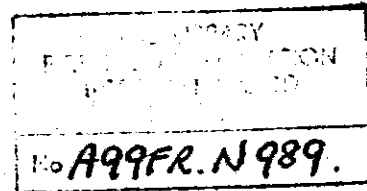


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**Fire Research Note
No 989**



THE ESTIMATED FIRE RISK OF VARIOUS OCCUPANCIES

by

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October 1973

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THE ESTIMATED FIRE RISK OF VARIOUS OCCUPANCIES

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SUMMARY

The risks of a fire occurring and of a fire death or injury are estimated for a number of building occupancies. The mean direct fire loss is also presented for these occupancies.

KEY WORDS: Fire statistics, fatalities, casualties, loss.

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INTRODUCTION

Knowledge of the level of fire risk in various occupancies is of use in a number of studies. It is a basic parameter for economic assessment of the correct level of expenditure on fire prevention and it serves to identify occupancies with particularly high risks, so that remedial action may be given high priority, e.g. hotels^{1,2}.

Four important parameters are estimated in the present note, namely the probability of a fire per establishment, the expected loss per establishment, the risk of personal injury and the risk of death by fire in various occupancies. The risk of death is measured by the number of deaths per person per unit time exposed to the hazard, a probability per unit time, which takes into account the number of deaths, the number of people at risk and the length of time for which they are at risk. This measure has been used to study industrial accidents³ and the safety of aircraft⁴, and to study fires in particular occupancies^{5,6}.

A major task in making such estimates is the collection of suitable data. Although fire statistics are readily available from brigade reports, other information occurs in a wide variety of sources, not always comparable, and in some cases it is necessary to resort to subjective estimates, representing the likely range of values of a particular data item. In spite of these difficulties, the collection and collation of such data, is a worthwhile task, and this note includes comprehensive tables of the data and the sources from which they are obtained.

DATA

For each occupancy considered, figures have been collected of the number of fires, the number of large fires (fires with an estimated direct fire loss of £10000 or greater), the estimated direct cost of these large fires and of the number of casualties, both fatal and non-fatal. Associated with these are the number of establishments and the number of persons at risk in this occupancy, together with a figure for the average length of time each person is at risk. This last is usually a subjective estimate but, in some cases, it has been possible to obtain objective

data. These basic data are given in Table 1 and it will be seen that not all the data have been obtained for all occupancies. The sources of the basic data are detailed in the Appendix. For many of the occupancies listed, figures are given of the mean value 1967-70. The fire data were taken from published sources (as detailed in the Appendix) and a weighted mean used to allow for those years in which only a sample of the fire reports were analysed.

DISCUSSION AND CONCLUSIONS

In order to make the basic data of Table 1 more comprehensible and comparable between the occupancies, four parameters have been calculated from them. Each represents one aspect of the fire risk and so we have:

- a) Probability of an outbreak of fire. The number of fires per establishment per year.
- b) Expected loss. The mean estimated direct fire loss per establishment per year. Since loss figures are only available for those fires in which the loss was £10 000 or more and such large fires account for about 65 per cent of all fire losses⁷, the loss figures of Table 1 have been multiplied by a factor of 100/65 before calculation of the mean loss. Some occupancies deviate markedly from this distribution and calculation gives meaningless figures, so, arbitrarily, occupancies in which less than 1 fire in every 100 reported to the brigade has an estimated direct loss of £10 000 or more, have not been included.
- c) Injury risk. The probability of a person suffering non-fatal injuries from fire per unit time spent in that occupancy.
- d) Fatality risk. The probability of a person suffering fatal injuries from fire per unit time spent in that occupancy.

These risk parameters are presented in Table 2.

Since fire deaths are generally few in the occupancies considered, there is considerable scatter in the values of the fatality risk and frequently no deaths have occurred in the years considered. In these circumstances, it is not possible to use the fatality risk as a measure of the relative hazard of different occupancies, since the best estimate of this risk is zero. However, in many cases, there are big differences between the exposure times in the occupancies with no deaths, and, since interest centres on the order of magnitude of the fatality risk, an 'exposure factor' has been calculated, defined as the inverse exposure hours. In Table 2, this is shown as a value enclosed in parentheses under the fatality risk column,

where applicable. These factors are equal to the estimated fatality risk had one death occurred in that occupancy in the period considered and can be used for purposes of comparison with the fatality risk in occupancies where genuine estimates are available.

The injury risk does not suffer from these difficulties since, in general, the frequency of non-fatal injuries is non-zero, but, although the correlation between injury risk and fatality risk was statistically highly significant, the scatter is too great for use in predicting the fatality risk.

The number of fires per establishment per year shows considerable variation between occupancies but is generally of the orders 10^{-1} to 10^{-2} , except for homes, which have $2 - 3 \times 10^3$ fires per home per year. Where it is available, the estimated direct fire loss is approximately between £100 and £1500 per establishment per year.

The various estimates for houses or all dwellings suggest that their true value of fatality risk lies somewhere in the range 0.13 to 0.20 deaths/person/ 10^8 exposed hours and this approximate value can form a yard-stick for comparison with other occupancies. The risks of the manufacturing industries lie around the range for homes, with the mean values for all manufacturing industries being very similar to those for homes. The largest deviation occurs in the timber and furniture industries for 1968 and this value depends on a single, freak fire. Apart from this, the chemical and petrochemical industries have the highest mean values (about 0.5 deaths/person/ 10^8 exposed hours). Elsewhere in Table 2, we have high life risks for the agriculture, forestry and fishing class and hotels and motels, while the values for hospitals are generally rather higher than for homes. The estimated risk of hotels, etc. is some 20 times that of houses but this is probably an over-estimate, since the figure used as an estimate of the number of persons at risk (Table 1 and Appendix, note 26) apparently only includes holiday-makers and overseas tourists, not business-men or staff. The inclusion of these latter could easily reduce the estimated risk by a factor of two or, conceivably, by four, but this would still leave hotels as one of the most hazardous occupancies considered.

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APPENDIX

SOURCE OF DATA

Table of note numbers which refer to the data source

Estimate No	Column No. in Table 1							
	1	2	3	4	5	6	7	8
1-4	8	8	8	8	8	9	10	11
5-8	8	8	8	8	8	4	4	15
9	2	7	7	6	6	2	3	30
10	12	7	7	6	6	5	3	30
11	25	8	8	25	25	-	26	27
12	1	1	1	1	1	1	1	1
13	8	8	8	8	8	2	1	1
14	8	8	8	8	8	2	29	29
15	8	8	8	8	8	2	13	14
16	8	8	8	8	8	2	-	-
17	8	8	8	8	8	2	-	-
18	8	8	8	8	8	2	-	-
19	8	8	8	8	8	2	28	21
20-37	12	7	7	6	8	16	16	14
38-55	12	17	17	12	12	18	13	14
56-57	12	19	19	12	12	20	13	21
58-69	12	19	19	12	12	20	13	14
70-73	12	19	19	12	12	20	13	21
74	12	19	19	12	12	-	3	30
75	12	19	19	12	12	20	13	14
76-79	8	8	8	8	8	22	-	-
80-83	8	8	8	8	8	9	23	11
84	-	-	-	-	24	24	24	11
85	25	8	8	8	8	-	26	27

NOTES ON THE SOURCES OF THE TABULATED VALUES

1. From: NORTH, M A and BALDWIN, R. Some statistics of fires in shops and their application to town centre developments. Joint Fire Research Organisation Fire Research Note No.946, 1972.
The average number of persons per shop is taken as 10.
2. From: BALDWIN, R. Some notes on the mathematical analysis of safety. Joint Fire Research Organisation Fire Research Note No.909, 1972.
3. The number of persons at risk is taken approximately as the total population of the area considered.
4. From: Annual Abstract of Statistics 1971. Central Statistical Office. London, 1971. H M Stationery Office (Table 98).
The number at risk includes both pupils and teachers.
5. From: Annual Abstract of Statistics 1971. Central Statistical Office. London, 1971. H M Stationery Office (Table 69).
6. From: United Kingdom Fire and Loss Statistics. Joint Fire Research Organisation. Annual. (Table 11A).
7. From: RAMACHANDRAN, G and KIRSOP, Patricia. A brief analysis of large fires during 1965 to 1968. Joint Fire Research Organisation Fire Research Note No.792, 1969.
8. From: Fire Research Station data-bank. For years in which only a sample of fire reports was coded (ie 1968 and 1969), this is generally an estimate.
9. From: Annual Abstract of Statistics 1971. Central Statistical Office. London, 1971. H M Stationery Office. (Table 57).
Figures increased by about 8 per cent to allow for occupancies in the Standard Industrial Classification which are not hospitals. (see NORTH, M A Fire Risks in Hospitals. Fire Research Note No.983, 1973.)
10. From: Hospital Year Book. London, annual. Institute of Hospital Administrators.
Increased by 8 per cent as above, together with one-third of the nursing staff (Annual Abstract of Statistics 1971, Table 56), so allowing for shift working.
11. Time at risk = 365 days x 24 hours \approx 8700 h/a.
12. From: United Kingdom Fire and Loss Statistics. Joint Fire Research Organisation. Annual. (Table 9A).

13. From: Annual Abstract of Statistics 1971. Central Statistical Office. London, 1971. H M Stationery Office. (Table 140).
14. Average weekly hours of full-time manual workers in the manufacturing industries 1967-1970 : men 45.4 h, women 38.0 h (Annual Abstract of Statistics 1971, Table 159). Total employees in employment (average 1967-1970) : men 14 387 000, women 8 714 000 (Annual Abstract of Statistics 1971, Table 140). Assuming that all these people work, on average, the hours above, we have 984 301 800 h worked per week in the United Kingdom. If a 49-week year is worked, this gives 48 230 788 200 h worked by 23 101 000 persons in a year, ie the average person works for 2090 h/a, or approximately 2100 h/a.
15. The average school day is 6.5 h long, if half of the school stops to lunch. There are 40 5-day weeks in the school year and, thus, the average person spends 1300 h/a on the school premises.
16. From: Annual Abstract of Statistics 1972. Central Statistical Office. London, 1972. H M Stationery Office. (Table 160).
17. From: RAMACHANDRAN, G., KIRSOP, Patricia and Christine. Large fires during 1970. Joint Fire Research Organisation Fire Research Note No.891, 1971.
18. From: Business Statistics Office, private communication.
19. From: RAMACHANDRAN, G and KIRSOP, Patricia. A brief analysis of large fires during 1965 to 1968. Joint Fire Research Organisation Fire Research Note No.792, 1969.
RAMACHANDRAN, G., KIRSOP, Patricia and EVELEIGH, Christine. Large fires during 1969. Joint Fire Research Organisation Fire Research Note No. 829, 1970.
RAMACHANDRAN, G., KIRSOP, Patricia and EVELEIGH, Christine. Large fires during 1970. Joint Fire Research Organisation Fire Research Note No.891, 1971.
20. Derived by linear inter-extrapolation from 1968 and 1970 (see notes 16 and 18).
21. Time at risk derived from this time in the manufacturing industries (see note 14) by a guess at the proportion of the day that the average worker is inside a building.
22. From: Statistics for town and country planning. Office of Population Censuses and Surveys. Series II, No.2. London, 1972. H M Stationery Office.

23. From: Hospital Year Book. London, Annual. Institute of Hospital Administrators. Increased by 8 per cent as note 9. The mean number of occupied beds in each year.
24. From: SCHWARTZ, B A. The Veterans Administration fire safety program. Fire Journal, 1973, 67 (1) 13.
25. From: CHANDLER, S E. Fire in hotels. Joint Fire Research Organisation Fire Research Technical Paper No.23. London, 1969. H M Stationery Office.
26. From: Tourism in OECD member countries. Organisation for Economic Co-operation and Development. Paris, 1968.
27. Time at risk is taken as approximately 8 h/d.
28. Likely range for the number of persons employed in each office.
29. From: Annual Abstract of Statistics 1972. Central Statistical Office. London, 1972. H M Stationery Office. (Table 102). Derived from the number of admissions to cinemas, 1967. The figure has been increased in proportion to allow for non-cinema places of entertainment. Each 'admission' is considered to spend 3 hours inside.
30. Time at risk is taken as approximately 15 h/d.

TABLES

TABLE 1
BASIC DATA (i)

Column No.			1	2	3	4	5	6	7	8
Estimate	Occupancy	Year	Fires/ year	Large-loss fires/year	Loss in large fires/ year (£)	Fire casualties/ year		No. of establish- ments	No. of persons at risk	Assumed mean time at risk/ person/year (hr)
						non- fatal	fatal			
9	Private Houses (UK)	1967	38142	27	6.9×10^5	1863	394	1.4×10^7	5.5×10^7	5500
10	All dwellings (GB)	1967	38583	28	7.1×10^5	2720	573	1.8×10^7	5.3×10^7	
74	Houses, mean	1967-70	43009	30.5	7.4×10^5	2779.6	572.4	-	5.5×10^7	
<u>MANUFACTURING INDUSTRIES</u>										
20	Food, drink & tobacco	1968	620	34	3.6×10^6	20	1	6463	7.9×10^5	2100
38		1970	697	33	2.0×10^6	12	1	7852	8.9×10^5	
58	Mean	1967-70	639	34.3	2.5×10^6	16.4	0.73	6810	8.7×10^5	
21	Coal & petroleum products	1968	68	7	3.9×10^5	8	0	256	4.2×10^4	2100
39		1970	67	2	1.3×10^5	6	1	277	6.3×10^4	
22	Chemical & allied industries	1968	840	47	2.8×10^6	16	4	3047	4.1×10^5	2100
40		1970	1031	55	3.2×10^6	68	5	3519	4.8×10^5	
59	Chemicals & petroleum	1967-70	948	51.3	3.5×10^6	66.5	11.27	3426	5.3×10^5	2100
23	Metal manufacture	1968	932	31	2.4×10^6	12	1	3044	5.5×10^5	2100
41		1970	1111	21	1.4×10^6	53	3	3346	5.9×10^5	
60	Mean	1967-70	979	30.5	1.8×10^6	44.0	1.82	3120	5.9×10^5	
24	Mechanical engineering	1968	448	22	1.0×10^6	16	1	12988	9.8×10^5	2100
42		1970	506	-	-	17	0	16147	1.2×10^6	
25	Instrument engineering	1968	52	7	5.1×10^5	8	0	2270	1.7×10^5	2100
43		1970	61	-	-	2	0	2835	1.6×10^5	
26	Electrical engineering	1968	316	29	5.2×10^6	16	0	4017	7.5×10^5	2100
44		1970	370	-	-	14	0	5609	9.1×10^5	

TABLE 1 (continued)
 BASIC DATA (i) (continued)

Column No.										
Estimate	Occupancy	Year	1	2	3	4 5		6	7	8
			Fires/ year	Large-loss fires/year	Loss in large fires/ year (£)	Fire casualties/ year		No. of establish- ments	No. of persons at risk	Assumed mean time at risk/ person/year (hr)
						non- fatal	fatal			
61	General engineering	1967-70	862	58.3	6.1×10^6	30.5	1.45	20604	2.3×10^6	2100
27	Shipbuilding & marine	1968	104	3	2.7×10^5	0	0	1298	1.9×10^5	2100
45		1970	134	7	2.7×10^5	5	0	1558	2.0×10^5	
62		Mean	1967-70	113	4.8	1.9×10^5	6.9	0.73	1363	2.0×10^5
28	Vehicles	1968	516	22	1.1×10^6	12	0	2631	7.9×10^5	2100
46		1970	784	24	8.3×10^5	12	1	3223	8.4×10^5	
63		Mean	1967-70	601	23.8	2.7×10^6	14.5	1.09	2779	8.3×10^5

FIRE RISK
BASIC DATA (ii)

Estimate	Column No Occupancy	Year	1	2	3	4 5		6	7	8
			Fires/ year	Large-loss fires/year	Loss in large fires/ year (£)	Fire casualties/ year		No. of establish- ments	No. of persons at risk	Assumed mean time at risk/ person/year (hr)
						non- fatal	fatal			
29	Metal goods NES	1968	644	15	1.2x10 ⁶	20	0	11364	5.4x10 ⁵	2100
47		1970	700	30	2.2x10 ⁶	25	1	14922	6.4x10 ⁵	
64	Mean	1967-70	654	22.8	2.3x10 ⁶	14.5	0.73	12254	6.2x10 ⁵	
30	Textiles	1968	1056	61	5.9x10 ⁶	32	0	6283	6.7x10 ⁵	2100
48		1970	1200	63	3.4x10 ⁶	20	0	6483	7.2x10 ⁵	
65	Mean	1967-70	1095	66.3	5.6x10 ⁶	18.5	0	6333	7.4x10 ⁵	
31	Leather and fur	1968	64	8	5.0x10 ⁵	0	0	1482	4.7x10 ⁴	2100
49		1970	98	6	1.4x10 ⁵	4	0	1779	5.4x10 ⁴	
32	Clothing and footwear	1968	172	21	1.7x10 ⁶	4	2	7556	4.5x10 ⁵	2100
50		1970	262	42	1.9x10 ⁶	15	0	9334	5.0x10 ⁵	
66	Clothing, footwear & leather	1967-70	294	36.5	1.9x10 ⁶	17.8	0.73	9557	5.8x10 ⁵	2100
33	Bricks, pottery, glass, etc	1968	428	17	1.1x10 ⁶	4	0	5125	2.9x10 ⁵	2100
51		1970	480	18	5.5x10 ⁵	15	2	5807	3.4x10 ⁵	
67	Mean	1967-70	439	17.0	7.6x10 ⁵	13.5	0.73	5296	3.5x10 ⁵	
34	Timber, furniture, etc	1968	944	41	1.8x10 ⁶	24	22	8995	2.6x10 ⁵	2100
52		1970	870	58	2.9x10 ⁶	34	1	12149	3.0x10 ⁵	
68	Mean	1967-70	832	48.8	2.2x10 ⁶	28.7	0.73	9784	3.1x10 ⁵	
35	Paper, printing, etc	1968	500	42	3.3x10 ⁶	8	3	10395	5.9x10 ⁵	2100
53		1970	631	45	7.7x10 ⁶	30	0	13632	6.6x10 ⁵	
69	Mean	1967-70	564	41.8	4.2x10 ⁶	20.7	0.36	11204	6.5x10 ⁵	
36	Other manufacturing ind.	1968	616	49	7.1x10 ⁶	20	0	4574	3.3x10 ⁵	2100
54		1970	635	48	2.1x10 ⁶	26	0	5798	3.6x10 ⁵	

FIRE RISK (continued)
BASIC DATA (ii)(continued)

	Column No		1	2	3	4	5	6	7	8
Estimate	Occupancy	Year	Fires/ year	Large-loss fires/year	Loss in large fires/ year (£)	Fire casualties/ year		No. of establish- ments	No. of persons at risk	Assumed mean time. at risk/ person/year (hr)
						non- fatal	fatal			
37	All manufacturing ind.	1968	8340	473	4.0×10^7	224	37	91788	7.8×10^6	2100
55		1970	9637	517	3.4×10^7	358	15	114270	8.9×10^6	
75		Mean	1967-70	8924	492.5	3.9×10^7	348.0	22.55	97409	

FIRE RISK
BASIC DATA (iii)

Estimate	Column No		1	2	3	4 5		6	7	8
	Occupancy	Year	Fires/ year	Large-loss fires/year	Loss in large fires/ year (£)	Fire casualties/ year		No. of establish- ments	No. of persons at risk	Assumed mean time at risk/ person/year (hr)
						non- fatal	fatal			
<u>OTHER CLASSIFIED INDUSTRIES</u>										
56	Agriculture, forestry, fishing	1967-70	3601	35.5	5.9×10^5	25.5	3.27	-	4.1×10^5	1000
57	Mining and quarrying	1967-70	129	0.5	5.0×10^4	4.0	1.09	-	4.8×10^5	1000
70	Construction	1967-70	2034	15.5	4.7×10^5	34.9	1.45	-	1.5×10^6	1500
71	Gas, electricity & water	1967-70	412	11.3	6.8×10^5	30.2	1.82	-	4.1×10^5	2100
72	Financial & scientific services	1967-70	3703	61.8	2.2×10^6	93.1	13.09	-	3.6×10^6	2000
73	Public admin. & defence	1967-70	1575	8.8	6.8×10^5	36.7	0.36	-	1.4×10^6	2000
<u>SUB-GROUPS</u>										
15	Industry	1967	8355	417	3.2×10^7	442	38	1.8×10^5	8.9×10^6	2100
76		1967	8355	417	3.2×10^7	442	38	9.8×10^4	8.9×10^6	
18	Storage	1967	2435	112	6.9×10^6	83	6	2.0×10^5	-	
78		1967	2435	112	6.9×10^6	83	6	2.0×10^5	-	
19	Commercial-offices	1967	942	11	3.7×10^5	29	3	1.5×10^5	10-100*	2000
79		1967	942	11	3.7×10^5	29	3	1.7×10^5	10-100*	
12	Commercial-shops	1967	5580	79	5.9×10^6	183	10	5.1×10^5	5.1×10^6	2000
13		1967	5580	79	5.9×10^6	183	10	6.6×10^5	6.6×10^6	
77		1967	5580	79	5.9×10^6	183	10	3.9×10^5	3.9×10^6	
14	Assembly-entertainment	1967	1447	35	1.6×10^6	63	0	1.3×10^4	2×10^9	3 ⁺

*persons/establishment

+ attendances/year and hours/attendance

FIRE RISK
BASIC DATA (iii) (continued)

	Column No		1	2	3	4	5	6	7	8
Estimate	Occupancy	Year	Fires/ year	Large-loss fires/year	Loss in large fires/ year (£)	Fire casualties/ year		No. of establish- ments	No. of persons at risk	Assumed mean time at risk/ person/year (hr)
						Non- fatal	fatal			
17	Assembly-non-residential	1967	2809	46	1.3×10^6	103	8	1.4×10^5	-	-
16	Residential-clubs, etc	1967	1352	28	8.2×10^5	128	19	3.7×10^4	-	-
11	Hotels & motels	1966	689	15	5.3×10^5	41	9	-	9.1×10^4	3000
85		1967	830	20	5.6×10^5	71	11	-	9.4×10^4	-

FIRE RISK
BASIC DATA (iv)

Estimate No	Column No Occupancy	Year	1 Fires/ year	2 Large-loss fires/year	3 Loss in large fires/ year (£)	4 5 Fire casualties/ year		6 No. of establish- ments	7 No. of persons at risk	8 Assumed mean time at risk/ person/year (hr)
						Non- fatal	fatal			
						1	Hospitals, etc (GB)			
2	(patients & staff)	1968	856	4	1.3×10^5	16	28	3121	5.7×10^5	
3		1969	1074	3	1.5×10^5	20	10	3086	5.7×10^5	
4		1970	1140	-	-	30	15	3035	5.7×10^5	
	Mean	1967-70	920	-	-	27.3	14.5	3090	5.7×10^5	
80	Hospitals, etc (GB)	1967	638	3	7.5×10^4	31	5	3116	4.8×10^5	8700
81	(patients only)	1968	856	4	1.3×10^5	16	28	3121	4.8×10^5	
82		1969	1074	3	1.5×10^5	20	10	3086	4.7×10^5	
83		1970	1140	-	-	30	15	3035	4.6×10^5	
	Mean	1967-70	920	-	-	27.3	14.5	3090	4.7×10^5	
84	Hospitals (US) (patients only)	1969-71	-	-	-	-	7.33	167	8.3×10^4	
5	Schools (E & W)	1967	1048	20	5.3×10^5	33	0	33390	8.3×10^6	1300
6		1968	1072	21	8.0×10^5	24	0	33183	8.5×10^6	
7		1969	1236	32	1.0×10^6	36	0	33077	8.8×10^6	
8		1970	1253	-	-	42	1	32900	9.0×10^6	
	Mean	1967-70	1159	-	-	36.0	0.25	33138	8.7×10^6	

TABLE 2
Estimates of fire risk

Estimate No	Occupancy	Year	Per establishment per year		Casualties/person/10 ⁸ exp.hours	
			fires	fire loss (£)	non-fatal*	fatal*
9	Private houses (UK)	1967	2.7 x 10 ⁻³	-	6.2 x 10 ⁻¹	1.3 x 10 ⁻¹
10	All dwellings (GB)	1967	2.2 x 10 ⁻³	-	9.3 x 10 ⁻¹	2.0 x 10 ⁻¹
	Domestic: mean	1967	2.4 x 10 ⁻³	-	7.7 x 10 ⁻¹	1.6 x 10 ⁻¹
74	Houses: mean	1967/70	-	-	9.2 x 10 ⁻¹	1.9 x 10 ⁻¹
<u>MANUFACTURING INDUSTRIES</u>						
20	Food, drink & tobacco	1968	9.6 x 10 ⁻²	8.7 x 10 ²	1.2	6.0 x 10 ⁻²
38		1970	8.9 x 10 ⁻²	3.9 x 10 ²	6.4 x 10 ⁻¹	5.3 x 10 ⁻²
	Mean	1968/70	9.2 x 10 ⁻²	6.1 x 10 ²	9.1 x 10 ⁻¹	5.7 x 10 ⁻²
58	Mean	1967/70	9.4 x 10 ⁻²	5.8 x 10 ²	9.0 x 10 ⁻¹	4.0 x 10 ⁻²
21	Coal & Petroleum products	1968	2.7 x 10 ⁻¹	2.4 x 10 ³	9.2	(1.1)
39		1970	2.4 x 10 ⁻¹	7.2 x 10 ²	4.5	7.6 x 10 ⁻¹
	Mean	1968/70	2.5 x 10 ⁻¹	1.5 x 10 ³	6.4	4.6 x 10 ⁻¹
22	Chemicals & allied ind.	1968	2.8 x 10 ⁻¹	1.4 x 10 ³	1.9	4.7 x 10 ⁻¹
40		1970	2.9 x 10 ⁻¹	1.4 x 10 ³	6.8	5.0 x 10 ⁻¹
	Mean	1968/70	2.8 x 10 ⁻¹	1.4 x 10 ³	4.5	4.9 x 10 ⁻¹
59	Chemicals & petroleum	1967-70	2.8 x 10 ⁻¹	1.6 x 10 ³	6.0	1.0
23	Metal manufacture	1968	3.1 x 10 ⁻¹	1.2 x 10 ³	1.05	8.7 x 10 ⁻²
41		1970	3.3 x 10 ⁻¹	6.3 x 10 ²	4.3	2.4 x 10 ⁻¹
	Mean	1968/70	3.2 x 10 ⁻¹	9.2 x 10 ²	2.7	1.7 x 10 ⁻¹
60	Mean	1967/70	3.1 x 10 ⁻¹	8.7 x 10 ²	3.6	1.5 x 10 ⁻¹
24	Mechanical engineering	1968	3.4 x 10 ⁻²	1.2 x 10 ²	7.8 x 10 ⁻¹	4.9 x 10 ⁻²
42		1970	3.1 x 10 ⁻²	-	6.7 x 10 ⁻¹	(3.9 x 10 ⁻²)
	Mean	1968/70	3.3 x 10 ⁻²	-	7.2 x 10 ⁻¹	2.2 x 10 ⁻²
*figures in parentheses are 'exposure factors', (see text)						

TABLE 2 (continued)

Estimate No	Occupancy	Year	Per establishment per year		Casualties/person/10 ⁵ exp.hours	
			fires	fire loss (£)	non-fatal*	fatal*
25	Instrument engineering	1968	2.3×10^{-2}	3.5×10^2	2.2	(2.8×10^{-1})
43		1970	2.2×10^{-2}	-	6.1×10^{-1}	(3.1×10^{-1})
	Mean	1968/70	2.2×10^{-2}	-	1.5	(1.5×10^{-1})
26	Electrical engineering	1968	7.9×10^{-2}	2.0×10^3	1.01	(6.3×10^{-2})
44		1970	6.6×10^{-2}	-	7.3×10^{-1}	(5.2×10^{-2})
	Mean	1968/70	7.1×10^{-2}	-	8.6×10^{-1}	(2.9×10^{-2})
61	General engineering	1967-70	4.2×10^{-2}	4.6×10^2	6.4×10^{-1}	3.0×10^{-2}
27	Shipbuilding & marine eng	1968	8.0×10^{-2}	3.2×10^2	(2.5×10^{-1})	(2.5×10^{-1})
45		1970	8.6×10^{-2}	2.7×10^2	1.2	(2.4×10^{-1})
	Mean	1968/70	8.3×10^{-2}	2.9×10^2	6.2×10^{-1}	(1.2×10^{-1})
62	Mean	1967/70	8.3×10^{-2}	2.1×10^2	1.6	1.7×10^{-1}
28	Vehicles	1968	2.0×10^{-1}	6.3×10^2	7.2×10^{-1}	(6.0×10^{-2})
46		1970	2.4×10^{-1}	3.9×10^2	6.8×10^{-1}	5.7×10^{-2}
	Mean	1968/70	2.2×10^{-1}	5.0×10^2	7.0×10^{-1}	2.9×10^{-2}
63	Mean	1967-70	2.2×10^{-1}	1.5×10^3	8.3×10^{-1}	6.3×10^{-2}
29	Metal goods NES	1968	5.7×10^{-2}	1.7×10^2	1.8	(8.9×10^{-2})
47		1970	4.7×10^{-2}	2.2×10^2	1.9	7.4×10^{-2}
	Mean	1968/70	5.1×10^{-2}	2.0×10^2	1.8	4.0×10^{-2}
64	Mean	1967/70	5.3×10^{-2}	2.8×10^2	1.1	5.6×10^{-2}
30	Textiles	1968	1.7×10^{-1}	1.4×10^3	2.3	(7.1×10^{-2})
48		1970	1.9×10^{-1}	8.1×10^2	1.3	(6.7×10^{-2})
	Mean	1968/70	1.8×10^{-1}	1.1×10^3	1.8	(3.4×10^{-2})
65	Mean	1967/70	1.7×10^{-1}	1.4×10^3	1.2	(2.3×10^{-2})
31	Leather & fur	1968	4.3×10^{-2}	5.2×10^2	(1.0)	(1.0)

*figures in parentheses are 'exposure factors', (see text)

TABLE 2 (continued)

Estimate No	Occupancy	Year	Per establishment per year		Casualties/person/10 ⁶ non-fatal*	exp.hours fatal*
			fires	fire loss (£)		
49	Leather & fur	1970	5.5×10^{-2}	1.2×10^2	3.5	(8.8×10^{-1})
	Mean	1968/70	5.0×10^{-2}	3.0×10^2	1.9	(4.7×10^{-1})
32	Clothing & footwear	1968	2.3×10^{-2}	3.4×10^2	4.3×10^{-1}	2.1×10^{-1}
50		1970	2.8×10^{-2}	3.2×10^2	1.4	(9.5×10^{-2})
	Mean	1968/70	2.6×10^{-2}	3.3×10^2	9.6×10^{-1}	1.0×10^{-1}
66	Clothing, leather & footwear	1967/70	3.1×10^{-2}	3.1×10^2	1.5	6.0×10^{-2}
33	Bricks, pottery, glass, etc.	1968	8.4×10^{-2}	3.3×10^2	6.5×10^{-1}	(1.6×10^{-1})
51		1970	8.3×10^{-2}	1.5×10^2	2.1	2.8×10^{-1}
	Mean	1968/70	8.3×10^{-2}	2.3×10^2	1.4	1.5×10^{-1}
67	Mean	1967/70	8.3×10^{-2}	2.2×10^2	1.8	1.0×10^{-1}
34	Timber, furniture, etc.	1968	1.0×10^{-1}	3.0×10^2	4.4	4.1
52		1970	7.2×10^{-2}	3.7×10^2	5.4	1.6×10^{-1}
	Mean	1968/70	8.6×10^{-2}	3.4×10^2	5.0	2.0
68	Mean	1967/70	8.5×10^{-2}	3.5×10^2	4.4	1.1×10^{-1}
35	Paper, printing, etc.	1968	4.8×10^{-2}	4.9×10^2	6.5×10^{-1}	2.4×10^{-1}
53		1970	4.6×10^{-2}	8.7×10^2	2.2	(7.3×10^{-2})
	Mean	1968/70	4.7×10^{-2}	7.1×10^2	1.5	1.2×10^{-1}
69	Mean	1967/70	5.0×10^{-2}	5.8×10^2	1.5	2.7×10^{-2}
36	Other manufacturing	1968	1.3×10^{-1}	2.4×10^3	2.9	(1.5×10^{-1})
54		1970	1.1×10^{-1}	5.6×10^2	3.4	(1.3×10^{-1})
	Mean	1968/70	1.2×10^{-1}	1.4×10^3	3.2	(6.9×10^{-2})
37	All manufacturing ind.	1968	9.1×10^{-2}	6.8×10^2	1.4	2.3×10^{-1}
55		1970	8.4×10^{-2}	4.6×10^2	1.9	8.0×10^{-2}
	Mean	1968/70	8.7×10^{-2}	5.6×10^2	1.7	1.5×10^{-1}
75	Mean	1967/70	9.2×10^{-2}	6.1×10^2	1.9	1.2×10^{-1}

*figures in parentheses are 'exposure factors' (see text)

TABLE 2 (continued)

Estimate No	Occupancy	Year	Per establishment per year		Casualties/person/10 ⁸ exp.hours	
			fires	fire loss (£)	non-fatal*	fatal*
<u>OTHER CLASSIFIED INDUSTRIES</u>						
56	Agriculture, forestry & fishing	1967/70	-	-	6.2	8.0 x 10 ⁻¹
57	Mining & quarrying	1967/70	-	-	8.4 x 10 ⁻¹	2.3 x 10 ⁻¹
70	Construction	1967/70	-	-	1.5	6.4 x 10 ⁻²
71	Gas, electricity & water	1967/70	-	-	3.5	2.1 x 10 ⁻¹
72	Financial & scientific	1967/70	-	-	1.3	1.8 x 10 ⁻¹
73	Public admin & defence	1967/70	-	-	1.3	1.3 x 10 ⁻²
<u>PURPOSE GROUPS</u>						
15	Industry	1967	4.6 x 10 ⁻²	2.7 x 10 ²	2.4	2.0 x 10 ⁻¹
76		1967	8.5 x 10 ⁻²	5.0 x 10 ²	2.4	2.0 x 10 ⁻¹
	Mean	1967	5.9 x 10 ⁻²	3.5 x 10 ²	2.4	2.0 x 10 ⁻¹
18	Storage	1967	1.2 x 10 ⁻²	5.3 x 10 ¹	-	-
78		1967	1.2 x 10 ⁻²	5.3 x 10 ¹	-	-
	Mean	1967	1.2 x 10 ⁻²	5.3 x 10 ¹	-	-
19	Commercial-offices	1967	6.2 x 10 ⁻³	3.7	1 - 0.1	10 ⁻¹ -10 ⁻²
79		1967	5.4 x 10 ⁻³	3.3	1 - 0.1	10 ⁻¹ -10 ⁻²
	Mean	1967	5.8 x 10 ⁻³	3.5	1 - 0.1	10 ⁻¹ -10 ⁻²
12	Commercial - shops	1967	1.1 x 10 ⁻²	1.8 x 10 ¹	1.8	9.9 x 10 ⁻²
13		1967	8.4 x 10 ⁻³	1.4 x 10 ¹	1.4	7.5 x 10 ⁻²
77		1967	1.4 x 10 ⁻²	2.3 x 10 ¹	2.4	1.3 x 10 ⁻¹
	Mean	1967	1.1 x 10 ⁻²	1.7 x 10 ¹	1.8	9.6 x 10 ⁻²
14	Assembly-entertainment	1967	1.2 x 10 ⁻¹	1.9 x 10 ²	1.1	(1.7 x 10 ⁻²)
17	Assembly-non-residential	1967	2.0 x 10 ⁻²	1.4 x 10 ¹	-	-
16	Residential-clubs, etc.	1967	3.7 x 10 ⁻²	3.5 x 10 ¹	-	-

*figures in parentheses are 'exposure factors' (see text)

TABLE 2 (continued)

Estimate No	Occupancy	Year	Per establishment per year		Casualties/person/10 ⁸ non-fatal*	exp. hours fatal*
			fires	fire loss (£)		
11	Hotels & motels	1966	-	-	1.5 x 10 ¹	3.3
85		1967	-	-	2.5 x 10 ¹	3.9
	Mean	1966/67	-	-	2.0 x 10 ¹	3.6
1	Hospitals, etc (GB)	1967	2.0 x 10 ⁻¹	-	6.2 x 10 ⁻¹	1.00 x 10 ⁻¹
2	(Patients + staff)	1968	2.7 x 10 ⁻¹	-	3.2 x 10 ⁻¹	5.6 x 10 ⁻¹
3		1969	3.5 x 10 ⁻¹	-	4.0 x 10 ⁻¹	2.0 x 10 ⁻¹
4		1970	3.8 x 10 ⁻¹	-	6.1 x 10 ⁻¹	3.0 x 10 ⁻¹
	Mean	1967-70	3.0 x 10 ⁻¹	-	5.5 x 10 ⁻¹	2.9 x 10 ⁻¹
80	Hospitals, etc (GB)	1967	2.0 x 10 ⁻¹	-	7.4 x 10 ⁻¹	1.2 x 10 ⁻¹
81	(Patients only)	1968	2.7 x 10 ⁻¹	-	3.9 x 10 ⁻¹	6.8 x 10 ⁻¹
82		1969	3.5 x 10 ⁻¹	-	4.9 x 10 ⁻¹	2.4 x 10 ⁻¹
83		1970	3.8 x 10 ⁻¹	-	7.5 x 10 ⁻¹	3.7 x 10 ⁻¹
	Mean	1967-70	3.0 x 10 ⁻¹	-	6.7 x 10 ⁻¹	3.5 x 10 ⁻¹
84	Hospitals (US) (patients only)	1969-70	-	-	-	1.01
5	Schools (E & W)	1967	3.1 x 10 ⁻²	2.5 x 10 ¹	3.0 x 10 ⁻¹	(9.2 x 10 ⁻³)
6		1968	3.2 x 10 ⁻²	3.7 x 10 ¹	2.2 x 10 ⁻¹	(9.0 x 10 ⁻³)
7		1969	3.7 x 10 ⁻²	4.8 x 10 ¹	3.2 x 10 ⁻¹	(8.8 x 10 ⁻³)
8		1970	3.8 x 10 ⁻²	-	3.6 x 10 ⁻¹	8.6 x 10 ⁻³
	Mean	1967-70	3.5 x 10 ⁻²	-	3.2 x 10 ⁻¹	2.2 x 10 ⁻³
* figures in parentheses are 'exposure factors' (see text)						

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