## Amendments log

<table>
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<th>Location of amendment</th>
<th>Details of amendment</th>
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<tr>
<td>July 2010 Version 1.2</td>
<td>Section 4 - Duties of Gas Supplier Liaison Arrangements for Gas Supplier Issues</td>
<td>Significant changes to enforcement responsibilities</td>
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<tr>
<td>July 2010 Version 1.2</td>
<td>Table 1</td>
<td>Deletion of: (i.e. parallel, not at right angles or end to end)</td>
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<td>Table 1</td>
<td>Insertion of ‘normally’ before ‘at point of entry into building’</td>
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<td>Further advice on inadequate security and fencing requirements</td>
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<td>Table A1</td>
<td>Clarification of meaning of LPG vessel capacity descriptions</td>
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### March 2011 Version 1.3

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<th>Section 2 (Scope)</th>
<th>– Inclusion of liquid phase guidance</th>
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|                  |                   | – Clarification of including entry point to buildings | __Reference to NIHHS / COMAH__
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<th>Section/Table</th>
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<td>Version 1.3</td>
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<td>Clarification of typical transition points (customer / supplier)</td>
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<td>Clarification of typical responsibilities for PSSR examinations</td>
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<td>Revised reference to advice &amp; examples re: tank security (Appendix 6 Refers)</td>
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<td>Clarification of IEE re: UPSO/OPSO valves</td>
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<td>Addition: IEE for electrostatic protection measures (Appendix 6 Refers)</td>
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<td>Addition: IEE for deficiencies in liquid phase pipework (Appendix 7 Refers)</td>
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<td>Clarification of requirements for pipework entry into building</td>
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</table>
| 2011 | Section 7        | - Clarification of specialist support arrangements  
|      |                   | - Introduces LPG WebCommunity resource and HELEX information  
|      |                   | - Deletion of reference to OC 286/105 (To be withdrawn)  
|      |                   | - Insertion of reference to IGEM/UP/2 Code of Practice |
| 2011 | Appendix 1       | - Clarification of UPSO/OPO requirements  
|      |                   | - Insertion of advice on avoiding corrosive soils and extreme temperatures when installing buried PE pipe  
|      |                   | - Clarification of requirements for pipework entry to buildings  
|      |                   | - Addition of reference to overhead power lines within points to check. |
| 2011 | Appendix 3       | Deletion of reference to OC 286/105 (To be withdrawn) |
| 2011 | Appendix 4       | Insertion – 5 Template notices:  
|      |                   | - PN for pipework in evidently poor condition  
|      |                   | - IN for inadequate control measures at bulk storage vessel  
|      |                   | - IN for replacement of buried metallic pipework  
|      |                   | - IN for examination / replacement of buried pipework of unknown composition  
|      |                   | - IN for replacement of metallic risers  
|      |                   | Deletion – IN for PSSR written scheme of examination |
| 2011 | Appendix 6 (New) | Insertion – 4 Topics:  

**Note for Inspectors re Equality Impact Assessments**

Inspectors should be aware of who, in terms of diversity are the target group in the sector they are dealing with. It is not about treating everyone the same but about addressing individual requirements in relation to Gender, Age, Disability, Race, Religion and Belief, Sexual orientation and Transgender.

Inspectors should give consideration to and factor into their approach any issues that may surround their audience, such as literacy, English as a second language and disability (access needs).
Public bodies are legally required to eliminate unlawful discrimination and to promote equality of opportunity when organising campaigns, work programmes and policy proposals or reviews.

HSE must ensure the services we provide are accessible and meet the needs of those we serve and the Equality Impact Assessment Toolkit is a way of accessing how a policy/guidance/webpage/regulation affects individuals.

An Equality Impact Assessment (EIA) looks at the actual, potential or likely impact of a service, policy, project or significant change on different groups of people.

It is also important to include gender issues in workplace risk assessments, and ‘mainstreaming’ gender issues into risk prevention is now an objective of the European Community.

For further information, please see:

http://intranet/diversity/impact_assessment/index.htm

Or email the Diversity Team.
TOPIC PACK

LPG BULK INSTALLATIONS AND PIPEWORK

CONTENTS

1. Introduction
2. Scope
3. LPG Pipework Replacement Programme
4. Legal Framework
5. Enforcement Allocation
6. Enforcement Management Model and Enforcement Guidance
7. Further Guidance and Assistance

Appendix 1  Aide memoire
Appendix 2  Glossary
Appendix 3  Inspection, Examination and Maintenance Strategies
Appendix 4  Model Notices
Appendix 5  Example Installations
Appendix 6  Topic Specific Requirements & Factors Relevant to IEE
Appendix 7  Liquid Phase Service Pipework
TOPIC PACK
LPG BULK INSTALLATIONS AND PIPEWORK

1. INTRODUCTION

This topic pack provides guidance for inspectors, visiting officers, RCOs and local authority enforcement officers on the inspection of LPG (liquefied petroleum gas) stored in fixed vessels together with the associated service pipework. (Typically this will be all pipework upstream of the emergency control valve, and should in any case include consideration of pipework entry points to buildings.) HSE inspectors are expected to make enquiries at visits about the safety of LPG installations where relevant as a Matter of Potential Major Concern (see OC 18/12). Local authority officers may also encounter bulk LPG installations during other visits.

2. SCOPE

This guidance is aimed at tanks up to 10 tonnes LPG capacity in non-domestic environments, and does not cover LPG cylinders, or appliances and pipework installed within buildings. Whilst liquid phase LPG pipework is excluded from the scope of the pipework replacement programme (instigated following Lord Gill’s public inquiry), guidance is provided on the key relevant safety aspects. Guidance on larger tanks may be found in the relevant UKLPG codes of practice.

Specific legislative requirements apply to sites where the total LPG inventory exceeds the following threshold values:

- 50 tonnes LPG capacity - Control of Major Accident Hazards (COMAH) Regulations apply: and
- 25 tonnes LPG capacity - Notification of Installations Handling Hazardous Substances (NIHHS) Regulations [NB these regulations were identified for replacement at time of June 2012 Topic Pack revision]

Whilst the general principles stated for safe bulk LPG storage remain valid, this guidance does not cover those specific hazards associated with large LPG inventories at such major-hazard sites. (e.g. the potential for sequential fire/explosion to multiple storage tanks.) Primary regulatory responsibility for the major hazards aspects of such sites rests with HSE Hazardous Installations Directorate (Chemical Industries Division.)

This guidance does not apply to domestic premises, including distribution networks and service pipework supplying residential caravans. However, LPG supplies to any communal buildings on caravan parks will be within scope as commercial LPG installations.

In cases of doubt, particularly concerning significant risks from liquid phase pipelines, specialist advice should be sought.
3. LPG PIPEWORK REPLACEMENT PROGRAMME (see http://www.hse.gov.uk/gas/lpg.htm)

On 16 July 2009, Lord Gill published his Inquiry Report into the explosion at the ICL Plastics factory in Glasgow in 2004, in which nine people died and 33 were injured. The report can be found on the ICL Inquiry website (http://www.theiclinquiry.org/index.aspx) LPG had leaked from a corroded underground metal pipe into the basement area of the factory and then ignited causing an explosion which led to the catastrophic collapse of the four storey building. One of Lord Gill’s recommendations was that there should be an action plan to identify sites with buried metallic LPG pipework, followed by its replacement on a systematic and prioritised basis with polyethylene.

HSE in conjunction with UKLPG (the body representing most LPG suppliers) compiled a questionnaire which was sent to commercial gas users in order to identify those with buried metallic pipework and this enabled risks to be prioritised for a pipework replacement programme. The first stage of the replacement programme is due to be completed by the end of 2013 at all identified higher risk sites.

For lower risk pipework, the timescales for site replacement have been revised from that originally set (end of 2015) in accordance with the recommendations of an Independent Expert Working Group (http://www.hse.gov.uk/gas/lpg/working-group-report.pdf) as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Replacement Deadline</th>
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</thead>
<tbody>
<tr>
<td>1. Medium pressure carbon steel pipework, installed before 1999, with one or more of the following risk factors:</td>
<td>December 2015</td>
</tr>
<tr>
<td>- Basement or Cellar</td>
<td></td>
</tr>
<tr>
<td>- 5 or more people on the premises</td>
<td></td>
</tr>
<tr>
<td>- Premises regularly used or visited by members of the public</td>
<td></td>
</tr>
<tr>
<td>2. All other buried carbon steel pipework</td>
<td>December 2020</td>
</tr>
<tr>
<td>3. Copper pipework with one or more of the following risk factors:</td>
<td>December 2025</td>
</tr>
<tr>
<td>- Medium Pressure</td>
<td></td>
</tr>
<tr>
<td>- Age is unknown, or installed prior to 1975</td>
<td></td>
</tr>
<tr>
<td>4. Low pressure copper pipework installed since 1975</td>
<td>By end of life expectancy (50 years from installation)</td>
</tr>
</tbody>
</table>

Risks associated with buried pipework at domestic sites are being addressed through a separate approach (http://www.uklpg.org/advice-and-information/safety-check/homeowner/emergency-control-valve/)
4. LEGAL FRAMEWORK

This topic pack does not set out a detailed consideration of all legal duties on gas users and suppliers but provides an indication of the more important areas that inspectors should be aware of when inspecting small bulk installations and associated pipework.

Background

The majority of LPG tanks in the UK are operated and filled in a similar way, i.e. the LPG supplier provides the tank and associated fittings and the user enters into a contract with them for bulk LPG deliveries. In spite of this near universal arrangement, users (and sometimes suppliers) have common misconceptions as to who is responsible for different parts of the installation. These misconceptions remain when customers switch LPG suppliers.

Bulk tanks are usually owned and installed by the gas supplier (who also employs or contracts the delivery drivers) but fitting the service pipework and connecting up may well have been contracted out. Although different parties are involved in the installation, on completion ownership of the pipework usually passes to the site occupier via terms and conditions of the written contract. They have to maintain the pipework but may not be aware of this responsibility nor what they have to do in practice to meet it.

At present there is no uniform arrangement for demarcation of ownership. The transition point between supplier and user may be at the end of the LPG tank compound but is more commonly from the first pressure regulating valve or the vapour take-off valve.

HSE has worked with the UKLPG to produce a template for an installation record (http://www.uklpg.org/uploads/DOC4E77447BE5BDE.pdf) – whilst this has no legal status (or requirement for its use), its use by site occupiers is recommended to ensure that the demarcation and responsibilities for the maintenance of the bulk installation and associated pipework are clear.

As a consequence of the ownership arrangements, both users and suppliers have certain legal responsibilities towards the safety of the installation. This means that cooperation and coordination between both parties may be required to address certain aspects of safety and, depending on the particular issue, action may need to be taken by either the user or the supplier or sometimes both. Important factors to consider will include the contractual arrangements and extent of control.

The relevant legislation which needs to be considered includes:

- Health and Safety at Work etc Act 1974 (HSWA)
- Management of Health and Safety at Work Regulations 1999 (MHSWR)
Inspectors and local authority enforcement officers should first consider the safety aspects of the installation that rest with the user or are affected by their work activity e.g. tank impact by vehicles, and then move to consider issues which may be the responsibility of the supplier.

DUTIES OF GAS USER

Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR)

These Regulations apply to work situations when a dangerous substance is present or liable to be present and presents a safety risk. In relation to LPG, the gas user has to:

- assess fire and explosion risks,
- take measures to eliminate or reduce identified risks,
- provide equipment and procedures to deal with emergencies
- give information and training to employees.

Where the supplier has provided an installation that meets the relevant standards, then the duties that fall to the user will effectively be to keep it maintained in a safe condition, provide measures to deal with emergencies and make sure their own activities do not adversely affect the installation.

Hence the enforcement focus for inspectors and local authority enforcement officers should be on ensuring that users have in place the necessary control measures. Detailed guidance on expected standards is set out in Table 1 below.

Pressure Systems Safety Regulations 2000 (PSSR)

PSSR aim to prevent serious injury from the hazards of stored energy in pressure systems, including pipelines conveying liquids or gases, above 0.5 bar. They do not deal with the fire and explosion risks from LPG.

Vessels and equipment (including pipework operating above 0.5 bar) should be the subject of a written scheme of examination, drawn up by a competent person. This will include fittings and pipework up to the second stage regulator, but will not include buried pipework as there is no reasonably foreseeable danger from the release of stored energy
Note: Although these duties fall on the user of a pressure system, under regulation 3(5) and Schedule 2, a person supplying an installed system for lease or hire may take over responsibility by written agreement. Commonly, LPG suppliers will retain responsibility for the examinations and written scheme. The results of any examination should be available to the customer.

Provision and Use of Work Equipment Regulations 1998

Service pipework is work equipment, which is exposed to conditions causing deterioration liable to result in a dangerous situation; the gas user is therefore required to maintain and inspect the service pipework owned by him.

Gas Safety (Installation and Use) Regulations 1998 (GSIUR)

GSIUR cover LPG storage vessels and pipework only where the premises themselves are covered by the Regulations - mainly in domestic and certain commercial premises e.g. offices, shops, hotels, public buildings such as schools, hospitals and similar places. With the exception of Regulation 37 (see below under suppliers duties) GSIUR do not apply where LPG is being used for the purposes of an industrial process carried out on industrial premises (including agricultural premises, factories, mines, quarries, sewage treatment works and temporary gas installations as part of a construction activity), but do apply (see Regulation 2(4)) to parts of industrial premises which are used for domestic or residential purposes or as sleeping accommodation.

The definition of “gas fittings” in Regulation 2(1) includes LPG service pipework (pipework from storage vessel to outlet of the ECV) and installation pipework (pipework downstream of the ECV to the appliance). This means anyone carrying out gas work (itself defined in Regulation 2(1)) on installation or service pipework in premises to which GSIUR apply must fulfill the criteria in Regulation 3 i.e. be competent and, if in business, be Gas Safe registered – for work on LPG systems/pipework.

DUTIES OF GAS SUPPLIER

The gas supplier may have duties under various regulations (MHSWR, DSEAR, PUWER and GSIUR) and HSW Act including s 3, arising both from the initial installation of the tank and pipework and as part of its ongoing relationship with the site as its gas supplier. These duties may include

- ensuring the initial integrity of the installation,
- ensuring that the separation distances have been met, and a DSEAR assessment has been carried out,
- providing adequate information to the user about the risks of LPG (HSW s6(4))
- ensuring that delivery is carried out safely,
- advising the user of their ongoing responsibilities.
The measures to be taken by the gas supplier should be identified and recorded in the gas supplier’s risk assessments (MHSW and DSEAR).

The potential duties can usefully be split between:

1. Enabling the user to comply by:
   - Ensuring the integrity of the installation before first supplying gas.
   - Providing information and advice to gas users that includes:
     - Hazards and properties of LPG
     - Clear demarcation as to who is responsible for what.
     - Suppliers must make it clear that users have responsibility for:
       - maintaining the service pipework
       - protecting the tank and pipework from vehicle impact,
       - controlling the presence of ignition sources,
       - keeping the tank area clear of combustible material.

2. Continuing duties of the LPG supplier
   a) In relation to the tank and pipework owned by the supplier
      - Ongoing checks on the installation and pipework owned by the supplier including:
        - Pressure Systems Safety Regulations (PSSR) inspections in accordance with a written scheme.
        - Annual routine inspection of the tank, storage site and pipework in the vicinity as set out in UKLPG Code of Practice 1 part 3, (which advises they may be carried out by the delivery driver.)
        - Driver visual checks - the driver should have clear guidelines about action to take in the event of serious concerns about an installation (including when not to deliver.)
        - Keeping suitable records
      - Safe systems of work when delivering gas
      - Providing an emergency service to deal with notified escapes of gas under GSIUR regulation 37 at any premises for which they are the gas supplier.
   b) In relation to service pipework owned by the user or other third party
      - To undertake an assessment of risks arising from the supply of LPG, through service pipework not owned by them, in order to identify measures to be taken to comply with relevant statutory provisions (including HSWA duties.)
      - May include making reasonable enquiries of the user (or owner/occupier) to ascertain the state of the service pipework in order to decide whether LPG can be supplied safely.

Additionally, inspectors may encounter LPG networks not contained wholly within the premises occupied by a single undertaking i.e. an LPG vessel with a distribution network supplying several premises e.g. metered estates. These
are subject to the Pipelines Safety Regulations 1996 and Regulation 13 which requires the pipeline operator (usually the gas supplier) to maintain the pipeline in good repair.

**GAS SUPPLIERS: ENFORCEMENT RESPONSIBILITY & GENERAL LIAISON ARRANGEMENTS**  
(See also OC 440/28)

**HSE**

By virtue of the Health and Safety (Enforcing Authority) Regulations 1998, HSE have regulatory responsibility for gas suppliers, including in relation to premises to which they supply gas. Whilst there is no uniform demarcation of responsibilities between gas suppliers and users, most commonly suppliers have responsibility for all equipment upstream of the first pressure regulating valve or the vapour take-off valve.

Suppliers have legal duties under various regulations (MHSWR, DSEAR, PUWER, GSIUR) as well as the HSW Act. Such duties may arise from both the initial installation of the tank and pipework (e.g. ensuring compliance with tank separation distances) and ongoing duties concerning the continuing supply of LPG (e.g. ensuring safe systems of work for LPG delivery).

FOD is responsible for enforcing the Gas Safety (Installation and Use) Regulations 1998 (GSIUR) Regulation 6(7), which places requirements on installers for the safe siting of LPG vessels at premises subject to GSIUR.

**Local Authorities**

Since local authorities have no vires as regards regulatory action against suppliers, any significant action, including all formal enforcement, must be undertaken by HSE. Local authority enforcement officers should therefore contact HSE through their enforcement liaison officer (as locally agreed) whenever such action against suppliers is being contemplated.

**SUPPLIER LIAISON ARRANGEMENTS:**

**HSE (FOD/HID)**

The following advice clarifies the agreed division of responsibilities between HID and FOD for action against suppliers arising from concerns regarding bulk LPG installations:

**SIGNIFICANT SITE-SPECIFIC SUPPLIER ISSUES**

HID is responsible for dealing with the HSW duties of gas suppliers, including in relation to premises which they supply with gas. These duties include overarching management arrangements and safe systems of work, including ensuring safe delivery to LPG tanks. Whilst HID retain the overall lead for HSE engagement with LPG suppliers, agreement has been reached that action (including formal enforcement) at **individual site level** regarding specific defects with the site installation will be taken by FOD.
Such site matters would include fundamental concerns over bulk tank location and separation distances, or circumstances where inspectors are contemplating serving prohibition notices which would affect the user’s continued supply.

**To maintain an effective regulatory relationship with suppliers, it is important for HID lead inspectors to be kept informed of significant FOD interactions with suppliers relating to any particular site.** FOD inspectors are thus requested to ensure that the relevant HID leads are advised of any serious supplier-related concerns (including those that may link back to systemic failures – see next section). Where formal enforcement action is being contemplated, then the lead HID inspector should be contacted in advance to discuss the matter.

**HID contact(s):**
Calor = Will Pascoe, HID Northampton
Flogas = Alex Nayar, HID Northampton
Avanti = Mark Burton, HID Bootle
Macc Gas = David Stephen, HID Edinburgh

If inspectors are considering enforcement action against LPG suppliers regarding service pipework they do not own, this should first be discussed with FODHQ Legal and Enforcement Section.

### ADDRESSING SYSTEMIC SUPPLIER ISSUES

HID retain the lead for ongoing engagement with LPG suppliers to address national issues emerging from the LPG Inspection Initiative including ensuring delivery of the pipework replacement programme against the revised national deadlines. Various systemic problems have been raised with suppliers (and UKLPG) and improvements sought, for example in relation to:

- the adequacy of pre-delivery driver checks and defect reporting
- achieving installation standards as set out in the UKPG Codes of Practice, including tank location
- driver training
- written schemes of examination under the Pressure Systems Safety Regulations 2000
- “like for like” tank exchanges

FOD HQ, in conjunction with HID lead inspectors, have undertaken central interventions to each of the major LPG suppliers. As a consequence, there exists a clear and robust shared understanding of the standards required during installation and delivery. Supplier performance in relation to such systemic issues will continue to be centrally monitored by HID.

Unless specifically agreed following consultation with HID lead inspectors, FOD inspectors should not take formal enforcement against any supplier in relation to such systemic issues, or matters not specific to an individual installation; these will generally be dealt with by HID. Where serious concerns
exist, these should be communicated to HID lead inspectors (where such arrangements are in place). Such consideration will include determination of how these concerns are best brought to the supplier’s attention.
Table 1 Summary of control measures and legal requirements

<table>
<thead>
<tr>
<th>ISSUE</th>
<th>EXPECTATION</th>
<th>LEGAL REQUIREMENTS</th>
<th>COMMENT</th>
<th>REFERENCES/GUIDANCE</th>
</tr>
</thead>
</table>
| Tank installation | • Separation from boundaries, buildings, fixed source of ignition (including overhead power lines) in accordance with UKLPG COP (may be less with fire walls)  
• Adequate separation from other tanks and positioned such that their integrity is not compromised  
• Standing on stable base  
• Good ventilation around tank  
• No open drains, (unless fitted with a water trap), culverts etc within separation distance | GSIUR Regulation 6(7)\(^1\)  
HSW Act s 2  
HSW Act s 3  
DSEAR Regulation 6 | User  
Gas supplier  
Prevention of formation of explosive atmosphere | UKLPG COP 1 Parts 1,2 |
| Underground tanks | • Located such that manhole and pressure relief valves are in well ventilated position and appropriately separated from buildings, boundaries etc. | | | |

\(^1\) UKLPG COP 1 Parts 1,2
<table>
<thead>
<tr>
<th>ISSUE</th>
<th>EXPECTATION</th>
<th>LEGAL REQUIREMENTS</th>
<th>COMMENT</th>
<th>REFERENCES/GUIDANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrity</td>
<td>Test data plate on vessel showing</td>
<td>PSSR Regulations 8,9</td>
<td>May also show date of last test</td>
<td>UKLPG COP 1 Part 3</td>
</tr>
<tr>
<td></td>
<td>• Date of manufacture</td>
<td>PSSR Regulation 3(5), Schedule 2</td>
<td>Where agreed in writing, duties discharged by tank owner</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Relevant manufacturing standard</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Test pressure</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Documentation of examination in accordance with written scheme</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vessel protection</td>
<td>• Appropriate security</td>
<td>GSIUR Regulation 6(7)</td>
<td>User</td>
<td>UKLPG COP 1 Parts 1, 2, 4</td>
</tr>
<tr>
<td></td>
<td>• Protection from impact e.g. vehicles</td>
<td>HSW Act s 2</td>
<td>Gas supplier</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Underground tanks</strong></td>
<td>HSW Act s 3</td>
<td>Avoidance of release</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The tank position should be permanently indicated, usually by marker</td>
<td>DSEAR Regulation 6</td>
<td></td>
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<tr>
<td></td>
<td>pegs positioned in the ground, and vehicle overrun prevented</td>
<td></td>
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<tr>
<td>ISSUE</td>
<td>EXPECTATION</td>
<td>LEGAL REQUIREMENTS</td>
<td>COMMENT</td>
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| Pressure regulation and controls | • First stage regulator as close as possible to service outlet connection on tank  
• UPSO/OPSO (under pressure shut off/over pressure shut off) valves fitted at second stage regulator  
• Emergency shut off valve suitably marked, normally at point of entry into building | HSWA s2,3  
DSEAR Regulation 6(1)  
GSIUR Regulation 14(2)  
GSIUR Regulation 9(2)(3)(4) | UPSO/OPSO valves required at premises subject to GSIUR. At certain other premises (see appendix 1) there is no UPSO by design, and a flame failure device on the appliance, or the use of other reasonably practicable means of preventing gas leaks and explosions, should be required. | UKLPG COP 1 Parts 1,2 |
<table>
<thead>
<tr>
<th>ISSUE</th>
<th>EXPECTATION</th>
<th>LEGAL REQUIREMENTS</th>
<th>COMMENT</th>
<th>REFERENCES/GUIDANCE</th>
</tr>
</thead>
</table>
| Ignition sources | • No combustible materials within separation distance  
• Tank not sited directly beneath overhead power lines  
• Earthing arrangements for tank and deliveries  
• ‘No smoking/no naked flames’ signs in place  
• Use of explosion-protected equipment in zones | HSW Act s 2, 3  
DSEAR Regulation 6  
DSEAR Regulation 7 | Other cables (including telephone cables) should be routed so as not to impede access or hinder installation.  
Avoidance of ignition sources | UKLPG COP 1 Parts 1,2  
UKLPG COP 1 Part 1 App.B2 |
| Mitigation    | • Fire extinguishers and training to tackle small fires  
• Emergency procedures, including arrangements for isolation at tank  
• Suppliers emergency notice on tank  
• Training and supervision | HSWA s2,3  
GSIUR Regulation 37  
DSEAR Regulation 8  
MHSWR Regulation 8 | All premises  
Arrangements to deal with incidents and emergencies | UKLPG COP 1 Parts 1,2 |
<table>
<thead>
<tr>
<th>ISSUE</th>
<th>EXPECTATION</th>
<th>LEGAL REQUIREMENTS</th>
<th>COMMENT</th>
<th>REFERENCES/GUIDANCE</th>
</tr>
</thead>
</table>
| Delivery | • Hard standing for delivery vehicle  
• Electrical bonding  
• Site arrangements for delivery  
• Prevention of overrun for underground tank  
• Procedures for driver, checks to be carried out before filling, when not to fill tank e.g. because installation is at risk | HSW Act s 2  
DSEAR Regulation 6  
HSW Act s 3 | User  
Avoidance of release | UKLPG COP 1 Parts 1,2,3  
UKLPG COP 2 |
| Integrity and maintenance of service pipework | • Of suitable material  
• Protected from corrosion and damage as necessary  
• Inspection regime as required *(pressure testing alone not sufficient)* | HSW Act s 2,3  
DSEAR Regulation 6  
PUWER Regulation 5, 6  
GSIUR Regulation 7 | Avoidance of release  
Work equipment exposed to conditions causing deterioration inspected at suitable intervals  
Installed so as to be protected from damage and corrosion | UKLPG COP 22  
UKLPG COP 1 Part 3 |
<table>
<thead>
<tr>
<th>ISSUE</th>
<th>EXPECTATION</th>
<th>LEGAL REQUIREMENTS</th>
<th>COMMENT</th>
<th>REFERENCES/GUIDANCE</th>
</tr>
</thead>
</table>
| Installation pipework entering building | • Sleeved as it passes through wall, sleeve sealed to structure  
• Entry above ground  
• No passage through unventilated void unless continuously sleeved, with sleeve ventilated to safe place | HSW Act s2,3  
DSEAR Regulation 6  
GSIUR Regulation 19 | Prevention of formation of explosive atmosphere | UKLPG COP 1 Part 2  
UKLPG COP 22 |

\(^1\) Where GSIUR applies
5. ENFORCEMENT ALLOCATION (see also 0C 124/11)

Table 2

<table>
<thead>
<tr>
<th>Situation</th>
<th>Allocation</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caravan site operated by an HSE enforced occupier on own premises e.g. farm</td>
<td>HSE</td>
<td></td>
</tr>
<tr>
<td>Caravan site for holiday or residential accommodation</td>
<td>LA for site operator and holiday lets</td>
<td>Individual domestic accommodation is HSE enforced</td>
</tr>
<tr>
<td>Accommodation for casual farm or construction workers</td>
<td>HSE</td>
<td></td>
</tr>
<tr>
<td>Hotels</td>
<td>LA</td>
<td></td>
</tr>
<tr>
<td>Residential care homes</td>
<td>LA</td>
<td></td>
</tr>
<tr>
<td>Nursing homes Health Care</td>
<td>HSE</td>
<td>Enforcement allocation may have been transferred in some areas</td>
</tr>
<tr>
<td>Gas work by person who does not normally work on premises (any)</td>
<td>HSE</td>
<td>Irrespective of premises allocation</td>
</tr>
<tr>
<td>Domestic premises</td>
<td>HSE</td>
<td></td>
</tr>
</tbody>
</table>

Major Hazard Sites

Specific legislative requirements apply to sites where the total LPG inventory exceeds the following threshold values:

- 50 tonnes LPG capacity - Control of Major Accident Hazards (COMAH) Regulations apply; and
- 25 tonnes LPG capacity - Notification of Installations Handling Hazardous Substances (NIHHS) Regulations apply [NB these regulations are being replaced at time of June 2012 Topic Pack revision]

This may particularly occur at sites with a large number of geographically remote bulk LPG tanks. Primary regulatory responsibility for the major hazards aspects of such sites rests with HSE Hazardous Installations Directorate (Chemical Industries Division.)

Should such a site be encountered, this should be referred to HID.

For HID CI1 – Ann Wilson
HID CI2 – Ron De Cort
HID CI3 – Chris Flint
6. ENFORCEMENT MANAGEMENT MODEL AND ENFORCEMENT GUIDANCE

Actual risk

The actual risk from a leak of LPG from pipework or tank, or from a fire impinging on the tank is of possible multiple serious personal injuries (or deaths) as an explosive/flammable concentration of gas from a leak can accumulate in a building or area and be ignited – either directly injuring persons from the blast or from secondary effects e.g. building collapses.

The likelihood of such an event occurring is dependent upon various factors, and the risk ranking process for buried LPG pipework which has underpinned the early years of the pipework replacement initiative, was designed to reflect this, with higher priority pipework being more likely to give rise to such a risk.

The changes to the replacement timescales for lower risk pipework (see page 9) as recommended by the IEWG\(^1\) are based on the likelihood of a leak and the (societal) consequences of such an event.

Benchmark

The benchmark standards are for:

1) The LPG tank to be installed in accordance with relevant codes of practice including:
   a) Separation distances
   b) Adequacy of ventilation
   c) Impact protection
   d) Security
   e) Avoidance of sources of ignition and combustible materials
   f) No open drains, gullies, ducts etc in vicinity

2) Buried metallic service pipework (including all metallic risers) should be either:
   a) Replaced with buried polyethylene pipes or other corrosion-resistant materials such as a suitable proprietary pipework system in accordance with the agreed timescales OR
   b) Routed above ground and protected from corrosion and mechanical damage OR
   c) Exceptionally, as an alternative to replacement or re-routing, pipework may be corrosion protected and inspected at such sufficient frequency that any degradation is identified and remedied in good time before it

\(^1\) www.hse.gov.uk/gas/lpg/working-group-report.pdf
compromises the safety of the installation (see Appendix 3 for required standard.) However, inspection should generally be considered an interim measure pending replacement or re-routing - but there is an ongoing duty to maintain the pipework until it is replaced.

3) Above ground pipework should be;

a) Protected from damage and corrosion (i.e. not in direct contact with pipework, concrete, brickwork etc)
b) Adequately supported
c) Subject to an appropriate inspection and maintenance strategy

so that in all cases there is a nil/negligible chance of a significant injury occurring.

Risk gap
Using the risk gap tables in the EMM for multiple casualties, the risk gap should normally be considered as extreme for higher priority pipework, but may be lower at installations with lower priority ranked pipes. Higher priority pipework are those identified for replacement by end of 2013 (and which were the focus of the inspection initiative during 2010/11 and 2011/12.)

Initial enforcement expectation

1) Tanks

Given an extreme risk gap and an established standard (codes of practice), the initial enforcement expectation is an Improvement Notice where there is evidence of significant failure to meet standards set out in the code of practice (e.g. a cumulative list of deficiencies.)

2) Pipework

Given an extreme risk gap and a defined standard (PUWER), the initial enforcement expectation is an Improvement Notice where there is evidence of higher priority risk ranked buried, metallic LPG pipework in poor or unknown condition or where there is no strategy for inspection, examination and maintenance.

If there is clear evidence that the pipework is significantly corroded or damaged and liable to leak, thus resulting in a risk of serious personal injury, then a prohibition notice will be appropriate.

See Table 3 for list of situations providing an indicative Initial Enforcement Expectation

For lower priority pipework the condition of the pipe and other relevant site-specific factors should be considered in determining appropriate enforcement action. In particular, it is important to have regard to the agreed revised
timescales for replacement of such pipework where there is no indication the
buried pipes are in poor condition.

**Dutyholder factors**

Where the dutyholder can provide evidence that higher risk pipework
replacement is already scheduled in line with their risk ranking in the
replacement programme, an IN may not be required, although inspectors
should still confirm that adequate action has been taken. The enforcement
decision will depend on the information provided by the dutyholder on which
the risk ranking has been undertaken and actual site conditions, or additional
factors, identified by the inspector.

**Strategic factors**

It is expected that the action taken will protect vulnerable groups, including
members of the public, who may be exposed to risks from LPG installations
that have not been appropriately installed and/or adequately maintained. It is
in the public interest that LPG installations incorporating buried, metallic LPG
pipes of poor or unknown condition are re-routed, replaced or inspected,
examined and maintained.

There may be circumstances where an alternative course of action is
considered appropriate depending on the nature of the installation e.g.

- the effect on vulnerable people such as residents of a nursing home,
  where cutting off heating, without adequate alternatives arranged, may
  cause significant risk. Replacement/action is still necessary but should
  be planned (i.e. temporary heating provided) to ensure that additional
  risks are not created
- a shop or house sited below the installation where a leakage of LPG
  could accumulate

The action should support the pipework replacement strategy in order to
promote scheme compliance whilst focusing the limited industry resource on
sites in a (risk based) priority order.
Table 3: Initial enforcement expectation

- Subject to the discretion of the individual inspector applying the Enforcement Policy Statement (EPS) to decide whether other enforcement action in a particular case may be appropriate and prior to consideration of any dutyholder and strategic factors that may modify the enforcement decision
- See also note 3 below re prosecution

This table has regard to the Gas Industry Unsafe Situations Procedure 6th edition (TRIM ref 2009/175241) applied under GSIUR by Gas Safe Registered engineers

<table>
<thead>
<tr>
<th>Situation</th>
<th>Initial enforcement expectation</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>STORAGE VESSEL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No evidence of tank examination in accordance with a written scheme</td>
<td>Improvement notice</td>
<td>Duty falls on tank user but is usually carried out by supplier where they own the tank. Some suppliers do not provide copies of the examination scheme to users, but details of the last and next scheduled examinations should be available (e.g. date due stamped on a plate.)</td>
</tr>
<tr>
<td>Inadequate separation distance from boundary, building, fixed source of ignition, firewall. Lack of ventilation</td>
<td>Improvement notice/letter Prosecution ³</td>
<td>Dependent on actual risk. Although duty falls on user, actions may involve gas supplier, who will also have duties if they installed the tank.</td>
</tr>
<tr>
<td>Inadequate security</td>
<td>Letter/Improvement notice</td>
<td>Risk based, dependent on location and the potential for an incident involving the tank to cause harm to people or property. (See Appendix 6)</td>
</tr>
<tr>
<td>Lack of impact protection</td>
<td>Improvement notice</td>
<td>Where vehicle impact foreseeable.</td>
</tr>
<tr>
<td>Open drains/gulleys etc within vessel separation distances</td>
<td>Improvement notice</td>
<td></td>
</tr>
<tr>
<td>Combustible materials</td>
<td>Improvement notice/letter</td>
<td>Dependent on risk. For advice on trees, shrubbery etc. refer to Appendix 6</td>
</tr>
<tr>
<td>Situation</td>
<td>Initial enforcement expectation</td>
<td>Comment</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>around tank</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No suitable delivery arrangements</td>
<td>Letter/Improvement notice</td>
<td>May include requirements on supplier.</td>
</tr>
<tr>
<td>No/inadequate emergency arrangements</td>
<td>Letter/Improvement notice</td>
<td></td>
</tr>
<tr>
<td>Lack of suitable and sufficient information, instruction and training</td>
<td>Letter/Improvement notice</td>
<td></td>
</tr>
<tr>
<td>Lack of 'no smoking/no naked flames' signs</td>
<td>Letter</td>
<td></td>
</tr>
<tr>
<td>Lack of fire fighting equipment for incidental fires e.g. dry powder fire extinguisher</td>
<td>Letter</td>
<td>Consider whether need to inform fire and rescue authority (see OC 217/06)</td>
</tr>
<tr>
<td>No/defective primary or secondary regulator</td>
<td>Prohibition notice</td>
<td>User to contact gas supplier</td>
</tr>
<tr>
<td>No UPSO/OPSO fitted at premises subject to GSIUR</td>
<td>Improvement notice</td>
<td>User to contact gas supplier</td>
</tr>
<tr>
<td>Situation</td>
<td>Initial enforcement expectation</td>
<td>Comment</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>At premises not subject to GSUIR, no UPSO fitted and no alternative reasonably practicable means of preventing explosions, e.g. flame failure device on the appliance.</td>
<td>Improvement Notice PN to be considered if evident significant risk</td>
<td>See Appendix 6.</td>
</tr>
<tr>
<td>Lack of required electrostatic protection and earthing arrangements</td>
<td>Letter/Improvement Notice</td>
<td>Risk based, see Appendix 6.</td>
</tr>
</tbody>
</table>

**SERVICE PIPEWORK**

<table>
<thead>
<tr>
<th>Situation</th>
<th>Initial enforcement expectation</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above ground service pipework not protected from foreseeable damage</td>
<td>Improvement notice/letter</td>
<td>Dependent on risk</td>
</tr>
<tr>
<td>Above ground service pipework showing signs of corrosion or damage</td>
<td>Improvement notice Prohibition notice¹</td>
<td>If obvious corrosion, liable to leak</td>
</tr>
<tr>
<td>Above ground service pipework not subject to strategy for inspection, examination and maintenance</td>
<td>Letter/Improvement notice Prohibition notice¹</td>
<td>Dependent on risk If obvious corrosion, liable to leak</td>
</tr>
<tr>
<td>Situation</td>
<td>Initial enforcement expectation</td>
<td>Comment</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>---------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>No emergency shut off valve (ECV) fitted</td>
<td>Improvement notice</td>
<td>ECVs are normally located external to the building being supplied, but in some situations it may be desirable for the ECV to be positioned internally, as close as possible to the point where the service pipe enters the building.</td>
</tr>
<tr>
<td>Buried metallic pipework, in poor condition with no strategy for inspection, examination and maintenance, no questionnaire returned for risk ranking</td>
<td>Improvement notice² /Letter Prohibition notice¹ Prosecution³</td>
<td>Dependent upon risk factors associated with specific installation Replacement/inspection strategy as in Appendix 3 If obvious corrosion, liable to leak</td>
</tr>
<tr>
<td>Buried metallic pipework, in unknown condition but questionnaire returned. Evidence that action planned in line with risk ranking, no additional risk factors</td>
<td>Letter confirming planned action with follow up to ensure action complete</td>
<td>Additional risk factors not considered in ranking exercise should require review of timetable</td>
</tr>
<tr>
<td>Situation</td>
<td>Initial enforcement expectation</td>
<td>Comment</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>---------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Buried metallic pipework, in poor condition but questionnaire returned. Action planned in line with risk ranking, no additional risk factors</td>
<td>Letter/improvement notice</td>
<td>Dependent upon risk associated with specific installation, with reference to agreed replacement timescales. If obvious corrosion, liable to leak</td>
</tr>
<tr>
<td></td>
<td>Prohibition notice¹</td>
<td></td>
</tr>
<tr>
<td>Buried metallic pipework, in unknown condition, questionnaire returned but with no action planned in line with risk ranking</td>
<td>Letter/Improvement notice²</td>
<td>Dependent upon risk associated with specific installation, with reference to agreed (national) replacement timescales. If obvious corrosion, liable to leak</td>
</tr>
<tr>
<td></td>
<td>Prosecution³</td>
<td></td>
</tr>
<tr>
<td>Buried metallic pipework, in unknown condition, and no questionnaire returned</td>
<td>Improvement notice²/Letter</td>
<td>Dependent upon risk factors associated with specific installation In the first instance action should be to get the pipework risk ranked [through completion of (<a href="http://www.hse.gov.uk/gas/lpg/survey.htm">http://www.hse.gov.uk/gas/lpg/survey.htm</a>)] to determine appropriate timescale for replacement also taking into account national timescales (see page 9)</td>
</tr>
<tr>
<td>PE risers with no GRP (glass reinforced plastic) sleeving or sleeving damaged</td>
<td>Improvement notice or prohibition notice¹</td>
<td>Depending on the age of the pipe a prohibition notice may be more appropriate as the pipe strength will have been seriously degraded by UV light</td>
</tr>
<tr>
<td>Steel risers not subject to inspection, examination</td>
<td>Letter/Improvement notice</td>
<td>Dependent upon risk associated with specific installation, with reference to agreed replacement timescales</td>
</tr>
<tr>
<td>Situation</td>
<td>Initial enforcement expectation</td>
<td>Comment</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>---------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>and maintenance strategy</td>
<td></td>
<td>Consistent with other buried metallic pipework. Note that risers are prone to corrosion at the ground/air interface and the horizontal/vertical transition point. Appendix 3 refers.</td>
</tr>
<tr>
<td>PE service pipework entry entering building without suitable gas tight metallic sheath</td>
<td>Improvement notice</td>
<td>Refer to Appendix 7 for information.</td>
</tr>
<tr>
<td>Liquid Phase LPG pipework-deficiencies</td>
<td>Improvement Notice</td>
<td>Refer to Appendix 7 for information.</td>
</tr>
</tbody>
</table>

**INSTALLATION PIPEWORK AT BUILDING ENTRY**

| Pipework entry not sleeved, sleeve not sealed | Improvement notice | Gas Industry Unsafe Situations Procedure would not indicate IN for installation pipework, but IN may be appropriate where there is potential for pipework leak to track into building |
| Unsleeved pipework passes through unventilated void or basement | Improvement notice | Require the pipe to be examined for corrosion and then rerouted for above ground entry into the building |
|                                               | Prohibition notice     | If corrosion is present - specialist advice is needed.                                                                                     |

1 **Prohibition notices:**

It may be necessary to serve a deferred prohibition notice where action by the gas supplier is required in order to control the identified risk e.g. relocating a tank. In other circumstances, isolation may be sufficient to control the risk.

2 **Improvement notices:**

When setting timescales for the replacement of buried pipework, inspectors and local authority enforcement officers should bear in mind the limited availability of competent fitters to carry out the work. For higher priority pipework or pipework in evidently poor condition, 6 months is suggested dependent on site conditions, age of the pipework (where known) and system pressure.
For pipework of unknown material 4-6 weeks is suggested for (online) completion and submission of the risk ranking questionnaire

Substantial works, and particular tank relocations, require planning and may necessitate liaison between customers, suppliers and other bodies such as utilities companies or local planning authorities. This should be considered when agreeing timescales for such work.

3 Prosecution:

Where widespread and significant deficiencies are identified and the attitude of management is, or has been, inadequate, and the EPS tests are met then prosecution as well as the most suitable Notice(s) should be considered.

Template Notices

Appendix 4 contains the following template notices:

1. PN for obviously corroded or damaged pipework liable to leak (NB - may need to be deferred to allow supplier to attend and make safe)
2. IN for inadequate control measures for LPG vessel
3. IN for replacement of buried metallic pipework in poor/unknown condition
4. IN for examination/ replacement of buried pipework of unknown composition
5. IN for replacement of metal risers.

7. FURTHER GUIDANCE AND ASSISTANCE

Specialist support

It is anticipated that the information in this topic pack and the guidance listed below should be sufficient for inspectors and local authority enforcement officers to deal with most situations they encounter. Where specialist resource is essential, e.g. to provide expert opinion for a notice appeal or advise on liquid phase systems, local authority enforcement officers should contact their enforcement liaison officer and HSE inspectors should contact their local mechanical engineering specialist (for pipework integrity issues) or corporate process safety specialist.

Since specialist resource is limited, Inspectors should discuss any proposed request for specialist advice in advance with their line managers. Any necessary support request should be clearly prioritised. It is anticipated that specialist resource will always be available to support appeals against Notices, prosecutions, or to give urgent advice where Prohibition Notices are being considered on site.

HSE guidance


7. OC 18/12 Matters of Evident Concern and Potential Major Concern

8. OC 440/34 Gas safety in touring caravans, motor caravans, caravan holiday homes and residential park homes

9. Leaflet INDG428 ‘Inspecting and maintaining or replacing buried metallic pipework carrying LPG vapour’

10. CS4 Use of LPG in small bulk tanks


12. HID Safety Report Assessment Guidance (Technical Aspects) - Inspection/Non-Destructive Testing

External Guidance

(HSE inspectors can access UKLPG Codes of practice through the intranet)


11. UKLPG COP 1: Bulk LPG Storage at Fixed Installations, Part 4: Buried or Mounded LPG Storage Vessels; 2008 Edition Incorporating Amendment 1 May 2012

12. UKLPG COP 2: Safe handling and transport of LPG in Road Tankers and Tank containers by road, 2007 edition


16. UKLPG website is http://www.uklpg.org/

17. IGEM/UP/2 Edition 2 (Installation pipework on industrial and commercial premises)
APPENDIX 1
AIDE MEMOIRE

Properties of LPG

LPG is used for heating and operating industrial processes in a wide range of premises. Bulk LPG consists of propane or butane, under pressure as a liquid, so that it can be stored in reduced volume.

LPG vapour is heavier than air and does not disperse easily. It will sink to the lowest level available and may accumulate in areas such as cellars, pits or drains. It forms flammable mixtures in air at concentrations between 2% and 10% and can therefore be a significant fire and explosion hazard if stored or used incorrectly.

LPG Installation

Siting of the tank should be in accordance with separation distances in table A1 below.

Table A1 SMALL SCALE BULK LPG INSTALLATION
Distances from Buildings, Boundaries and Sources of Ignition.

<table>
<thead>
<tr>
<th>Nominal LPG Capacity</th>
<th>Minimum separation distances of above ground vessels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A (Metres)</td>
</tr>
<tr>
<td></td>
<td>LPG (Tonnes)</td>
</tr>
<tr>
<td>0.05 – 0.25</td>
<td>0.8</td>
</tr>
<tr>
<td>&gt;0.25 – 1.1</td>
<td>3.5</td>
</tr>
<tr>
<td>&gt;1.1 – 4</td>
<td>12.5</td>
</tr>
<tr>
<td>&gt;4 – 60</td>
<td>200</td>
</tr>
</tbody>
</table>

A From buildings, boundary, property line or any fixed source of ignition.

B As A, but with a fire wall.

Fire walls

Where the separation distances cannot be met, a fire wall may be positioned closer to the tank on one side. Its purpose is to protect the tank from thermal
radiation from a fire nearby and it should be imperforate and of solid masonry, concrete or similar construction. It should be at least 2 m high or as high as the top of the pressure relief valve (PRV) on the tank (whichever is the greater), sited between 1m and 3m from the nearest point of the vessel. The width of the fire wall should be such that the distance between the vessel and a boundary, building, property line, or fixed source of ignition measured around the ends of the fire wall is equal to or greater than the distance specified in column A in Table A1 above for the nominal LPG capacity involved.

Typical small scale installations are illustrated together with their fittings and attachments in Figures A1 – A4. Definitions of the various features are included in the glossary (appendix 2).

Pressure regime

The storage vessel pressure of up to 9 bar is reduced in two stages:

1st stage regulator, mounted on the storage vessel reduces the pressure to an intermediate pressure of 0.75 – 2 bar dependent on volume of use and pipework sizing.

2nd stage regulator reduces pressure to the operating pressure (for many appliances) of 37mbar. This can be mounted either on the storage vessel or on the wall of the building. It can also be an integral part of an UPSO/OPSO valve.

Valves

Service valve controls the high pressure stage, usually sited under a locked cover on the tank.

Pressure relief valve (PRV) on top of the tank, provided with a cover to prevent water ingress. There should be no building openings directly above the pressure relief valve (see diagram A4).

UPSO (under pressure shut off valve)/OPSO (over pressure shut off valve) protect the installation and appliances from under and over pressure situations. Although these valves may not have been fitted on all commercial installations, they should normally be required consistent with the associated risk. However there are some industrial applications where equivalent protection is provided by controls at the appliance.

UPSO/OPSO valves are required at all premises subject to GSIUR.

Service pipework

Service pipework until the 1980s/early 1990s was metallic e.g. of copper or steel. Steel pipework was usually galvanised to protect against corrosion. It was also often wrapped with anti-corrosion tape (known by a trade name as Denso tape) for additional corrosion protection, but to be effective this tape
must be correctly prepared and applied. Other corrosion protection methods included coating with bitumen for cast iron pipes, plastic sleeves, and cathodic protection. The efficiency of corrosion protection deteriorates over time and the rate of pipe corrosion will depend on a number of factors including soil type and moisture levels. For example, as highlighted in the ICL Inquiry report, pipework nearest the building is the most likely to corrode due to the soil having a higher moisture content.

PE pipework should not be laid in chemically corrosive soils, such as those containing tars, oil, plating, dry cleaning fluids, etc. nor should it be exposed to extremes of temperature encountered, for example, near a steam main. Para 8.4.2.4 of IGEM/UP/2 Edition 2 (Installation pipework on industrial and commercial premises) refers.

It should also be noted that although replacement LPG tanks may have been installed at sites, the original pipework is less likely to have been changed and may therefore be older than the tank. It may be difficult to establish the pipework installation date due to changes in site personnel, and a lack of accurate records.

It is therefore not possible to predict the life expectancy of metallic pipes and they are now subject to the risk based replacement plan described earlier.

Steel risers: When polyethylene pipework was first introduced, the practice was to use it for the buried section (it degrades when exposed to sunlight) with metallic risers at either end. Later, the industry used polyethylene risers protected by GRP sleeves. Steel risers should be treated in the same way as other buried metallic pipework and replacement is the preferred option, or if not then they should be subject to an inspection, examination and maintenance strategy (which will necessitate exposure to establish condition.)

**Entry of pipework into building**

A suitably marked ECV should be fitted. This is normally sited at the point of entry to the building where LPG is to be used.

Pipework should, wherever practicable, enter a building above ground level, and should be sleeved, with the sleeve sealed to the structure internally to ensure any leaking gas escapes to atmosphere. In exceptional circumstances, it is permissible for pipework to enter through a floor via a continuous gas-tight sleeve. Specific requirements apply, which are detailed within IGEM/UP/2 *Installation pipework on industrial and commercial premises*. Pipework should not pass through an unventilated void, unless it is itself contained in a ventilated duct.

**Visual Screens**

Visual screens are permitted for above ground LPG vessels. They should not interfere with ventilation around the tank or access to it.
Practical examples of screening options are suggested in the UKLPG Code of Practice 1, part 1,2. While screening using evergreen shrubs and trees is restricted to one side only of the installation other options are suggested for more than one side. Where screening is provided on two sides or more of the installation there is the potential for ventilation to be restricted and the type of screening should be carefully considered particularly for larger tanks. (See Appendix 6)
<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bulk tank</td>
</tr>
<tr>
<td>2</td>
<td>Lockable cover for the protection of combined multi-valve unit</td>
</tr>
<tr>
<td>3</td>
<td>Multi-Valve unit With LPG fill connection, vapour off-take valve, maximum fill bleed valve + 1st stage regulator</td>
</tr>
<tr>
<td>4</td>
<td>Pressure relief valve (PRV)</td>
</tr>
<tr>
<td>5</td>
<td>1st stage regulator</td>
</tr>
<tr>
<td>6</td>
<td>Combined 2nd stage regulator, UPSO &amp; OPSO</td>
</tr>
</tbody>
</table>

Figure A2
Figure A3

7. GRP Sleeve
   For the protection of Polyethylene pipework from UV Sunlight

8. Transition coupling
   Metal pipe to Polyethylene pipework

9. Polyethylene pipework (yellow)
   Polyethylene pipework with GRP protection sleeve

10 & 11. Emergency control valve & Instructions

12. Test data plate

13 & 14. Gas supplier & Emergency number
Note:
For tanks up to 1.1 tonnes (2,500 litres) capacity the fire wall may form part of the building wall as shown. Where part of the building is used for residential accommodation the wall should be imperforate and of 60 minutes fire resisting construction. For larger tanks the separation distances in Table A1, column A apply.
Points to check

Storage vessel

- What is the tank condition? Are there any signs of corrosion?
- Is the tank adequately ventilated and the right distance from buildings, boundaries, overhead power lines, etc? Other cables, (including telephone cables) should not impede access for installation or maintenance.
- Is there a 'no smoking/no naked flames' sign in place
- Are there any combustible materials close to it such as LPG cylinders, grass and vegetation, wooden pallets?
- Is the tank protected from damage such as vehicle impact?
- Consider if anyone unauthorised could interfere with the tank. The cover over the tank control valve should be locked. Who has the key? Is the security of the tank suitable for its location.
- Look for any drains, culverts, ducts or low lying areas where LPG gas could accumulate, or track into buildings.
- Is the vessel bonded to an earthing point?
- Is there hard standing for the delivery tanker and can the driver see both the tank and his vehicle?
- Do the notices on the tank tell the occupier what to do if there is a gas leak?
- Does the site have a plan for dealing with a leak or fire that could affect the tank?
- Have employees received information, instruction or training e.g. on the properties of LPG, the need to keep the tank clear of combustible materials etc, and emergency actions?
- Are there other storage tanks in the area and do they comply with the minimum separation distances as specified in UKLPG Code of Practice 1, parts 1,2.

LPG service pipework

1. Check that any visible pipework is
   - adequately supported
   - protected from damage
   - not in contact with other surfaces (spacers should be used to keep pipework away from concrete, brickwork, etc), pipework or conduit
   - (for polyethylene pipework) protected from UV degradation (i.e. sleeved with protective material such as GRP)
   - free from obvious signs of corrosion or damage
   - provided with cathodic protection (for metallic pipework)

2. If the buried pipework is polyethylene, is it connected to steel risers? Are they subject to an inspection, examination and maintenance strategy and known to be in good condition?
   - If not, pursue replacement.

3. Has the site completed and returned a questionnaire?
   - If not, then require the site to complete the online questionnaire where the buried pipework is either metallic or unknown material
   - Follow the flowchart in Figure A5, considering also risk factors listed below, the replacement timescales for lower risk buried metallic pipework (with the dominant risk
• If the site has completed the questionnaire and has buried metallic pipework, check the validity of the questionnaire and whether there are any additional risk factors - as outlined below - that have not been considered

4. Are there any factors that may create additional risk of physical damage to the pipework, e.g.

• Was the pipework installed before 1993? If so it is more likely to be metallic
  - Make enquiries about when LPG was first supplied to the site and assume that is the age of the pipework unless there is evidence that it has been replaced. Even if the tank has been replaced, the pipework may not have been changed at the same time
• Does traffic pass over the pipework route, or is the ground liable to movement?
• Are there signs of excavations or building work near the pipe?
• Has the ground been resurfaced since the pipe was laid and might this have disturbed it?

5. Are there any factors that may increase the likelihood or consequences of fire and explosion in the event of a leak, e.g.

• What pressure is the gas in the pipework? (medium pressure above 75mbar increases the risk)
• What route does the pipework take to the building entry point – is it direct (lower risk) or does the pipework run parallel to the building (higher risk)?
• How does the pipework enter the building?
  - Is it below ground level?
  - Is the pipework sleeved as it passes through the wall?
• Could vulnerable people e.g. nursing home residents with limited mobility be affected by a leak?
• Does the building have a basement or below ground service ducts where gas could accumulate?
• Are there occupied buildings sited below the level of the installation where the gas could migrate?

6. Does the site plan to replace buried metallic pipework?

• Is the date in line with the national/LPG supplier’s plan?
• Is the timescale appropriate given any other unidentified risk factors?
• Consider what interim measures such as implementing an inspection and maintenance strategy are needed, whilst awaiting replacement. (see Appendix 3)

Replacement of service pipework should only be undertaken by competent persons. Where GSIUR apply they should be Gas Safe registered specifically with competency to work on LPG systems

7. Where the pipework is subject to an inspection and maintenance strategy, establish:

• how accurate or reliable the strategy is
• how representative of the whole LPG pipework system the information is
• whether or not the strategy includes a visual inspection of underground pipework and assessment of its condition over the expected lifespan of the pipe, including its planned replacement in the future.
- How it compares to HSE’s generic guidance (for interim inspection/maintenance until replacement) where this can be applied

**Pressure testing alone is not sufficient.**

An inspection, examination and maintenance strategy should meet the standards set out in Appendix 3

Although a site may have such a strategy in place, which may be regarded as a reasonably practicable alternative means of compliance, site occupiers should be advised that in the longer term, replacement is likely to be necessary and is the recommendation of Lord Gill's report
Figure A5 Flow Chart For Considering LPG Service Pipework

Where survey has not been completed

- Is pipework all above ground?
  - Yes: Minimum Standard
    - Protected from damage
    - No signs of corrosion
    - Checked for gas tightness
    - Adequately maintained
    - Visual inspection
  - No: Minimum Standard
    - Polyethylene or proprietary pipework system installed in accordance with manufacturer's instructions
    - Steel Risers
    - Check whether there are steel risers. They should be subject to an inspection, examination and maintenance strategy devised by a competent person. If not consider IN for replacement

- Is buried pipework non-metallic (may not all be of same construction)?
  - Yes: Consider issuing a prohibition notice
  - No:

- Is there any apparent damage or corrosion to the pipework?
  - Yes: Minimum standard
    - Underground metallic pipework in otherwise acceptable condition should be subject to an inspection, examination and maintenance strategy devised by a competent person
  - No:

- Is the buried section effectively protected from corrosion? And is it known to be in good condition?
  - Yes: Action Required
    - Replace with polythene or proprietary system OR
    - Re-route above ground and protect against mechanical damage OR
    - Examine and assess pipework to confirm condition as acceptable AND make subject to an inspection, examination and maintenance strategy devised by a competent person
  - No:

- Are there any additional risk factors?
  - Don't Know
  - Yes: Action required
    - Consider giving site option of immediate return of questionnaire to HSL. Otherwise consider IN

See Appendix 3
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk tank</td>
<td>Fixed storage vessel containing LPG under pressure. Size usually over 1 tonne</td>
</tr>
<tr>
<td>Denso tape</td>
<td>Proprietary non-woven synthetic fibre fabric (tape) impregnated and coated with natural compound based on saturated petroleum hydrocarbons and inert silicon based fillers wrapped around metallic pipework to inhibit corrosion</td>
</tr>
<tr>
<td>Cathodic protection</td>
<td>A technique for protecting metal pipes from electrolytic corrosion by making the metallic structure the cathode of an electro-chemical cell, either by applying an electromotive force directly or by putting it in contact with a more positive electropositive force.</td>
</tr>
<tr>
<td>ECV</td>
<td>Emergency control valve (shut off valve)</td>
</tr>
<tr>
<td>Emergency number</td>
<td>This telephone contact number is to be found on the bulk tank. It is to be dialled in an emergency situation to contact the gas supplier.</td>
</tr>
<tr>
<td>Firewall</td>
<td>Purpose built wall to primarily safeguard the LPG installation from heat radiation emitted from a foreseeable fire beyond the nearby site boundary, property line or building.</td>
</tr>
<tr>
<td>First stage regulator</td>
<td>Reduces the bulk tank LPG pressure to a medium pressure, usually 0.75 – 2 bar</td>
</tr>
<tr>
<td>Fittings</td>
<td>Term used to describe valves, regulators, pipe elbows associated with the LPG installation</td>
</tr>
<tr>
<td>Gas supplier</td>
<td>Firm contracted to supply the LPG and fill the bulk tank when required. They will also normally be the tank owner.</td>
</tr>
<tr>
<td>Gas user</td>
<td>The person(s) who also usually owns and has the responsibility for all the pipework and fittings downstream of the first stage regulator fitted on the LPG tank</td>
</tr>
<tr>
<td>GRP</td>
<td>Glass reinforced plastic (glass fibre/resin mix)</td>
</tr>
<tr>
<td>LPG cylinder</td>
<td>Portable vessels usually up to 47kg containing LPG under pressure</td>
</tr>
<tr>
<td>LPG installation</td>
<td>Describes the complete LPG setup; from bulk tank, through service pipework to ECV</td>
</tr>
<tr>
<td>LPG tank compound</td>
<td>Designated area around bulk tank that provides a secure compound/environment for the tank</td>
</tr>
<tr>
<td>MDPE (PE)</td>
<td>Medium density polyethylene pipe – used underground to transport vapour phase LPG from the bulk tank to the ECV. Must be covered by GRP sheathing above ground.</td>
</tr>
<tr>
<td>OPSO</td>
<td>Over Pressure Shut-Off valve. This device must be re-set by the gas supplier if it trips out and shuts off the gas supply when over-pressure conditions prevail.</td>
</tr>
<tr>
<td>Pressure relief valve (PRV)</td>
<td>Valve fitted to top of Bulk Tank to relief internal pressure if this increases due to external influences</td>
</tr>
<tr>
<td>Second stage regulator</td>
<td>Reduces the medium pressure (0.75 bar – 4 bar) provided by the first stage regulator to the usual working pressure of 37 mbar serving the LPG fired appliances.</td>
</tr>
<tr>
<td>Service pipework</td>
<td>Pipework carrying vapour phase gas from fixed vessel to the outlet of the ECV</td>
</tr>
<tr>
<td>Sheathing</td>
<td>Outer cover (usually GRP) placed over the yellow polyethylene service pipe to prevent degradation by UV rays from sunlight and mechanical damage</td>
</tr>
<tr>
<td>UPSO</td>
<td>Under Pressure Shut-Off valve. This device may be re-set by the gas user if it trips out and shuts off the gas supply</td>
</tr>
</tbody>
</table>
We need to revisit this and distinguish between inspection strategies proposed as an alternative to replacement, and interim inspection pending replacement. This is a list of items that should be considered when deciding if an inspection strategy is sufficient instead of replacement of LPG pipework. Mechanical Engineering Specialist assistance should be sought to decide if the proposed strategy is sufficient. In most cases, it should be noted that the ongoing cost of an inspection strategy usually makes this option less attractive and it is more cost effective to replace the pipework, which is a one-off cost. As time passes and pipework corrodes it may still be necessary to replace at a later point.

APPENDIX 3
INSPECTION, EXAMINATION AND MAINTENANCE STRATEGIES

Above ground pipework

An inspection and maintenance strategy for above ground pipework should be based on a risk assessment that considers:

- Operating pressure
- Size of pipe
- Materials of construction
- Age of pipework
- Any corrosion protection
- Potential failure modes

It should include:

- A regular visual inspection for corrosion and damage, especially where pipework passes through supports.
- Checks on:
  - the condition of supports
  - any repairs or modifications have been carried out
  - any changes near the pipework to ensure they do not affect operation or safety
- Gas tightness test at the designated operating pressure

Buried metallic pipework (including steel risers)

Strategy requirements

1. An inspection, examination and maintenance strategy should be devised to ensure the continuing integrity of the buried metallic pipes and ensure that any deterioration is detected and remedied in good time.

2. The strategy should be devised by a competent person (for example, Institute of Corrosion, Pipelines Coating Inspector, Level 2) who should undertake the following:

   - An initial visual inspection of the underground LPG pipework sufficient to establish its condition and the condition of any corrosion protection e.g. coating, wrapping, sleeving or cathodic protection
   - An assessment of the ground conditions and their likely effect on the condition of the pipe and its corrosion protection
• An assessment of the required frequency of inspection given the pipe specification, failure modes, age, condition, location and environment of the pipe, including the operating pressure and phase of LPG in the pipe, identifying any immediate remedial measures required

• An assessment of the required inspection methods (examinations, tests and measurements) to be performed at each inspection. This may include non-destructive testing techniques outlined in the HID Safety Report Assessment Guidance (Technical Aspects)- Inspection/ Non Destructive Testing or in the API 570 Piping inspection code

3 The strategy should include the safe systems of work for carrying out the inspections and any resulting maintenance. It should include precautions for avoiding danger from underground services and preventing damage to the underground pipe and protective coatings.

4 After each inspection, the competent person should review the strategy and inspection frequency and amend as required. The inspection frequency should be based on the condition of the pipe at the initial inspection and other factors, including, but not limited to, those outlined above, taking into account relevant industry inspection codes and standards, e.g. API 570

5 The strategy should also outline the policy for replacement of the buried metallic pipes with the replacement frequency based on the same factors as those considered for the inspection strategy.

N.B. This strategy should not be confused with the requirement for a statutory written scheme of examination for a pressure system required under the Pressure Systems Safety Regulations which relates to risks associated with pressure.

Methods of inspection and test

Gas tightness test (also referred to as pressure test)

A gas tightness test of the pipework (and specifically the buried pipework) will highlight any leaks that require immediate attention. However, such a test will not indicate the exact location of the leak, nor the condition of the pipework. Any test that suggests that the system is leak free is not necessarily proving that the system is gas tight as the ground conditions at the time of the test may provide a gas tight barrier; in such cases, an inspection strategy, including a visual inspection, is still required.

Leakage survey

A leakage survey carried out using a gas detector is not considered an effective indication of integrity of the pipework because the LPG vapour will accumulate at low points e.g. in drains and gullies or remain in porous ground, where it may not be registered by gas detector sensors.

Excavation of pipe work and visual inspection

It is not considered good practice to excavate a live pipe i.e. containing LPG. Often, when the ground or pipework has been disturbed, a corroded pipe can fail (sometimes catastrophically) causing a significant release of gas. Where excavating along the pipe cannot be avoided, safe digging practices should be used e.g. using hand tools, excavating alongside the pipe rather than above it, and then exposing the pipe by horizontal digging, supporting the pipe if necessary. If there is a likelihood of a gas release, further precautions may be required, e.g. monitoring the LPG concentration in the excavation. HSG 47 “Avoiding Danger from Underground Services” gives further advice.
Cathodic protection

Methods to check the continued effectiveness of cathodic protection include measuring pipe to soil potentials and anode or transformer current outputs.
1. PN for obviously corroded or damaged pipework liable to leak (NB - may need to be deferred to allow supplier to attend and make safe)

I am of the opinion that the following activities namely

The use of service pipework for the conveyance of liquefied petroleum gas (LPG) on your site from tank serial no XXXXXX

Involve a risk of serious personal injury, and that the matters which give rise to the said risks are

The apparent significant damage to/corrosion of* sections of the pipework to the extent that a leak may develop
* delete as required

And that the said matters involve contravention of the following statutory provisions

Health and Safety at Work etc Act 1974 sections 2 (1) and 3 (1), The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) regulation 6(1) Provision and Use of Work Equipment Regulations 1998 regulation 5 (1)

Because

You have failed to control the risks from a dangerous substance, namely liquefied petroleum gas (LPG) in that you have not taken reasonably practicable measures to avoid its uncontrolled release as you have not maintained the service pipework in good repair

SCHEDULE

Compliance with this notice may be achieved by completing Item (1) OR item (2)

ITEM 1

Replace the damaged LPG pipework with pipework suitable for the location, adequately supported, and protected from mechanical damage and corrosion and devise an inspection, examination and maintenance strategy to ensure its on-going integrity and that any deterioration is detected and remedied in good time.

OR:

ITEM 2

Any other equally effective measures to remedy the said contraventions
2. **IN for inadequate control measures for LPG vessel**

...you are contravening ... the following statutory provisions:

Health and Safety at Work etc Act 1974 sections 2 (1) and 3 (1),
The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) regulation 6(1).

...the reasons for my said opinion are:

You have not ensured that risk of a fire or explosion involving LPG stored in your bulk tank is either eliminated or reduced so far as is reasonably practicable in that (insert specific matters e.g. combustible material is stored within the separation distance).

**SCHEDULE**

In order to comply with the Notice, you should *(select as appropriate)*:

1. Provide a minimum separation distance of $x^1$ metres from the vessel outline to buildings, boundary/property lines and any fixed sources of ignition; *(dependent on tank size, (see table 1))

AND

2. Remove weeds, long grass, shrubs and combustible material from the area within the separation distance; chemical weed killers (such as sodium chlorate) or any other method which might provide a source of ignition should not be used.

AND

3. Fit a water trap or otherwise suitably seal to any open drains, gullies or ducts within the separation area which would permit access and passage of LPG vapours

AND

4. Provide suitable barriers around the tank to minimise the risk of damage from vehicle impact;

AND

5. Provide fixed signage prohibiting smoking and use of naked flames within the separation distance. These should comply with the Health and Safety (Safety Signs and Signals) Regulations 1996, be durable, clearly visible and legible to all;

AND

6. Provide a clear line of sight for a person delivering LPG to the tank form the position to control the product transfer to both the receiving vessel and the delivery vehicle;

AND

7. Provide appropriate earthing arrangements for the tank and delivery vehicle

AND

8. Provide a secure 2 metre high wire mesh or otherwise suitably ventilated fence around the LPG tank installation

OR

9. Any other equally effective measures to remedy the said contraventions
3. IN for replacement of buried metallic pipework in poor/unknown condition

...you are contravening ... the following statutory provisions:

Health and Safety at Work etc Act 1974 sections 2 (1) and 3 (1).
The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) Regulation 6(1)

...the reasons for my said opinion are:

Liquid petroleum gas (LPG) is conveyed on your site from a bulk storage tank (serial no XXXX) via buried metallic pipework of unknown condition; such buried metallic pipework is subject to deterioration unless provided with effective corrosion protection and evidence has not been provided (e.g. from inspection and examination) that demonstrates the ongoing integrity of the pipework so that LPG can be conveyed via such pipework without risk of leakage

SCHEDULE

Compliance with this notice may be achieved by completing EITHER item (1) OR item (2) OR item (3) OR item (4) OR item (5).

(1) Replace the buried metallic LPG pipework with buried polyethylene pipework or a proprietary pipework system which should be installed in accordance with manufacturers’ instructions.

OR:

(2) Re-route the LPG pipework above ground with protection against mechanical damage, and devise an inspection, examination and maintenance strategy to ensure its integrity and that any deterioration is detected and remedied in good time.

OR:

(3) Put in place arrangements to implement HSE’s published interim inspection and maintenance guidance for buried metallic pipework until the pipework is replaced - including written justification that it is appropriate to apply the guidance to the installation in question

OR:

(4) Devise an inspection, examination and maintenance strategy to ensure the continuing integrity of the buried metallic pipes used to convey LPG and ensure that any deterioration is detected and remedied in good time. The strategy should be devised by a competent person (for example, Institute of Corrosion, Pipelines Coating Inspector, Level 2) who should undertake the following:

(a) An initial visual inspection of the underground LPG pipework sufficient to establish its condition and the condition of any corrosion protection e.g. coating, wrapping, sleeving or cathodic protection;

(b) An assessment of the ground conditions and their likely effect on the condition of the pipe and its corrosion protection;
(c) An assessment of the required frequency of inspection given the pipe specification, failure modes, age, condition, location and environment of the pipe, including the operating pressure and phase of LPG in the pipe, identifying any immediate remedial measures required;

(d) An assessment of the required inspection methods (examinations, tests and measurements) to be performed at each inspection.

The strategy should also include the safe systems of work for carrying out the inspections and any resulting maintenance, and include any precautions for avoiding danger from underground services and preventing damage to the underground pipe and protective coatings.

The strategy should include a provision for the competent person to review, after each inspection, the strategy and inspection frequency and amend as required. The inspection frequency should be based on the condition of the pipe at the initial inspection and other factors, including, but not limited to, those outlined above, taking into account relevant industry inspection codes and standards, e.g. API 570 Piping Inspection Code 'Inspection, Repair, Alteration and Re-rating of in service piping systems in the Process Industries'.

The strategy should also outline the policy for replacement of the buried metallic pipes, with the replacement frequency based on the same factors as those considered for the inspection strategy.

OR:

(5) Any other equally effective measures to remedy the said contraventions
4. IN for examination / replacement of buried pipework of unknown composition

...you are contravening ... the following statutory provisions:
Health and Safety at Work etc Act 1974 sections 2 (1) and 3 (1),
The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) Regulation 6(1)

...the reasons for my said opinion are:
Liquid petroleum gas (LPG) is conveyed on your site from a bulk storage tank (serial no XXXX) via buried pipework of unknown composition and condition; such pipework is subject to deterioration unless constructed from corrosion-resistant material (such as polyethylene) or provided with effective corrosion protection. Evidence has not been provided (e.g. from inspection and examination) that demonstrates the ongoing integrity of the pipework so that LPG can be conveyed via such pipework without risk of leakage

SCHEDULE
To comply with this notice,

EITHER

(1) Undertake such investigations as are necessary to determine the composition and condition of the buried LPG pipework.

AND

(2) For those components of the buried pipework (including riser pipes) which are determined to be metallic by (1) above:

EITHER

a. Replace the buried metallic components of the LPG pipework with buried polyethylene pipework, or a proprietary corrosion-resistant pipework system installed in accordance with manufacturers’ instructions.

OR:

b. Re-route LPG pipework above ground with protection against mechanical damage, and devise an inspection, examination and maintenance strategy to ensure its integrity and that any deterioration is detected and remedied in good time.

OR:

c. Put in place arrangements to implement HSE’s published interim inspection and maintenance guidance for buried metallic pipework until the pipework is replaced - including written justification that it is appropriate to apply the guidance to the installation in question

OR:
d. Devise an inspection, examination and maintenance strategy sufficient to ensure the continuing integrity of the metallic components of the buried LPG pipework, and to ensure that any deterioration is detected and remedied in good time. The strategy should be devised by a competent person (for example, Institute of Corrosion, Pipelines Coating Inspector, Level 2) who should undertake the following:

(i) An initial visual inspection of the underground LPG pipework sufficient to establish its condition and the condition of any corrosion protection e.g. coating, wrapping, sleeving or cathodic protection;

(ii) An assessment of the ground conditions and their likely effect on the condition of the pipework and its corrosion protection;

(iii) An assessment of the required frequency of inspection given the pipe specification, failure modes, age, condition, location and environment of the pipe, including the operating pressure and phase of LPG in the pipe, identifying any immediate remedial measures required;

(iv) An assessment of the required inspection methods (examinations, tests and measurements) to be performed at each inspection.

The strategy should also include the safe systems of work for carrying out the inspections and any resulting maintenance, and include any precautions for avoiding danger from underground services and preventing damage to the underground pipe and protective coatings.

The strategy should include a provision for the competent person to review, after each inspection, the strategy and inspection frequency and amend as required. The inspection frequency should be based on the condition of the pipe at the initial inspection and other factors, including, but not limited to, those outlined above, taking into account relevant industry inspection codes and standards, e.g. API 570 Piping Inspection Code 'Inspection, Repair, Alteration and Re-rating of in service piping systems in the Process Industries'.

The strategy should also outline the policy for replacement of the metallic components, with the replacement frequency based on the same factors as those considered for the inspection strategy.

OR:

(3) Implement any other equally effective measures to remedy the said contraventions
5. IN for replacement of metallic risers

...you are contravening ... the following statutory provisions:
Health and Safety at Work etc Act 1974 sections 2 (1) and 3 (1),
The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) Regulation 6(1)

...the reasons for my said opinion are:
Liquid petroleum gas (LPG) is conveyed on your site from a bulk storage tank (serial no XXXX) via buried pipework having metallic components (including riser pipes); such metallic components are subject to deterioration unless provided with effective corrosion protection. Evidence has not been provided (e.g. from inspection and examination) that demonstrates the ongoing integrity of the metallic components so that LPG can be conveyed via such pipework without risk of leakage

SCHEDULE
To comply with this notice,

EITHER

(1) Replace the buried metallic components of the LPG pipework (including riser pipes) with polyethylene pipework protected where necessary against ultraviolet degradation, or with a proprietary corrosion-resistant pipework system installed in accordance with manufacturers’ instructions.

OR:

(2) Re-route LPG pipework above ground with protection against mechanical damage, and devise an inspection, examination and maintenance strategy to ensure its integrity and that any deterioration is detected and remedied in good time.

OR:

3. Put in place arrangements to implement HSE’s published interim inspection and maintenance guidance for buried metallic pipework until the pipework is replaced - including written justification that it is appropriate to apply the guidance to the installation in question

OR:

(4) Devise an inspection, examination and maintenance strategy sufficient to ensure the continuing integrity of the metallic components of the buried LPG pipework, and to ensure that any deterioration is detected and remedied in good time. The strategy should be devised by a competent person (for example, Institute of Corrosion, Pipelines Coating Inspector, Level 2) who should undertake the following:

(i) An initial visual inspection of the underground LPG pipework sufficient to establish its condition and the condition of any corrosion protection e.g. coating, wrapping, sleeving or cathodic protection;

(ii) An assessment of the ground conditions and their likely effect on the condition of the pipework and its corrosion protection;
(iii) An assessment of the required frequency of inspection given the pipe specification, failure modes, age, condition, location and environment of the pipe, including the operating pressure and phase of LPG in the pipe, identifying any immediate remedial measures required;

(iv) An assessment of the required inspection methods (examinations, tests and measurements) to be performed at each inspection.

The strategy should also include the safe systems of work for carrying out the inspections and any resulting maintenance, and include any precautions for avoiding danger from underground services and preventing damage to the underground pipe and protective coatings.

The strategy should include a provision for the competent person to review, after each inspection, the strategy and inspection frequency and amend as required. The inspection frequency should be based on the condition of the pipe at the initial inspection and other factors, including, but not limited to, those outlined above, taking into account relevant industry inspection codes and standards, e.g. API 570 Piping Inspection Code 'Inspection, Repair, Alteration and Re-rating of in service piping systems in the Process Industries'.

The strategy should also outline the policy for replacement of the metallic components, with the replacement frequency based on the same factors as those considered for the inspection strategy.

OR:

(5) Implement any other equally effective measures to remedy the said contraventions
Faults:

Poor ventilation due to sloping ground behind tank
Dead grass around tank should be cleared
Covered duct (below crash barrier) has gaps allowing ingress of leaking gas.
Duct leads into adjacent building:

Solution:

IEE would be IN to relocate tank.
Note drain pipe on end of building:

Open drain and entry into building
Pipework

Illustrations of corrosion on galvanised pipe

1. Zinc layer is partly consumed though still protecting large areas but isolated small spots of rust may be visible - warrants a further inspection within the short to medium term future.

2. Significant areas of rusting and/or numerous sites of rusting where the zinc has been fully consumed and the steel beneath is obviously corroded. Significant corrosion such as this would give cause for concern.
3. Little or no zinc remaining with widespread corrosion of the steel and extensive rust formation. A further stage of corrosion such as this would again give cause for concern.

4. Service pipework in direct contact with concrete – note corrosion at edge, Denso-taped metal riser connected to sleeved metallic pipe. System taken out of use immediately and pipework replaced. IEE would be PN.
APPENDIX 6:  Topic Specific Requirements & Factors Relevant to Initial Enforcement Expectation (TABLE 3)

1. Security Fencing: LPG bulk storage tanks

The UKLPG Codes contain requirements for the adequate security of bulk LPG tanks. This advice is intended to help inspectors and local authority enforcement officers to apply these requirements in a consistent way, particularly to LPG tanks in remote locations, e.g. on farms.

Table 3 gives the initial enforcement expectation as follows:

<table>
<thead>
<tr>
<th>Situation</th>
<th>Initial enforcement expectation</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>STORAGE VESSEL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inadequate security</td>
<td>Letter/ Improvement notice</td>
<td>Risk based,</td>
</tr>
</tbody>
</table>

Inspectors will always need to make a judgment on the likelihood of public access and the nature of the individuals who might be near the installation and what they might do (and compare a rural setting, say, to an urban industrial setting where the risk of vandalism etc. may be higher). Inspectors will then apply the Enforcement Policy Statement (EPS) after consideration of dutyholder and strategic factors, to decide whether enforcement action may be appropriate.

The fencing requirements are given in the UKLPG COPs, and COP 1 Part 1 (section 2.6.3) gives some conditions whereby these requirements may be relaxed for vessels of less than 4 tonnes capacity. The specific reference suggesting that the requirements should not be relaxed where the general public have uncontrolled access has been removed. Inspectors should still consider whether it is appropriate for fencing requirements to be relaxed at LPG installations. In particular they should consider the potential for harm to persons or property if there is unauthorised tampering or access to the storage tank.

When deciding what an appropriate level of security is at a particular site inspectors should consider the following:

- There is a presumption that some form of fencing is required unless it can be demonstrated that it is not needed.
- The purpose of security fencing is to prevent unauthorised access/tampering; potential access is a factor that has to be taken into account on a case by case basis.
- Who might be able to get access to the tank and how? Give strong consideration to the possibility of access by members of the public. Pragmatically, reasonable practicability requires an element of foreseeability regarding public access, rather than an actual history of
• If no secondary fencing is required in the immediate vicinity of tanks, is access to valves otherwise prevented? E.g. lockable cover, wire meshing underneath between skids etc).
• Does any perimeter fencing provide a suitable barrier (not acceptable for tanks >4 tonne)? If so how? – e.g. tests in LPGA CoP, likelihood of trespassers.

The following examples illustrate the above points, but they are not exhaustive. Inspectors will need to consider site-specific circumstances for each LPG installation and, if required, obtain process safety specialist assistance when deciding on the most appropriate course of action.

In all these examples it is presumed that the covers are kept locked with the key positioned in a secure place that can be accessed easily in the event of an emergency.

**Example 1:** Rural location. 2 x 2 tonne LPG bulk storage vessel - both have lockable covers. LPG is used to heat a chicken shed. The vessels have a plug on the drain connections. Remote from a public highway / footpath. No other occupied buildings within the vicinity. No fence required.

**Example 2:** Urban location. 2 x 2 tonne LPG bulk storage tanks - both have lockable covers. The vessels have a plug on the drain connections. Sited to the rear of an industrial unit. The company premises have a 2m perimeter fence. The public are not permitted to the rear of the premises, which is enforced by employees. No additional fence required for the LPG tank.

**Example 3:** Rural location. 2 tonne LPG tank with lockable covers sited on a farm in a field which is downhill from the farmhouse and other occupied buildings. There is a public footpath adjacent to the tank, though no evidence of trespassing / break-ins in the area. Fence required. Initial enforcement expectation: letter.

**Example 4:** Urban location. 2 x 0.5 tonne LPG storage tanks with lockable covers, used to heat a public library incorporating a coffee shop, which is located in the centre of a small market town. The public are likely to be within the immediate vicinity of the LPG tanks. The premises are open between the hours of 9am and 5.30pm, and there is no CCTV monitoring provided on the premises covering the LPG tanks. Fence required. Initial enforcement expectation: improvement notice.

2. **Lack of UPSO/OPSO**

**UPSO/ OPSO valves are required at all premises subject to GSIUR.**

However, in some large industrial premises (e.g. poultry sheds heated by a small number of large heaters,) the increased demand for LPG as the heaters
fire up could cause an UPSO to operate, shutting off the fuel supply and the heaters and putting the lives of the poultry at risk. Given that the LPG-fired equipment has flame failure devices (this would be a requirement,) and that there is generally a low exposed human population, the risk of a dangerous incident is likely to be very low. Therefore, it appears reasonable not to require UPSOs in this situation. However, where there is no UPSO, it is essential that there are other reasonably practicable measures in place to prevent gas leaks and explosions, such as having appliances fitted with a flame failure device.

The onus is on the dutyholder to justify the absence of UPSO/OPSO valves from service pipework to any industrial premises not subject to GSIUR.

3. Electrostatic Protection Measures & Earthing

The term “electrostatic protection” concerns the means for ensuring that no electrostatic potential exists which could give rise to danger, e.g. an electrical spark during connection or disconnection of the bulk tanker supply hose during refilling operations.

The term “earthing” has a specific meaning associated with electrical installations, this advice reflects the terminology used within the UKLPG Codes of Practice.

Generally, the tank filling area should be considered as a hazardous area during tanker offloading operations due to the risk of leakage due to worn/failed couplings, hose failure, etc. In order to adequately control the risk of ignition of any potential leak, it is essential that the tanker and tank are at the same electrical potential during the refilling operation. This can only be demonstrated if there is a properly engineered means by which tanker and tank can be electrically bonded together prior to offloading commencing.

Electrostatic protection is required for all LPG tanks, and an Improvement Notice should be considered where appropriate electrostatic protection measures are not in place. (See below:)

Code of Practice 1, part 2 makes no specific requirements for earthing of small vapour take-off vessels but reference is made to Code of Practice 1, part 1 for general issues such as vessel design and installation. Earthing provision is still a requirement for these smaller installations.

Vessels above 1 tonne capacity (2200 litres)

All LPG storage vessels above 1 tonne capacity should be permanently bonded to an effective earthing point to prevent the accumulation of static electricity. Generally, this will be achieved via an earthing rod. This earthing point should be located so as to facilitate connection to the bulk tanker via its own earthing/bonding cable before LPG delivery connections are made.

The electrical bonding should be mechanically sound and protected against foreseeable causes of damage (no excess wire length, not running across an
area required for access, etc). There should be test records to prove that the bonding point is effective. Tests should be frequent enough that the earth continuity is unlikely to be lost between tests. Tanker drivers should perform a visual check of the installation, including the earthing point, before commencing offloading.

**Vessels up to 1 tonne capacity**

As an alternative to the above method, a bonding connection may be provided on the tank itself to which the bulk tanker can directly connect its earthing/bonding cable before LPG delivery connections are made. Ideally, the bonding connection would be a dedicated brass or copper stud, but may be provided via a lifting lug or leg. In any case, it must be a corrosion-free and unpainted metal part via which the bulk tanker can achieve a secure electrical connection.

Where there is no evidence that a bonding clamp or other engineered electrical bonding means can be used effectively (e.g. clamp marks on thick paintwork or plastic parts etc.) then an Improvement Notice should be considered. A dedicated equipotential bonding connection point should be provided which can be proved as providing a good electrical connection with the tank. This should be accessible, and maintained free from corrosion which may impair its function.

**Buried or Mounded Tanks**

A bonding connection providing bare metal contact with the bonding cable from the LPG road tanker should be attached or connected to the vessel.

Buried earth rods should not be used or connected to buried or mounded storage vessels using cathodic protection, either for electro-static dissipation or for the earthing of electrical equipment. Electric pumps should be earthed through the electric supply system.

**Earthing Requirements**

Site earthing is required for all sizes of storage vessel when fitted with electrical equipment, with the primary requirement being protection against electric shock. The earth should be adequate to ensure that electrical protection devices operate in the event of a fault. BS 7671 provides guidance on this. Test reports should be available for inspection. This is not the same as the equipotential bonding required for the dissipation of static electricity.

**References & Further Information**

More detailed information can be found in:

Section 5 of the UKLPG Code of Practice 1, *Bulk LPG Storage at Fixed Installations; Part 1: 2009: Design, Installation and Operation of Vessels Located Above Ground;* Incorporating Amendment 1 May 2012 and
4. **Trees and Shrubbery within Separation Distance**

The expected standards regarding the proximity of trees, shrubs etc. to LPG installations are established within UKLPG Code of Practice 1 part 1 – 2009. In particular, the following requirements should be noted:

2.3.1.9 No part of the storage vessel should be located directly beneath any part of the structure of the premises or extension from it, for example roof eaves, car ports, etc., nor beneath overhanging tree branches.

2.3.1.10 Weeds, long grass, deciduous shrubs and trees, and any combustible material should be removed from an area within the separation distance for vessels not exceeding 1,1 tonnes LPG capacity, or within 6m for larger vessels. Chemical weed killers (such as sodium chlorate) or any other method which might provide a source of ignition should not be used in these areas.

2.3.1.11 Where a visual screen is required for above ground LPG vessels, this should be located at least 1m from the vessels and not interfere with access or ventilation. The screen should not obstruct more than 50% of natural ventilation around the vessel.

Several practical examples of types of visual screen are then given.

The Code of Practice no longer refers to the need for visual screens to be located a minimum of 6m away from vessels exceeding 2.2 tonnes.

In determining appropriate enforcement action, a judgement will always be required as to the extent of any departure from established standards, and the associated level of risk. The following factors should be considered in making such judgements.

- **Combustible Materials:** Trees, shrubs, grasses etc. have the potential to generate significant amount of combustible material. (e.g. through leaf-fall, or in drying out during summer months.) The accumulation of such materials, and the foreseeable event of them being involved in a fire could threaten the LPG installation and its contents. It is therefore vital that duty holders have adequate systems in place to minimise the potential for such materials to build-up within the minimum separation distances specified in Table 1 of UKLPG COP 1 Part 1 - 2009. This may require a robust systems for removal of weeds and long grass away from LPG tanks on a regular basis. The removal of combustible materials such as pallets and spent vehicle tyres also applies where they are allowed to build-up within the proximity of an LPG installation.
**Ventilation:** Even when trees and shrubs may be planted for aesthetic / screening reasons, around an LPG installation, they should not impair the availability of ventilation necessary around the installation. The Code of Practice allows for screening using evergreen shrubs and trees to a single side only. Shrubs and trees to multiple sides within the separation distance are likely to impair ventilation to an unacceptable degree, and should thus be removed.

The Code of Practice does now provide examples where multiple sides of the installation may be screened using various configurations of open ranch fencing and walls. There is the potential for the ventilation around the tank to be compromised where multiple sides are screened. Consideration should be given to the level of obstruction the screening provides and the potential for any leak or LPG to accumulate and not disperse. For example where two sides of a closed panel type fence or wall meet forming a corner.

Where visual screening is provided for larger vessels greater separation will be required between the screen and the vessel to ensure adequate ventilation.

Whatever type of screen is selected it should not obstruct more that 50% of the natural ventilation around the tank.

**Potential For Impact Damage:** High winds and other factors may cause trees branches to fall, which could cause significant damage to LPG tanks and pipework. Tanks should not be situated beneath overhanging branches, and steps should be taken to prune back any such trees.

**Potential for Damage to Buried Pipes:** Trees and shrubs may have extensive root systems, which could potentially cause damage to buried pipework, and in extreme cases to areas of hard standing etc. supporting bulk storage tanks. Inspectors should be aware of this issue when considering the proximity of trees and shrubs, and ensure that dutyholders have adequate arrangements to manage any such risks.

**Action**
Ultimately, the question as to whether trees, shrubs or other foliage represent such a severe hazards that HSE must insist on their removal requires the judgement of the field inspector.

Dense shrubbery, completely surrounding and very close to an LPG tank would both represent a serious fire risk and impair ventilation. As such this would be a clear issue merits enforcement action. However, the presence of a single evergreen tree to one side and some distance away from a similar tank would not necessarily merit the same response. Any enforcement decision should be made on the strength of specific risks relevant to the installation. It is not possible to provide definitive guidance for all circumstances.
APPENDIX 7: LIQUID PHASE SERVICE PIPEWORK

Background

LPG exists as a gas at normal temperatures and pressures, but can be liquefied under moderate pressure. The LPG will return to vapour if the pressure is released. Leaks from liquid phase pipework are considered more hazardous than those from vapour phase lines for the following reasons:

- Liquid phase lines operate at much higher pressures than vapour phase lines, typically 7bar for propane;
- Liquid phase LPG occupies approximately 1/250th of the vapour volume, so a relatively small leak from a liquid phase LPG supply can quickly produce sufficient vapour to create a flammable concentration.

Where an installation requires a liquid LPG feed, the storage and delivery of LPG will be in liquid form.

Applications

The use of liquid phase LPG is much more restricted than vapour-phase. In commercial and industrial premises, liquid phase supplies may typically be required for the following applications:

- As a fuel for motor vehicles (Autogas etc.) including retail road fuel outlets.
- As a fuel for fork lift trucks and similar plant.
- To supply large-scale burners having a high calorific output, in particular:
  - Grain driers
  - Kilns (e.g. brick manufacture)
- As a propellant for aerosols.
- For the filling of portable LPG cylinders.

Also, there are a small number of LPG distribution networks (metered estates) which use vaporisers to provide the needed gas volumes. These therefore have a liquid phase pipeline between the bulk storage tank(s) and the vaporiser. The pipework between the storage tank(s) and vaporiser is generally above ground.

LPG Installations and Associated Pipework

Irrespective of whether a liquid or vapour phase supply is required, supply tanks should be sited in accordance with the established separation distances for vapour phase LPG supplies. These are listed in UKLPG Code of Practice 1, Part 1: 2009, Section 2.

Within domestic and light commercial premises, such as pubs, restaurants and offices, installation pipework should not carry liquid phase LPG nor carry vapour at a nominal operating pressure greater than 37mbar. One indication
that a tank is supplying LPG in liquid phase is that the supply pipework may originate from the bottom of the storage tank, rather than the top.

<table>
<thead>
<tr>
<th>Pipework material</th>
<th>Above ground</th>
<th>Below ground</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cast iron</td>
<td>Unsuitable</td>
<td>Unsuitable</td>
</tr>
<tr>
<td>Copper</td>
<td>Unsuitable</td>
<td>Unsuitable</td>
</tr>
<tr>
<td>Polyethylene</td>
<td>Unsuitable</td>
<td>Unsuitable</td>
</tr>
<tr>
<td>Carbon steel</td>
<td>√</td>
<td>Not recommended*</td>
</tr>
<tr>
<td>Stainless Steel</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Proprietary systems</td>
<td>√</td>
<td>√</td>
</tr>
</tbody>
</table>

* Currently, UKLPG Code of Practice 22 permits the use of carbon steel below ground for liquid phase LPG. However, it is not the preferred option, and stainless steel or a suitable proprietary system should be encouraged. Where carbon steel is utilised for below ground liquid-phase supplies, it should be laid in a shallow open masonry or concrete lined trench, and must be protected against corrosion e.g. by zinc coating and painting and should be subject to a robust inspection regime. Where essential the trench can be backfilled with clean sand, in which case corrosion protection in the form of cathodic protection is essential; bitumen based wrappings alone are not sufficient.

**Proprietary Pipework Systems**
A number of proprietary systems are available which are suitable for liquid-phase applications. In particular, the BRUGG/Flexwell system is frequently used. Whilst designed for use in the retail fuel sector, its use is becoming more widespread in commercial applications. It is semi-flexible with inherent corrosion protection. The design-life of the product is considered by the manufacturers to be 30 years.

**Pipework Routing**

Where possible, liquid phase LPG service pipework should be located above ground. This enables the service pipework to be inspected more easily over its lifetime.

Pipework containing LPG in the liquid phase or the vapour phase at nominal operating pressures greater than 2 bar should not be routed into or through buildings unless necessary for process purposes, e.g. aerosol filling, engine testing, in that building.

Wherever liquid phase LPG may be trapped e.g. between closed valves or check valves, protection against the pressure exceeding the design pressure of the system should be provided. Further guidance is provided within UKLPG Code of Practice 22, *LPG Piping System – Design and Installation*.

Where pipework carrying liquid phase LPG is installed below ground, the following apply:

**Below Ground Liquid Phase Pipework**

- The pipework design should make allowance for any additional loading or constraints imposed;
- Corrosion protection should be provided where necessary, for example, cathodic protection;
- Piping should be run, adequately supported and laid, in a shallow open concrete or masonry lined trench with open grid covers, where necessary, to allow safe movement of pedestrians;
- If necessary, trenches may be backfilled with an inert, non-corrosive material free from abrasive particles likely to damage corrosion protection;
- Protection should be provided in the form of load bearing slabs or covers for those sections of trench over which traffic passes or where superimposed loads will occur;
- All pipe joints should be welded;
- As an alternative to running a liquid filled pipe in a concrete or masonry trench, the pipe may be run within a separate pipe sleeve. This sleeve should be sealed to the inner pipe at both ends and the space between the two should be monitored to detect leakage, normally by detecting a pressure change. The outer sleeve should terminate above ground or in a suitable inspection pit;
- Isolation valves should be provided at both ends of the underground section;
• The route of the pipe-run should be recorded and, where practicable permanently marked;
• Piping conveying inert or flammable liquids may be laid in the same trench, but those containing corrosive substances, toxic materials or steam should not be;
• It is recommended that electric cables are not laid in the same trench as LPG piping. Electric cables may be laid in the same trench if protected by an outer pipe or sleeve.
• Pipelines, fittings and hoses conveying liquid phase LPG should have electrical continuity and be effectively connected to earth. This may mean the fitting of electrical bonding straps across connecting joints.

Additional Information: Grain Dryers

UKLPG publish an information sheet containing recommended safe practice in the use of LPG fired grain dryers. This is available at:

http://www.uklpg.org/uploads/DOC4D42E4EE3FE73.pdf