Safety changes in the industrial and commercial use of LPG: 2009-2015

A report by:

UKLPG - Trade association for the LPG industry in the UK

and

HSE – Health and safety regulator in GB

Executive Summary

On the 11 May 2004 an explosion at Grovepark Mills, owned by ICL group in Glasgow, killed nine people and seriously injured 33 more. The incident was caused by the ignition of leaking liquefied petroleum gas (LPG) vapour and was subject of a public inquiry chaired by Lord Gill who recommended:

- A risk based LPG pipework replacement programme
- Development of a new safety regime for the industry
- Improved communication and clarification of responsibilities

Following the incident and subsequent Inquiry, HSE and the LPG supply industry worked together to develop a risk based plan to identify and replace all the high risk LPG pipework and further improve safe use of LPG. At the core of this pipework replacement plan was the fact that service pipework is usually owned by the LPG customer not the supplier. Consequently, action on pipework replacement required involvement of LPG suppliers (UKLPG members), users and the relevant enforcing authorities.

Initially 60,000 sites were identified where LPG was used as a fuel in industrial or commercial enterprises. These were surveyed and risk ranked to develop a high level replacement plan that aimed to replace the highest priority pipework by December 2013 and all other metallic pipework by the end of 2015. The work involved developing an industry training programme to increase the number of pipework fitters, and training and up-skilling of regulatory inspectors. The December 2013 target was almost achieved, with only a relatively small number of unresponsive or difficult customers having to be chased the following year. This high priority phase involved more than 5,700 regulatory inspection visits, resulting in at least 2,330 improvement and 50 prohibition notices being issued. In addition, LPG suppliers visited more than 3600 sites in order to carry out site inspections and or remedial work where necessary.

In 2011, the HSE appointed an Independent Expert Working Group (IEWG) to review progress and advise on the replacement timescale for the low priority premises. The IEWG categorised the low priority risk pipework into four risk groups (p 1 to 4) and came to a view that replacing all by the end of 2015 was not justifiable in terms of additional costs and resource implications. Its conclusions were agreed and accepted by the industry and regulator and meant that priority 1 (p1) low risk pipework was planned to be replaced by end of 2015 with longer deadlines given for even lower risk pipework. LPG suppliers completed work at approximately 4,500 p1 sites by the end of 2015, a small number of resistant or difficult customers are being dealt with by the regulators.

In addition to the LPG pipework replacement, that was part of the Inquiry recommendations and replacement plans, by December 2015 suppliers had completed remedial work at all high priority metered estates and caravan parks using LPG. Further, although not within HSE's regulatory responsibility and not part of the Inquiry recommendations, HSE and UKLPG have worked together to provide a tool for domestic customers, so they can assess their risks, and get LPG suppliers to adopt appropriate strategies towards domestic customers.

Alongside the work to replace pipework, there has been extensive research, information sharing and creation of systems to make users aware of risks and prevent future incidents.

As an outcome of the incident the LPG industry and its trade association, UKLPG, have renewed their commitment to safety at LPG installations. They have demonstrated leadership in the implementation of Lord Gill's recommendations and a continued drive to improve safety at their customers' LPG installations.

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1. Introduction

On the 11 May 2004 an explosion at Grovepark Mills, owned by the ICL group in Glasgow killed nine people and seriously injured 33 more. The incident was caused by the ignition of liquefied petroleum gas (LPG) that had accumulated from a leaking corroded metallic service pipe. Following conclusion of a joint police- HSE investigation, a public inquiry was initiated chaired by Lord Gill, to establish and make public the full facts of the incident[1]. Following publication of the Inquiry report in 2009, on-going actions were focused and developed in light of the Inquiry recommendations, subsequent consultation[2], and the government response[3]. Notably areas where regulatory and industry actions were proposed included:

- A risk based LPG pipework replacement programme
- Development of a new safety regime for the industry
- Improved communication and clarification of responsibilities

This report, co-written by UKLPG, the association of LPG suppliers, and HSE documents the response of the LPG industry and regulator to date. Emphasis is on efforts to replace higher risk service pipework but it provides an overall snapshot of the current health and safety position of industrial and commercial LPG use in Britain.

2. Pipework replacement programme

The critical and potentially most resource intensive recommendation by the Lord Gill Inquiry was the risk based pipework replacement programme that involved replacement of high risk metallic service pipework with polyethylene pipework. The duty for replacement fell on the owner of the service pipework who in most cases was the LPG user. However, LPG suppliers agreed to work with HSE to identify higher risk installations and assist in the replacement programme. This was overseen by a high level team of HSE and industry representatives that met regularly to oversee the progress on the replacement programme and other recommendations. Action to achieve the inquiry recommendations on pipework replacement required involvement of UKLPG members, LPG users and relevant enforcing authorities.

2.1 Planning and installation prioritisation

Understanding the extent of the issue, key risk factors and resources available to undertake a risk based replacement programme was necessary to deliver a sensible replacement plan.

The HSE led a project to establish the risk ranking of all industrial and commercial (hence forth termed just commercial) LPG installations, that included among other things a prioritisation survey of commercial users[4] and use of a tailored computer model developed and applied by GL Noble Denton. Concurrently the industry modelled resource requirements that considered LPG engineer resource constraints and seasonal effects in the industry. These were brought together in 2009 into a high-level plan agreed between HSE and UKLPG for the replacement of buried metallic LPG service pipework across England, Scotland and Wales[5]. This plan confirmed that high risk pipework, that being carbon steel pipework in the most corrosive soils, should be targeted first. Such high risk pipework was scheduled for replacement by the end of 2013 and all other metallic pipework by the end of 2015.

At the core of the replacement programme is the fact that the service pipework is usually owned by the customer to whom the LPG distributor is supplying gas. The success of the programme would require both a willingness on part of the customer to identify specific factors in their installations and an agreement to replace the pipework. At first lack of resources to replace pipework was thought to be the critical constraint. However, initial responses from duty holders indicated that encouraging a positive response and action from them would be the critical constraint limiting progress.

The high level plan required industry and the regulator to work in tandem, with the industry leading on replacement and the resources to deliver this. This included the industry working with the gas competency standards setting body to develop standards and training materials to be used to conduct a training programme to increase the number of skilled fitters certified to carry out the pipe work replacement in a safe manner. Similarly, the HSE developed guidance, operational materials, and training to skill up its inspectors[6]. Further, the regulator backed up the industry replacement efforts by inspection of high risk sites and follow up on such sites where the suppliers indicated that the commercial customer appeared unwilling to replace their pipework.

2.2 High priority pipework replacement

Approximately 60,000 commercial sites were identified by HSE and LPG suppliers for the risk ranking exercise. The sites were ranked as either high or low priority. Following discussions with industry and local authorities (LAs) via HSE's Local Authority Unit (LAU), high priority sites were allocated to HSE, LAs, and industry for inspection and remedial works. This risk ranking exercise and on-going evaluation of sites resulted in a significant reduction of the number of installations in scope of the replacement programme. Indeed, approximately 50,000 sites upon deeper investigation were found not to be high priority. Among other things such sites were found to no longer use LPG, be closed, have polyethylene pipework, or have pipework situated above ground, etc.

By the end of March 2012, HSE Inspectors had completed 3,565 inspection visits, which were almost all HSE-enforced sites with high priority pipework that required an inspection. In addition the LAs had delivered an estimated total of 1,728 inspection visits.

In the latter half of 2013 and first half of 2014, LPG suppliers contacted and surveyed more than 3,600 commercial premises that had not responded to the original questionnaires. The results of the surveys were processed by HSE and all sites were risk ranked. The resultant lists of high priority sites were sent out to LPG suppliers who agreed to work with their customers to carry out all necessary remedial works, or else inform HSE of those users who proved difficult or resistant. These "difficult customers" were then prioritised for visits by HSE and LA's as appropriate.

By the end of the high priority phase of the project, HSE and the LPG industry had visited over 7,000 sites and LAs had visited more than 2,140 sites. Additionally, HSE worked with larger duty holders with responsibility for multiple LPG installations and influenced safety management at over 650 additional sites. This inspection programme resulted in approximately 1,900 sites receiving Improvement Notices and 37 sites receiving Prohibition Notices issued by HSE, and 429 sites receiving Improvement Notices and 13 sites receiving Prohibition Notices issued by LA's. Actual notices issued would have been higher given some sites received more than one notice. Approximately 50% of notices issued by both enforcing authorities were concerned with pipework issues. Generally, standards of LPG risk management were found to be variable with some

improvement noted towards the end of the inspection programme as a result of information provided to customers during the programme.

Throughout the period of replacement, the HSE and LPG industry met on a regular basis to ensure progress was monitored, information shared, and difficult cases resolved. The High Level team continued to meet well into the replacement programme with its final meeting after the publication of an Independent Expert Working Group (IEWG) report in November 2011.

The December 2013 target for replacement of buried metallic pipework at all high priority sites was almost achieved. A relatively small number of unresponsive or difficult customers had to be chased the following year. All three major LPG supply companies, and all smaller (identified) suppliers, have since reported that they have completed the necessary replacement works at all of their high priority pipework sites.

2.3 Lower priority pipework replacement

In 2011, the HSE appointed an Independent Expert Working Group (IEWG) to review progress and advise on the replacement timescale for low priority premises[7]. The IEWG estimated that 14,000 low priority premises would require remedial works. The IEWG considered that the high priority installations could be replaced by the agreed deadline, but that the remaining lower priority installations would require a ramping up of resource if the 2015 deadline was to be met. In view of the relatively lower level of risk at the remaining installations, the IEWG considered that it would be difficult to justify the additional cost this would entail.

The IEWG considered factors from historic LPG incidents and concluded that factors other than soil types, i.e. soil corrosivity values, could affect the consequence of any leak from metallic pipework. They also used evidence from a report on domestic premises[8], concluding they could apply this to commercial settings. The IEWG recommended reclassifying the remaining installations with priority being given to those installations with certain defined location or supply characteristics. This reclassification and the recommended deadline dates for replacement are set out in Table 1 over page. The group also concluded that any metal pipework other than carbon steel, e.g. copper, was a much lower risk.

At the end of 2013, HSE's analysis of supplier lists, using the criteria in the Table 1, identified approximately 7,000 low priority sites for remedial works, less than the original IEWG estimate of 14,000.

By December 2015, LPG suppliers had completed work at approximately 4,500 p1 sites. Excepting a number of resistant or difficult customers the deadline for completion of p1 sites was met. These difficult customers are being visited by HSE and LA inspectors and enforcement action taken where necessary to secure compliance. A few sites' risk ratings were reclassified during site visits by suppliers. This reclassification was generally to a lower risk category recognising the conservative approach to risk ranking, as where information was missing the assumption was the site was in the highest risk category.

Table 1. IEWG Priority ranking for low priority sites

Priority ranking	Target Date	Installation/Property Characteristics
p1	2015	Installations, with Medium Pressure underground carbon steel pipework or components age 10 years or more at the time of the survey with one or more of the risk factors • regularly used/visited by members of the public, • regularly occupied by more than 5 people at a time, • (c) has a cellar, basement or other significant void space below ground level
p1*	2015	As p1 but including any installations with incomplete survey information that COULD fall into priority p1
p2	2020	All other installations with underground carbon steel pipework
p3	2025	Installations with copper underground pipework • EITHER aged >34 years at the time of the survey • OR operating at medium pressure (>75mbar), • OR both
p4	On life expiry	Copper pipework aged 34 years or less at the time of the (2009-10) survey

2.4 Metered estates and caravan parks

Whilst not within the scope of Lord Gill's Inquiry Report, the pipework replacement programme considered how to develop a programme for metered estates and caravan parks. Each of these had a distinct set of challenges related to the type of site, its ownership and nature of the industry.

Metered estates use bulk LPG tank(s) and pipework which supply more than one customer with individual consumption measured by a meter. These metered estates are typically owned by the gas supplier. The regulator working with industry ensured that each supplier with responsibility for any metered estates surveyed those sites and produced an action plan for appropriate remedial work that was approved by HSE. By December 2015 all high priority metered estates had been addressed by suppliers with planned completion of all low priority metered estates by December 2016.

Some caravan parks are similar to metered estates in that there is a bulk supply with a piped network conveying LPG to each caravan or park home, where it is metered on entry. Caravans and park homes by their nature have ventilation below which greatly reduces the consequence of a leak. One concern was to ensure that an appropriate standard for ventilation was understood and implemented by site owners and residents. To support this HSE republished and promoted a guidance note on ventilation under caravans or park homes to encourage checking by site owners[9]. The priority with caravan and holiday homes was to replace buried metallic pipes to communal areas, e.g. swimming pools, laundry facilities, clubhouses, bars, restaurants etc., given that the risks to individual homes were addressed by appropriate ventilation. The seasonal nature of the industry meant practically that replacement was limited to winter and off peak times. By December 2015

appropriate remedial work on all high priority and nearly all p1 communal areas within caravan parks and holiday home sites had been undertaken.

2.5 Domestic homes

Domestic homes do not fall under HSE oversight and they were not within the scope of Lord Gill's Inquiry Report. Nevertheless, the issues affecting corroded underground metallic pipework could affect certain domestic premises. In 2009, the HSE commissioned TTAC Ltd to assess the risk of corrosion at domestic premises[8]. TTAC identified the key risk factors to be; (i) the pressure of gas supply; (ii) certain building characteristics such as underfloor voids and basements; and (iii) homes where the gas riser might have been incorporated into the fabric of the building. Homes with such risk factors were considered to be at greater risk and termed "special risk premises". However, the report indicated that the individual fatality risk at these special risk premises was generally considerably lower for domestic as opposed to commercial premises.

As a result of recommendations in the TTAC report, the HSE and UKLPG developed a questionnaire tool for LPG domestic customers to assist them in ascertaining whether their pipework required attention. This LPG underground pipework safety checking tool was placed on the UKLPG website[10] with individual supplier members either linking to this tool or offering versions of this for their LPG customers. Initially, LPG suppliers wrote to all their customers highlighting the possible risks and made them aware of this tool through their on-going customer contact. Over and above this, each LPG supplier company has been encouraged to develop a strategy for identification, and where necessary, the replacement of domestic customers' buried metallic pipework. This is supported by UKLPG who will be publishing in 2016 an industry information sheet outlining possible actions members can, or should, take. It is expected this will be reflected in individual supplier company policies, although competition law precludes mandating a uniform policy across all LPG suppliers on domestic customers. The substance of this industry information sheet will also be incorporated into UKLPG Code of Practice 22 (Design, installation and testing of LPG piping systems) in 2016, carrying with it the weight and gravitas that is recognised in all UKLPG Codes.

3. Additional actions

Lord Gill's proposals relating to a new safety regime were subject to a formal consultation. Many of the specific recommendations were supported by stakeholders who expressed the view that the existing legislative framework allows for Lord Gill's objectives to be achieved. The Government agreed with this view[3] but recognised the need to ensure that duty holders are aware of how their legal obligations should be applied to the use of LPG and that they are compliant with them.

The Government asked HSE to engage further with stakeholders on implementing, within the existing legal framework, proposals made by Lord Gill that received their support, e.g. an installation record, some form of register of suppliers of LPG and the production of an asset register by suppliers. It was the Government view that competent installation, assessment and maintenance of an LPG installation already existed through the responsibilities placed on owners and operators within the existing legal framework.

The Government accepted the recommendations in relation to the continuing development of the safety regime and also accepted Lord Gill's proposals in relation to knowledge and information

sharing, between regulators, suppliers and users and believed this was critical in delivering the continuing safety of small bulk LPG installations.

3.1 Industry communications

On the back of the initial high level regulatory monitoring of the pipework replacement programme, meetings between the industry and the regulator has been continuing formally around 3-4 times per year. This monitors the continuing pipework replacement and additional actions the industry is taking. This is in addition to any *ad hoc* reactive regulatory liaison with the industry that occurs within any standard regulatory approach. Such regular regulatory monitoring will continue albeit with a lighter touch as risks in the industry diminish.

3.2 Customer communication

A programme of communication with customers was instigated by the HSE and UKLPG with a regular sequence of letters to a common format and content issued by individual companies. The LPG industry team agreed the standard content, recommended the frequency of communication and worked with UKLPG member companies to ensure the communication programme was delivered. The letters were intended to raise awareness of the issue, encourage customers to respond to the questionnaire and advise pipework owners' of their responsibility. A recent survey of commercial users indicated that 43% of users reported that they were aware of their legal responsibilities with respect to the LPG installation. This is a significant improvement on earlier awareness levels[11]. Given the fact that most of these businesses were small or micro businesses that have a high turnover in ownership, and the level of customer communication undertaken by the LPG supply industry has been high, such levels of awareness may be all, or close to all, that is practically achievable without disproportionate additional efforts. However, it does point to the fact that it is incumbent on LPG suppliers to at least continue their current on-going communications efforts and seek new innovative ways to engage their customers on safety issues.

3.3 Installation Record

One of Lord Gill's key observations was that LPG buried metallic pipework was "out of sight, out of mind". To address this Lord Gill recommended that all commercial premises with an LPG system have an Installation Record, to cover details of; pipework installation dates, material, maintenance, tank data from the supplying company and, where the demarcation lies between supply company ownership and customer ownership. To this end a sample Installation Record template was developed and made available via UKLPG to its members[12]. Each member was able to adapt and brand appropriately, and one large company trialled the Record with a significant customer with multiple LPG locations to learn lessons for its current use. Current estimates indicate that around 60% of LPG commercial customers claim to have an installation record[11] and this number is likely to rise as plant ages and is replaced.

3.4 Web-based guidance and information

Both HSE and UKLPG refined and developed the range of information available on their respective websites. HSE has a dedicated LPG microsite[13] that contains among other things; information on the pipework replacement programme[14], information on relevant legislation[15], links to various research reports, and guidance on other specific issues[16]. Following various reviews of the health and safety

system[17] HSE has moved to refresh and simplify health and safety guidance whilst encouraging industry ownership by incorporating some earlier guidance into industry information sheets and codes of practice with HSE endorsement if they meet the necessary standard. The UKLPG maintain a broad range of freely available information sheets[18] and more detailed codes of practice[19] covering a range of areas and issues with respect to safe use of LPG. As stated some of these carry regulatory endorsement. There is a regular review and update of all guidance material provided by both HSE and the UKLPG.

4. Current and future safety

4.1 Lifespan of plastic pipes

The Inquiry report indicated that polyethylene pipework was thought to have a safe working life of around 50 years but there had been insufficient experience of long term use with LPG. To investigate polyethylene lifetime under LPG use HSE has undertaken a review of the literature and consulted manufacturers[20]. This work has been unable to provide a sufficiently robust assessment. Industry are committed to supporting further work that among other things will assess a range of polyethylene pipe samples that have carried LPG for a number of years. This on-going research will provide a more definitive assessment of the lifetime of polyethylene pipework use with LPG and will therefore provide a better evidence base on which to inform the future industry replacement and maintenance strategy.

4.2 Industry approach going forward

Industry with critical support from the regulator (through expertise and, where necessary enforcement) has given priority to addressing pipework replacement at the highest risk installations within the agreed timescales. Thanks to a huge effort by all involved, and a willingness by many customers to address this issue promptly, the highest risk replacement programme was achieved. Industry is committed to meeting the timeline suggested by the IEWG for dealing with lower risk pipework shown previously in Table 1. If difficulties arise, HSE will be informed. Indeed, at the end of 2015 industry had already made significant progress towards reducing the numbers in the lower risk pipework categories. Industry has also made steps to address issues that were out with the Inquiry recommendations and the agreed replacement programme, notably dealing with metered estates, caravan parks and developing approaches to deal with domestic clients as noted previously.

The UKLPG publishes a wide range of guidance material and Codes of Practice and has an ongoing programme to update these. The UKLPG Technical and Safety Management Team meets quarterly. This team regularly collates safety statistics and other information from across the industry, such as near miss reports, and process safety indicator measures. It identifies incidents where lessons can be learned for dissemination to the industry and other stakeholders, in the UK and through European and World Trade LPG bodies. It provides information including lessons learned, to members through a regular newsletter and makes recommendations on safety improvements to the UKLPG Board. Indeed, safety is on every UKLPG Board meeting agenda. UKLPG member organisations who account for over 98% of the LPG sold in the UK commit on joining to adhere to the Codes of Practice and safety recommendations made by the UKLPG Board.

The LPG supply industry and its trade association UKLPG have renewed their commitment to safety at LPG installations, in particular working with their customers to build their awareness. The industry's own control procedures have always had safety at their core and lessons learned from the Gill report have been incorporated into procedures. It remains the industry's intent to work with its customers and stakeholders to improve processes and procedures to minimise any risk from the storage, distribution and use of LPG

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