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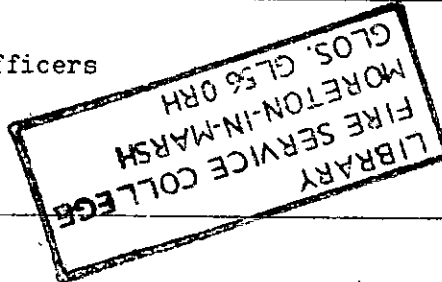


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No. 7/1982

To: All Chief Fire Officers



Your reference

Our reference

(A) FIR/81 620/33/8 (B) FIR/80 620/33/5

Date (C) FIR/81 15/107/1

14 May 1982

Dear Chief Officer

- A) OPERATIONAL STUDY ON DANGEROUS SUBSTANCES
- B) FIRES INVOLVING LIQUID PETROLEUM GAS (LPG)
- C) GAS SUPPLY SYSTEM - BRITISH GAS CORPORATION APPRECIATION PAPER FOR FIRE BRIGADES

A. OPERATIONAL STUDY ON DANGEROUS SUBSTANCES

I enclose at Appendix A a copy of the note of the proceedings of the Operational Study on Dangerous Substances, which was held at the Fire Service Technical College on 14/15 April 1981. The note includes the papers presented at the Study together with a summary of the discussions which took place after each session and at the conclusion of the Study. A report on the results of the Chemical Incident Survey 1980, which provided the data on which the Study was based, was issued to all brigades attending the Study and has not been included in the note of the proceedings. Further copies of the Survey Report may be obtained on request from Home Office Fire Department (Room 944), but the number available is limited.

As chief officers will know, one of the reasons for conducting the survey of incidents in 1980 and holding the Study was the increasing concern expressed in the service about incidents involving dangerous substances. The involvement of brigades in such incidents has raised issues for the service which have not been susceptible of ready solution. The outcome of the survey and the Study has contributed to the continued examination of these issues. At the request of the Central Fire Brigades Advisory Council, the Joint Committee on Fire Brigade Operations has discussed the issue of co-ordination of work on the provision of information on dangerous substances; this had been initiated in view of the many projects, including Hazfile, being undertaken in this area. A long and careful study on the outcome of the feasibility studies on the marking of buildings with Hazchem codes has been made by the Standing Panel on Dangerous Substances and their report, together with the views of the Operations Committee will be put to the HSE. The Committee has also put in hand a study of certain aspects of inspections under Section 1(I)(d) of the Fire Services Act 1947 which have implications in respect of premises where dangerous substances are present.

B. FIRES INVOLVING LIQUID PETROLEUM GAS (LPG)

During the course of the past year, the Joint Committee on Fire Brigade Operations has been examining the level of LPG involvement in fires to determine whether there was a need for any operational guidance to be issued to the service. In so doing, the Committee has gathered a good deal of statistical information on the subject which they consider would be of interest to brigades. A summary of this information is attached at Appendix B for the information of Chief Officers.

Chief Officers may also like to know that, following their examination of the data, the Committee concluded that, from an operational point of view, no significant problems were revealed by the review despite the rapid increase in the use of LPG. However, the Committee acknowledged that increasing use of LPG could change the situation and they are keeping in mind the possible need to re-examine the matter in the light of additional information. During the course of their discussions, the Committee's attention was drawn to the existence of a potential hazard where LPG cylinders fitted with pressure relief valves are involved in a fire. In such circumstances, activation of the pressure relief valve can result in the emission of a large jet of flame in whatever direction the aperture of the valve is pointing. The relief valve is designed to operate when in contact with vapour, ie when the cylinder is upright; it may not operate as intended if the cylinder is not upright. The Committee considered that the attention of brigades should be drawn to these points.

C. GAS SUPPLY SYSTEM - BRITISH GAS CORPORATION PAPER FOR FIRE BRIGADES

As a contribution to the revision of Part 6B of the Manual of Firemanship, the British Gas Corporation have provided, at the Department's request, a paper which gives an up-to-date description of the UK Gas Supply System and sets out the procedures for dealing with emergency situations such as fires and gas escapes. This paper, a copy of which is attached at Appendix C, has been considered by the Joint Committee on Fire Brigade Operations.

The paper contains some very basic material, as well as some not directly relevant to the fire service. Appropriate information from the paper will be adapted for inclusion in the Manual of Firemanship, and in doing so the detailed comments of members of the Joint Committee will be taken into account. The Joint Committee considered nevertheless that, as it stood, the paper contained a good deal of useful and up-to-date information which would be of value to brigades, particularly to recruits, and that it should therefore be circulated for the information and attention of Chief Officers.

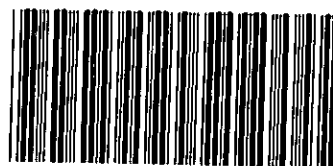
There are no additional cost or manpower implications arising from this letter.

Yours sincerely



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The Fire Service
College



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A STATISTICAL REVIEW OF FIRES INVOLVING LIQUEFIED PETROLEUM GAS
IN THE UNITED KINGDOM IN 1979

Introduction

1. The purpose of this paper is to make available to Fire Service personnel some of the statistics on the involvement in fires on liquefied petroleum gas (LPG) which have become available as a result of the introduction of the new Report of Fire form FDRI in 1978. The figures presented in the paper are for 1979: figures for 1978 and 1980 are incomplete because not all fires were reported in full during those years.

2. It is convenient to define three categories of involvement of LPG in fires.

"Slight" involvement The source of ignition was an LPG-fuelled appliance but there was no other LPG involvement.

"Moderate" involvement LPG was either the material first ignited or the material mainly responsible for the development of the fire (or both) but there was no LPG explosion and LPG was not reported as a dangerous substance.

"Severe" involvement There was an LPG explosion, or LPG was reported as a dangerous substance (or both).

It should be borne in mind that the choice of the terms Slight, Moderate and Severe is arbitrary and that they represent only the degree of LPG involvement and not the seriousness of the fire. For example, even a very serious fire would be categorised as "Slight" if the only LPG involvement was that it was started by an LPG blowlamp.

Analysis of fires and casualties by location and degree of LPG involvement

3. Table 1 shows numbers of LPG fires and resulting casualties in various locations. In this and subsequent tables the term "occupied building" implies merely that the building was in commission or under construction and does not necessarily imply that anyone was present when the fire started. Roughly speaking, for every 5 LPG fires in dwellings there were 4 in other occupied buildings and 3 in locations other than occupied buildings. Casualties from LPG fires were distributed roughly in the ratio 5 in dwellings to 2 in other occupied buildings and 2 not in occupied buildings. In occupied buildings other than dwellings, industrial premises (not including the construction industry) had the greatest number of fires (about one seventh of the number in dwellings) and also the greatest number of non-fatal casualties (about one twelfth of the number in dwellings). There were no fatal casualties in occupied buildings other than dwellings. About three quarters of the fires not in occupied buildings were in outdoor plant, caravans or road vehicles. The greatest number were in outdoor plant but similar numbers of casualties occurred in each of the three locations. These included 4 fatal casualties in caravans and 1 in outdoor plant. Eight fires occurred in derelict buildings: these caused no casualties and in view of their small number have been included in the "other and unrecorded" category in Table 1 and subsequent tables.

Table 1 Fires and casualties from fires involving LPG by location

United Kingdom 1979				Number
Location	Fires	Non-fatal casualties		Fatal casualties (All 'Not Brigade')
		Not Brigade	Brigade	
In occupied buildings				
Dwellings	2,165	303	5	14
Industry (not construction)	333	24	2	-
Construction industry	256	17	-	-
Private sheds and garages	133	13	3	-
Shops	130	14	4	-
Restaurants, clubs etc	118	18	1	-
Schools	93	1	-	-
Agriculture	87	1	-	-
Hotels, hostels, etc	68	3	-	-
Distributive trade (not shops)	49	4	8	-
Public entertainment	37	3	-	-
Hospitals	35	-	-	-
Other and unrecorded	314	21	3	-
Total in occupied buildings	3,818	422	26	14
Not in occupied buildings				
Outdoor plant	487	29	2	1
Caravans	248	29	1	4
Road vehicles	240	27	2	-
Outdoor storage	81	2	-	-
Ships and boats	48	12	-	-
Tents	29	13	-	-
Other and unrecorded	130	6	-	-
Total not in occupied buildings	1,263	118	5	5

Table 2 Fires in occupied buildings involving LPG by location and degree of LPG involvement

United Kingdom 1979		Number of fires		
Location (Use of building)	Degree of LPG involvement			Total
	Slight	Moderate	Severe	
In occupied buildings				
Dwellings	1,171	750	244	2,165
Industry (not construction)	195	89	49	333
Construction industry	106	58	92	256
Private sheds and garages	63	31	39	133
Shops	58	56	16	130
Restaurants, clubs etc	61	43	14	118
Schools	71	14	8	93
Agriculture	63	13	11	87
Hotels, hostels etc	43	19	6	68
Distributive trade (not shops)	23	6	20	49
Public entertainment	19	9	9	37
Hospitals	32	3	-	35
Other and unrecorded	188	71	55	314
Total in occupied buildings	2,093	1,162	563	3,818
Not in occupied buildings				
Outdoor plant	298	127	62	487
Caravans	98	88	62	248
Road vehicles	126	67	47	240
Outdoor storage	33	22	26	81
Ships and boats	27	8	13	48
Tents	7	18	4	29
Other and unrecorded	30	71	29	130
Total not in occupied buildings	619	401	243	1,263

4. In Table 2, the number of fires in each location are analysed by degree of LPG involvement. Apart from dwellings, the category with most fires involving serious LPG involvement was the construction industry. In the construction industry, other industry, private sheds and garages, and shops, the numbers of fires with moderate or severe involvement were greater than the numbers with slight involvement. The number of fatal and non-fatal casualties in the three location groups ("dwellings", "other occupied buildings" and "not in occupied buildings") are analysed by degree of LPG involvement in Table 3.

Table 3 Fires and casualties from fires involving LPG by degree of LPG involvement and location group

United Kingdom 1979

Degree of LPG involvement	Location group	Fires	Non-fatal Casualties		Fatal Casualties (All 'Not Brigade')
			Not Brigade	Brigade	
			Number		
Slight	Dwellings	1,171	46	-	4
	Other occupied buildings	922	42	1	-
	Not in occupied buildings	619	22	3	-
	Total	2,712	110	4	4
Moderate	Dwellings	750	149	5	3
	Other occupied buildings	412	32	4	-
	Not in occupied buildings	401	41	1	-
	Total	1,563	222	10	3
Severe	Dwellings	244	108	-	7
	Other occupied buildings	319	45	16	-
	Not in occupied buildings	243	55	1	5
	Total	806	208	17	12
All combined	Dwellings	2,165	303	5	14
	Other occupied buildings	1,653	119	21	-
	Not in occupied buildings	1,263	118	5	5
	Total	5,081	540	31	19
Totals for all fires (for comparison)		355,577	7,841	1,042	1,096

5. It can be found from Table 3 that about 70 per cent of casualties from LPG fires in occupied buildings (both dwellings and others) and about 80 per cent of casualties from LPG fires not in occupied buildings resulted from fires in which the LPG involvement was moderate or severe. In Table 4 such fires and casualties are analysed by location and fires with severe LPG involvement have been further categorised into those with LPG explosions and those in which LPG was reported as a dangerous substance but did not explode.

Table 4 Fires and non-fatal casualties from fires with severe involvement of LPG by location

United Kingdom 1979		Number		
Location	Fires		Non-fatal casualties	
	DS*	Explosion	DS*	Explosion
Occupied buildings				
Dwellings	136 ⁽¹⁾	108 ⁽²⁾	46	62
Construction industry	49	43	-	14
Industry (not construction)	26	23	3	5
Shops	6	10	-	4
Private sheds and garages	20	19	4	8
Restaurants, clubs etc	9	5	-	2
Distributive trades (not shops)	13	7	7	4
Hotels, hostels etc	3	3	-	1
Agriculture	7	4	-	-
Schools	5	3	-	-
Places of public entertainment	4	5	-	-
Hospitals	-	-	-	-
Other and unrecorded	32	23	3	6
Total in occupied buildings	310	253	63	106
Not in occupied buildings				
Outdoor plant	43 ⁽⁴⁾	19 ⁽³⁾	-	14
Caravans	30 ⁽⁴⁾	32 ⁽⁵⁾	3	7
Road vehicles	31	16	12	4
Outdoor storage	18	8	-	1
Ships and boats	2	11	-	9
Tents	2	2	1	1
Other and unrecorded	17	12	-	4
Total not in occupied buildings	143	100	16	40

*DS: fires in which LPG was reported as a dangerous substance but in which there was no explosion

(1), (2), (3), (4) and (5): Numbers of fatal casualties from these fires were, respectively, 2, 2, 3, 6, 1. One fatality resulted from a fire in a dwelling with only moderate LPG involvement.

6. It can be seen from Table 4 that in most locations explosions occurred in something like half the fires with severe LPG involvement and that in almost every location they led to the majority of the casualties from such fires.

Circumstances in which fires occurred

7. Statistics alone cannot give a full picture of the types of fires which occur or the circumstances in which they come about. To supplement the statistics, brief individual descriptions of a sample of 32 fires with severe LPG involvement are given at Annex A. The descriptions are arranged in tabular form and give, for each fire, brief details of location, how the fire occurred, details of explosion (if applicable) and details of LPG reported as a dangerous substance (if applicable.)

Summary and conclusions

8. The main points to emerge from this review are as follows:

a. The degree of LPG involvement in LPG fires in 1979, using the terms defined in paragraph 2, was "slight" in about 2,700 fires, "moderate" in 1,600 fires and "severe" in 800 fires. Nineteen people died from these fires and 571 were injured. About 20 per cent of the casualties occurred in the fires with slight LPG involvement, 40 per cent in fires with moderate LPG involvement and 40 per cent in fires with severe LPG involvement.

b. There were about 35 per cent more non-domestic than domestic fires involving LPG but the non-domestic fires led to 17 per cent fewer casualties than the domestic fires.

c. No single type of location had more than a quarter the number of LPG fires that occurred in domestic dwellings, or more than one ninth the number of resulting casualties. In non-domestic occupied buildings, LPG fires were most numerous in the construction industry and in other industrial premises but 100 or more LPG fires also occurred in private sheds and garages, shops and in restaurants and clubs. LPG explosions occurred most frequently in construction industry premises. In outdoor locations, LPG fires were most frequent in outdoor plant, caravans and road vehicles.

d. The statistics indicate that although LPG fires occur infrequently relative to other kinds of fire, they have a greater than average propensity to cause casualties and are much more likely to involve explosions than most other types of fires. These characteristics are demonstrated by the following figures for 1979.

i. In relation to the total of 355,000 fires attended by Fire Brigades the number involving LPG, about 5,000, was not large. But the LPG fires led to a significant proportion (about 6 per cent) of non-fatal casualties as well as about 2 per cent of the fatal casualties. About 2.5 per cent of non-fatal casualties resulted from LPG fires in non-domestic premises.

ii. In about 7 per cent of LPG fires, explosions occurred and in a further 10 per cent LPG was reported as a dangerous substance. These proportions are high compared with those in other types of fire. LPG was involved in about one third of all explosions reported in fire and also in about one third of all fires in which dangerous substances were reported. The relatively high frequency of explosions in LPG fires applied both to domestic and non-domestic premises.

Sample of fires not in dwellings in the United Kingdom in which an LPG explosion occurred or LPG was reported as a dangerous substance

Serial number	Location	How fire occurred	Details of explosion	Details of LPG reported as a dangerous substance
1.	Portakabin used as railway workmen's hut.	Children with matches ignited paper.	Fire caused explosion of <u>50kg propane cylinder.</u>	
2.	Timber shed used by scrap dealer in a quarry which spread to another timber shed.	Intentional burning of timber left unattended.	Fire caused explosion of unknown number of cans and drums (25-200 litre) of paraffin, paint and lubricating oils.	8.69 cubic metre acetylene cylinder and <u>two propane cylinders (11kg and 23.2kg)</u> altered fire fighting procedures.
3.	Private greenhouse in garden.	Leakage of <u>propane gas</u> from disconnected regulator ignited by greenhouse heater.	Explosion of leaking <u>propane gas</u> in atmosphere only. Cylinder not involved.	
4.	Retail shoe warehouse and furniture warehouse.	Mobile <u>butane gas fire</u> left turned on ignited soft furniture.	Fire caused explosion of <u>30lb butane cylinder.</u>	<u>5 butane cylinders present,</u> 2 cylinders attached to heating appliances, 3 cylinders badly affected by fire. All safety devices appeared to have operated.
5.	School store-room for camping equipment.	Doubtful ignition of outer covering of camping equipment.	Fire caused explosion of <u>10 x 190 grammes disposable butane gas containers.</u>	
6.	Caravan on building site.	Unknown source ignited internal fittings.	Fire caused rupture of <u>48kg propane cylinder.</u>	
7.	Garden shed used as private workshop.	Defective lead to electric motor short-circuited igniting insulation.	Fire caused explosion of <u>10lb propane cylinder.</u>	

Serial number	Location	How fire occurred	Details of explosion	Details of LPG reported as a dangerous substance
8.	Caravan (mobile home).	Defective lead to electric blanket ignited bedding.	Fire caused explosion of <u>14kg propane cylinder.</u>	
9.	Mobile office on building site.	Occupant attempted unsuccessfully to light a <u>small propane gas cooker.</u> Left it turned on. Went to turn on and light the light. Match ignited gas escaping from cooker.	Explosion caused fire. Escaping gas from <u>47kg propane cylinder</u> ignited with explosive violence. Fire did not follow.	
10.	Private garage.	Doubtful.	Fire caused explosion of <u>32lb Calor Gas cylinder.</u>	
11.	Portable office on construction site.	Smell of gas noted 20 minutes earlier. Building ventilated. Occupants closed all openings and used match to light <u>LPG convector heater</u> supplied from external cylinder. Gas in atmosphere ignited.	Explosion caused fire. <u>45kg LPG cylinder</u> outside of building and not involved.	
12.	Workshop and garage of roofing contractors (timber building).	Unknown.	Fire caused explosion. <u>3 x 15kg propane cylinders</u> ruptured.	
13.	Private hotel and restaurant.	Flame from burner of <u>portable butane gas cooker</u> used in restaurant dining-room ignited leakage from cylinder.	Explosion caused fire. <u>1.05lb interchangeable butane gas cartridge</u> exploded.	

Serial number	Location	How fire occurred	Details of explosion	Details of LPG reported as a dangerous substance
14.	Storage and canteen hut of building renovators. Spread to three dwellings.	<u>Propane gas fire</u> ignited <u>propane escaping</u> from faulty tubing to cylinder.	Fire caused explosion of <u>47kg propane container.</u>	
15.	Motor-car on driveway of dwelling, which spread to a hut and to an aviary.	Flash-back at carburettor ignited petrol and/or <u>LPG leak.</u>		100lb of <u>propane</u> assisted spread of fire.
16.	Allotment garden hut.	Unknown.		60kg of <u>LPG</u> hindered approach to scene of fire.
17.	Doctors surgery and delicatessen.	Possibly electrical surge due to electric storm causing breakdown of insulation.		47kg of <u>propane</u> and natural gas from mains supply intensified fire.
18.	Workmans roadside hut of local authority works department.	Match ignited <u>propane gas</u> from heater left turned on.		27kg of <u>propane</u> made fire more severe.
19.	Cemetary building for storage of gardening equipment.	Doubtful ignition of paper towels.		3 x 25lbs of <u>propane</u> burnt, intensifying fire.
20.	Storage hut on building site.	Doubtful ignition of <u>propane gas</u> . <u>Propane cylinders</u> adjacent to hut - persons seen tampering with just prior to fire.		9kg of <u>propane</u> caused spread of fire.
21.	Minibus on highway.	Vehicle converted to run on LPG or petrol. <u>LPG leaking from loose union</u> on diaphragm of gas valve ignited by hot engine manifold.		<u>LPG</u> intensified fire.

Serial number	Location	How fire occurred	Details of explosion	Details of LPG reported as a dangerous substance
22.	Public house. Bedroom of dwelling as part of premises occupied by landlord.	Match ignited <u>butane gas-filled atmosphere.</u>		<u>100 grammes of butane in camping gas cylinder</u> escaped and destroyed at ignition.
23.	Workmans hut of civil engineers.	Hut had been forcibly entered. Source of ignition and material first ignited unknown.		<u>3 x 20kg propane</u> present. Only one container involved due to supply pipe burnt through causing leakage intensifying fire.
24.	Range of lock-up garages and spread to separate garage containing dangerous substances.	Unknown.		110lb oxygen cylinder and <u>42lb propane cylinder</u> heated by fire.
25.	Plant hire office and workshop and building contractors toolshed.	Unknown.		Acetylene cylinders (size and number not stated) ignited at the valves. <u>42lb propane cylinder.</u> Both kinds sprayed to cool.
26.	Caravan.	Spark from unguarded coal fire ignited carpet.		<u>15kg Calor Gas cylinder</u> delayed access.
27.	Mobile trailer of local authority works department on main road and spread to steamroller.	Matches ignited tarpaulin deliberately pushed under trailer.		<u>45 litres of butane</u> escaping from rubber tubing burnt through intensified fire.
28.	Propane gas cylinder of civil engineering contractor on open ground.	Children playing with matches <u>ignited gas from propane cylinder.</u>		<u>47kg propane cylinder.</u> Fire confined to gas escaping and damage to valve.

Serial number	Location	How fire occurred	Details of explosion	Details of LPG reported as a dangerous substance
29.	Workmen's hut of building contractor used as canteen.	Heat from portable gas cooker ignited wooden work - top when left unattended.		2 x 56lb Calor Gas cylinders spread fire when supply tube burnt through. 8 other cylinders present but not affected.
30.	Timber shed used as local authority groundsman's hut and store and spread to shed used as cricket store.	Doubtful.		32lb Calor Gas cylinder in each shed. Both enhanced ferocity of fire.
31.	Steel works colliery arch plant.	<u>Propane gas cylinder</u> with valve left open ignited by workman's brazier. (Cylinder being used as seat close to brazier).		104lbs of <u>propane gas</u> escaped and burned.
32.	Residential hotel bar.	<u>Leakage of LPG from cylinder</u> ignited by burner of <u>LPG portable heater</u> .		<u>32lbs of propane</u> leaking from container burnt through supply tube and increased heat until contents totally vaporised.