A copy of the Report of The Inquiry into Serious Gas Explosions chaired by Dr P J King is available at the National Archives in File POWE 29/1005. Photographs of relevant pages in that report follow.

Summary of the Report.

SUMMARY

References to the relevant clauses of the report are given in the left-hand margin.

Clauses 9 and 11 — (i) The investigation by the inquiry of the severe gas explosions at Bristol, Brentford, Beckenham and Bradford showed that no single cause was responsible, and the causes are typical of the general pattern.

Clauses 34 to 36 — (ii) For the last five years, there has been a yearly average of 108 serious explosions which have resulted either in fatality or at least £100 worth of damage. There is no evidence of an upward trend in these figures; in fact the number of serious explosions per therm of gas distributed has fallen over the last five years.

Clause 12 — Such explosions occur roughly twice as often in winter as in summer, and the long Christmas-New Year shutdown last winter did not result in a significant increase in explosions.

Clauses 38 to 40 — (iii) There are approximately 11 fatalities each year resulting from gas explosions, which shows that such explosions are a minor cause of accidental death, and no trend can be found in these figures. There was, however, an increase in the amount of property damage in the last year. The number of explosions causing severe structural damage averages 29 per year, but last year 37 such severe explosions occurred. The reason for this increase, which is just within the bounds of chance, has not been established.

Clauses 60 and 61 — There is no evidence that the changeover from town gas to natural gas has resulted in any increase in the number or severity of explosions.

Clause 42 — (iv) One third of all explosions is caused by gas escaping from the distribution mains or service pipes outside the property, with the remaining two thirds

Clauses 103 and 105

being associated with installation pipework, meters or appliances within the property. Most of these internal explosions result either from misuse of appliances, or deliberate interference with the gas supply. A common example of appliance misuse is forgetting to light the gas when distracted by children or the telephone, a situation which will gradually improve as appliances with automatic ignition and re-ignition become more prevalent.

Clause 120

The cost of equipping existing appliances with such devices is estimated at £800 million.

Clause 117

(v) The 'deliberate interference' category includes suicide attempts which are presumably commited under the mistaken impression that natural gas is toxic and are therefore generally abortive, but result

Clauses 103 and 109

in explosions and property damage. Attempts to obtain free gas by by-passing the meter, and 'do-it-yourself' gas fitting are further examples of interference which often lead to explosions. Some evidence that explosions in this category have been increasing recently may not be unconnected with current economic problems.

Clauses 49 to 69

(vi) There is cause for concern about the general level of public awareness of the common properties of distributed gas. These include its characteristic smell, its non-toxicity, its potential to form explosive mixtures with air, and the fact that it is

Clauses 18 to 22

lighter than air. It is disturbing to find that most gas escapes are reported only when it is convenient to do so, rather than when detected, and that many people are unaware of the British Gas policy of not charging for investigating reported leaks. An easily remembered telephone number should be introduced to simplify the reporting of gas escapes.

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Clause 113

(vii) The use of fixed domestic gas alarms to detect leaks has been considered, but it is concluded that low-cost maintenance-free fixed gas detectors have not yet been developed to the point where they can be recommended for installation in domestic or commercial premises. The characteristic odour of gas is still the best safety device for giving notice of leaks.

Clause 25 and Appendix E

(viii) Approximately 3 per cent. of internally caused explosions result from faulty workmanship by British Gas employees. The recent introduction of new training and assessment schedules for both the British Gas labour force and that of its contractors should be pursued with vigour.

Clause 23

(ix) An investigation of the response of British Gas to escape reports has shown it to be good. Typically, over 99 per cent. of customers' escape reports are visited in less than one hour. The

Clauses 23, 24, 47 and 48

safety standards of British Gas are undoubtedly high, and its safety record compares well with that of other countries.

Clause 42

Clause 75

Clauses 77 to 86

(x) A major reason for explosions inside premises resulting from gas escapes outside the property is fracturing of cast iron mains. Very few explosions result from leaking joints in the mains, such leakage being primarily an economic problem. Fractures result not so much from age or corrosion as from ground movement. This can be caused by drying out and wetting of soils, especially clays, and this factor has been particularly important in the last two years when very dry summers occured. Fractures occur mostly in winter. There are times during the winter when the ground surface is sealed by snow or frost, and gas escaping from the broken main cannot then escape upwards and seeks a sideways path. In this way, it is possible for the gas to enter property

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Clauses 97 to 101

especially premises with cellars into which various unsealed services (gas, water, electricity, telephone) may pass. It is clear that all service ducts which enter premises below the ground level should be properly sealed to prevent the ingress of gas.

Clauses 87 and 88

(xi) Another important cause of ground movement, and hence fracturing of cast iron mains, is heavy traffic. Consideration of an EEC proposal to increase the maximum permitted weights of vehicles should take account of the likelihood that this will also increase the rate of fracturing of gas mains. In this respect, it is recommended that the routing of heavy traffic through towns should also take account of the gas distribution system. Similarly, existing restrictions on the parking or moving of vehicles on pavements and verges should be enforced.

Clauses 89 to 93

(xii) Although the laying of grey cast iron mains ceased some years ago, about 80 per cent. of the distribution system still consists of this material. The cost of its complete replacement has been estimated at £4,000 million. Rapid replacement of the whole of the cast iron system is not practicable in terms of availability of trained manpower, nor probably is it desirable in national terms considering the disruption to traffic, and the huge sums of money involved. It is, however, recommended that the part of the system which is most at risk should be replaced by 1984 (the estimated cost being £400 million).

Clause 120

(xiii) There could be no guarantee that massive expenditure on the wholesale replacement of mains, or on modifications to appliances or their connections, would result in a significant reduction in the already low rate of fatalities or damage arising from gas explosions. It is for consideration whether such resources could be deployed elsewhere to better advantage. For instance £800 million would provide 50 or 60 hospitals, the life saving potential

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of which must be considerable.

Clause 121 (xiv) A substantial proportion of accidents and fatalities could be avoided at far less cost by increasing the amount of publicity devoted to safety. This should place emphasis on the potential hazards of gas, on hazards which may result from mistakes or ill-considered actions by customers, on the need to report leaks as soon as they are detected, and on the necessity for the installation and regular servicing of appliances by trained personnel.

Clause 122 (xv) A detailed list of specific recommendations is to be found at the end of the body of report.

Recommendations of the Report

RECOMMENDATIONS

122. The following recommendations are made to indicate the general areas in which the inquiry considers that action is necessary. The detailed implementation of these recommendations is outside the terms of reference of the inquiry, and it is appreciated that some of the matters referred to are already under consideration by the appropriate bodies. References to the relevant clauses of the report are given in the left-hand margin.

Clause 121 (i) Safety campaign - There should be sustained public relations activity to emphasize the characteristics of gas and the hazards which may result from mistakes or ill-considered actions by customers when using gas. Various aspects of this activity are referred to in several recommendations below.

Clause 19 (ii) Reporting of gas leaks - Suspected gas leaks should be reported as soon as they are detected.

Clause 68 (iii) Odour - Gas users are recommended to ensure that they can recognise the odour of natural gas.

British Gas is recommended to use cards containing micro-encapsulated odorant as part of a publicity campaign on gas safety.

Clauses 20 and 21 (iv) Emergency telephone numbers - The presentation of emergency telephone numbers in Post Office telephone directories should be improved.

British Gas is recommended to consult with the Post Office on the feasibility of allocating an easy-to-remember telephone number for each area of the country, giving direct contact to a British Gas emergency centre.

Adequate publicity should be given to any change in emergency telephone arrangements.

Clauses 109 and 111

(v) Installation piping - Amateur pipe fitting for gas installations should be discouraged, and a sustained publicity campaign should encourage customers to ensure that only British Gas or CORGI contractors undertake work on their installation piping.

Internal gas pipes should be properly disconnected if they are likely to remain unused.

Clause 103

(vi) Tampering with gas supplies - The deterent effect of increasing the number of prosecutions brought against those who tamper with gas meters and the associated pipework should be examined.

Clauses 97 to 101

(vii) Sealing of service entries - Gas service entries and all other service entries into properties should be sealed against the ingress of gas.

The Building Regulations should be amended to specify measures to prevent the ingress of gas around pipe ducts and cable entries (and through any other possible lines of entry).

Owners or occupiers of existing properties should consider or take advice on what reasonable measures can be taken to seal such entries.

Builders, particularly when working on reclaimed land, should take particular care to identify and fill any abandoned drains before building.

The foregoing recommendations on sealing apply equally for properties with gas supplies and for properties without supplies provided that there are gas mains in the vicinity.

Clauses 93, 94 and 96

(viii) Replacement of mains and services - British Gas is recommended to replace all higher risk priority mains by 1984 at the latest, to maintain the current service replacement programme, and to step up these programmes as and when resources permit.

Clause 84

(ix) Interference with underground services - Efforts should continue to try to improve co-operation between the utilities (and between contractors and the utilities) to reduce the damage done to the utilities' services during trenching activities.

Clauses 87 and 88

(x) Effects of vehicles on mains - Existing restrictions on the parking or movement of vehicles on pavements or verges in the vicinity of gas mains should be enforced.

Vehicles of the maximum laden weights now being envisaged by the EEC should be restricted to special routes and should not be allowed to use roads containing gas mains.

Clause 85

(xi) Effects of abnormal weather on mains - British Gas should maintain extra vigilance during periods of abnormal weather to detect fractures of cast iron gas mains.

Clause 22

(xii) Charging policy for investigating reported gas escapes - British Gas policy on not charging for the investigation of reported gas escapes should form part of a publicity campaign on gas safety.

Clause 112

(xiii) Cooker installations - New cooker installations should incorporate self-sealing plug-in flexible connections. Consumers should consider having their existing installations modified.

These connections should be included in the basic costs of the cooker.

Clauses 115 and 116

(xiv) Appliances - It is recommended that for new cookers the present policy of fitting flame failure devices to the ovens, and automatic ignition and re-ignition for hotplates, be continued.

The need for service contracts for appliances should be emphasized to consumers, and they should be priced as cheaply as possible or made attractive to the consumer by some other financial means.

Clause 113	(xv) Automatic gas alarms - Research and development should continue with the aim of producing a fixed automatic gas alarm which is cheap, reliable, safe, and with little need for maintenance.
Clause 24	(xvi) Investigation of reported gas escapes - British Gas should monitor the use of the system for classifying leaks in order to ensure that the system is always applied as intended.
Clause 25	(xvii) Training and assessment - The training and assessment schedules for both the British Gas labour force and that of its contractors should be pursued with vigour.
Clause 118	(xviii) Ventilation requirements - The minimum ventilation requirements specified by British Gas for appliances should be observed.
Clause 119	(xix) Secondhand appliances - Sellers of second-hand gas appliances and the general public should be made more widely aware of the law as it applies to the sale and installation of such appliances.
Clauses 13 and 14	(xx) Unoccupied premises - If practicable, consumers are recommended to turn off the supply at the meter control tap when premises are to be left unattended for an extended period. Anyone entering a building when it has been unoccupied for a period is recommended to be particularly vigilant to detect any trace of gas odour, and to take the correct action if there is any such odour.

Clause 31 (xxi) Sources of data on gas explosions - There should be an official source of information on incident statistics which should receive, from such bodies as police, ambulance, fire brigade, gas, water and electricity authorities, notice of all significant injury, fatality or property damage incidents. This agency should classify and correlate this information and issue regular reports.

P. J. King (Chairman)

G. T. Clegg

W. J. Walters

G. L. Chambers (Secretary)

23rd May 1977

Mains Replacement

Policy for replacement of mains

89. Mains are now laid in a variety of materials - see Appendix 1 - particularly ductile iron, steel and polyethylene, which do not suffer the same likelihood of tensile fracture as grey cast iron. The newer materials do, however, have their own drawbacks; ductile iron

pipes still require mechanical joints, steel requires particular care for corrosion prevention, for which cathodic protection is normally provided in addition to protective coatings. The purchasing of grey cast iron ceased completely in 1972. This will result eventually in grey cast iron (non-ductile) mains being replaced by mains of other materials.

90. Such replacement would occur naturally over the course of time, the rate being accelerated by the provision of new distribution systems in areas of city redevelopment. Some other factors which lead to mains and services being replaced are :

main or service being in very poor condition;
main being undersized;
properties supplied from the main to be modernised;
road to be re-levelled;
major road re-construction;
changed traffic conditions leading to sub-surface damage; and
subsidence from water movements, trenching or mining activities.

91. In order to supplement this slow normal replacement British Gas has implemented a programmed policy which is aimed at a more rapid replacement of particular parts of the cast iron system. Complete replacement would be a major task, and, safety apart, the difficulties are not solely a question of economics. The replacement of 80 per cent. of the 200,000 km system (the low pressure system, mainly of cast iron, is 80 per cent. of the whole) would cost British Gas (and hence the community) an enormous sum of money - an estimate of at least £4,000 million at present day prices has been made. In addition neither the manpower nor the material would be available for such replacement over a short time span, and the disruptive effect of the additional street works could not be ignored.

92. A realistic approach to the problem is to give priority to the mains which create the greatest risk, such as steel mains without corrosion protection; small diameter grey cast iron mains (particularly when operating at medium pressure (see Appendix I, Clause I8), or where such mains are close to premises with cellars or basements); mains which have a history of fractures; a high incidence of joint leakage which does not respond to gas conditioning (see Appendix H, Clauses H13 to H28) , or where the pipe material condition is suspect; and mains which are in areas of local subsidence or in corrosive soils. On the basis of such an assessment those mains at greatest risk have been replaced at a rate governed by the availability of manpower, material and financial resources.

93. British Gas policy was revised in 1974 to make more resources available for this purpose (see Appendix I, Clause I23), and is currently under review again in relation to resources and how they are utilised. At least one region of British Gas expects to have all small diameter cast iron mains (most of them laid before 1953) in the more hazardous locations replaced by 1984. This represents about 8 per cent. of the total low pressure mains in this region. A similar programme for replacing cast iron medium pressure mains in the more hazardous locations is also in hand. The cost to the industry of this programme, if applied nationally, is estimated to be £400 million.

94. The inquiry believes that this sort of timescale for the replacement of higher risk priority mains forms a reasonable minimum. Mains in less hazardous locations should be replaced as resources permit. The wholesale replacement of mains even in areas of relatively high risk cannot be justified on economic grounds by the amount of damage caused to property and, since the level of personal injury is very low, it is for consideration whether a significant proportion of national resources should be expended in attempting to reduce it further.

Extract from Appendix I (See clause 93)

I22. Leakage survey policy. A further fundamental part of the policy is system surveillance and vehicle or foot patrols utilising flame ionisation gas detection techniques are used to inspect the system at least annually. Standards have been set both for the equipment and the method of survey to ensure consistency throughout the industry whether the surveys are carried out by British Gas or contract labour. Indications of gas found during a survey are recorded on a chart and these are classified according to the potential hazards involved. This enables the potentially hazardous indications to receive priority attention, whilst allowing non-hazardous situations to be treated on a programmed basis.

I23. Policy for replacement of mains and services. Selective replacement of mains and services forms an integral part of the policy. Priority is given to unprotected steel mains, and small diameter (4 in. or less) grey cast iron mains, particularly when operating at medium pressure or where such mains are close to premises with cellars or basements. Mains which have a history of fractures, a high incidence of joint leakage which does not respond to gas conditioning, or where the pipe material condition is suspect, are also considered for priority treatment. Highly corrosive soils, areas of local subsidence, roads to be re-surfaced with expensive materials and redevelopment areas are additional factors influencing replacement. A decision was taken in 1974 to increase the rate of replacement of mains from 500 to 1200 miles per year over a period of three years.

I24. A high percentage of all public reported escapes occur on service pipes and faults found usually involve the complete replacement of a service. Service renewals fall into two categories :

(a) leaking services, found as a result of a report or from a survey, are usually relaid; and

(b) bulk renewals where, in a particular road or estate, surveys, local knowledge or history of service leakage show a need, all services are relaid.