and the subsequent behaviour of the drums. One of these was thrown into the air and the contents spilled out a s it turned over.

Within short distances of the charge, very heavy contamination occurred, and decontamination of any equipment would be attended with difficulty.

In considering the results of vapour samples, it is to be noted that the maximum concentration recorded on the line 100 yards from the source during the passage of the initial cloud, was 35 mgm/m^3. The sampling time was two minutes and the cloud was fifty yards wide at this line.

A shifting wind gave considerable lateral dispersion to the cloud during the next thirty minutes, and concentrations were quite low at all lines.

Tests 24 hours later at distances of 100 and 200 yards, failed to give measurable concentrations of vapour. Under the temperature conditions prevailing during this period, the areas which were subject to light contamination had weathered until decontaminated. Heavily contaminated areas had partially dried as the mustard soaked into the ground. There was an unpleasant concentration of vapor at the source at this time.

CONCLUSION

A large quantity (approximately 800 lbs.) of H.S.(U.S.) dispersed as in this trial is not effective in setting up dangerous vapour concentrations. The maximum C.T. value under the conditions of the trial was not greater than 10 at 100 yards from the source and ground contamination, while in excess of 50 gm/m^2 over an area of about 500 sq.yds., did not present any vapour danger 100 yards downwind of source after 24 hours.

Appendix I, II, III attached .

This report was written by Capt. J.W.Young, R.C.E., of the Chemistry Section and Dr. B.A.Griffiths of the Physics and Meteorological Section, Experimental Station, Suffield, Alta.,

E.Ll.Davies
Chief Superintendent,
Experimental Station

TJ

APPENDIX I

Meteorological Conditions

Date	21 July, 1942
Time	Zero at 1454 hours.
Surface Wind	Direction 140° to 160° near zero, veering to 200° - 230° about three-quarters of an hour later. Mean - 185°. Speed (mean) - 8.1 m.p.h.
Air Temperature	Mean - 91°F
Surface Temperature	106°F.
Relative Humidity	19%
Wind Gradient	Mean R for period - Estimated 1.08.
Gustiness	Mean value of Gy - 0.53 Mean value of Gz - 0.33
Date	22nd July 1942 (24 hours test)
Time	1400 - 1430 hours
Surface wind	0 - 5 m.p.h.
Air Temperature	90°F
Surface Temperature	102°F
Relative Humidity	27%
Wind Gradient	Mean R for period of 1.10 estimated
Gustiness	Mean value of Gy - 0.44 Mean value of Gz - 0.33

APPENDIX 11

Contamination (Gr.per sq.meter) Range	Mean	Area Contaminated (Sq.Yds)	% of Total Area Contaminated	Recovery Weight (Gms)	% of Total Recovered	% of Total Charging
15,000	15,000	6.25	0.3-	78,500	37.4	22.5
1000-2500	1,312	25	1.1	27,400	13.0	7.8
800-1000	942	25	1.1	19,700	9.4	5.6
600-800	784	6.25	0.3-	4,000	2.0	1.2
400-600	438	50	2.3	18,300	8.7	5.2
300-400	340	32.25	1.5	9,200	4.4	2.6
200-300	228	118.75	5.4	22,600	10.8	6.5
100-200	134	181.25	8.3	20,300	9.7	5.8
50-100	76	50	2.3	3,180	1.5	0.9
20-50	28.2	93.75	4.3	2,210	1.0	0.6
10-20	13.8	93.75	4.3	1,080	0.5	0.3
5-10	7.5	143.75	6.5	905	0.4	0.2
1-5	2.0	1350	61.5	2,260	1.1	0.7
0.1-1.0	0.26	18.75	0.9	4	-	-

Total Area of Contamination assessed - 2,195 square yards

Total Recovery - 210,000 grams (approximately) - 463 lbs.
(original charge estimated at 800 lbs.)

APPENDIX 111

Vapour Samples

100 Yard Line. Spacing 5 yards, positions numbered from right facing source. Rate of sampling - 10 litres/min.

Position	Mgm H/m^3 Average Concentration over Sampling Times Z - Z + 2 mim.	Z - Z min. - Z + 30 mins.
1	nil	1
2	nil	1
3	nil	1
4	nil	1
5	nil	1
6	5	2
7	10	2
8	5	2
9	35	-
10	6	2
11	5	2
12	3	1.5
13	12	1.5
14	5	1.5
15	3	2
16	nil	1.5
17	nil	1
18	nil	1

200 yard line. Spacing 10 yards, positions numbered from right facing source. Rate of sampling 10 liters/min.

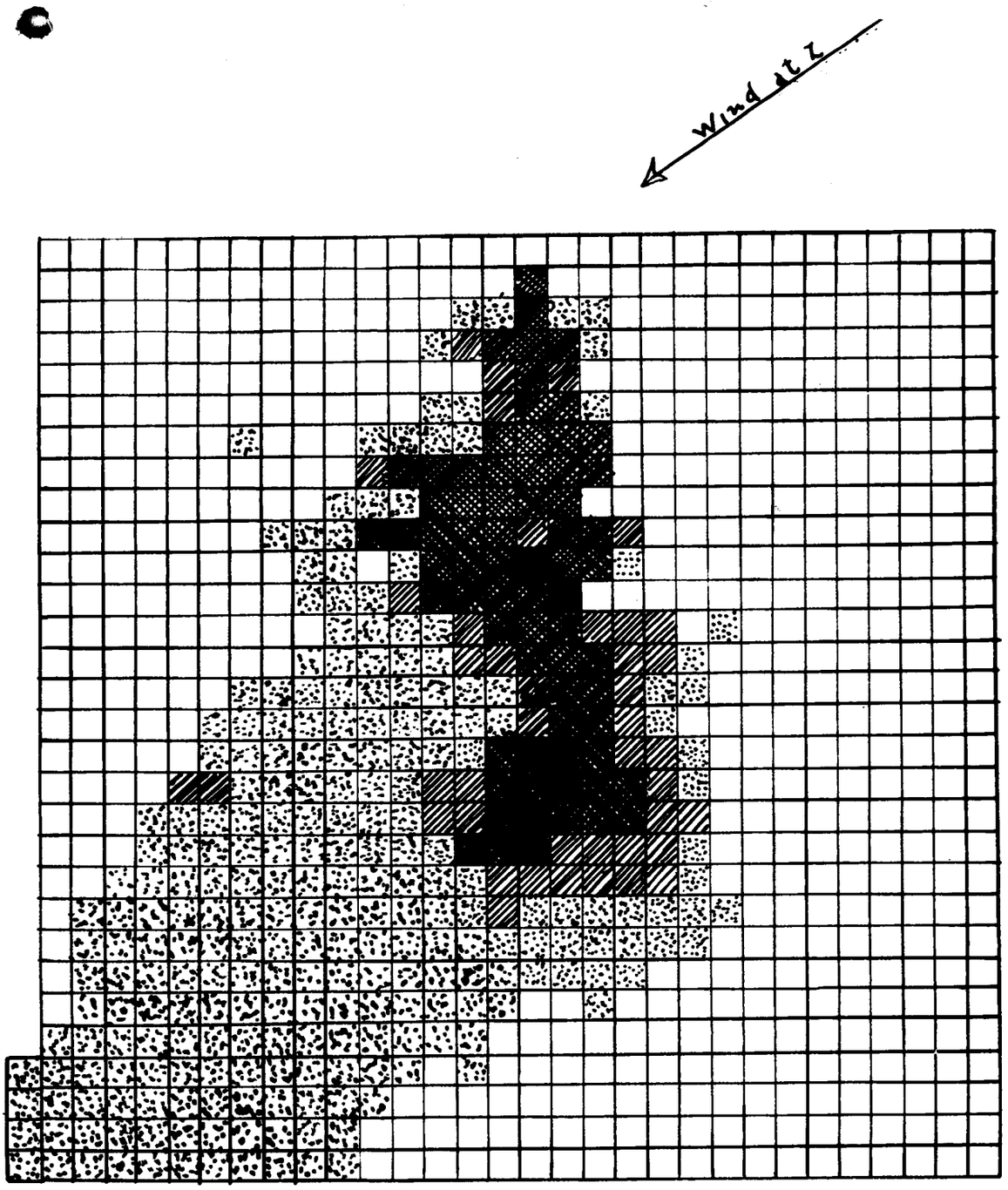
Position	Mgm H/m^3 (Average Concentration Over Sampling Times, Z to Z + 30 min
1	0.2
2	0.2
3	0.2
4	0.2
5	0.3
6	0.4
7	0.4
8	0.8
9	0.6
10	0.6
11	0.8
12	0.5
13	0.4
14	0.3
15	-
16	nil
17	0.5
18	nil
19	0.3
20	nil
21	nil
22	nil

APPENDIX 111
(Continued.)

400 yard line — Spacing 20 yards, positions numbered from right facing source. Rate of sampling - 10 liters/Min.

Position	Mgm H/m^3 (Average Concentration Over Sampling Times, Z to Z + 30 mins)
1	0.02
2	0.02
3	0.03
4	nil
5	nil
6	nil
7	nil
8	0.1
9	0.07
10	0.13
11	0.1
12	0.02
13	0.07
14	0.10
15	0.03
16	0.03
17	nil
18	nil
19	nil
20	nil
21	nil
22	nil

Tests at Z 24 hours. Negative results were obtained at all points on both the 100 and 200 yard lines on 40 minutes sampling.



Contamination

- ■ > 1000 gm/m².
- ▩ 100 - 1000 gm/m²
- ▨ 10 - 100 gm/m²
- ▦ < 10 gm/m².

○ Source
2.5 yard squares

J.W.Y.

Field Experiment 44

Figure 1.