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CHEMICAL INCIDENTS HANDLED BY THE UNITED KINGDOM PUBLIC FIRE SERVICE IN 1980

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Summary

The public fire service in the United Kingdom is called upon to deal with a wide range of fires, as well as other incidents not involving fires, which are known as special service calls. Over recent years increasing concern has been expressed about the number of fires and special service calls which have involved dangerous chemicals in some form. The presence of these chemicals has placed a burden on the brigades to develop the special knowledge and skills necessary to deal safely with the incidents, yet until recently, very little information was available as to the frequency and seriousness of the incidents.

As a result, a full-scale survey of the numbers and characteristics of dangerous chemical incidents which were dealt with by the public fire brigades was carried out in 1980. In order not to place too great a burden of reporting on the brigades, the definition of "dangerous chemical incident" was restricted to certain specific categories.

Over the twelve month duration of the survey, a total of 1158 incidents were reported, of which 983 were special service calls in which dangerous chemicals were involved, 132 were fires in which dangerous chemicals affected the fire-fighting operations, 18 were fires in which dangerous chemicals behaved in an abnormal or unexpected manner, and 25 were fires in which the presence of chemicals gave rise to one or more casualties.

Introduction

In many instances in recent years, the public fire service has been called upon to deal with spillages, fires and other incidents which have involved dangerous chemicals, or to render assistance at such incidents. As a result, the fire brigades have given increasing attention to the information, knowledge, skills, training, equipment and procedures necessary to enable them to discharge their functions efficiently and with regard to the safety of both their personnel and members of the public. The chemical and transport industries and many other organisations have supported the fire brigades in this task.

Until recently, however, little detailed information was available about the number and nature of the chemical incidents to which the fire brigades were called. A survey of those incidents which involved chemicals in transit, carried out by the Home Office Fire Department for the Joint Committee on Fire Brigade Operations in 1977, suggested that the total number of such incidents

amounted to about 405 annually. The results of the survey were considered by the Operations Committee to be inconclusive, however, because the time-scale of the survey was restricted and there was no other information available against which to assess the results.

A further survey was carried out by the Scientific Advisory Branch of the Home Office (SAB) in 1979/80, to estimate the numbers of all types of chemical incidents dealt with by the brigades in Great Britain, as part of the evaluation of a computerised chemical information retrieval system for use by brigades [1]. On the basis of its results, it was estimated that the total number of incidents during the twelve month period of the survey was about 1350. The survey was not designed to provide a detailed description of the incidents however, nor did it provide the information which the Operations Committee needed to assess the demands which were being placed on the fire service by these chemical incidents. As a result, a further and more detailed survey was carried out for the Operations Committee by SAB in 1980. The scope of the survey was to extend over a wide range of incidents attended by brigades, both static and in transit, and including both fires and special service calls. To avoid excessive demands being placed upon brigades, it was decided that the scope of the survey should be restricted to incidents which involved dangerous chemicals, where the term dangerous chemicals was to be limited to those in the United Nations list or those having similar characteristics. Four specific categories of incident were included:

(a) Special service calls which involved dangerous chemicals. In this context, the chemicals could be identified as hazardous because they were flammable, toxic, corrosive, explosive, radioactive or had some other characteristic which made them hazardous in the circumstances.
(b) Fires in which dangerous chemicals were present and had a significant effect on fire-fighting operations.
(c) Fires in which dangerous chemicals were present, and the chemicals behaved in such a way as to create a particular hazard.
(d) Fires in which dangerous chemicals were present and where members of the public or the fire service received medical treatment as a result of the effects of the chemicals.

Examples of some incidents which would be excluded by these criteria would be:

(1) A special service call to deal with an unknown material which later proved to be harmless (although in the case of chemicals which were washed ashore, an exception was made because of the difficulty of identifying the contents of containers whose labelling has been obliterated by weathering).
(2) A special service call to deal with chemicals which are known not to be dangerous (and for the purposes of the survey, this included petroleum spirit and its associated variants, when present in small quantities).
(3) A fire at which dangerous chemicals are present, but which are not involved in the fire and do not affect fire fighting operations to any significant degree.

It was recognised, however, that some incidents might well arise which fell on the borderline of these criteria. For these cases where there might be some doubt, provision was made for brigades to report the incident and for members of the Home Office Fire Services Inspectorate to apply the selection criteria. This ensured that the criteria were applied, as far as possible, in a consistent manner in all brigades. Nevertheless, it should be borne in mind that there may yet be some degree of individual interpretation at the brigade level, and this may influence the numbers of incidents reported. As a result, the total numbers of incidents recorded in the survey may not reflect the total of all dangerous chemical incidents throughout the country. However, it is unlikely that this would significantly affect the overall picture of the numbers of serious incidents which place significant demands on brigade resources.

The survey

The survey was based on a self-completion questionnaire, copies of which were sent to all brigades in Great Britain in November 1979. Each brigade was asked to complete one of the questionnaires for each chemical incident to which it was called during the period 1 January to 31 December 1980, and which met the selection criteria for "dangerous chemical incidents", as outlined above.

The questionnaire, shown in Appendix 1, was designed by SAB in close consultation with the Home Office Fire Department and the Joint Committee on Fire Brigade Operations. Prior to the survey, a draft of the proposed questionnaire was prepared and trialled in two brigades for a period of a month, and on the basis of the experience gained during this trial period, some minor adjustments to the design were made.

From the outset, the survey was designed for computer analysis, to enable progress reports to be prepared at intervals throughout the twelve-month duration. In the event, two interim reports were prepared and circulated to members of the Operations Committee. The data storage and analysis were carried out entirely on a Zilog MCZ microcomputer, using a combination of software which was prepared by SAB specifically for the survey and general purpose survey analysis programs prepared by SAB [2].

Questionnaire forms submitted by brigades were forwarded in the first instance to the Home Office Fire Inspectorate, where details of the forms were examined for completeness, and the descriptions of the incidents were checked against the selection criteria. Any errors or omissions detected at this stage were corrected, where necessary by reference to the reporting brigade. A further two stages of validation were incorporated after the information had been coded onto the computer; the first of these took the form of a specially written computer program, to validate the data; this checked the details of each reported incident for internal consistency. For example, the program would identify cases in which a fire-fighting medium had been reported as be-

ing in use, but where no fire was reported. The second check occurred towards the end of the survey, when all the computer records were checked manually against the questionnaire forms to eliminate, as far as possible, any remaining coding errors and to ensure that throughout the twelve month duration of the survey, standard interpretation criteria had been applied.

Results of the survey

Numbers of incidents reported

Throughout the twelve months of the survey, a total of 1424 completed questionnaire forms were received from brigades (excluding nil returns). Of this total, 266 were excluded from the main survey as being outside the criteria for dangerous chemical incidents. (A brief summary of these 266 incidents is given in Appendix 2.) Of the remaining 1158 incidents which did fall within the criteria, 190 (16%) were identified as arising from chemicals which were washed ashore around the coast. This was a particularly large, and unrepresentative number of such incidents, attributable primarily to the sinking of the Motor Vessel "Aoelian Sky" off the Isle of Wight, and which gave rise to many containers of chemicals being washed ashore on the coasts of the Isle of Wight, Hampshire, East Sussex and West Sussex. The special nature of these incidents led to their being analysed separately from the remaining incidents in the survey.

Overall, of the 1158 incidents included in the survey, 983 were special service calls in which dangerous chemicals were involved, 132 were fires in which the presence of dangerous chemicals affected the fire fighting operations to a significant degree, 18 were fires in which dangerous chemicals behaved in an abnormal or unexpected manner and 25 were fires at which dangerous chemicals were present and which gave rise to casualties.

These incidents can be categorised further, according to the nature of the circumstances giving rise to the incident. Overall, the numbers and percentages of the incidents in each of the main categories of circumstances were as follows:

Nature of circumstances	Number of incidents	Percentage of total
Chemical overheated	9	1
Spillage	419	43
Leakage	211	22
Vapour or gas escape	80	8
Potential spillage	11	1
Fire	173	18
Explosion	10	1
Chemical found	19	2
Other	20	2
Not recorded	16	2
Total	968	100
(Chemicals washed ashore	190)	

Incidents by time of year (Table 1)

The date of attendance by the brigade was known for every reported incident, and the distribution of incidents by the month of the year is shown in Table 1. For normal incidents (i.e. excluding those involving chemicals washed ashore) roughly equal numbers of incidents were recorded in each of the first nine months of the survey. There was a steady decline, however, in the numbers recorded in October, November and December 1980, the final three months of the survey. This may be attributable to a degree of under-reporting due to the time lag involved in submitting the completed forms for analysis, but may also be affected by an industrial dispute which involved fire brigade personnel between mid-November and mid-December and which may well have affected the extent to which the incidents were reported. Over the first nine months of the survey, the number of dangerous chemical incidents (excluding those involving chemicals washed ashore) averaged 92 per month. If this is representative of the year as a whole, it is estimated that the total number of dangerous chemical incidents attended by the public brigades in 1980

TABLE 1

Chemical incidents by brigade and time of year

NUMBER OF CHEMICAL INCIDENTS (EXCLUDING CHEMICALS WASHED ASHORE)
FIGURES IN BRACKETS DENOTE NUMBERS OF INCIDENTS INVOLVING CHEMICALS WASHED UP ON THE SHORE.

	MONTH OF OCCURRENCE												
BRIGADE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ALL
AVON	4	1	1	1	2	2	0	2	2	0	0	1	16
BEDS	1	2	0	0	1	1	1	0	2	1	0	0	9
BERKSHIRE	3	1	1	0	1	2	1	1	1	0	0	1	11
BUCKS	0	0	1	0	0	0	1	2	1	1	0	0	6
CAMBS	0	0	0	1	0	0	0	0	2	0	1	0	4
CHESHIRE	2	2	2	0	1	3	3	3	4	3	4	0	27
CLEVELAND	1	0	3	4 (2)	1	4	3	1	1	3	1	1	23 (2)
CORNWALL	0 (1)	0	1 (1)	0	0	0	1	1 (1)	0	1	0	0	4 (3)
CUMBRIA	0	2	0	0	0	0	0	0	0	0	0	0	2
DERBYSHIRE	1	1	0	0	0	1	0	0	0	0	0	0	3
DEVON	1	1 (4)	3	1	0	1	0	2	1	3	2	1	16 (4)
DORSET	0	2	1	0	1	0	0	1	0	0	0	0	5
DURHAM	0	0	0	0	1	0	0	0	0	0	0	0	1
E. SUSSEX	0 (1)	0 (25)	0	1	0	0	0	0	0	1 (1)	1	0	3 (27)
ESSEX	15	12	1	1	4	9	8	2	8	2	0	0	62
GLOUCS	0	0	0	0	0	0	1	0	0	0	0	0	1
HAMPSHIRE	2 (1)	2	6	5	5	5	5	4	1	3	3	2	43 (1)
HER & WORC	1	2	0	2	0	1	2	1	1	0	1	1	12

TABLE 1 (continued)

NUMBER OF CHEMICAL INCIDENTS (EXCLUDING CHEMICALS WASHED ASHORE)
FIGURES IN BRACKETS DENOTE NUMBERS OF INCIDENTS INVOLVING CHEMICALS WASHED UP ON THE SHORE.

BRIGADE	MONTH OF OCCURRENCE JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ALL
HERTS	1	2	3	2	0	0	1	0	2	0	0	0	11
HUMBERSIDE	1	5	2	6	6	10	5	3	6	10	2	2	58
I. O. W.	1 (9)	1 (90)	0 (15)	0 (9)	0 (1)	1	0	0 (3)	0 (1)	0	0	0	3 (128)
KENT	2	0	0	0	6	0	0	0	0	0	0	0	8
LANCS	1	7	4	1	0	1	0	10	2	1	0	0	27
LEEDS	3	2	1	0	2	5	0	2	1	0	0	0	16
LINCS	3	2	0	1	2	2	1	0	1	0	1	0	13
NORFOLK	2	2	2	2	0	1	1	4	2	1	0	1	18
N YORKS	0	2	0	1	2	0	0	0	3	0	1	0	9
NORTHANTS	0	2	0	2	2	2	1	0	0	0	0	0	9
NORTHUMBLD	0	0	0	0	0	0	1	0	0	0	0	0	1
NOTTS	0	0	1	1	0	0	0	1	0	0	0	0	3
OXON	0	2	2	0	0	0	0	0	0	0	0	0	4
SHROPSHIRE	1	0	0	0	0	0	0	0	0	0	0	0	1
SOMERSET	0	0	0	1	2	1	1	1	2	2	0	0	10
STAFFS	0	3	0	0	0	0	0	0	0	0	0	0	3
SUFFOLK	1	3	2	1	6 (1)	4	3	1	2	3	1	2	29 (1)
SURREY	0	1	0	2	1	0	0	1	1	2	0	0	8
WARWICKS.	1	2	1	1	0	0	2	1	0	1	1	0	10
W. SUSSEX	2 (1)	3 (15)	5	6	0	3	0	1	1	2	1	3	32 (16)
WILTSHIRE	0	0	1	0	0	0	0	0	0	0	0	0	1
NON - MET	54 (33)	67 (134)	44 (16)	43 (11)	46 (2)	59	42	45 (4)	47 (1)	40 (1)	20	15	522 (182)
GT. MANCH	4	2	0	3	2	0	1	2	0	1	2	0	17
MERSEYSIDE	1	0	2	2	4	2	4	2	4	2	1	0	24
S. YORKS	0	0	2	0	0	0	0	2	3	1	0	0	8
TYNE+WEAR	0	0	2	1	0	1	1	1	0	1	0	0	7
W MIDLANDS	2	5	4	0	1	1	1	1	2	1	3	1	22
W YORKS	4	5	3	2	10	2	7	2	5	3	0	1	44
TOTAL(MET)	11	12	13	8	17	6	14	10	14	9	6	2	122
GT LONDON	15	20	23	25	19	24	37	12	14	9	13	8	219

TABLE 1 (continued)

NUMBER OF CHEMICAL INCIDENTS (EXCLUDING CHEMICALS WASHED ASHORE)
FIGURES IN BRACKETS DENOTE NUMBERS OF INCIDENTS INVOLVING CHEMICALS WASHED UP ON THE SHORE.

BRIGADE	MONTH OF OCCURRENCE JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ALL
CLWYD	2	0	0	0	0	2	0	1	0	3	0	0	8
DYFED	1	0	0	0	0	0	0	0	0	0	0	0	1
GWENT	0	0	1	0	0	0	0	0	0	0	0	0	1
GWYNEDD	0	0 (1)	0	3	0	0 (1)	0 (1)	1	0	1	2	0	7 (3)
MID GLAM.	0	0	0	1	1	1	0	0	0	0	0	0	3
POWYS	0	1	0	0	0	0	1	0	0	0	0	0	2
S.GLAM	0	0	0	2	0	1	1	1	2	0	0	0	7
W GLAM	0	0	0	0	1	0	0	0	0	1	0	0	2
TOT - WALES	3	1 (1)	1	6	2	4 (1)	2 (1)	3	2	5	2	0	31 (3)
CENTRAL	0	0	0	0	0	0	0	0	0	0	0	0	0
DUM & GALL	1	1	3	2	0	0	1	0	1	0	0	0	9
FIFE	0	0	0	0	1	2	1	0	0	0	0	0	4
GRAMPIAN	1	0	0	0	1	0	0	0	0	0	0	0	2
LOTH & BOR	0	1	0	1	1	4	1	1	0	0	1	0	10
NORTHERN	0	0	0	0	0	0	1	0	0	0	0	0	1
STRTHCLYDE	3	7 (1)	4 (1)	4 (1)	2	6 (1)	3	4	3 (1)	1	3	1	41 (5)
TAYSIDE	1	0	1	0	1	0	0	1	1	0	0	2	7
TOT (SCOT)	6	9 (1)	8 (1)	7 (1)	6	12 (1)	7	6	5 (1)	1	4	3	74 (5)
ALL BRIG.	89 (13)	109 (136)	89 (17)	89 (12)	90 (2)	105 (2)	102 (1)	76 (4)	82 (2)	64 (1)	45	28	968 (190)

was about 1100. It should be re-emphasised, however, that the incidents recorded in this survey do not include all incidents in which chemicals may have been present.

In contrast to the relatively even distribution throughout the year, the number of incidents involving chemicals washed ashore (shown in brackets in Table 1) displays a very marked peak in the month of February, following the sinking of the "Aoelian Sky" off the Isle of Wight. A total of 136 (72%) of the 190 incidents involving chemicals washed ashore occurred in this one month. However, apart from those incidents which were directly attributable to the "Aoelian Sky", only one or two incidents involving chemicals being washed ashore occurred each month.

Incidents by time of day (Table 2, Figure 1)

As might be expected, the survey has shown that chemical incidents arise to a proportionately greater extent during the day than at night. This is particularly noticeable with incidents which involved chemicals washed ashore. For these, 74% were known to occur between 0800h and 1800h, compared with 61% of the other incidents.

TABLE 2

Chemical incidents by brigade and time of day

NUMBER OF CHEMICAL INCIDENTS (EXCLUDING CHEMICALS WASHED ASHORE)
FIGURES IN BRACKETS DENOTE NUMBERS OF INCIDENTS INVOLVING CHEMICALS WASHED UP ON THE SHORE.

BRIGADE	TIME OF DAY (HOURS) 0-2H	2-4H	4-6H	6-8H	8-10	10-12	12-14	14-16	16-18	18-20	20-22	22-24	UNKNOWN
AVON	0	0	0	1	0	4	5	2	1	2	1	0	0
BEDS	0	1	0	0	2	1	1	1	0	1	2	0	0
BERKSHIRE	0	0	0	1	2	2	1	2	0	1	0	1	1
BUCKS	0	0	0	1	1	0	1	1	0	1	1	0	0
CAMBS	1	0	1	0	0	0	0	1	1	0	0	0	0
CHESHIRE	2	2	1	2	5	5	2	4	1	2	0	1	0
CLEVELAND	2	0	0	0	2	1	1	2	1	2	1	1	18 (2)
CORNWALL	0	0	0	0	0 (1)	1 (1)	2	1	0	0	0 (1)	0	0
CUMBRIA	0	0	0	0	0	1	1	0	0	0	0	0	0
DERBYSHIRE	0	0	0	0	1	1	1	0	0	0	0	0	0
DEVON	1	0	1	1	4 (1)	2 (1)	0 (2)	3	1	1	1	1	0
DORSET	1	0	1	0	0	1	0	0	1	0	1	0	0
DURHAM	0	0	0	0	0	0	0	0	0	1	0	0	0
E. SUSSEX	0	0	0	0 (5)	1 (4)	0 (1)	1 (3)	0 (6)	1 (1)	0 (2)	0 (1)	0 (1)	0 (3)
ESSEX	2	0	2	2	5	6	4	9	12	11	5	3	1
GLOUCS	0	0	1	0	0	0	0	0	0	0	0	0	0
HAMPSHIRE	0	0	0	0	0	4	0	1	2	1	1	0	34 (1)
HER & WORC	0	0	0	0	1	4	3	1	1	1	1	0	0
HERTS	0	1	0	2	3	2	2	0	0	1	0	1	0
HUMBERSIDE	3	0	0	2	4	7	7	5	5	4	1	1	19
I. O. W.	0	0	0	0 (12)	1 (49)	0 (34)	0 (7)	1 (10)	0 (1)	1 (2)	0 (1)	0	0 (12)
KENT	1	0	0	1	0	1	0	4	0	1	0	0	0
LANCS	2	0	1	0	2	5	2	7	3	1	1	3	0
LEICS	0	0	0	1	1	2	4	3	4	1	0	0	0
LINCS	0	0	0	1	0	4	0	0	1	4	0	3	0
NORFOLK	0	1	0	0	3	2	5	1	3	3	0	0	0
N YORKS	0	1	0	0	1	2	3	0	1	0	1	0	0
NORTHANTS	1	0	0	2	0	1	0	2	2	0	0	1	0
NORTHUMBLD	0	0	0	0	0	1	0	0	0	0	0	0	0
NOTTS	0	0	0	1	0	1	0	1	0	0	0	0	0
OXON	0	0	0	0	0	2	1	1	0	0	0	0	0
SHROPSHIRE	0	0	0	0	0	0	0	0	0	0	1	0	0
SOMERSET	0	0	0	0	2	1	0	1	3	3	0	0	0
STAFFS	0	0	0	0	0	0	0	1	0	0	2	0	0
SUFFOLK	1	0	1	1	3	4	3	1	8	3	2	0	2 (1)
SURREY	0	0	0	0	1	3	1	0	0	0	1	1	1

TABLE 2 (continued)

NUMBER OF CHEMICAL INCIDENTS (EXCLUDING CHEMICALS WASHED ASHORE)
FIGURES IN BRACKETS DENOTE NUMBERS OF INCIDENTS INVOLVING CHEMICALS WASHED UP ON THE SHORE.

BRIGADE	TIME OF DAY (HOURS) 0-2H	2-4H	4-6H	6-8H	8-10	10-12	12-14	14-16	16-18	18-20	20-22	22-24	UNKNOWN
WARWICKS.	1	0	0	0	2	0	1	3	1	1	0	0	1
W. SUSSEX	2	0	0	1	4 (1)	5 (3)	4 (4)	3 (3)	6 (2)	4 (2)	2	1 (1)	0
WILTSHIRE	0	0	0	0	0	1	0	0	0	0	0	0	0
NON - MET	20	6	2	20 (17)	50 (56)	77 (40)	56 (16)	62 (19)	59 (4)	51 (6)	25 (3)	18 (2)	69 (19)
GT. MANCH	0	0	0	1	2	4	2	0	3	1	2	2	0
MERSEYSIDE	0	2	1	0	2	3	4	4	4	0	3	1	0
S. YORKS	0	0	0	0	2	2	3	1	0	0	0	0	0
TYNE+WEAR	0	0	0	0	1	3	1	1	0	1	0	0	0
W MIDLAND'S	0	0	0	1	3	3	0	4	2	3	1	4	1
W YORKS	2	0	1	5	6	9	3	6	4	3	1	4	0
TOTAL(MET)	2	2	2	7	16	24	13	16	13	8	7	11	1
GT LONDON	8	6	2	13	27	24	25	33	29	20	19	12	1
CLWYD	0	0	0	0	2	0	1	0	2	0	0	2	1
DYFED	0	0	0	0	1	0	0	0	0	0	0	0	0
GWENT	0	0	0	0	0	0	0	0	1	0	0	0	0
GWYNEDD	0	0	0	0	0	1	0	4 (1)	0 (1)	0	1	1 (1)	0
MID GLAM.	0	0	0	0	0	1	0	0	1	1	0	0	0
POWYS	0	0	0	0	1	1	0	0	0	0	0	0	0
S.GLAM	0	0	0	0	0	2	0	1	2	1	0	1	0
W GLAM	0	1	0	0	0	0	0	0	0	0	0	1	0
TOT -WALES	0	1	0	0	4	5	1	5 (1)	6 (1)	2	1	5 (1)	1
CENTRAL	0	0	0	0	0	0	0	0	0	0	0	0	0
DUM & GALL	0	0	0	1	2	1	1	0	1	0	2	1	0
FIFE	0	0	0	0	1	2	0	0	1	0	0	0	0
GRAMPIAN	0	0	0	0	0	0	1	1	0	0	0	0	0
LOTH & BOR	0	1	2	1	5	0	1	0	0	0	0	0	0
NORTHERN	0	0	0	0	0	0	0	0	1	0	0	0	0
STRTHCLYDE	4 (1)	1	0	1	5 (1)	5	3 (1)	4	5 (1)	2 (1)	2	4	0
TAYSIDE	0	0	0	0	1	0	2	2	0	1	1	0	0
TOT (SCOT)	4 (1)	2	2	3	14 (1)	8	8 (1)	7	8 (1)	3 (1)	10	5	0
ALL BRIG.	34 (1)	17	15	43 (17)	111 (57)	138 (40)	103 (17)	123 (20)	115 (6)	84 (7)	62 (3)	51 (3)	72 (19)

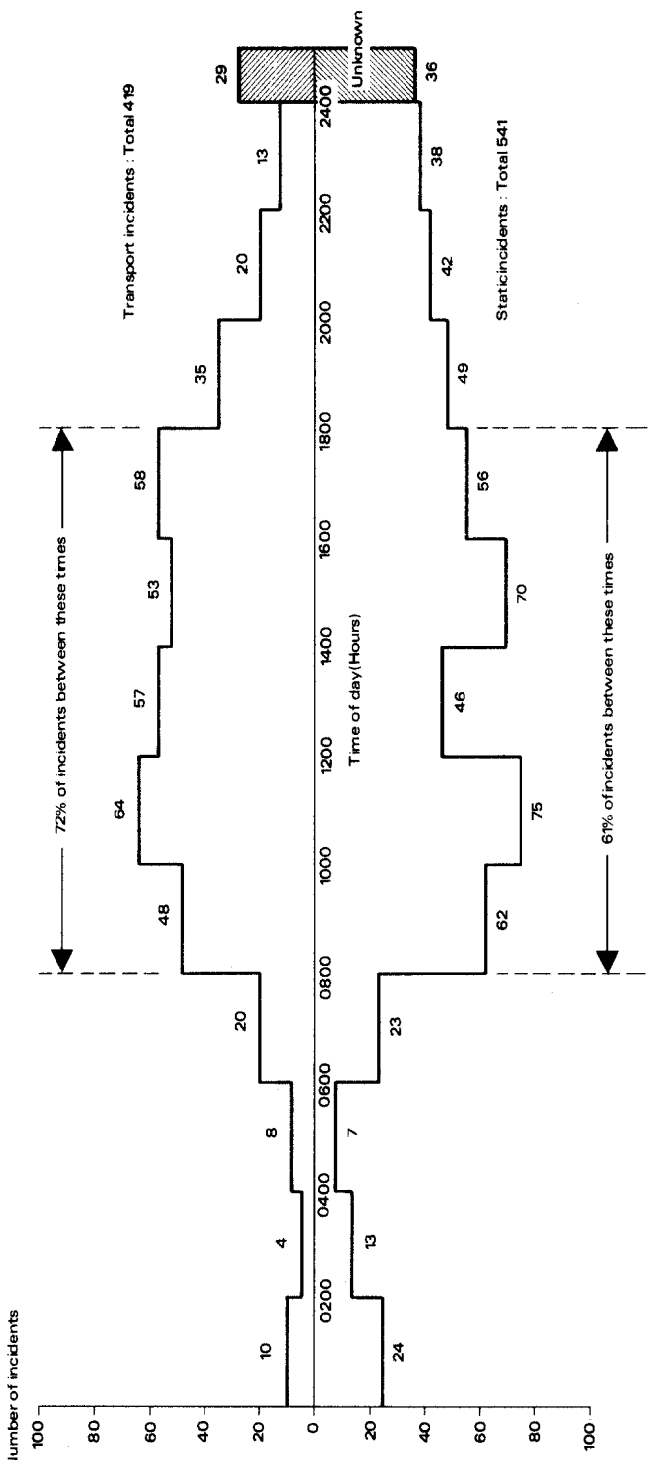

Fig. 1. Distribution of chemical incidents throughout the day — Static and transport incidents.

There is some evidence to suggest that the distribution by time of day differs slightly between incidents which involved chemicals in transit and those which did not, although the difference is unlikely to be of practical consequence. For static incidents, the distribution is slightly less peaked during daytime hours than for transport incidents, but it displays a more marked drop in the numbers of incidents around midday. This is illustrated in Fig. 1.

Types of chemical involved

In total, over 450 separate identifiable chemicals were reported in the survey. Many of these occurred in only one or two incidents, but a number were reported on several occasions. The chemicals reported most frequently were:

Chemical	Number of times reported
Hydrochloric acid	66
Ammonia	65
Liquified petroleum gas (includes gases variously referred to as LPG, Calor Gas, Propane, Butane)	42
Sulphuric acid	34
Sodium hydroxide	30
Nitric acid	27
Formaldehyde	25
Trichlorethylene	23
Isopropyl alcohol	17
Perchlorethylene	17
Sodium hypochlorite	14
Petroleum (excluding minor spillages)	14
Acetylene	14
Sulphur	13
Methanol	13
Phosphoric acid	13
Formic acid	12
Phosphorus	11
Arsenic	11
Toluene	10
Arsenic trichloride	10
Hydrogen peroxide	10
Acetic acid	10
Ammonium nitrate	10
Phenol	10

(Note that a single incident may involve several different chemicals)

For the two most frequently reported chemicals, hydrochloric acid and ammonia, the breakdown of the nature of the incidents is as follows:

Chemical	Nature of incident	Number of incidents
Hydrochloric acid	Fire	3
	Leakage in transit	22
	Leakage in domestic premises	7
	Leakage at industrial premises	13
	Other leakages	17
	Other and unknown	4
Ammonia	Fire	2
	Leakage in transit	11
	Leakage — domestic fridge	20
	Leakage — refrigeration plant	15
	Other leakages	15
	Other and unknown	2

Properties of chemicals involved

In the questionnaire form, space was provided to record the particular hazards which the chemical materials presented at the time of the incident. Specific reference to flammability, toxicity, corrosiveness, explosiveness and radioactivity were included on the form, as well as a general "other" heading. Remembering that any single material involved in an incident may have more than one hazardous characteristic, and that any incident may involve more than one material, a total of 450 (46%) of the incidents involved chemicals of which at least one was flammable. Similarly, 591 (61%) involved toxic material, 347 (36%) corrosive material and 5 (1%) explosive material. 112 (12%) of the incidents included some other hazard associated with the chemicals. These other hazards included "irritant to skin/eyes" (21 incidents), "asphyxiant" (11 incidents), "oxidising agent" (9 incidents), "reacts violently with water" (7 incidents) and "poisonous by absorption" (6 incidents).

Cause of incident and type of call (Tables 3 and 4, Figure 2)

The cause of the incident was known or could be positively identified from the details provided in the questionnaire form for 1112 (96%) of the total of 1158 reported incidents. Twelve separate causes were identified, and the numbers of incidents arising from each of these causes is shown below:

Cause	Number of incidents	Percentage of total for which a cause was identified
Deliberate action/vandalism	30	3

Accidental action:			
— overfilling containers	10	1	34
— mishandling materials etc.	204	18	
— insecure load or poor storage	130	12	
— inadequate sealing	32	3	
Defective containers	97	9	
Defective plant, leak from pipe or flange	181	16	
Defective vehicle	8	1	
Spontaneous ignition	53	5	
Fire involving chemicals	128	12	
Road or rail accident	48	4	
Chemicals washed ashore	190	16	
Unknown	47		

TABLE 3

Chemical incidents by brigade and estimated cause

CODE LIST FOR COLUMNS IN TABLE 3

1 = Deliberate or vandalism
2 = Negligence - overfilling
3 = - mishandling
4 = - insecure load or bad storage
5 = - inadequate sealing
6 = Defective or damaged containers
7 = Leakage from pipe or flange; defective plant
8 = Chemical reaction or spontaneous ignition
9 = Fire involving chemicals
10= Defective vehicle
11= Road or rail accident
12= Chemicals washed ashore

NUMBER OF CHEMICAL INCIDENTS (EXCLUDING CHEMICALS WASHED ASHORE)
FIGURES IN BRACKETS DENOTE NUMBERS OF INCIDENTS INVOLVING CHEMICALS WASHED UP ON THE SHORE.

	Estimated cause (see list for codes)												
BRIGADE	1	2	3	4	5	6	7	8	9	10	11	12	Unknown
AVON	1	1	3	1	0	0	5	2	2	0	1	0	0
BEDS	0	0	4	3	0	1	1	0	0	0	0	0	0
BERKSHIRE	1	0	4	0	1	1	1	2	0	0	1	0	0
BUCKS	0	0	1	1	0	0	3	0	1	0	0	0	0
CAMBS	0	0	0	1	0	0	1	0	0	1	1	0	0
CHESHIRE	0	0	6	0	1	1	9	2	7	0	1	0	0
CLEVELAND	0	0	1	2	0	2	4	1	5	0	0	0 (2)	8
CORNWALL	0	0	1	1	0	0	0	1	0	0	1	0 (3)	0
CUMBRIA	0	0	0	0	0	0	1	0	0	1	0	0	0
DERBYSHIRE	0	0	1	0	0	0	1	0	0	0	1	0	0
DEVON	0	1	1	2	0	0	5	1	4	0	1	0 (4)	1
DORSET	0	0	2	0	0	1	0	0	2	0	0	0	0

TABLE 3 (continued)

NUMBER OF CHEMICAL INCIDENTS (EXCLUDING CHEMICALS WASHED ASHORE)
FIGURES IN BRACKETS DENOTE NUMBERS OF INCIDENTS INVOLVING CHEMICALS WASHED UP ON THE SHORE.

	Estimated cause (see list for codes)												
BRIGADE	1	2	3	4	5	6	7	8	9	10	11	12	Unknown
DURHAM	0	0	0	0	0	0	0	0	1	0	0	0	0
E. SUSSEX	0	0	1	1	0	1	0	0	0	0	0	0 (27)	0
ESSEX	4	1	14	10	5	11	10	2	1	2	2	0	0
GLOUCS	0	0	0	1	0	0	0	0	0	0	0	0	0
HAMPSHIRE	0	0	1	3	1	4	8	1	1	0	2	0 (1)	22
HER & WORC	1	0	2	4	0	2	2	0	0	0	1	0	0
HERTS	0	0	3	3	0	1	1	0	1	1	1	0	0
HUMBERSIDE	1	0	12	5	1	11	12	3	8	0	4	0	1
I. O. W.	0	0	0	1	0	0	1	0	0	0	0	0 (128)	1
KENT	0	0	2	1	0	2	1	1	1	0	0	0	0
LANCS	1	1	5	3	2	3	6	4	1	0	1	0	0
LEEDS	0	0	3	5	1	3	1	1	1	0	1	0	0
LINCS	0	0	3	4	0	2	2	1	1	0	0	0	0
NORFOLK	0	0	5	3	2	1	3	0	1	0	3	0	0
N YORKS	0	1	0	1	1	1	0	0	1	1	2	0	1
NORTHANTS	0	0	3	2	0	0	1	1	0	0	2	0	0
NORTHUMBLD	0	0	0	0	0	0	0	0	1	0	0	0	0
NOTTS	0	0	2	0	0	0	0	0	1	0	0	0	0
OXON	0	0	2	1	0	0	0	0	1	0	0	0	0
SHROPSHIRE	0	0	0	0	0	0	0	0	1	0	0	0	0
SOMERSET	0	0	0	3	2	1	2	1	1	0	0	0	0
STAFFS	0	0	1	0	0	0	0	0	0	0	2	0	0
SUFFOLK	0	0	9	4	0	6	6	2	1	0	1	0 (1)	0
SURREY	0	0	2	1	0	2	1	1	0	1	0	0	0
WARWICKS.	1	0	4	2	0	1	1	0	1	0	0	0	0
W. SUSSEX	2	0	9	2	0	2	8	1	5	0	2	0 (16)	1
WILTSHIRE	0	0	0	0	0	0	0	1	0	0	0	0	0
NON - MET	12	5	107	71	17	60	97	29	51	7	31	0 (182)	35
GT. MANCH	2	0	4	1	0	2	0	2	4	0	1	0	1
MERSEYSIDE	1	0	8	2	0	2	8	2	1	0	0	0	0
S. YORKS	0	0	1	0	0	0	3	0	1	0	2	0	1
TYNE+WEAR	0	0	2	1	0	0	1	1	1	0	1	0	0
W MIDLANDS	2	1	4	0	0	0	4	3	3	0	2	0	1
W YORKS	2	0	5	6	1	4	12	6	7	0	1	0	0
TOTAL(MET)	7	1	26	10	1	8	28	14	17	0	7	0	3
GT LONDON	10	0	56	35	10	18	31	5	46	0	1	0	7

TABLE 3 (continued)

NUMBER OF CHEMICAL INCIDENTS (EXCLUDING CHEMICALS WASHED ASHORE)
FIGURES IN BRACKETS DENOTE NUMBERS OF INCIDENTS INVOLVING CHEMICALS WASHED UP ON THE SHORE.

BRIGADE	Estimated cause (see list for codes) 1	2	3	4	5	6	7	8	9	10	11	12	Unknown
CLWYD	0	0	0	3	0	0	0	1	4	0	0	0	0
DYFED	0	0	0	1	0	0	0	0	0	0	0	0	0
GWENT	0	0	1	0	0	0	0	0	0	0	0	0	0
GWYNEDD	0	0	3	0	1	0	1	0	0	0	1	0 (3)	1
MID GLAM.	0	0	0	2	0	1	0	0	0	0	0	0	0
POWYS	0	0	0	1	0	0	1	0	0	0	0	0	0
S.GLAM	0	0	3	0	0	1	3	0	0	0	0	0	0
W GLAM	0	0	0	0	0	0	2	0	0	0	0	0	0
TOT -WALES	0	0	7	7	1	2	7	1	4	0	1	0 (3)	1
CENTRAL	0	0	0	0	0	0	0	0	0	0	0	0	0
DUM & GALL	0	1	1	1	1	0	1	0	0	1	3	0	0
FIFE	0	0	1	1	0	1	0	1	0	0	0	0	0
GRAMPIAN	0	0	0	0	0	0	1	1	0	0	0	0	0
LOTH & BOR	0	1	1	0	2	2	1	1	0	0	2	0	0
NORTHERN	0	0	0	0	0	1	0	0	0	0	0	0	0
STRTHCLYDE	1	1	5	4	0	4	13	1	9	0	2	0 (5)	1
TAYSIDE	0	1	0	1	0	1	2	0	1	0	1	0	0
TOT (SCOT)	1	4	8	7	3	9	18	4	10	1	8	0 (5)	1
ALL BRIG.	30	10	204	130	32	97	181	53	128	8	48	0 (190)	47

TABLE 4

Chemical incidents by brigade, type of call and type of incident

NUMBER OF CHEMICAL INCIDENTS (EXCLUDING CHEMICALS WASHED ASHORE)
FIGURES IN BRACKETS DENOTE NUMBERS OF INCIDENTS INVOLVING CHEMICALS WASHED UP ON THE SHORE.

BRIGADE	STATIC INCIDENT: SPEC. SERV. CALLS	FIRE + CHEM	FIRE + CHEM ABNM	FIRE + CAS.	NOT REC.	ALL	TRANSPORT INCIDENT: SPEC SERV. CALLS	FIRE + CHEM	FIRE + ABNM	FIRE + CAS.	NOT REC.	ALL	ALL
AVON	6	2	0	1	0	9	7	0	0	0	0	7	16
BEDS	4	0	0	0	0	4	5	0	0	0	0	5	9
BERKSHIRE	8	0	0	0	0	8	3	0	0	0	0	3	11
BUCKS	4	0	0	1	0	5	1	0	0	0	0	1	6
CAMBS	0	0	0	0	0	0	4	0	0	0	0	4	4
CHESHIRE	8	6	1	2	0	17	9	1	0	0	0	10	27
CLEVELAND	11	4	1	0	2	18	2 (2)	0	0	0	0	2 (2)	20 (2)
CORNWALL	1	1	0	0	0	2	2 (3)	0	0	0	0	2 (3)	4 (3)
CUMBRIA	0	0	0	0	0	0	2	0	0	0	0	2	2
DERBYSHIRE	2	0	0	0	0	2	1	0	0	0	0	1	3

TABLE 4 (continued)

NUMBER OF CHEMICAL INCIDENTS (EXCLUDING CHEMICALS WASHED ASHORE)
FIGURES IN BRACKETS DENOTE NUMBERS OF INCIDENTS INVOLVING CHEMICALS WASHED UP ON THE SHORE.

BRIGADE	STATIC INCIDENT						TRANSPORT INCIDENT						ALL
	SPEC. SERV. CALLS	FIRE + CHEM	FIRE CHEM ABNM	FIRE + CAS.	NOT REC.	ALL	SPEC SERV. CALLS	FIRE + CHEM	FIRE + ABNM	FIRE + CAS.	NOT REC.	ALL	
DEVON	7	2	1	1	0	11	4 (4)	0	0	1	0	5 (4)	16 (4)
DORSET	1	2	0	0	0	3	2	0	0	0	0	2	5
DURHAM	0	1	0	0	0	1	0	0	0	0	0	0	1
E. SUSSEX	0	1	0	0	0	1	2 (27)	0	0	0	0	2 (27)	3 (27)
ESSEX	12	1	0	1	0	14	48	0	0	0	0	48	62
GLOUCS	0	0	0	0	0	0	1	0	0	0	0	1	1
HAMPSHIRE	21	2	0	0	0	23	15 (1)	0	0	0	0	15 (1)	38 (1)
HER & WORC	3	0	0	0	0	3	9	0	0	0	0	9	12
HERTS	2	1	0	1	0	4	7	0	0	0	0	7	11
HUMBERSIDE	15	4	0	1	0	22	34	2	0	0	0	36	58
I. O. W.	2	0	0	0	0	2	1 (128)	0	0	0	0	1 (128)	3 (128)
KENT	3	1	0	0	0	4	4	0	0	0	0	4	8
LANCS	14	3	2	0	0	19	8	0	0	0	0	8	27
LEICS	8	1	0	1	0	10	6	0	0	0	0	6	16
LINCS	4	1	0	0	0	5	8	0	0	0	0	8	13
NORFOLK	5	0	0	1	0	6	12	0	0	0	0	12	18
N YORKS	2	1	0	0	0	3	6	0	0	0	0	6	9
NORTHANTS	4	0	0	0	0	4	5	0	0	0	0	5	9
NORTHUMBLD	0	1	0	0	0	1	0	0	0	0	0	0	1
NOTTS	1	1	0	0	0	2	1	0	0	0	0	1	3
OXON	1	0	0	2	0	3	1	0	0	0	0	1	4
SHROPSHIRE	0	1	0	0	0	1	0	0	0	0	0	0	1
SOMERSET	1	1	0	1	0	3	7	0	0	0	0	7	10
STAFFS	0	0	0	1	0	1	0	2	0	0	0	2	3
SUFFOLK	11	1	0	0	0	12	17 (1)	0	0	0	0	17 (1)	29 (1)
SURREY	3	0	0	1	0	4	4	0	0	0	0	4	8
WARWICKS.	4	1	0	0	0	5	5	0	0	0	0	5	10
W. SUSSEX	19	5	2	0	0	26	6 (16)	0	0	0	0	6 (16)	32 (16)
WILTSHIRE	1	0	0	0	0	1	0	0	0	0	0	0	1
NON - MET	188	47	7	15	2	259	249 (182)	5	0	1	0	255 (182)	514 (182)
GT. MANCH	10	3	0	2	0	15	2	0	0	0	0	2	17
MERSEYSIDE	11	3	0	0	0	14	9	0	1	0	0	10	24
S. YORKS	4	1	0	0	0	5	3	0	0	0	0	3	8
TYNE+WEAR	4	1	0	0	0	5	2	0	0	0	0	2	7
W MIDLANDS	11	6	1	0	0	18	4	0	0	0	0	4	22
W YORKS	17	6	3	1	0	27	15	1	0	1	0	17	44
TOTAL(MET)	57	20	4	3	0	84	35	1	1	1	0	38	122
GT LONDON	100	41	0	4	0	145	72	2	0	0	0	74	219

TABLE 4 (continued)

NUMBER OF CHEMICAL INCIDENTS (EXCLUDING CHEMICALS WASHED ASHORE)
FIGURES IN BRACKETS DENOTE NUMBERS OF INCIDENTS INVOLVING CHEMICALS WASHED UP ON THE SHORE.

BRIGADE	STATIC INCIDENT						TRANSPORT INCIDENT						ALL
	SPEC. SERV. CALLS	FIRE + CHEM	FIRE CHEM ABNM	FIRE + CAS.	NOT REC.	ALL	SPEC SERV. CALLS	FIRE + CHEM	FIRE + ABNM	FIRE + CAS.	NOT REC.	ALL	
CLWYD	0	2	2	1	0	5	3	0	0	0	0	3	8
DYFED	1	0	0	0	0	1	0	0	0	0	0	0	1
GWENT	1	0	0	0	0	1	0	0	0	0	0	0	1
GWYNEDD	1	0	0	0	0	1	6 (3)	0	0	0	0	6 (3)	7 (3)
MID GLAM.	0	0	0	0	0	0	3	0	0	0	0	3	3
POWYS	0	0	0	0	0	0	2	0	0	0	0	2	2
S.GLAM	5	1	0	0	0	6	1	0	0	0	0	1	7
W GLAM	1	1	0	0	0	2	0	0	0	0	0	0	2
TOT -WALES	9	4	2	1	0	16	15 (3)	0	0	0	0	15 (3)	31 (3)
CENTRAL	0	0	0	0	0	0	0	0	0	0	0	0	0
DUM & GALL	3	0	0	0	0	3	5	0	1	0	0	6	9
FIFE	2	0	0	0	0	2	2	0	0	0	0	2	4
GRAMPIAN	2	0	0	0	0	2	0	0	0	0	0	0	2
LOTH & BOR	2	0	0	0	0	2	7	0	1	0	0	8	10
NORTHERN	1	0	0	0	0	1	0	0	0	0	0	0	1
STRTHCLYDE	13	11	2	0	0	26	15 (5)	0	0	0	0	15 (5)	41 (5)
TAYSIDE	0	1	0	0	0	1	6	0	0	0	0	6	7
TOT (SCOT)	23	12	2	0	0	37	35 (5)	0	2	0	0	37 (5)	74 (5)
ALL BRIG.	377	124	15	23	2	541	406 (190)	8	3	2	0	419 (190)	960 (190)

Apart from the incidence of chemicals washed ashore, there is little evidence to suggest that the distribution of incidents by cause differed between metropolitan and non-metropolitan brigades (Fig. 2), apart from a higher incidence of fires involving chemicals in metropolitan brigades (19% of the total number of incidents reported by these brigades) than in non-metropolitan (10% of the total) and a lower incidence of road/rail accidents (2% of incidents in metropolitan brigades compared with 6% in non-metropolitan, although the numbers involved are very small).

In defining the types of incident for inclusion in the survey, four categories were identified (see "Numbers of incidents reported" above). Table 4 shows the numbers of static and transport incidents reported in each of these four categories. In this, and throughout the rest of the survey, incidents involving chemicals washed ashore have been classified as transport incidents. Overall, just over half the incidents involved chemicals in transit and only 13 (2%) of the 596 transport incidents involved fire, compared with 162 (30%) of the 541 static incidents.

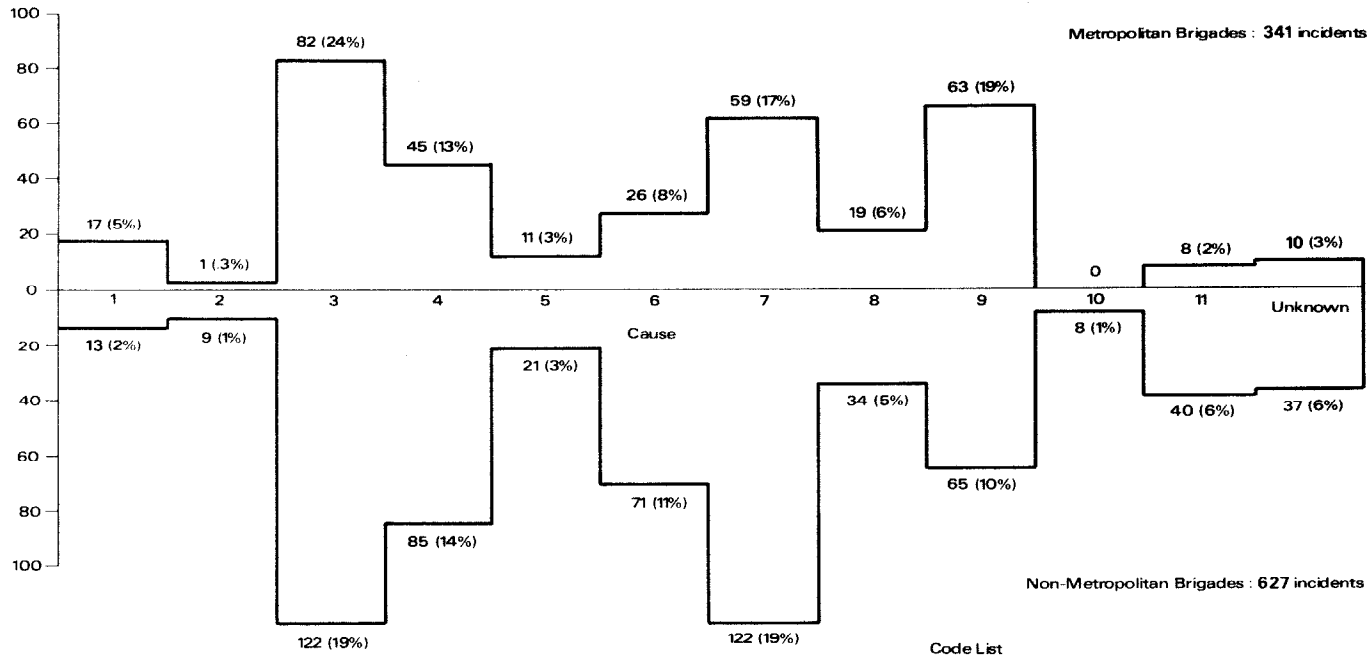

Fig. 2. Causes of the chemical incidents — Metropolitan and non-metropolitan brigades.

Degree of involvement of chemicals

In a chemical incident, chemicals which are present may be involved to varying degrees. For example, in a fire in a chemical warehouse, chemicals themselves may be neither the cause of the fire nor be consumed by it, but may nevertheless play a part in restricting the fire fighting activities of the brigade. At the other extreme, chemicals may be the direct cause of the incident, such as where a tank of corrosive liquid splits, and the liquid leaks out. For incidents other than where they were washed ashore, chemicals were directly involved in 838 of the cases (96% of the total for which the degree of involvement of chemicals was known). In 38 incidents, chemicals were not directly involved, but in 19 of these 38 incidents, it was reported that chemicals were in danger of becoming directly involved.

Quantity of chemicals (Table 5, Figures 3 and 4)

The quantities of chemicals involved in the reported incidents were known in 893 (77%) of the total 1158 cases. Overall, 31% of these 893 incidents involved 10 litres or less of chemicals (the term "involved" here meaning both directly involved and in danger of becoming directly involved), 69% involved 210 litres or less (210 litres is approximately the volume of a standard oil

TABLE 5

Chemical incidents by brigade and quantity of chemicals

NUMBER OF CHEMICAL INCIDENTS (EXCLUDING CHEMICALS WASHED ASHORE)
FIGURES IN BRACKETS DENOTE NUMBERS OF INCIDENTS INVOLVING CHEMICALS WASHED UP ON THE SHORE.

BRIGADE	Quantity of chemicals involved (Kilograms or Litres) 0-5	6-10	11-15	16-20	21-25	26-50	51-75	76-100	101-210	211-500	501-998	999 + OVER	NOT REC.
AVON	1	1	0	0	0	0	0	0	2	3	0	5	4
BEDS	1	0	0	0	0	1	1	0	1	3	0	0	2
BERKSHIRE	2	1	1	0	0	1	1	2	2	0	0	1	0
BUCKS	0	0	0	0	1	1	0	0	0	1	0	0	3
CAMBS	1	0	0	0	1	0	0	0	0	0	0	1	1
CHESHIRE	0	3	0	1	1	2	1	0	1	3	0	8	7
CLEVELAND	0	0	0	0	1	2	2	0	1	0	2	4	11 (2)
CORNWALL	0	0 (1)	0	1	1 (1)	0	0	0	1	0	0	0 (1)	1
CUMBRIA	0	0	0	0	0	0	0	0	0	0	0	1	1
DERBYSHIRE	0	0	0	0	0	0	0	1	0	0	0	2	0
DEVON	2	0	2	0	0	0	0 (1)	0 (2)	2 (1)	1	0	4	5
DORSET	1	0	0	0	1	1	0	0	1	0	0	1	0
DURHAM	0	0	0	0	0	0	0	0	0	1	0	0	0
E. SUSSEX	0 (15)	0 (1)	1 (2)	0	0 (1)	1 (1)	0	0	0 (1)	1 (1)	0	0	0 (5)
ESSEX	8	3	3	1	2	1	1	4	7	2	5	16	9
GLOUCS	0	0	0	0	0	0	0	0	0	1	0	0	0
HAMPSHIRE	1	0	0	0	1	3	0	0	0	0	0	5	33 (1)
HER & WORC	1	0	0	1	2	1	0	0	1	1	0	3	2

TABLE 5 (continued)

NUMBER OF CHEMICAL INCIDENTS (EXCLUDING CHEMICALS WASHED ASHORE)
FIGURES IN BRACKETS DENOTE NUMBERS OF INCIDENTS INVOLVING CHEMICALS WASHED UP ON THE SHORE.

BRIGADE	Quantity of chemicals involved (Kilograms or Litres) 0-5	6-10	11-15	16-20	21-25	26-50	51-75	76-100	101-210	211-500	501-998	999 + OVER	NOT REC.
HERTS	0	0	1	3	0	0	1	0	1	0	0	3	2
HUMBERSIDE	10	1	0	2	1	3	1	2	8	5	1	11	13
I. O. W.	1 (45)	0 (3)	0	0 (4)	0 (9)	0 (9)	0	0	1 (4)	0 (1)	0	1	0 (53)
KENT	2	1	0	0	0	0	0	0	2	0	1	2	0
LANCS	9	1	0	0	1	3	0	0	1	1	1	3	7
LEICS	0	1	0	0	3	3	0	1	2	0	1	2	3
LINCS	1	0	0	0	1	0	0	0	3	2	2	3	1
NORFOLK	2	1	0	0	3	2	0	0	1	0	0	6	3
N YORKS	2	0	1	0	0	0	0	0	1	0	1	3	1
NORTHANTS	1	1	0	0	2	2	0	0	0	1	0	2	0
NORTHUMBLD	1	0	0	0	0	0	0	0	0	0	0	0	0
NOTTS	0	0	0	0	0	0	0	0	0	0	0	3	0
OXON	1	1	0	0	0	0	0	0	0	0	0	1	1
SHROPSHIRE	0	0	0	0	0	0	0	0	0	0	0	1	0
SOMERSET	1	0	0	0	2	3	0	4	0	0	0	0	0
STAFFS	0	0	0	0	0	0	0	0	0	0	0	1	2
SUFFOLK	6	0	2	0	2 (1)	1	0	0	4	3	0	4	7
SURREY	3	0	0	1	1	0	0	0	0	2	0	0	1
WARWICKS.	1	0	0	0	2	0	2	0	1	0	0	4	0
W. SUSSEX	8 (12)	2	2	1	1	2 (2)	0	3	3 (1)	0	0	6	4 (1)
WILTSHIRE	1	0	0	0	0	0	0	0	0	0	0	0	0
NON - MET	68 (72)	17 (5)	13 (2)	11 (4)	30 (12)	33 (12)	10 (1)	17 (2)	47 (7)	31 (2)	14	107 (1)	124 (62)
GT. MANCH	6	0	0	0	0	3	1	0	0	1	0	3	3
MERSEYSIDE	2	0	1	0	1	2	0	0	3	6	0	5	4
S. YORKS	0	0	0	0	0	0	0	0	0	0	0	1	7
TYNE+WEAR	3	0	0	0	0	0	0	0	0	0	0	1	3
W MIDLANDS	3	0	0	1	0	1	0	0	2	6	1	3	5
W YORKS	3	2	2	1	1	4	1	1	6	3	1	13	6
TOTAL(MET)	17	2	3	2	2	10	2	1	11	16	2	26	28
GT LONDON	67	7	3	8	15	16	3	13	17	9	5	27	29
CLWYD	0	1	0	0	1	0	0	2	1	0	1	2	0
DYFED	0	0	0	0	0	1	0	0	0	0	0	0	0
GWENT	0	0	0	0	0	1	0	0	0	0	0	0	0
GWYNEDD	3 (3)	0	0	0	1	2	0	0	0	0	0	1	0
MID GLAM.	0	0	0	1	0	1	0	0	1	0	0	0	0
POWYS	0	0	0	0	0	0	0	0	1	0	0	1	0
S.GLAM	2	0	0	0	0	0	0	0	0	0	0	3	2
W GLAM	0	0	0	0	0	1	0	0	0	0	0	0	1
TOT -WALES	5 (3)	1	0	1	2	6	0	2	3	0	1	7	3

TABLE 5 (continued)

NUMBER OF CHEMICAL INCIDENTS (EXCLUDING CHEMICALS WASHED ASHORE)
FIGURES IN BRACKETS DENOTE NUMBERS OF INCIDENTS INVOLVING CHEMICALS WASHED UP ON THE SHORE.

BRIGADE	Quantity of chemicals involved (Kilograms or Litres) 0-5	6-10	11-15	16-20	21-25	26-50	51-75	76-100	101-210	211-500	501-998	999 + OVER	NOT REC.
CENTRAL	0	0	0	0	0	0	0	0	0	0	0	0	0
DUM & GALL	0	0	1	0	1	0	0	0	0	0	0	7	0
FIFE	0	0	0	0	1	0	0	0	0	2	0	1	0
GRAMPIAN	0	0	0	0	0	0	1	0	0	0	0	1	0
LOTH & BOR	0	1	0	0	0	1	0	0	2	1	2	2	1
NORTHERN	0	0	0	0	0	0	0	1	0	0	0	0	0
STRTHCLYDE	4 (1)	2	0	0	0 (1)	2	1	0	5 (1)	0	0	11	16 (2)
TAYSIDE	1	0	0	0	2	0	0	0	0	0	1	3	0
TOT (SCOT)	5 (1)	3	1	0	4 (1)	3	2	1	7 (1)	3	3	25	17 (2)
ALL BRIG.	162 (76)	30 (5)	20 (2)	22 (4)	53 (13)	68 (12)	17 (1)	34 (2)	85 (8)	59 (2)	25	192 (1)	201 (64)

drum), and 22% involved 1000 litres or more. Figure 3 shows the distribution of incidents according to the quantities of chemicals involved, for normal and washed ashore incidents separately, and Fig. 4 similarly for fire and non fire incidents separately. Incidents involving chemicals which were washed ashore had a markedly greater proportion of small quantities of chemicals than other types of reported incident.

Protection and decontamination

There were marked differences in the extent to which protective suits were worn in incidents involving chemicals washed ashore and the remainder. Accordingly, these two groups of incidents are examined separately below:

(a) Chemicals not washed ashore

Gas tight chemical protection suits were known to have been worn in 185 (19%) of the incidents, and other chemical protection suits in 362 (37%). A total of 25 of these incidents reported using both types of protection. Of the total of 522 incidents in which protection suits of some description were worn, the suits were reported to be satisfactory in 497 (95%), not satisfactory in 14 (3%) and the performance was not recorded in the remainder.

The unsatisfactory aspects of the suits varied; in one instance it was reported that the management at the firm concerned had advised that the chemical protection suits would not afford protection against the chemicals involved. The remaining aspects were: the suits leaked in an unspecified manner (2 incidents), the suits leaked around the head area (2 incidents), the suit leaked at the inner sleeves (1 incident), the suits tore (2 incidents), the suits were a poor fit and caused discomfort (2 incidents), the sleeves rode up leaving the wearers' arms exposed (2 incidents), the gloves were too stiff and

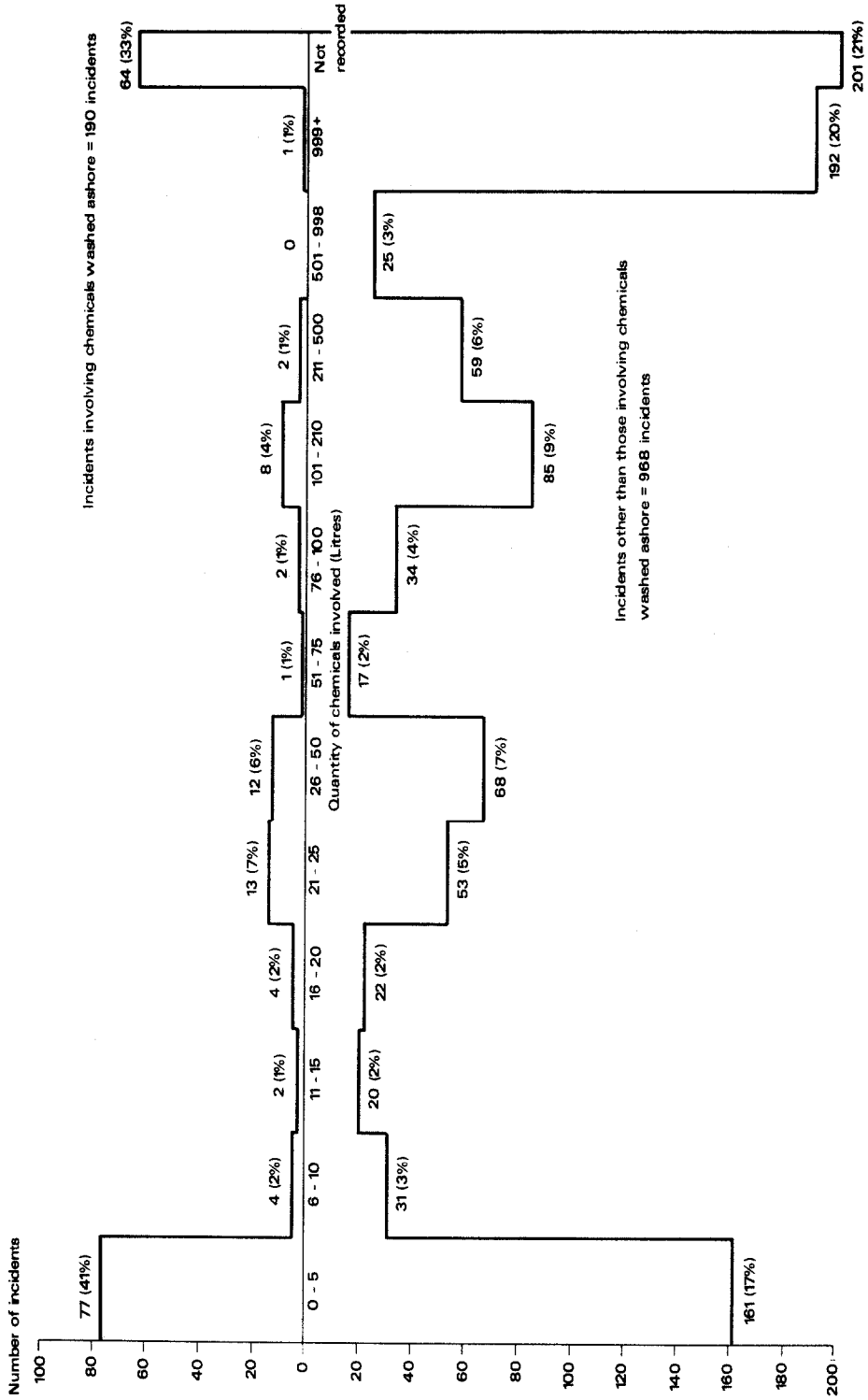

Fig. 3. Distribution of quantity of chemicals involved — Normal and washed ashore incidents.

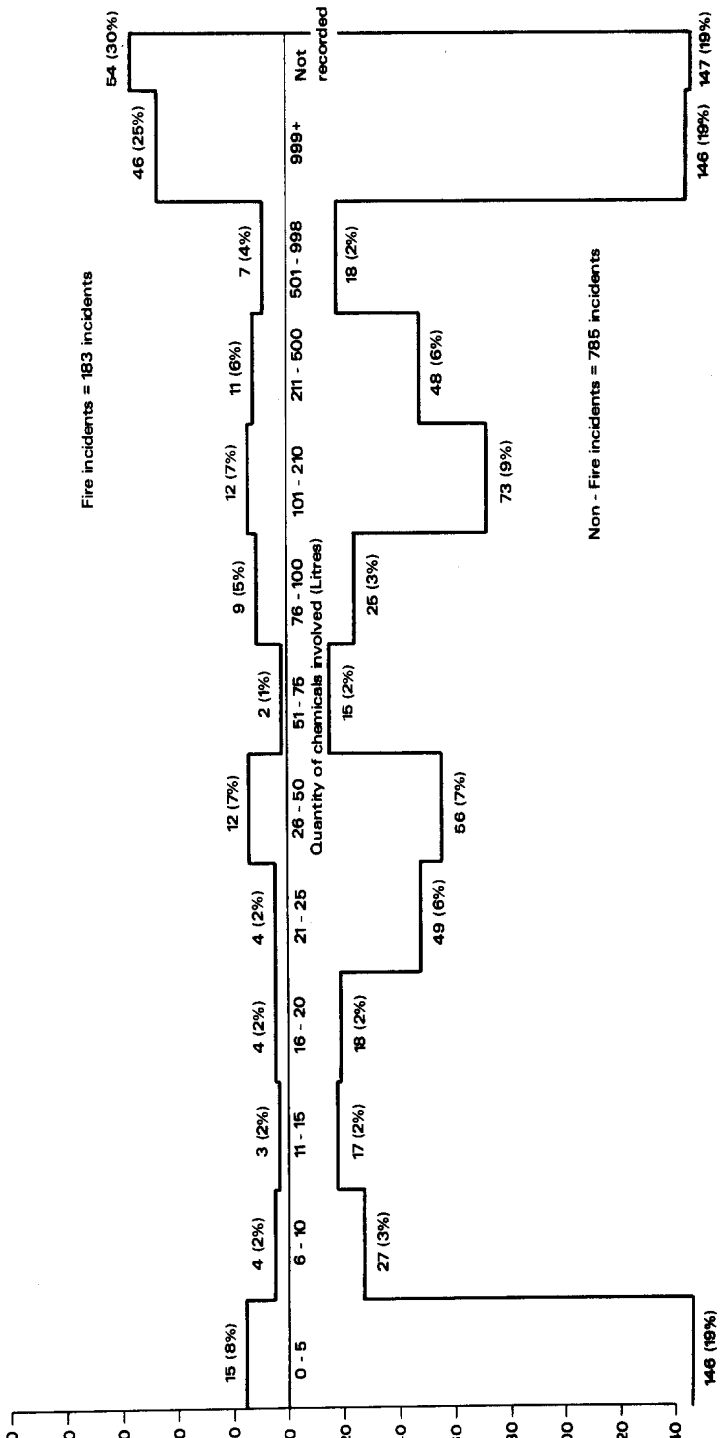

Fig. 4. Distribution of quantities of chemicals involved — Fire and non-fire incidents.

there was difficulty in picking up bags of chemicals (1 incident), and the suit gave no protection against cold temperatures when handling a leakage of LPG (1 incident). Of the 14 incidents where the suits were reported to be unsatisfactory, 6 involved brigade casualties.

Breathing apparatus was reported to have been used without chemical protection suits in 311 of the incidents, of which 90 were fire incidents and 221 were special service calls.

Decontamination procedures following the incident were known to have been carried out in 414 of the 815 incidents for which it was reported that some form of decontamination was carried out. Of these, 408 involved a wet process and 6 a dry process. The dry processes which were identified involved brushing down tunics and equipment (2 incidents), ventilation of breathing apparatus and fire gear (1 incident) and unspecified dry decontamination (3 incidents).

(b) Chemicals washed ashore

Chemical protection suits were worn in a much higher proportion of incidents involving chemicals washed ashore than for other incidents. Gas tight chemical protection suits were known to have been worn in 141 (74%) of the incidents, and other protection suits in 24 (13%). In ten incidents, both categories of suit were used. The suits, where used, were reported to perform satisfactorily in all but one case in which there was an inadequate seal around the wristband. Breathing apparatus was reported to have been used without chemical protection suits in 5 incidents.

Decontamination procedures were known to have been carried out in 144 of the 178 incidents for which it was reported that decontamination was carried out. All of these involved a wet process.

Fire brigade resources involved (Tables 6, 7, 8 and 9)

The resources which are examined here are the time required for dealing with the incident, the loss of equipment through contamination, and the particular procedures which were followed for dealing with the incident.

Overall, 172 (16%) of the incidents, for which the duration of the brigade involvement in dealing with the chemicals was known, lasted for 30 minutes or less, 268 (25%) for between 30 minutes and an hour, 116 (43%) between 1 hour and 3 hours, and 176 (16%) over 3 hours. However, the duration of brigade involvement depended on the quantity of chemicals involved (Table 6); the greater the quantity of chemical involved in general, the greater the likelihood that the duration of the brigade involvement at the incident would be long.

Overall, the average duration of the brigade involvement in each chemical incident was estimated to be about 2.3 hours, but this ranged from just over one and a quarter hours on average for dealing with incidents caused by deliberate action or vandalism, to over 7 hours for dealing with road or rail accidents. The average for these incidents, however, was influenced by one in-

TABLE 6

The total number of incidents for which the duration of the involvement and the quantity of chemicals involved were known was 863

Quantity of chemical involved (litres)	Duration of brigade involvement (minutes)						Total
	0—30	31—60	61—180	181—360	361—998	999 and over	
	Numbers of incidents						
1— 10	71	76	104	7	3	1	262
11— 50	29	42	100	18	4	1	194
51—100	11	13	15	6	5	1	51
101—210	9	23	42	14	1	0	60
501—998	5	4	12	2	2	0	25
999 and over	12	33	72	33	27	5	182
Total	144	207	371	90	43	8	863

TABLE 7

Average duration of the brigade involvement by cause of incident

Cause	Average duration (minutes)	Number of incidents on which average is based
Deliberate action/vandalism	76	28
Accidental — overfilling	110	10
— mishandling	97	193
— insecure load	117	123
— inadequate sealing	155	29
Defective or damaged containers	127	93
Leak from pipework, flange etc.	128	172
Chemical reaction/spontaneous ignition	132	50
Fire involving chemicals	165	116
Defective vehicle	380	6
Road or rail accident	446	44
Chemicals washed ashore	126	182
Unknown cause	121	35

stance in which the brigade was involved for five days. Apart from that one exceptional incident, the average for road or rail accidents was just over 5 hours. Transport incidents other than those involving chemicals washed ashore took slightly longer to deal with than other incidents, 160 minutes, compared with 130 minutes. The duration of involvement in transport incidents other than those involving chemicals washed ashore, in which no markings of any kind were visible on the vehicle of the containers, was about 90 minutes on average.

TABLE 8

Average duration of the brigade involvement by static/transport and type of incident

	Average duration (mins) (Figures in brackets are the numbers of incidents on which the averages are based)				
	Special service calls	Fires where chemicals were involved	Fires where chemicals behaved abnormally	Fires with casualties	All
Static	120 (355)	140 (115)	120 (11)	160 (18)	130 (499)
Transport					
— normal	140 (385)	1030 (8)	80 (2)	800 (2)	160 (397)
— washed ashore	130 (181)	—	—	—	130 (181)

TABLE 9

Fire fighting medium used in fire and explosion

Fire fighting medium	Number of incidents where medium was used
Water	131
Steam	1
Water and sand	2
Foam	6
Sand and other dry materials	15
Fire allowed to burn out	5
Water fog and soda ash	4
Asbestos blanket	1
Fire out on arrival	5
Not recorded	13
Total	183

In 38 of the 1158 reported incidents, some item of equipment was reported to have been discarded. The majority of the equipment was minor (such as disposable plastic gloves), but in a few of the incidents, equipment of a more valuable nature had to be discarded. The detailed breakdown is as follows:

Items discarded (note more than one item may be discarded at any incident)	Number of items discarded
Gloves — rubber	5
— plastic/PVC	12

— leather	6
— other/unspecified	7
Boots — rubber	3
Over-trousers	1
Parts of BA equipment	4
Plastic bags	6
Plastic sheets	6
Bag of sand	1
Decontamination pool	2
Bucket	6
Fire tunic	10 (includes one recorded "several")
Leggings	9
Helmet liner	9
Lengths of hose	4
Lengths of line	2
Belt lines	4
Decontamination suits	2
Personal clothing	5 (includes one recorded "several")
No details	1

For incidents other than those involving chemicals washed ashore, brigade chemical procedures were reported to have been invoked in 604 (62%) of the 968 incidents, not invoked in 229 (24%) and details were not recorded in the remainder. For incidents involving chemicals washed ashore, the corresponding figures were 148 (78%) and 16 (8%).

For the 184 incidents involving a fire or explosion, the fire fighting media used are shown in Table 7.

The procedures for dealing with the chemicals in those incidents, other than those involving chemicals washed ashore, were as follows:

Means of dealing with chemicals	Number of incidents
Chemicals contained	394
Chemicals diluted	369
Contained and diluted	40
Removed	8
Vented into atmosphere	7
Allowed to burn	1
Cooled	1
Action not recorded	148
Total number of incidents	968

Casualties (Tables 10 and 11)

Overall, a total of five fatal and 681 non-fatal casualties were reported at the 1158 incidents.

The five fatalities occurred at three separate incidents. In one incident, involving three of the deaths, the casualties were the result of an explosion which occurred when a steel oil tank was being cleaned internally. In another incident involving an explosion, one person died. In the third incident, the driver of a road tanker was killed when his vehicle was involved in a road traffic accident, overturned and caught fire.

Overall, 985 (85%) of the 1158 reported incidents involved no casualties of any kind, 1109 (96%) involved no brigade casualties and 21 (2%) involved 9 or more casualties. The term casualties includes a wide range, however, and the great majority of those recorded in the survey suffered very minor complaints, if any, and required only very brief attendance at hospital for a check. Table 11 lists the degree of hospital treatment involved for the 537 non-fatal casualties for which the method of treatment was recorded. Overall, 86% of these non-fatal casualties were taken to hospital but released, and only 48

TABLE 10

Chemical incidents by brigade, number and nature of casualties

NUMBER OF CHEMICAL INCIDENTS WITH GIVEN NUMBER OF CASUALTIES
FIGURES IN BRACKETS REFER TO BRIGADE CASUALTIES ONLY.

	FATAL CASUALTIES			NON-FATAL CASUALTIES								
BRIGADE	0	1	2 AND OVER	0	1	2	3	4	5	6	7	8	9 AND OVER
AVON	16 (16)	0	0	13 (16)	2	0	1	0	0	0	0	0	0
BEDS	9 (9)	0	0	6 (8)	1	1	1 (1)	0	0	0	0	0	0
BERKSHIRE	11 (11)	0	0	10 (10)	1 (1)	0	0	0	0	0	0	0	0
BUCKS	6 (6)	0	0	3 (4)	2 (1)	0	1 (1)	0	0	0	0	0	0
CAMBS	4 (4)	0	0	4 (4)	0	0	0	0	0	0	0	0	0
CHESHIRE	27 (27)	0	0	22 (25)	1	0	1	0	1	1 (1)	0	0	1 (1)
CLEVELAND	25 (25)	0	0	22 (24)	0	3 (1)	0	0	0	0	0	0	0
CORNWALL	7 (7)	0	0	7 (7)	0	0	0	0	0	0	0	0	0
CUMBRIA	2 (2)	0	0	2 (2)	0	0	0	0	0	0	0	0	0
DERBYSHIRE	3 (3)	0	0	3 (3)	0	0	0	0	0	0	0	0	0
DEVON	20 (20)	0	0	16 (19)	2	1	0	0	0	0	0	0	1 (1)
DORSET	5 (5)	0	0	5 (5)	0	0	0	0	0	0	0	0	0
DURHAM	1 (1)	0	0	1 (1)	0	0	0	0	0	0	0	0	0
E. SUSSEX	30 (30)	0	0	28 (29)	1	1 (1)	0	0	0	0	0	0	0
ESSEX	62 (62)	0	0	51 (61)	6 (1)	1	1	1	0	1	0	1	0
GLOUCS	1 (1)	0	0	1 (1)	0	0	0	0	0	0	0	0	0
HAMPSHIRE	44 (44)	0	0	43 (43)	0	1 (1)	0	0	0	0	0	0	0
HER & WORC	12 (12)	0	0	9 (12)	2	1	0	0	0	0	0	0	0

TABLE 10 (continued)

NUMBER OF CHEMICAL INCIDENTS WITH GIVEN NUMBER OF CASUALTIES
FIGURES IN BRACKETS REFER TO BRIGADE CASUALTIES ONLY.

BRIGADE	FATAL CASUALTIES			NON-FATAL CASUALTIES									
	0	1	2 AND OVER	0	1	2	3	4	5	6	7	8	9 AND OVER
HERTS	11	0	0	8	2	0	0	0	1	0	0	0	0
	(11)			(10)					(1)				
HUMBERSIDE	56	1	1	51	1	2	1	1	1	0	0	0	1
	(58)			(56)	(1)								(1)
I. O. W.	131	0	0	129	1	1	0	0	0	0	0	0	0
	(131)			(130)		(1)							
KENT	8	0	0	4	2	1	0	0	0	0	0	0	1
	(8)			(7)	(1)								
LANCS	27	0	0	24	1	0	0	0	0	0	0	0	2
	(27)			(26)									(1)
LEICS	16	0	0	14	1	1	0	0	0	0	0	0	0
	(16)			(15)		(1)							
LINCS	13	0	0	13	0	0	0	0	0	0	0	0	0
	(13)			(13)									
NORFOLK	18	0	0	14	1	1	0	1	0	0	0	0	1
	(18)			(16)		(1)							(1)
N YORKS	9	0	0	8	1	0	0	0	0	0	0	0	0
	(9)			(9)									
NORTHANTS	9	0	0	8	1	0	0	0	0	0	0	0	0
	(9)			(9)									
NORTHUMBLD	1	0	0	1	0	0	0	0	0	0	0	0	0
	(1)			(1)									
NOTTS	3	0	0	1	0	0	0	0	0	0	0	0	2
	(3)			(2)									(1)
OXON	4	0	0	1	2	1	0	0	0	0	0	0	0
	(4)			(3)		(1)							
SHROPSHIRE	1	0	0	1	0	0	0	0	0	0	0	0	0
	(1)			(1)									
SOMERSET	10	0	0	8	0	1	0	0	0	0	0	0	1
	(10)			(9)									(1)
STAFFS	3	0	0	2	0	1	0	0	0	0	0	0	0
	(3)			(3)									
SUFFOLK	30	0	0	27	0	2	1	0	0	0	0	0	0
	(30)			(30)									
SURREY	8	0	0	5	2	0	1	0	0	0	0	0	0
	(8)			(8)									
WARWICKS.	10	0	0	9	1	0	0	0	0	0	0	0	0
	(10)			(10)									
W. SUSSEX	48	0	0	39	3	2	1	0	1	0	1	1	0
	(48)			(47)		(1)							
WILTSHIRE	1	0	0	1	0	0	0	0	0	0	0	0	0
	(1)			(1)									
NON - MET	702	1	1	614	37	22	9	3	4	2	1	2	10
	(704)			(680)	(5)	(8)	(2)		(1)	(1)			(7)
GT. MANCH	17	0	0	12	2	1	0	0	1	1	0	0	0
	(17)			(16)		(1)							
MERSEYSIDE	24	0	0	16	1	2	0	0	1	0	0	0	4
	(24)			(20)	(2)	(1)		(1)					
S. YORKS	8	0	0	4	0	2	0	0	0	0	1	0	1
	(8)			(8)									
TYNE+WEAR	7	0	0	5	0	1	1	0	0	0	0	0	0
	(7)			(7)									
W MIDLANDS	22	0	0	16	2	2	0	1	0	0	1	0	0
	(22)			(20)	(1)			(1)					
W YORKS	43	1	0	34	3	2	0	0	1	2	0	0	2
	(44)			(40)		(1)				(1)			(2)
TOTAL(MET)	121	1	0	87	8	10	1	1	3	3	2	0	7
	(122)			(111)	(3)	(3)		(2)		(1)			(2)
GT LONDON	219	0	0	185	12	11	2	1	3	2	0	0	3
	(219)			(207)	(5)		(1)	(2)	(2)	(1)			(1)
CLWYD	8	0	0	7	1	0	0	0	0	0	0	0	0
	(8)			(8)									
DYFED	1	0	0	1	0	0	0	0	0	0	0	0	0
	(1)			(1)									
GWENT	1	0	0	1	0	0	0	0	0	0	0	0	0
	(1)			(1)									
GWYNEDD	10	0	0	10	0	0	0	0	0	0	0	0	0
	(10)			(10)									
MID GLAM.	3	0	0	3	0	0	0	0	0	0	0	0	0
	(3)			(3)									
POWYS	2	0	0	2	0	0	0	0	0	0	0	0	0
	(2)			(2)									

TABLE 10 (continued)

NUMBER OF CHEMICAL INCIDENTS WITH GIVEN NUMBER OF CASUALTIES
FIGURES IN BRACKETS REFER TO BRIGADE CASUALTIES ONLY.

BRIGADE	FATAL CASUALTIES 0	1	2 AND OVER	NON-FATAL CASUALTIES 0	1	2	3	4	5	6	7	8	9 AND OVER
S.GLAM	7 (7)	0	0	4 (6)	0	2	0	0	0	1 (1)	0	0	0
W GLAM	2 (2)	0	0	2 (2)	0	0	0	0	0	0	0	0	0
TOT -WALES	34 (34)	0	0	30 (33)	1	2	0	0	0	1 (1)	0	0	0
CENTRAL	0	0	0	0	0	0	0	0	0	0	0	0	0
DUM & GALL	9 (9)	0	0	9 (9)	0	0	0	0	0	0	0	0	0
FIFE	4 (4)	0	0	4 (4)	0	0	0	0	0	0	0	0	0
GRAMPIAN	2 (3)	0	0	0 (1)	0	1 (1)	1	0	0	0	0	0	0
LOTH & BOR	10 (10)	0	0	10 (10)	0	0	0	0	0	0	0	0	0
NORTHERN	1 (1)	0	0	1 (1)	0	0	0	0	0	0	0	0	0
STRTHCLYDE	46 (46)	0	0	39 (46)	2	2	1	0	0	1	0	0	1
TAYSIDE	7 (7)	0	0	6 (7)	1	0	0	0	0	0	0	0	0
TOT (SCOT)	79 (79)	0	0	69 (78)	3	3 (1)	2	0	0	1	0	0	1
ALL BRIG.	1155 (1158)	2	1	985 (1109)	61 (13)	48 (12)	14 (3)	5 (4)	10 (3)	9 (4)	3	2	21 (10)

TABLE 11

Degree of hospital treatment required for the non fatal casualties — numbers of casualties

Degree hospital treatment	Chemical incidents other than those involving chemicals washed ashore	Chemical incidents involving chemicals washed ashore
Released	454	8
Outpatients	39	0
Inpatients	36	0

(4%) of the total 1158 incidents resulted in one or more casualties which were sufficiently serious to warrant treatment, either as an outpatient or as an in-patient at hospital.

Static incidents

A total of 541 of the 1158 reported incidents in the survey were recorded as static; that is, the chemicals involved in the incidents were not in any form of transport, and were located at a site where they were being stored, were in use, or were in the course of manufacture.

Of the 541 static incidents, 344 (64%) involved chemicals in a building,

173 (32%) not in a building, and for 24 (4%) the location was not recorded.

In 27 (5%) of the static incidents the chemicals involved were being made, in 147 (27%) they were in storage, in 184 (34%) they were in use, and in 183, the details were not recorded. The premises were known to be under fumigation at the time of the incident in only 3 cases.

Transport incidents

A total of 609 of the 1158 reported incidents were reported to involve chemicals in transit. Of these, 190 involved chemicals washed ashore (which for consistency were all assumed to involve transport).

For the incidents other than those involving chemicals washed ashore, 105 (25%) occurred in a rural location, 187 (45%) in an urban industrial location, 113 (27%) in an urban residential location and for the remaining 14, the details were not recorded. 89 (21%) involved chemicals in loading or unloading operations.

The types of loads involved were as follows:

Type of load	Number of incidents
Bulk single tank	100
Bulk multi-compartment	28
Packages — full load	46
Packages — mixed load	57
Small packages	154
Details not recorded	34

The majority of the 419 transport incidents (excluding those involving chemicals washed ashore) involved road transport in some form; 336 (80%) of the transport incidents fell into this category, compared with 42 (10%) involving rail transport, 34 (8%) involving water transport and only 2 involving air transport. 5 of the incidents had no details to indicate which form of transport was involved.

Since road transport accounted by far for the majority of the transport incidents, it was subjected to further analysis. 21 (6%) of the 335 road transport incidents occurred on motorways, 120 (36%) on A-class roads, 56 (17%) on B-class roads, 29 (9%) on unclassified roads and 96 (29%) occurred off public roads. 14 of the incidents provided no details as to the location. 97 (29%) of the road transport incidents occurred in a parking area; the vehicle was attended at the time of the incident in 243 (72%). A road traffic accident was reported as a primary cause of the incident in only 36 cases.

The transport was marked in 195 (34%) of the incidents involving some form of transport, and the containers in 268 (89%) of the incidents for which containers were involved and the presence or absence of the markings on the containers was noted. In 19 of the transport incidents (excluding those involving chemicals washed ashore) no form of marking was visible either on the vehicle or the containers. The markings which did appear on

the vehicle or containers were as follows:

Markings visible on vehicle or containers	Number of incidents
Product name	290
Telephone number	177
Hazard diamond	239
Other relevant marking	97

(Note: more than one item of information may be recorded at one incident)

In 134 incidents, the presence or absence of a UKTHIS label was recorded; it was present in 85 (63%) cases, the details on the label were correct in 75 (88%) of these 85 cases.

For the 190 incidents involving chemicals washed ashore, the containers were marked in only 17 (9%) of the instances, although this is not to say that the containers were not originally clearly marked before they found their way into the sea. For those 17 incidents where the containers were marked, the markings present were:

Markings visible on containers	Number of incidents
Product name	11
Telephone number	1
Hazard diamond	7
Other relevant marking	6

Source of advice (Table 12)

The sources of advice used by the brigades in dealing with the incidents are listed in Table 12. Overall, London Fire Brigade was recorded as a source of advice for 22% of the 1168 incidents, and the supplier of the chemicals in 19%. Hazfile was recorded as a source in only 3% of the incidents.

Concluding remarks

The picture which emerges from this, the first full survey of the nature of the dangerous chemical incidents with which the public fire service have to deal, is that although the number of incidents which arise from dangerous chemicals is not insignificant, the indications are that only 4% of the total number of reported incidents resulted in any casualties which were sufficiently serious to warrant treatment. In terms of brigade resources, the total number of brigade hours spent in attendance at the 1158 incidents was about 2700, and the brigade equipment discarded as a result of dealing with the in-

TABLE 12

Sources of advice for brigades in dealing with the chemical incidents — number of incidents where source used

Source	Incidents other than those involving chemicals washed ashore	Incidents involving chemicals washed ashore
Scientist at premises	194	3
Harwell	34	4
London Fire Brigade	256	1
Chemical supplier	220	2
Other chemical company	94	5
Brigade control	111	7
Hazfile	30	5
Local authority	77	143
Works Engineer	17	0
Reference cards, etc.	31	1
Government establishment	15	4
Chemsafe	68	5

cidents is relatively insignificant. Over a third of the incidents in the survey arose from some form of accidental action in which the incident could have been avoided through more careful handling of the materials. A further 16% arose from defects, either in containers, plant or vehicles. Thus there would appear to be scope for reducing the number of dangerous chemical incidents through both closer attention to the methods of handling and closer inspection of plant and equipment.

References

1 J.J. Stedman, Hazfile 1979/80 Evaluation Report, Home Office Scientific Advisory Branch Report 9/80, London, 1980.
2 A.D. Maclean and A.J. Butler, Tablet — a data retrieval and analysis program for a microcomputer, Home Office Scientific Advisory Branch Program Manual 1/80, Home Office, London, 1980.

Appendix 1

Questionnaire form

Form SABCIS80/3

Chemical Incidents Survey 1980

Please complete this questionnaire for any of the following types of incident attended by the fire brigade:

- special service calls in which dangerous chemicals are involved
- fires in which dangerous chemicals have a significant effect on fire-fighting operations
- fires in which dangerous chemicals are present and behave in an abnormal or unexpected manner
- fires in which dangerous chemicals are present and where members of the public or fire service receive medical treatment as a result of the effects of the chemicals.

For the purposes of this survey, the term "dangerous chemicals" includes those substances contained in the United Nations list of dangerous goods, and any other substances which have similar characteristics.

If in doubt about a particular incident, please complete and return a form.

The period of the survey is from 1 January to 31 December 1980. When you have completed the questionnaire, please return it to:

Mr Clark
Home Office, Fire Service Inspectorate,
Room 904, 50 Queen Anne's Gate
LONDON SW1H 9AT

No stamp is necessary. Replacement forms will be sent to you automatically as necessary.
Any queries concerning the survey or the questionnaire form should be directed to Mr Clark at the above address, or by telephoning 01-213 7249.

1 To be completed in all cases

1.1 Name of brigade .....

1.2 Date of call to incident ..... 1.3 Time of call to incident .....

1.4 Address or location of incident .....

1.5 Where applicable, FDR1 number for the call .....

1.6 For your own reference, and if you wish to do so, enter an incident serial number here. (This number will be used in any correspondence related to the incident. .....

In Sections 2 to 10 below, please complete or tick answers as requested. If you have insufficient room, please use the back page of this form, marking any entries clearly with the question number.

2 Details of incident

2.1 **Nature of chemicals.** For each dangerous chemical or product present at the incident, fill in below as many identifying details as were available to you **at the time of the incident.**

	Principal substance	Any other substances
chemical name	.....	.....
trade name	.....	.....
UN number	.....	.....
manufacturer's name	.....	.....
other details	.....	.....
tick if no details	☐	☐

2.2 For each substance identified in question 2.1, please tick the box(es) below corresponding most closely with any characteristics which affected action by the brigade.

Characteristic	Principal substance	Any other substances
flammable	☐	☐
toxic	☐	☐
corrosive	☐	☐
explosive	☐	☐
radioactive	☐	☐

other hazard (please specify) ☐ ☐

2.3 Were any of the substances identified above: (Tick as appropriate)

- directly involved in the incident? Yes ☐ No ☐
- not directly involved but in danger of being so? Yes ☐ No ☐

2.4 Were brigade chemical procedures involved? Yes ☐ No ☐

2.5 Please tick the box(es) corresponding most closely to the descriptions of the incident as a whole:

fire ☐ spillage ☐ other ☐

If 'other', please specify .....

.....

2.6 In the space below, please give a brief description of the incident .....

.....

.....

.....

2.7 What was the approximate total quantity of chemicals involved? (State whether kilogrammes, litres etc) .....

3 Protection

3.1 Indicate by ticking the appropriate box(es) whether chemical protection suits or gastight chemical protection suits were used by fire brigade personnel.

Gastight chemical protection suits worn ☐ Chemical protection suits worn ☐

3.2 Was the performance of the chemical protective clothing satisfactory? Yes ☐ No ☐ If "NO", please give details: .....

.....

.....

3.3 Was BA used without chemical protective clothing? Yes ☐ No ☐

3.4 Please describe any decontamination procedures for personnel and fire brigade equipment subsequently carried out. (Include whether a "wet" or "dry" process was used, and whether decontamination was carried out at or away from the incident.) If none, write ***"None"***

.....

.....

.....

.....

4 Brigade action & resources

4.1 What was the approximate duration of fire brigade involvement in dealing with the chemicals aspect of the incident? ..... hrs

4.2 Was any fire brigade equipment discarded as a result of the incident? Yes ☐ No ☐

If "***Yes***", please give details: .....

.....

4.3 What firefighting medium was used? .....

4.4 Were the chemical contained or diluted? (Please tick) Contained ☐ Diluted ☐

5 Casualties

5.1 Please record here the numbers of all fatal and non-fatal casualties which were directly attributable to the chemicals at the incident. If necessary, please advise separately if symptoms are delayed until after the report has been made.

	Brigade personnel	Other
Fatal	☐	☐
Non Fatal	☐	☐

5.2 Of these, how many were:

- taken to hospital but released? .....
- treated as hospital outpatients? .....
- treated as hospital inpatients? .....

6 Static/transport incidents

6.1 Did the incident involve chemicals in any form of transport (including during loading and unloading etc)?

Yes ☐ No ☐

If "Yes", go straight to Section 8. Otherwise continue with Section 7

7 Static incidents

7.1 Were the chemical in a building? Yes ☐ No ☐

If, ***"Yes"***, were they: (tick one answer)

being made? ☐ in storage? ☐ being used? ☐

7.2 Were the premises under fumigation at the time of the incident? Yes ☐ No ☐

Now go straight to Section 9

8 Transport incidents

8.1 Please indicate the type of locality where the incident occurred. (Tick one answer.)

rural ☐ urban - industrial ☐ urban - residential ☐

8.2 Did the incident occur during loading or unloading operations?

Yes ☐ No ☐

8.3 What was the nature of the load? (Tick one answer)

Bulk single tank load ☐
Bulk multi-compartment load ☐
Packages - full load ☐
Packages - mixed load ☐
Small packages (including individual drums or containers dropped from transport.) ☐

8.4 What was the mode of transport? (Tick one answer.) Road ☐ Rail ☐ Water ☐ Air ☐

If "Road" continue with questions 8.5 to 8.7 otherwise go straight to question 8.8

8.5 ***(Road Transport Only)*** On what type of road did the incident occur? (Tick one answer.)

Motorway ☐ A class ☐ B class ☐ Other ☐ Not on road ☐

8.6 ***(Road Transport Only)*** Did the incident involve a vehicle in a parking area? Yes ☐ No ☐ Not known ☐

Was the vehicle attended? Yes ☐ No ☐ Not known ☐

8.7 ***(Road Transport Only)*** Was the incident the result of a road traffic accident? Yes ☐ No ☐

If ***"No"***, indicate cause, if known. .....

.....

.....

8.8 ***(All Transport)*** Was the transport marked? Yes ☐ No ☐

8.9 Were the containers/packages marked? Yes ☐ No ☐ Not applicable ☐

8.10 If any marking to the transport or containers/packages was provided, tick the box(es) to indicate the information present

Product name ☐ Telephone number for specialist advice ☐ Hazard warning diamond ☐

Other (please specify) ☐ .....

.....

.....

8.11 If the vehicle was a tanker, was it carrying the UKTHIS label? Yes ☐ No ☐

If ***"No"***, please specify possible reason (eg exempt vehicle), if known. .....

.....

.....

If ***"Yes"***, were all the details correct? Yes ☐ No ☐

9 Specialist advice

9.1 What sources of specialist advice were contacted? (Tick one or more answers.)

Scientific adviser at the premises concerned ☐
Harwell ☐
London Fire Brigade ☐
Chemical company which supplied the product ☐
Another chemical company ☐
Other (please specify) ☐

.....

.....

.....

Section 10: (Overleaf)

9.2 Was the Chemsafe Scheme invoked? Yes ☐ No ☐

If "Yes", please give details .....

.....

.....

9.3 If any sources of information proved inadequate, please indicate in what way .....

.....

.....

10 Additional details

In the space below, please provide any other relevant details concerning the incident (eg. pollution of water courses, etc.).

Signature _____ Rank _____ Date _____

Appendix 2

Summary of excluded incidents

Summary analysis of the chemical incident report forms which were excluded from the survey because they fell outside the selection criteria.

Type of incident	Number of forms
Uncategorised fire	59
Smell of fumes or suspected gas leak	13
Harmless substance	3
Small fire involving LPG	43
Small leakage of LPG	15
Fire involving asbestos cement sheeting	7
Small spillage of petrol or fuel oil	65
Fire involving gas cylinders	18
Standing by during transfer of load	2
Insufficient information to code	1
Duplicate report	8
No action by brigade	32
Total number of forms rejected	266