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DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH AND FIRE OFFICES' COMMITTEE
JOINT FIRE RESEARCH ORGANIZATION

THE USE OF BREATHING APPARATUS AT FIRES

by

Mrs. J.E.L. Hinton

Summary

An analysis has been made of the reports of fires at which breathing apparatus was used and which were included in a one-in-four sample of all reports from Brigades in the United Kingdom in 1955. There were 351 such incidents included in the sample, of which 37 per cent occurred in private dwellings, 22 per cent in industrial premises and 20 per cent in commercial premises, professional establishments and public institutions. The damage by fire and heat was confined to the room or compartment of origin in about 62 per cent of the incidents; in 59 per cent of the incidents the fire was controlled by the brigades in less than 20 minutes after arrival. Almost all the fires at which breathing apparatus was in use required the use of hose reel jets or jets from pumps and hydrants.

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INTRODUCTION

Reports of all fires attended by Fire Brigades in the United Kingdom during 1955 have been analysed on the basis of a one-in-four random sample. In this sample there were reports of 351 incidents at which breathing apparatus was in use, representing an estimated total of about 1 400 fires, a little more than 1 per cent of all attendandes by the Fire Brigades.

Data on these incidents have been analysed with the object of comparing features of the fires in which it was necessary to use breathing apparatus with those of fires in general.

TYPE OF PREMISES IN WHICH FIRES INVOLVING THE USE OF BREATHING APPARATUS OCCURRED

In Table 1 the fires at which it was necessary to use breathing apparatus are analysed with respect to the type of premises in which they occurred. Thirty seven per cent of the incidents at which breathing apparatus was in use occurred in dwellings, 22 per cent in industrial premises and 20 per cent in commercial premises, professional establishments and public institutions.

In houses and flats the number of incidents was greater than that in other occupancies, but the rate of incidence of fires requiring the use of breathing apparatus was low - 5.5 per 1 000 fires attended. The rate calculated for fires in industrial premises, and for those in commercial premises, professional establishments and public institutions was in each case about 12 incidents at which breathing apparatus was in use per 1 000 fires attended.

EXTENT OF DAMAGE BY FIRE AND HEAT

The extent of damage by fire and heat in incidents where breathing apparatus was used is shown in Table 2. In the majority of incidents in all types of premises fire and heat damage was confined to the room or compartment of origin. This was most marked in "ships and other outdoor hazards" where over 90 per cent of the incidents in which breathing apparatus was necessary were confined to the compartment of origin.

TIME INTERVALS BETWEEN THE ARRIVAL OF THE BRIGADE AND THE CONTROL OF THE FIRE

The distribution of the reported time intervals between the arrival of the Brigade and the control of fire is given in Table 3 and Fig. I.

Two hundred and six fires, 59 per cent of the total number of fires at which breathing apparatus was used, were controlled in less than 20 minutes after the arrival of the Fire Brigade. Seventytwo per cent of the incidents in which damage by fire and heat was confined to the room or compartment of origin were controlled in less than 20 minutes, but only 36 per cent of the fires which spread beyond the room or compartment of origin were controlled in less than 20 minutes.

METHODS OF EXTINCTION USED BY FIRE BRIGADES

The methods of extinction used by Fire Brigades at incidents where breathing apparatus was in use are shown in Table 4, and compared with the methods used at all fires in buildings. Three hundred and thirty incidents, 94 per cent of those at which breathing apparatus was in use, required the use of hose reel jets or jets from pumps and hydrants, and 310 of these occurred in buildings. The overall proportion of fires in buildings which call for the use of apparatus larger than extinguishers is about 70 per cent, so that the larger means of extinction are used more frequently in "breathing apparatus fires" than in fires in general.

Table 6

NUMBER OF SETS OF BREATHING APPARATUS IN USE AT FIRES

(Incidents included in a one-in-four sample of reports from Fire Brigades in the United Kingdom, 1955)

Numbers of sets of B.A. in use	No. of incidents	Percentage of total incidents
1	46	13.1
2	189	53.8
3	34	9.7
4	36	10.3
5	11	3.1
6	9	2.6
7	-	-
8	6	1.7
More than 8	8	2.3
Unknown	12	3.4
Total	351	100.0

THE TIME TAKEN TO CONTROL THE FIRE IN INCIDENTS IN WHICH MORE THAN EIGHT SETS OF BREATHING APPARATUS WERE IN USE

Number of sets of B.A. in use	Time to control fire
	(mins.)
9	45
11	24
11	61
12	84
12	143
14	93
16	20
20	55

THE MAKE OF BREATHING APPARATUS IN USE

Make of B.A.	No. of incidents	Percentage of total incidents
"Salvus"	103	29.3
"Proto"	132	37.6
"Siebe Gorman"	2	0.6
"Lungavox"	3	0.9
"Compressed air"	29	8.3
"Proto and Salvus"	27	7.7
Other combinations	14	4.0
Unknown	41	11.7
Total	351	100.0

suffering from the effects of smoke and toxic gases at fires in which breathing apparatus was used but the reports did not indicate whether these casualties were themselves wearing breathing apparatus.

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METHODS OF EXTINCTION USED BY FIRE BRIGADES

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Table 5 shows the number of jets in operation at incidents in the types of premises in which breathing apparatus was most frequently used. In 118 of the incidents considered (44 per cent) only one jet was used, and in a further 89 of the incidents two jets were used. Seven per cent of the incidents required the use of 5 or more jets.

THE NUMBERS OF BREATHING APPARATUS SETS IN USE AND THE TYPES MOST GENERALLY USED

The numbers of breathing apparatus sets in use are shown in Table 6. In 189 incidents (54 per cent of the total) two sets were in use; in many of these it is possible that two sets were used in accordance with standard Brigade safety practice and not because one would have been insufficient.

In 8 incidents the use of more than 8 sets of breathing apparatus was necessary. The time between the arrival of the Brigade and the control of fire has been tabulated for these, and it is apparent that these were all difficult fires to tackle.

The makes of breathing apparatus in use have also been tabulated, Proto and Salvus being the most frequently used.

The numbers of persons who were rescued or escaped, and the fatal and non-fatal casualties which resulted from the incidents in which it was necessary to use breathing apparatus are shown in Table 7. The greatest number in each case occurred in dwellings.

DISCUSSION OF RESULTS

Although fires in dwellings make the greatest contribution to the number of incidents at which breathing apparatus was in use, the rate of incidence, calculated as the number of attendances requiring the use of breathing apparatus per 1 000 fires attended in dwellings, was lower than the rate calculated for industrial and commercial premises. The greatest numbers of casualties, rescues and escapes also occurred in fires in dwellings presumably because breathing apparatus is frequently used in dwellings even for fairly small fires, in order to gain entry and to ascertain that the evacuation of occupants is complete. Breathing apparatus is also often needed in dwellings to fight fires in roof voids which rapidly become smoke-logged, and in which pungent fumes may be produced by burning roofing felt.

The rate of incidence of fires at which breathing apparatus was used both in industrial premises and in commercial premises and professional establishments, was about 12 per 1 000 fires attended in these types of premises. The materials involved in fires in these premises are usually those which produce most pungent fumes when ignited, e.g. textiles, chemicals, packing materials; the buildings are often large and uncompartmented, and liable to become smoke-logged quickly.

In all types of premises damage by fire and heat was confined to the room or compartment of origin in most of the incidents at which breathing apparatus was necessary. About 60 per cent of the incidents were controlled by the Fire Brigades in less than 20 minutes and about 80 per cent in less than 30 minutes. (Table 3). The time interval between the arrival of the Brigade and the control of fire is the only indication of the length of time for which breathing apparatus was in use and from consideration of these it can be inferred that in the great majority of cases half hour sets were adequate.

At about 67 per cent of the incidents 1 or 2 sets of breathing apparatus were in use (Table 6).

In the reports considered in this analysis there was no indication of any breathing apparatus failing while in use, although one fireman was reported as a casualty suffering from "over oxygenation". Seven firemen were reported as suffering from the effects of smoke and toxic gases at fires in which breathing apparatus was used but the reports did not indicate whether these casualties were themselves wearing breathing apparatus.

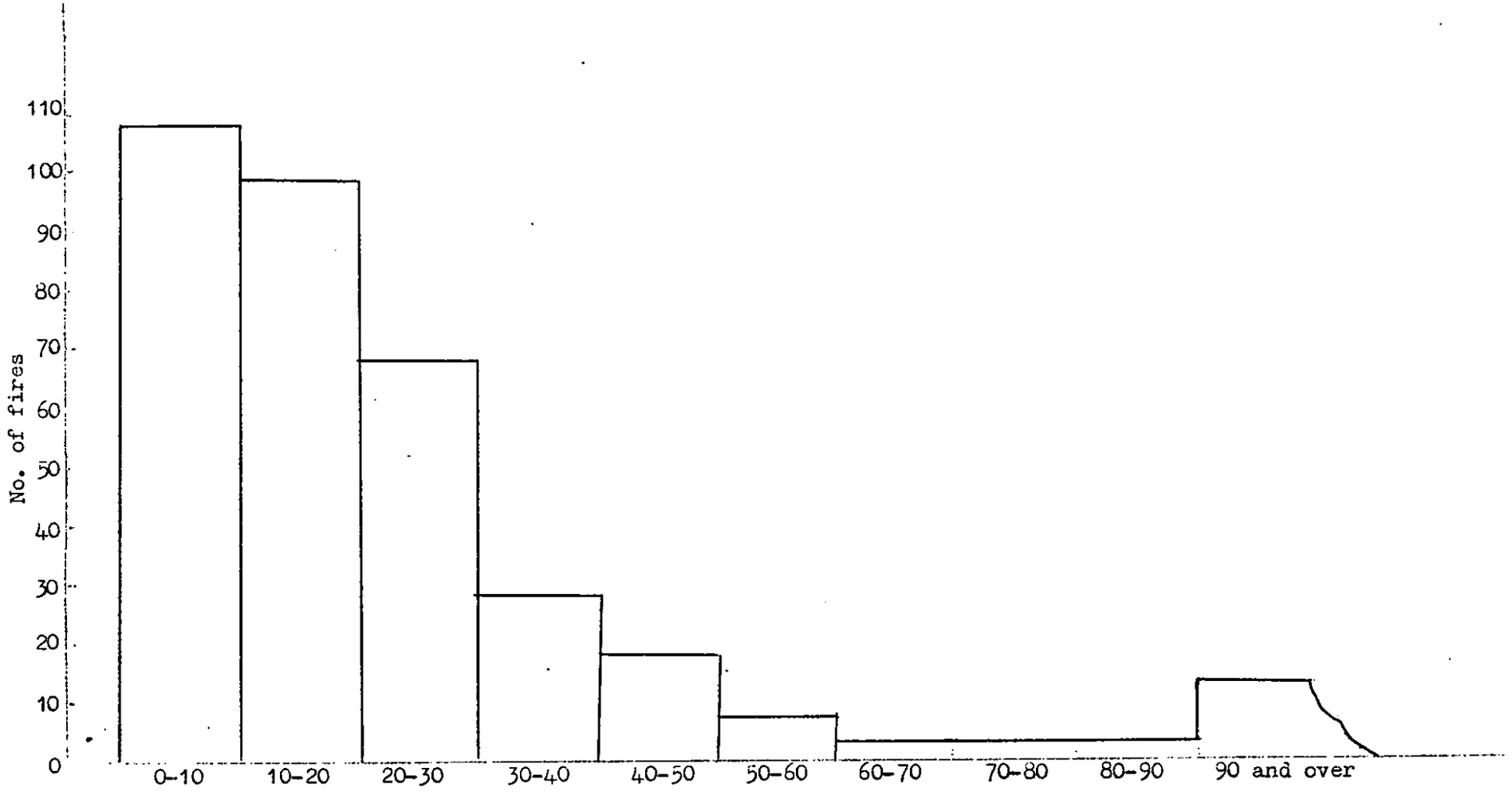

Fig.1. DISTRIBUTION OF REPORTED TIME INTERVALS BETWEEN THE ARRIVAL OF THE FIRE BRIGADES AND THE CONTROL OF FIRE AT INCIDENTS AT WHICH BREATHING APPARATUS WAS IN USE.

(Incidents included in a one-in-four sample of reports from Fire Brigades in the United Kingdom, 1955)

Table 1

TYPES OF PREMISES IN WHICH BREATHING APPARATUS WAS IN USE DURING FIRES

(Incidents included in a one-in-four sample of reports from Fire Brigades in the United Kingdom, 1955)

Type of premises	No. of incidents	Percentage of total number of incidents requiring B.A. %	Fires requiring B.A. per 1 000 total fires attended
Industrial premises	79	22.5	11.9
Transport, public utilities and service premises	16	4.6	7.0
Commercial premises, offices, professional establishments	71	20.2	12.5
Houses and flats	130	37.0	5.5
Other buildings	31	8.8	2.5
Ships and other outdoor hazards	24	6.8	0.3
Total	351	100.0	2.9

Table 2

EXTENT OF DAMAGE BY FIRE AND HEAT TO PREMISES IN INCIDENTS WHERE BREATHING APPARATUS WAS IN USE

(Incidents included in a one-in-four sample of reports from Fire Brigades in the United Kingdom, 1955)

Type of premises	Damage by fire and heat					
	Confined to room or compartment of origin		Spread beyond room or compartment of origin		Total	
	No.	Per cent	No.	Per cent	No.	Per cent
Industrial premises	42	12.0	37	10.5	79	22.5
Transport, public utilities and service premises	14	4.0	2	0.6	16	4.6
Commercial premises, offices, professional establishments	41	11.7	30	8.5	71	20.2
Houses and flats	78	22.2	52	14.8	130	37.0
Other buildings	22	6.3	9	2.3	31	8.8
Ships and other outdoor hazards	22	6.3	2	0.6	24	6.8
Total	219	62.4	132	37.6	351	100.0

Table 3

DISTRIBUTION OF REPORTED TIME INTERVALS BETWEEN ARRIVAL OF BRIGADE AND CONTROL OF FIRE (i.e. PROBABLE TIME FOR WHICH BREATHING APPARATUS WAS REQUIRED)

(Incidents included in a one-in-four sample of reports from Fire Brigades in the United Kingdom, 1955)

Time in mins.	No. of fires	Per cent of total	Cumulative % of total
0- 5	36	10.2	10.2
5-10	72	20.5	30.8
10-15	58	16.5	47.3
15-20	40	11.4	58.7
20-25	41	11.7	70.4
25-30	27	7.7	78.1
30-35	16	4.6	82.6
35-40	12	3.4	86.0
40-45	8	2.3	88.3
45-50	10	2.8	91.2
50-55	4	1.1	92.3
55-60	3	0.9	93.2
60-65	3	0.9	94.0
65-70	-	-	-
70-75	2	0.6	94.6
75-80	1	0.3	94.9
80-85	3	0.9	95.7
85-90	-	-	-
90-95	1	0.4	96.0
95-99	-	-	-
Over 99	12	3.4	99.4
Unknown	2	0.6	100.0
Total	351		

Table 4

METHODS OF EXTINCTION USED BY FIRE BRIGADES IN INCIDENTS WHERE BREATHING APPARATUS WAS IN USE

(Incidents included in a one-in-four sample of reports from Fire Brigades in the United Kingdom, 1955)

Method of extinction	All fires where B.A. was in use	Fires in buildings where B.A. was in use	All fires in buildings
First aid methods	19 (5.4)	17 (5.2)	3 116 (30.4)
Water from hose reel jets	185 (52.7)	180 (55.0)	5 280 (51.5)
Jets from pumps and hydrants	89 (25.3)	79 (24.1)	1 634 (15.9)
Hose reel jets and jets from pumps and hydrants	47 (13.4)	44 (13.5)	7 (-)
Hose reel jets or jets from pumps and hydrants and first aid methods	9 (2.6)	7 (2.1)	...
Total	349*	327	10 251

* There were two incidents at which B.A. was used although the fire was extinguished before the arrival of the Fire Brigade.

Note: Figures in brackets are percentages

Table 5

THE NUMBER OF JETS OPERATING ON FIRES WHERE BREATHING APPARATUS WAS IN USE

(Incidents included in a one-in-four sample of reports from Fire Brigades in the United Kingdom, 1955)

Number of jets operating	Industrial premises	Commercial premises, offices, professional establishments	Houses and flats	Total
1	23 (30.7)	31 (47.6)	64 (50.0)	118 (44.2)
2	30 (40.0)	12 (18.5)	47 (37.0)	89 (33.3)
3	10 (13.3)	12 (18.5)	9 (7.1)	31 (11.6)
4	4 (5.3)	3 (4.6)	4 (3.1)	11 (4.1)
5 or more	8 (10.6)	7 (10.7)	3 (2.4)	18 (6.7)
	75 (100.0)	65 (100.0)	127 (100.0)	267 (100.0)

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Table 7

THE NUMBERS OF PERSONS RESCUED AND ESCAPED, AND FATAL AND NON-FATAL CASUALTIES IN FIRES WHERE BREATHING APPARATUS WAS IN USE

(Incidents included in a one-in-four sample of reports from Fire Brigades in the United Kingdom, 1955)

Type of premises	Persons rescued	Persons escaped	Non-fatal casualties	Fatal casualties
Industrial premises	2 (1)	-	6 (4)	-
Transport, public utilities and service premises	-	-	-	-
Commercial premises, offices, professional establishments	6 (2)	-	9 (6)	-
Houses and flats	41 (20)	4 (3)	29 (16)	12 (9)
Other buildings	-	-	2 (1)	-
Ships and other outdoor hazards	-	-	2 (1)	-
Total	49 (23)	4 (3)	48 (28)	12 (9)

Figures in brackets are numbers of incidents.