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A BRIEF ANALYSIS OF LARGE FIRES DURING 1965 TO 1968

by

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SUMMARY

During the four year period 1965 to 1968 there were 3600 fires which cost £10,000 or more in direct damage. The aggregate loss in all these fires was £211 million out of a total estimated direct loss of £347 million in all fires during that period. This note contains a brief analysis of 3464 of these fires. Of these, 126 fires started outside buildings some of which spread to nearby buildings.

KEY WORDS: Large, Fire, Loss, Fire Statistics.

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1. Introduction

During the period 1965 to 1968 there were about 368,000 fires that started in buildings. Of these, 3474 (about one per cent) were large ones costing £10,000 or more in direct damage. This paper contains an analysis of 3338 of these fires together with 126 large fires that started outside the buildings (giving 3464 in all). Data on 136 fires that started in buildings during 1965 are not available to this organization. In some of the tables figures for 1968 have been reproduced from a previous note<sup>1</sup>.

The tables provided in the appendix to this note have been compiled from reports on these fires furnished by local authority fire brigades. Data on financial losses provided by the Fire Insurance Companies were received from the Fire Protection Association. The average costs per large fire given in the tables are simple averages of the figures for the four year period. The figures have not been adjusted for the decreasing value of money.

In the case of the year 1965, as already mentioned, the analysis (except Table 2) is based on a sample of 641 out of a total of 777 large fires. For the years 1966 and 1967, in some of the tables, the total losses shown are £48,304,000 and £56,678,000 respectively. These tables have been reproduced from the analyses of large fires for these two years published in the journal of the Fire Protection Association. They include revised estimates in respect of a few of the fires which were not communicated to this organization. Hence the total losses shown in other tables for these two years are £48,370,000 and £55,708,000 respectively.

## 2. Frequency distribution.

The distribution of large fires according to different size categories is shown in Table 1. The frequency has also been expressed as a percentage of all large fires (in brackets). If adjustments due to inflation are ignored the pattern of the frequency distribution of large fires does not appear to be changing significantly from year to year. However, there is some indication that the proportion of fires escaping into £20,000 plus region was increasing up to 1967 and dropping in the year 1968. Perhaps it is too early to be optimistic that the upward trend has been reversed.

## 3. Occupancies in which fires occurred.

The distribution of the number of fires and total cost according to the occupancies in which large fires occurred is shown in Table 2. About 55 per cent of the large fires were in manufacturing industries; these accounted for 64 per cent of the total loss in large fires. The manufacturers of metal, engineering and electrical goods lead the frequency table due to the fact that as a group, they form the largest number of industrial establishments (33 per cent) of those employing 11 or more persons according to Board of Trade statistics<sup>2</sup>. Though occupying the second position, large fires in the textiles industry were more expensive, perhaps due to a higher concentration of monetary value in the form of plant, machinery and other equipment in these buildings. Comparatively the textile industry enjoys a high level of fire protection, especially sprinklers. The general trend in the average cost in the manufacturing industries uncorrected for the effect of inflation on numbers is slightly but not significantly upwards, but in individual groups, like textiles and clothing and footwear, the trend is downwards. It appears that fire protection and fire fighting activities are coping with the growth of individual fires (but not their frequency) in the industrial field.

Ranking next to the manufacturing industries, the distributive trades account for nearly 18 per cent of the large fires. After a sharp increase between 1965 and 1966 the frequency of large fires in these occupancies has remained more or less a constant. However, the situation seems to be gradually worsening in the case of buildings engaged in retail distribution (departmental stores etc.).

Among the remaining occupancies costly fires occurred during 1966 and later in buildings engaged in public administration and defence activities though the number involved was small. Large fires in cinemas etc. are becoming costlier while the frequency in hotels etc. has trebled during the period.

As mentioned earlier, a small group of fires (126) started outside buildings some of which spread to nearby buildings. The distribution of these fires according to occupancy is given in Table 3. The outdoor plants, machinery and equipment top the frequency table; among these, fires in chemical plants including oil and petroleum were very costly.

#### 4. Place of origin

The areas in which fires started are shown in Table 4. Large fires in production and maintenance areas were as frequent as such fires in storage areas (29 per cent). During 1966, Fire Brigades in U.K. attended almost an equal number of fires in each of these two areas<sup>3</sup>. Though, on the whole, the probability of becoming large is equal for the two types of area, the distribution according to the areas varies from one industry to another. The pattern is also different for the distributive trades which utilise most of the space for storage purposes while industries are mainly concerned with production activity.

Large fires in storage areas were costlier. These areas are often unoccupied so that a fire has a higher chance to grow to large proportions before it is discovered and they also have a higher density of value at risk. The necessity for the use of automatic detectors and sprinklers to protect storage areas needs no emphasis.

About 13 per cent of the large fires originated in miscellaneous areas such as cloakrooms and offices. In nearly 22 per cent of the fires the place of origin was not known. The figures given in Table 4 are more or less of the same order as the corresponding figures for fires fought with five or more jets<sup>4</sup>.

#### 5. Source of ignition

The various sources of ignition of the fires are shown in Table 5. In about 50 per cent of the fires the source was unknown as the evidence of the cause of the fire is often destroyed by a large fire. Of the remainder, electrical installations and apparatus maintained the lead in all the four years with no apparent year to year variation in the frequency. However the average cost in these fires was not exceptionally high. These facts are to some extent encouraging when viewed against the background of increasing usage of electricity and the increasing number of fires due to this source<sup>5</sup>. It has been found that a fire due to this source, has a lower chance of spreading beyond the room of origin than fires attributed to most of the other known sources<sup>6</sup>.

It appears that electricity is not an inherently dangerous source of power contributing to fire spread. Much depends upon the maintenance and

usage of electrical appliances and installations.

Careless disposal of smoking materials was the second major source of ignition in large fires. All fires in buildings due to this cause during 1966 numbered only 35 per cent of all fires due to electrical appliances and installations, but the percentage for large fires was about 69. It is apparent that fires thought to have been started by smoking materials have a higher tendency to costing more than £10,000 and to spreading beyond the room of origin. Effective publicity campaigns seem to provide the only possibility of reducing their numbers by making people more careful in throwing away cigarette ends, matches etc.

The third important source was malicious or intentional ignition with a higher average cost than that of fires due to the first two sources. Part of the startling increase in the number of these figures during 1966 and later was due to a change in the classification. Up/to 1965, suspected malicious or intentional ignition was grouped either with 'children with fire' or with 'unknown' causes. The fact however, remains that with arson fires a serious situation is gradually developing which calls for a closer analysis and strengthening of measures aimed at early detection i.e. automatic detectors, security patrols etc.

Fires arising from oxyacetylene cutting and welding operations appear to be the most expensive of the large fires.

#### 6. Material ignited first

As with the source of ignition, in more than half the large fires, the material ignited first was unknown (Table 6). Considered as a single group, packaging, wrapping, paper and cardboard form the largest among known materials with an average cost slightly less than the overall average. Fires in general which start with these materials are comparatively few in number indicating that they seem to carry a high risk of fire spread in the monetary sense, as was also observed in the case of fires fought with five or more jets. Large fires that started in liquids were quite expensive. Textiles and structural features were other important materials ignited first in large fires.

#### 7. Age of the building

According to a survey conducted by the Building Research Station in 1962<sup>7</sup> about 16 per cent of the industrial buildings at risk then were constructed before 1900 and about 11 per cent between 1900 and 1914. With about 30 and 17 per cent of the large fires occurring in these premises (Table 7), it appears that older buildings are more exposed to the risk of large fires than newer ones. However, the age of the building does not appear to influence the average cost if a large fire breaks out.

8. Number of storeys

Table 8 gives details of the number of storeys in the buildings involved in large fires. According to the Building Research Station survey, 43 per cent of the industrial buildings are single storeyed and 33 per cent are double storeyed. Only 24 per cent of the buildings have three or more storeys but in these about 46 per cent of the large fires had occurred. The average cost was also higher in these buildings. The height of a building would be expected to play some part in fire loss because of the relative difficulty of locating and fighting fires on the upper floors and because of the likelihood of the vertical spread of damage.

9. Spread of fires

The large fires were analysed according to whether they had spread to other hazards or buildings and the results are given in Table 9. About 76 per cent of the fires were confined to the buildings in which they started. The average costs shown in the table reflect the additional loss incurred when the fires spread beyond the building of origin. This emphasises the need in fire protection problems to take into consideration the hazard not only due to 'origin' but also due to 'exposure' i.e. the risk of damage to a building by exposure depending on the location of the building in relation to surrounding buildings and their characteristics.

10. Number of jets used.

The frequency distribution of the number of jets used to extinguish large fires is shown in Table 10. About 50 per cent of the fires required the use of 4 or less. The table also indicates the high correlation between the number of jets and the average cost.

11. Time of occurrence.

No estimates are available about the time of origin of fires. The time of discovery and time of call to the brigade, however, are recorded in the fire reports. The distribution of large fires according to time of call is shown in Table 11. There is some evidence that night time is the most dangerous as regards both the number and the cost of large fires. In industrial buildings, during the night, there are fewer people about and hence fires are likely to burn undetected for a longer time.

12. Day of the week

The distribution of the fires according to the day of the week is shown in Table 12. The table shows no evidence of a significant difference in the number and average cost of large fires for different days of the week. But fires on Sundays and Tuesdays appear to be slightly costlier.



### 13. Attendance time

The distribution of the large fires according to the fire brigade attendance time is shown in Table 13. It is logical to expect that the size of fire and hence the loss would increase with delay not only in discovering the fire and calling the fire brigade but also in the brigade arriving at the scene of fire. There is, however, an opposing influence affecting the loss due to the location of fire stations near to areas belonging to higher risk categories. Hence from the data in the table it is difficult to judge the value of attendance time in large fires. The loss data are also confounded with the effects due to the delays in the discovery of fire which could be substantially higher for fires discovered during night than for those discovered in the day time. Delay in discovering the fire is likely to be a more important factor in causing a large fire to become larger than either delay in calling the brigade or in its arrival. As in the case of five-jet fires, about 70 per cent of the large fires were attended within 5 minutes.

### 14. Control Time

Table 14 shows the distribution of the fire brigade estimates of the duration of burning from the time of arrival to the time of control of large fires. The peak (mode) of the distribution was between 30 and 40 minutes while the median control time was between 40 and 50 minutes. In the case of fires fought with five or more jets the logarithmic mean (median) of the control time was about 120 minutes as roughly these fires cost £20,000 or more. Here again there is some difficulty in interpreting the average costs as there is no information on the size of the fire at the time of arrival of the fire brigade. The loss is likely to exceed £100,000 if the fire is not controlled within 100 minutes and is almost certain to exceed this figure if the control time is more than 140 minutes. An analysis of large fires during 1965 revealed that this limiting control time for a loss exceeding £100,000 would be about 120 minutes<sup>8</sup>.

### 15. Fire Protection Devices

The performance of fire protection devices in the form of fixed installations such as sprinklers and detectors in buildings involved in large fires is given in Table 15. About 77 per cent of the fires occurred where there were no fire protection devices or where this information was not given in reports or was unknown or not applicable. The average cost in these fires was comparatively small presumably due to the fact that the value at risk in these buildings is also low in comparison with buildings provided with fire protection devices. In fires in which sprinklers

operated the fire loss was substantially lower than in those where sprinklers were installed but did not operate. Considerable saving was also revealed in the case of combinations of fire protection devices mainly those involving sprinklers. In the case of automatic detectors and fire doors the numbers as given in the table are too small to be of any real use for purposes of comparison. However, an analysis of the performance of fire doors in large fires during 1965 and 1966 revealed a significant saving if these are kept closed during fires<sup>9</sup>.

## 16. Discussion

Large fires though comparatively few in number are of considerable economic importance. A few hundred of these fires occur every year but are responsible for more than half of the total estimated fire loss. Before data on financial losses became available to this organisation, fires requiring five or more jets to extinguish them were defined as large fires. An analysis of these fires for the period July 1962 to December 1964 is contained in the technical paper frequently cited in this note. Each of these fires cost approximately £20,000 or more. This paper takes a further look at large fires but defining them in the monetary sense as those costing £10,000 or more. The analysis is a simple survey of frequency and average costs of these fires. A critical statistical treatment would require adjustments for inflationary forces (it is intended to make these in future analyses); but, if such adjustments are made, some of the large fires during the years 1966 to 1968 within roughly the 10 to 12 thousand cost band though large in the current sense would be below the £10,000 if valued at 1965 prices. This would yield an entirely new set of tables.

The paper has helped to pinpoint a number of factors causing fires to become large. The study corroborates many of the conclusions drawn in connection with the analysis of five-jet fires. In addition it was possible to do the analysis in terms of average costs which could lead to solutions for problems in fire protection economics. The probability of a fire becoming large and the expected loss in large fires are the two main ingredients used in such studies.

The estimated gross capital stock in industrial buildings in 1965 at 1958 replacement cost was £14,110 million in plant and machinery and £7,950 million in building structures<sup>10</sup>. Based on current trends the average values for the period 1965 to 1968 could be about £14,900 million and £8,300 million respectively or about £18,800 million and £10,500 million at 1966 prices. No estimates are available for capital stock in consumer durables. Adding about £10,000 million towards this the value at risk could be about £40,000 million. Of this amount, about £34 million was lost every year in large fires.

This gives a figure of 20 pence per £100 of value at risk as loss in large fires.

Estimates of total working population are published in the Annual Abstract of Statistics. The survey by the Building Research Station has also yielded estimates of gross floor area per person for different industries. Based on these two sets of figures, the gross floor area in building in the manufacturing industries could be estimated at 2370 million sq.ft. (This figure excludes industries included under other manufacturing industries). With an annual loss of £31 million in these buildings the loss was about 3 pence per sq.ft in large fires. The floor area given above has been underestimated to some extent as no correction has been possible for the number of shifts employed in production activity.

The estimates for loss per unit value at risk and loss per unit floor area at risk need to be assessed individually for different industries and also separately for buildings with and without fire protection devices. Also what is ideally required is fire loss in a building of given size and other characteristics. With more information about value at risk etc. in individual buildings becoming available such studies might be possible at a later stage.

#### 17. Conclusion.

The conclusions are almost identical to those reached in the case of five jet fires. About 55 per cent of the large fires were in manufacturing industries accounting for 64 per cent of the total loss in large fires. The manufacturers of metal, engineering and electrical goods lead the frequency table with the textiles industry in the second position. But large fires in the latter buildings were more expensive. With no significant upward trend in the average cost it appears that, fire fighting and fire protection activities are coping with the fire situation in the industrial field. But the same cannot be said about fire prevention activities.

Distributive trades account for nearly 18 per cent of the large fires. The main cause for concern being in buildings engaged in retail distribution, especially departmental stores etc. Large fires in cinemas etc. are becoming costlier while the frequency in hotels etc. has trebled during the period of four years. Large fires in outdoor chemical plants including oil refineries etc. were very costly.

The probability of becoming large appears to be equal for production and storage areas but large fires in the latter areas were costlier. Storage areas are often unoccupied so that a fire has a higher chance to grow to large proportions before it is discovered.

Among the fires for which the source of ignition was known, electrical installations and apparatus maintained the lead in all the four years with no apparent year to year variation in the frequency. With no more than average cost in fires due to this source and with increasing usage of this form of fuel, electricity does not appear to be inherently more dangerous than other sources of power in its contribution to fire spread. It seems that fires due to the careless disposal of smoking materials have a high probability of costing more than £10,000. It appears likely that fires due to malicious or intentional ignition may develop into a serious situation. Large fires due to oxyacetylene cutting and welding equipment were the most expensive.

Among the materials ignited first, packaging wrapping paper and cardboard were the most frequent with a high risk of fire spread. Textiles and building structures were other important materials. Large fires that started in liquids were very expensive.

There is some evidence that buildings constructed before the first world war are more exposed to the risk of large fires than buildings of later period. But the age of the building does not seem to influence the expected loss if a large fire breaks out. Large fires are more frequent in taller buildings with a higher loss due to the difficulty in locating and fighting fires on upper floors.

About 76 per cent of the large fires were confined to the buildings in which they started. Therefore the probability of a building catching fire due to a large fire in the neighbouring building is 24 per cent.

About 50 per cent of the large fires required the use of 4 or less jets to extinguish them. There is a high correlation between the number of jets and average cost.

There is some truth in the statement that night fire is the most dangerous as regards both the number and the cost of large fires. Neither of these variables differs significantly from one day of the week to another.

Delay in discovering the fire is likely to be more important a factor in causing a fire to become large than either delay in calling the brigade or in its arrival. If the fire is not controlled within 100 or 120 minutes the loss is likely to exceed £100,000.

About 77 per cent of the fires occurred where there were no fire protection devices or where this information was not known. The comparatively lower level of losses in these buildings is probably due to the fact that the value to be protected is lower than in the buildings provided with fire protection devices. In fires which sprinklers operated there was a significant saving by way of expected reduction in fire loss.

The annual loss in a large fire in industrial buildings was about 20 pence per £100 of value at risk or about 3 pence per sq.ft. of floor area. The latter figure may be over estimated to some extent but to be on the safer side the figure could serve as a guide for planning fire protection in an industrial building.

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TABLE 1

## FREQUENCY DISTRIBUTION OF LARGE FIRES

Size Group (£ thousands)	1965		1966		1967		1968		For the four year period		
	No. of fires	Total Cost (£ thousands)	No. of fires	Total Cost (£ thousands)	No. of fires	Total Cost (£ thousands)	No. of fires	Total Cost (£ thousands)	No. of fires	Total Cost (£ thousands)	Average Cost per fire (£ thousands)
10 to 15	225 (35.1)	2839	263 (29.6)	3210	255 (27.5)	3082	304 (30.2)	3720	1047 (30.2)	12851	12.3
16 to 20	88 (13.7)	1662	116 (13.0)	2105	131 (14.1)	2403	153 (15.2)	2813	488 (14.1)	8983	18.4
21 to 25	44 (6.9)	1043	89 (10.0)	2105	84 (9.1)	1951	95 (9.5)	2247	312 (9.0)	7346	23.5
26 to 30	42 (6.6)	1223	59 (6.6)	1675	64 (6.9)	1836	69 (6.9)	1965	234 (6.8)	6699	28.6
31 to 35	28 (4.4)	940	41 (4.6)	1364	57 (6.1)	1893	53 (5.3)	1772	179 (5.2)	5969	33.3
36 to 40	33 (5.1)	1286	40 (4.5)	1540	44 (4.7)	1696	41 (4.1)	1585	158 (4.6)	6107	38.6
41 to 50	37 (5.8)	1727	49 (5.5)	2290	60 (6.5)	2810	56 (5.6)	2587	202 (5.8)	9414	46.6
51 to 75	51 (8.0)	3245	80 (9.0)	4984	75 (8.1)	4794	62 (6.2)	3885	268 (7.7)	16908	63.1
76 to 100	19 (3.0)	1750	54 (6.1)	4736	49 (5.3)	4473	38 (3.8)	3386	160 (4.6)	14345	89.7
101 to 150	28 (4.4)	3465	43 (4.8)	5465	38 (4.1)	4592	45 (4.5)	5445	154 (4.4)	18967	123.2
151 to 200	12 (1.9)	2150	12 (1.3)	2111	16 (1.7)	2729	31 (3.1)	5535	71 (2.0)	12525	176.4
201 to 250	6 (0.9)	1428	13 (1.4)	2890	9 (1.0)	2111	16 (1.6)	3668	44 (1.3)	10097	229.5
251 to 500	17 (2.6)	5608	24 (2.7)	8328	38 (4.1)	12527	31 (3.1)	11202	110 (3.2)	37665	342.4
501 to 1000	9 (1.4)	6347	5 (0.6)	3292	4 (0.4)	3470	7 (0.6)	5044	25 (0.7)	18153	726.1
Over 1000	2 (0.2)	3226	2 (0.3)	2275	4 (0.4)	5341	4 (0.3)	6710	12 (0.4)	17552	1462.7
TOTAL	641 (100.0)	37939	890 (100.0)	48370	928 (100.0)	55708	1005 (100.0)	61564	3464 (100.0)	203581	58.8

TABLE 2  
HAZARD IN WHICH FIRES STARTED

Occupancy	1965		1966		1967		1968		For the four year period		
	No. of fires	Total cost (£thousands)	No. of fires	Total cost (£thousands)	No. of fires	Total cost (£thousands)	No. of fires	Total cost (£thousands)	No. of fires	Total cost (£thousands)	Average cost per fire (£thousands)
<b>Manufacturing Industries</b>											
1. Agriculture, forestry, fishing	22	336	19	378	29	502	28	460	98	1676	17.1
2. Mining and quarrying	-	-	1	42	2	100	-	-	3	142	47.3
3. Food, drink and tobacco	42	3149	29	1224	37	2854	34	3631	142	10858	76.5
4. Chemicals and allied industries	40	3062	43	2518	51	4394	61	3566	195	13530	69.4
5. Metal manufacture	22	780	24	874	35	1275	31	2437	112	5366	47.9
6. Engineering and electrical goods	49	2999	80	4319	74	7101	78	7364	281	21783	77.5
7. Ship building and marine engineering	3	57	4	85	1	10	3	272	11	424	38.5
8. Vehicles	25	3333	12	876	23	3154	22	1073	82	8436	102.9
9. Metal goods, not elsewhere specified	18	904	19	656	18	2443	15	1229	70	5232	74.7
10. Textiles	55	6404	59	3966	65	4552	63	5944	242	20866	86.2
11. Leather, leather goods and fur	5	235	7	546	7	198	8	499	27	1478	54.7
12. Clothing and footwear	34	2572	28	1664	32	1867	21	1680	115	7783	67.7
13. Bricks, pottery, glass, cement	9	989	16	1942	16	581	17	1098	58	4610	79.5
14. Timber, furniture	49	1774	37	1839	41	1803	43	1921	170	7337	43.2
15. Paper printing and publishing	30	1468	40	3015	43	3586	45	3674	158	11543	73.0
16. Other manufacturing industries	35	1897	36	3028	40	1884	55	7297	166	14106	85.0
17. Construction industry	13	255	12	336	16	479	14	269	55	1339	24.3
TOTAL	451	30214 (Av. 67.0)	466	27308 (Av. 58.6)	530	36583 (Av. 69.0)	538	42414 (Av. 78.8)	1985	136519	68.8
<b>Utilities</b>											
18. Gas, water and electricity	12	307	20	1546	14	651	13	798	59	3302	56.0
19. Transport and communication	14	861	14	1030	6	774	56	3538	90	6203	68.9
TOTAL	26	1168 (Av. 44.9)	34	2576 (Av. 75.8)	20	1425 (Av. 71.3)	69	4336 (Av. 62.8)	149	9505	63.8
<b>Commercial</b>											
20. Distributive trades - wholesale	45	1986	66	3563	44	2806	45	1920	200	10275	51.4
21. Distributive trades - retail	60	3069	59	3282	84	5522	89	4232	292	16105	55.2
22. Distributive trades - others	28	1817	45	3292	35	1970	39	1232	147	8311	56.5
TOTAL	133	6872 (Av. 51.7)	170	10137 (Av. 59.6)	163	10298 (Av. 63.2)	173	7384 (Av. 42.7)	639	34691	54.3
23. Insurance, banking, finance	3	106	1	31	4	68	4	45	12	250	20.8
24. Professional and scientific services	34	1044	45	1736	38	1101	58	1811	175	5692	32.5
25. Cinema, theatres, radio, sport	13	466	18	680	20	1075	23	1125	74	3346	45.2
26. Catering, hotels	19	424	45	1413	53	1746	60	1848	177	5431	30.7
27. Miscellaneous services	28	1401	24	583	29	849	30	993	111	3826	34.5
28. Public administration and defence	5	118	9	838	7	692	12	808	33	2456	74.4
29. Private residential houses	13	296	13	339	27	694	32	591	85	1920	22.6
30. Private flats & maisonnettes	3	101	5	97	1	15	3	175	12	388	32.3
31. Unoccupied premises, private sheds, garages	10	333	17	311	13	294	2	24	42	962	22.9
32. Multiple tenure, mixed occupancies	32	2062	36	2141	21	1789	-	-	89	5992	67.3
33. Not specified	7	154	7	114	2	49	1	10	17	327	19.2
TOTAL	167	6505 (Av. 39.0)	220	8283 (Av. 37.7)	215	8372 (Av. 38.9)	225	7430 (Av. 33.0)	827	30590	37.0
GRAND TOTAL	777	44759 (Av. 57.6)	890	48304 (Av. 54.3)	928	56678 (Av. 61.1)	1005	61564 (Av. 61.3)	3600	211305	58.7

TABLE 3

## FIRES IN OUTDOOR HAZARDS

	1965		1966		1967		1968		For the four year period		
	No. of fires	Total cost (£thousands)	No. of fires	Total cost (£thousands)	No. of fires	Total cost (£thousands)	No. of fires	Total cost (£thousands)	No. of fires	Total cost (£thousands)	Average cost per fire (£thousands)
Outdoor storage	9	180	12	359	8	259	6	228	35	1026	29.3
Gas works plant and mains	3	56	3	95	5	105	4	208	15	464	30.9
Transformer, electrical sub-station generator	-	-	2	415	1	11	1	100	4	526	131.5
Tar boiler	-	-	-	-	1	13	3	54	4	67	16.7
Chemical plants	Included under other outdoor plants		2	155	2	1012	6	392	10	1559	155.9
Other outdoor plants, machinery and equipment	16	525	-	-	2	25	3	120	21	670	31.9
Machinery and electrical goods	-	-	1	12	1	23	2	61	4	96	24.0
Textile industry	-	-	-	-	1	38	2	40	3	78	26.0
Manufacturers of paper and board	-	-	-	-	-	-	1	355	1	355	355.0
Other manufacturing industries	-	-	3	855	3	42	2	26	8	923	115.4
Distributive trades	-	-	1	142	4	142	4	217	9	501	55.7
Others	2	29	4	93	2	35	4	205	12	362	30.2
TOTAL	30	790	28	2126	30	1705	38	2006	126	6627	52.6



Table 4  
Place of origin of fires

Place of origin	1965		1966		1967		1968		For the four year period		
	No. of fires	Total cost (£ thousands)	No. of fires	Total cost (£ thousands)	No. of fires	Total cost (£ thousands)	No. of fires	Total cost (£ thousands)	No. of fires	Total cost (£ thousands)	Average Cost per fire (£ thousands)
Production and maintenance	202	10713	229	12565	286	17030	279	20401	996	60709	60.9
Assembly	27	1132	55	2165	51	1990	51	2383	184	7670	41.7
Storage	210	16326	233	16387	258	20138	310	24284	1011	77135	76.3
Structure, fitting	10	488	13	595	24	778	26	964	73	2825	38.7
Miscellaneous	92	4501	81	2942	118	4458	155	5090	446	16991	38.1
Unknown not applicable	100	4779	279	13716	191	11314	184	8442	754	38251	50.7
<b>TOTAL</b>	<b>641</b>	<b>37939</b>	<b>890</b>	<b>48370</b>	<b>928</b>	<b>55708</b>	<b>1005</b>	<b>61564</b>	<b>3464</b>	<b>203581</b>	<b>58.8</b>

TABLE 5

## SOURCE OF IGNITION OF FIRES

	1965		1966		1967		1968		For the four year period		
	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	Average cost per fire (£ thousand)
Electrical installations and apparatus	121	5,247	88	4,135	105	7,062	123	5,640	437	22,084	50.5
Smoking materials	67	3,973	63	3,583	84	3,852	88	3,934	302	15,342	50.8
Malicious or intentional ignition	39	3,821	70	3,832	91	3,240	92	5,018	292	15,911	54.5
Naked lights	14	554	9	449	11	1,097	7	234	41	2,334	56.9
Oxy-acetylene apparatus	5	240	17	877	11	848	10	2,777	43	4,742	110.3
Mechanical heat and sparks	15	1,067	20	548	15	644	23	1,080	73	3,339	45.7
Gas appliances and installations	8	333	13	1,041	14	581	12	995	47	2,950	62.8
Oil appliances and installations	17	594	16	462	18	512	20	383	71	1,951	27.5
Children with matches	12	648	11	405	10	509	19	602	52	2,164	41.6
Other miscellaneous known causes	63	3,205	90	2,940	89	3,972	107	6,683	349	16,800	48.1
Unknown	280	18,257	493	30,032	480	34,361	504	34,218	1,757	116,868	66.5
<b>TOTAL</b>	<b>641</b>	<b>37,939</b>	<b>890</b>	<b>48,304</b>	<b>928</b>	<b>56,678</b>	<b>1,005</b>	<b>61,464</b>	<b>3,464</b>	<b>204,485</b>	<b>59.0</b>

TABLE 6  
MATERIAL IGNITED FIRST

Material ignited first	1965		1966		1967		1968		For the four year period		
	No. of fires	Total cost (£thousands)	No. of fires	Total cost (£thousands)	No. of fires	Total cost (£thousands)	No. of fires	Total cost (£thousands)	No. of fires	Total cost (£thousands)	Average cost per fire (£thousands)
<b>Agricultural forestry produce</b>											
Cut but unprocessed straw and cereal	6	99	7	117	8	122	9	126	30	464	15.5
Cut but unprocessed hay	-	-	-	-	3	47	3	91	6	138	23.0
Wood, dust, shavings	6	127	5	127	8	417	12	355	31	1026	33.1
Standing vegetation, grass, heather etc.	1	54	-	-	1	15	3	406	5	475	95.0
Wood-boards, planks, thin sheets	12	369	2	82	3	54	-	-	17	505	29.7
Others	1	20	1	33	-	-	1	14	3	67	22.3
<b>Structure</b>											
Roof, roof members	9	433	15	923	19	691	15	872	58	2919	50.3
Floor, skirting board	3	210	5	107	9	658	13	486	30	1461	48.7
Wall partition, wall lining	7	419	6	385	5	107	9	1030	27	1941	71.9
Ceiling, ceiling lining	2	162	3	97	1	24	3	87	9	370	41.1
Others	4	256	6	138	5	109	9	270	24	773	32.2
<b>Liquids</b>											
Paint, varnish, etc.	10	252	14	807	10	623	6	111	40	1793	44.8
Diesel oil, fuel oil	8	379	1	10	3	1062	5	153	17	1604	94.3
Others	21	1529	48	2710	48	2839	52	5027	169	12105	71.6
<b>Furnishings or furniture</b>											
Upholstery	5	131	5	178	5	184	7	285	22	778	35.4
Bedding	3	102	4	102	7	148	5	127	19	479	25.2
Others	6	150	16	707	7	185	7	196	36	1238	34.4
<b>Textiles</b>											
Raw fibres	28	2145	25	1418	21	1136	24	1615	98	6314	64.4
Others	15	419	15	475	16	629	15	901	61	2424	39.7
<b>Gases</b>											
Town gas	4	132	7	210	4	95	12	825	27	1262	46.7
Others	10	823	9	197	7	226	8	435	34	1681	49.4
<b>Fitting and fixtures</b>	11	558	8	332	10	475	12	918	41	2283	55.7
<b>Miscellaneous</b>											
Paper, cardboard	17	933	26	2229	37	1766	37	1723	117	6651	56.8
Packing, wrapping	31	2301	31	1096	38	1715	44	2144	144	7256	50.4
Insulation (material to which fire first spread unknown)	29	1036	18	691	20	2548	16	582	83	4857	58.5
Dust, powder, flour etc.	8	916	8	348	7	232	12	350	35	1846	52.7
Hessian, hemp, sisal, jute	1	22	3	57	5	120	2	34	11	233	21.2
dusters rags	3	46	2	49	2	42	2	28	9	165	18.3
Lagging	5	211	6	1138	6	110	7	225	24	1684	70.1
Rubber											
Carbonaceous materials											
coal, coke, soot	2	46	3	120	7	288	9	285	21	739	35.2
Others	17	534	33	2307	23	1829	21	972	94	5642	60.0
Unspecified waste	9	368	18	972	18	975	17	1112	62	3427	55.3
<b>Unknown</b>	347	22757	540	30208	565	36237	608	39779	2060	128981	62.6
<b>TOTAL</b>	<b>641</b>	<b>37939</b>	<b>890</b>	<b>48370</b>	<b>928</b>	<b>55708</b>	<b>1005</b>	<b>61564</b>	<b>3464</b>	<b>203581</b>	<b>58.8</b>

TABLE 7

## DATE OF CONSTRUCTION OF BUILDINGS INVOLVED IN FIRES

Period of construction	1965		1966		1967		1968		For the four year period		
	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	Average cost per fire (£ thousand)
Prior to 1900	191	11,131	267	14,797	283	15,113	279	12,463	1020	53,504	52.5
1900 - 1914	98	5,548	146	7,008	160	9,689	193	7,977	597	30,222	50.6
1915 - 1918	6	234	11	612	4	141	5	439	26	1,426	54.8
1919 - 1939	93	4,791	126	8,982	139	9,976	157	11,895	515	35,644	69.2
1940 - 1945	16	438	21	1,273	16	809	19	1,298	72	3,818	53.0
1946 onwards	152	10,910	198	10,602	184	12,897	241	22,590	775	56,999	73.5
Not known, not stated or not applicable	85	4,887	121	5,030	142	8,053	111	4,902	459	22,872	49.8
<b>TOTAL</b>	<b>641</b>	<b>37,939</b>	<b>890</b>	<b>48,304</b>	<b>928</b>	<b>56,678</b>	<b>1005</b>	<b>61,564</b>	<b>3464</b>	<b>204,485</b>	<b>59.0</b>

TABLE 8

## NUMBER OF STOREYS IN BUILDINGS IN WHICH FIRES OCCURRED

No. of storeys	1965		1966		1967		1968		For the four year period.		
	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	Average cost per fire (£ thousand)
1	172	8,618	244	11,511	243	11,865	285	15,875	944	47,869	50.7
2	171	8,780	217	11,739	252	14,185	294	21,117	934	55,821	59.8
3	133	9,395	166	8,368	177	11,392	182	7,919	658	37,074	56.3
4	62	3,481	110	7,779	87	4,720	86	6,059	345	22,039	63.9
5	27	2,889	41	2,437	43	5,036	44	3,661	155	14,023	90.5
6	13	485	9	1,464	20	3,755	8	436	50	6,140	122.8
7	4	1,019	5	349	4	107	8	1,494	21	2,969	141.4
8	1	20	3	131	1	25	2	202	7	378	54.0
9 or more	-	-	2	95	4	197	8	973	14	1,265	90.4
Not known, not stated or not applicable	58	3,252	93	4,497	97	4,426	88	3,828	336	16,003	47.6
TOTAL	641	37,939	890	48,370	928	55,708	1005	61,564	3464	203,581	58.8

TABLE 9  
EXTENT OF SPREAD OF FIRES

	1965		1966		1967		1968		For the four year period		
	No. of fires	Total cost (£thousand)	No. of fires	Total cost (£thousand)	No. of fires	Total cost (£thousand)	No. of fires	Total cost (£thousand)	No. of fires	Total cost (£thousand)	Average cost per fire (£thousand)
Confined to building/hazard of origin	506	27381	662	33147	703	41756	758	42371	2629	144655	55.0
Extended to adjoining buildings	62	4838	62	4062	79	5466	73	4462	276	18828	68.2
Extended to separate buildings	38	3625	49	3566	43	2449	50	7295	180	16935	94.1
Extended to other hazards	14	425	14	411	16	1514	28	1796	72	4146	57.6
Extended to adjoining and separate buildings	7	809	7	656	4	293	8	210	26	1968	75.7
Extended to adjoining buildings and other hazards	3	240	3	228	1	12	5	224	12	704	58.7
Extended to separate buildings and other hazards	4	421	11	2430	10	1118	12	1639	37	5608	151.6
Extended to adjoining and separate buildings and other hazards	7	200	8	417	6	545	11	1176	32	2338	73.1
Unknown	-	-	74	3453	66	2555	60	2391	200	8399	41.2
TOTAL	641	37939	890	48370	928	55708	1005	61564	3464	203581	58.8

TABLE 10

## NUMBER OF JETS USED TO EXTINGUISH THE FIRES

No. of jets	1965		1966		1967		1968		For the four year period		
	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	Average cost per fire (£ thousand)
0 - 4	312	7,961	461	12,896	468	13,701	496	16,163	1,737	50,721	29.6
5 - 9	205	12,562	238	13,201	283	16,916	329	19,108	1,055	61,787	58.6
10 - 14	56	7,900	73	8,137	72	9,988	82	12,997	283	39,022	137.9
15 - 19	23	3,999	25	3,702	19	4,649	23	5,842	90	18,192	202.1
20 - 24	10	2,147	9	2,709	9	5,971	9	1,735	37	12,562	339.5
25 - 29	4	550	5	2,109	5	1,121	2	674	16	4,454	278.4
30 and over	-	-	5	2,097	5	1,687	5	2,679	15	6,463	430.2
Not known not applicable	31	2,820	74	3,453	67	2,645	59	2,366	231	11,284	48.8
<b>TOTAL</b>	<b>641</b>	<b>37,939</b>	<b>890</b>	<b>48,304</b>	<b>928</b>	<b>56,678</b>	<b>1,005</b>	<b>61,564</b>	<b>3,464</b>	<b>204,485</b>	<b>59.0</b>

TABLE 11

## TIME OF CALL

Time of call	1966		1967		1968		For the three year period		
	No. of fires	Total cost (£thousands)	No. of fires	Total cost (£thousands)	No. of fires	Total cost (£thousands)	No. of fires	Total cost (£thousands)	Average cost per fire (£thousands)
00.01 - 01.00	44	2098	49	4426	50	4388	143	10912	76.3
01.01 - 02.00	41	2142	48	3791	49	1970	138	7903	57.3
02.01 - 03.00	44	2920	50	2820	49	2670	143	8410	58.4
03.01 - 04.00	31	2040	38	1632	46	2415	115	6087	52.9
04.01 - 05.00	26	1297	41	1112	42	3236	109	5645	51.8
05.01 - 06.00	30	1240	24	2833	27	1757	81	5830	71.9
06.01 - 07.00	24	3030	33	1537	25	1825	82	6392	77.9
07.01 - 08.00	26	947	29	1394	26	1960	81	4301	53.9
08.01 - 09.00	15	624	24	893	18	441	57	1958	34.3
09.01 - 10.00	29	1978	18	835	20	840	67	3653	54.5
10.01 - 11.00	26	941	17	750	25	2195	68	3886	57.1
11.01 - 12.00	18	667	27	2588	36	1624	81	4879	60.2
12.01 - 13.00	38	2053	27	1209	31	2099	96	5361	55.8
13.01 - 14.00	36	2351	35	1735	41	1965	112	6051	54.0
14.01 - 15.00	36	1692	39	3247	44	2966	119	7905	66.4
15.01 - 16.00	41	1836	40	3005	45	3248	126	8089	64.2
16.01 - 17.00	21	1344	31	2460	46	2072	98	5876	59.9
17.01 - 18.00	48	3031	38	1927	44	3616	130	8574	65.9
18.01 - 19.00	54	2193	43	1549	40	1553	137	5295	38.6
19.01 - 20.00	41	2659	68	3437	37	2084	146	8180	56.0
20.01 - 21.00	34	1032	34	2146	46	1756	114	4934	43.3
21.01 - 22.00	27	769	41	3534	58	3006	126	7309	58.0
22.01 - 23.00	42	1973	44	2375	56	3573	142	7921	55.8
23.01 - 00.00	43	3310	24	1918	44	5774	111	11002	99.1
Unknown	75	4203	66	2555	60	2531	201	9289	46.2
TOTAL	890	48370	928	55708	1005	61564	2823	165642	58.7



TABLE 12

## DAY OF THE WEEK

Day	1965		1966		1967		1968		For the four year period		
	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	Average cost per fire (£ thousand)
Sunday	87	4,418	96	4,738	125	8,890	117	8,078	425	26,124	61.5
Monday	75	4,659	140	7,482	121	8,233	145	7,664	481	28,038	58.3
Tuesday	96	5,695	104	6,589	134	8,185	162	11,310	496	31,779	64.1
Wednesday	91	7,620	143	5,964	141	7,354	140	9,013	515	29,951	58.2
Thursday	104	4,677	133	9,851	149	8,194	151	9,538	537	32,260	60.1
Friday	92	5,928	134	7,482	130	7,930	161	9,927	517	31,267	60.5
Saturday	96	4,942	140	6,198	128	7,892	129	6,034	493	25,066	50.8
TOTAL	641	37,939	890	48,304	928	56,678	1005	61,564	3464	204,485	59.0

TABLE 13

## ATTENDANCE TIME

Attendance time (minutes)	1965		1966		1967		1968		For the four year period		
	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	No. of fires	Total cost (£ thousand)	Average cost per fire (£ thousand)
1	8	897	10	419	16	726	17	1,069	51	3,111	61.0
2	92	4,869	128	5,867	111	6,954	103	6,474	434	24,164	55.7
3	151	8,106	209	9,524	227	16,715	232	15,264	819	49,609	60.6
4	135	5,669	187	10,727	183	8,792	218	14,404	723	39,592	54.8
5	90	5,513	118	8,244	115	7,472	128	9,851	451	31,080	68.9
6	41	5,182	40	2,393	54	3,919	69	3,061	204	14,555	71.3
7	19	1,674	36	1,639	38	2,040	38	1,678	131	7,031	53.7
8	15	868	21	1,234	32	1,919	38	2,724	106	6,745	63.6
9	10	294	20	1,259	15	1,262	18	1,052	63	3,867	61.4
10	10	303	15	276	18	676	29	1,728	72	2,983	41.4
11 and above	37	1,351	30	2,310	52	2,653	54	1,715	173	8,029	46.4
Unknown	33	3,213	76	4,478	67	2,580	61	2,544	237	12,815	54.1
<b>TOTAL</b>	<b>641</b>	<b>37,939</b>	<b>890</b>	<b>48,370</b>	<b>928</b>	<b>55,708</b>	<b>1,005</b>	<b>61,564</b>	<b>3,464</b>	<b>203,581</b>	<b>58.8</b>

TABLE 14  
CONTROL TIME

Control time (minutes)	1965		1966		1967		1968		For the four year period		
	No. of fires	Total cost (£thousand)	No. of fires	Total cost (£thousand)	No. of fires	Total cost (£thousand)	No. of fires	Total cost (£thousand)	No. of fires	Total cost (£thousand)	Average cost per fire (£thousand)
Below 10	29	1211	41	1848	53	1055	46	984	169	5098	30.2
11 - 20	47	1156	82	1776	94	2717	92	2672	315	8321	26.4
21 - 30	71	1647	97	3060	114	3652	131	3605	413	11964	29.0
31 - 40	81	2297	121	4364	92	4324	133	5395	427	16380	38.4
41 - 50	77	2979	97	4157	110	4660	106	3688	390	15484	39.7
51 - 60	59	2679	74	3056	88	3964	91	3989	312	13688	43.9
61 - 70	53	3665	70	3793	78	3962	75	4423	276	15843	57.4
71 - 80	37	1601	40	2116	40	3597	50	2758	167	10072	60.3
81 - 90	27	1537	42	2083	39	3273	50	4804	158	11697	74.0
91 - 100	25	3128	24	1647	30	2134	33	4689	112	11598	103.6
101 - 110	13	886	21	1985	24	2220	27	7413	85	12504	147.1
111 - 120	10	493	25	1568	19	2390	16	2060	70	6511	93.0
121 - 130	16	1946	14	1921	15	1368	15	1047	60	6282	104.7
131 - 140	7	501	7	474	7	2230	11	1273	32	4478	139.9
141 - 150	9	182	7	538	7	745	10	1752	33	3217	97.5
151 - 180	11	3024	11	2344	14	2611	27	3491	63	11470	182.1
181 - 240	9	1826	22	3435	14	3393	13	2437	58	11091	191.2
241 - 300	7	2264	7	1680	8	1038	7	1061	29	6043	208.4
More than 300	14	1574	12	2280	14	3780	10	1469	50	9103	182.1
Unknown	39	3343	76	4245	68	2595	62	2554	245	12737	52.0
TOTAL	641	37939	890	48370	928	55708	1005	61564	3464	203581	58.8

TABLE 15

## FIRE PROTECTION DEVICES

Fire protection device	Performance	1965		1966		1967		1968		For the four year period		
		No. of fires	Total cost (£thousands)	No. of fires	Total cost (£thousands)	No. of fires	Total cost (£thousands)	No. of fires	Total cost (£thousands)	No. of fires	Total cost (£thousands)	Average cost per fire (£thousands)
Sprinklers and drenchers	Did not operate or performance not known	15	1999	4	321	7	1143	6	1476	32	4939	154.3
	Operated	33	1125	28	1068	23	1666	22	950	106	4809	45.4
CO <sub>2</sub> , foam steam and nitrogen systems	Did not operate or performance not known	1	51	2	51	1	153	1	93	5	348	69.6
	Operated	6	141	63	3466	108	7523	101	9418	278	20548	73.9
Automatic detectors	Did not operate or performance not known	} Included under 'Others'		2	80	1	15	2	375	5	470	94.0
	Operated			2	505	1	80	7	763	10	1348	134.8
Fire doors	Did not operate or performance not known			2	178	1	73	2	146	5	397	79.4
	Operated			8	621	4	405	1	500	13	1526	117.4
Others	Did not operate or performance not known	5	692	4	738	7	822	12	1154	28	3406	121.6
	Operated	5	1543	43	3346	42	3636	60	7063	150	15588	103.9
Combination	Did not operate or performance not known	2	62	5	1421	10	758	15	2423	32	4664	145.7
	Operated	8	1134	33	1696	46	5388	46	3276	133	11494	86.4
	Not installed, unknown or not applicable	566	31192	694	34879	677	34046	730	33927	2667	134044	50.2
	TOTAL	641	37939	890	48370	928	55708	1005	61564	3464	203581	58.8

