

Medium pressure ductile iron gas pipes not owned by major gas distribution networks

OC 438/4

Version 2

Target Audience:

FOD staff

HID Specialised Industries Gas & Pipelines Unit

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Description

This OC sets out the background and risks associated with medium pressure (75 mbar – 2 bar) ductile iron (MPDI) gas pipes, which may be found in premises and networks not operated by the major gas distribution networks. It advises inspectors on action that should be taken and sources of technical support. The attached Information Document may be given to enquirers and brought to the attention of employers and site owners where these pipes are or could be found. This OC has been revised to reflect major structural changes in the gas industry in July 2005.

Background

Iron gas distribution mains have a known history of failure. Cast iron mains can fail unpredictably through fracture if exposed to excessive loading e.g. heavy traffic or ground movement. Ductile iron pipe, which was introduced in the 1970s in response to problems with cast iron, has greater strength and flexibility, but was later found to fail unpredictably through corrosion. When this happens, there is a risk that the gas will track into adjacent properties and ignite. Properties located more than 30 metres away from mains are not considered at risk.

Ductile and cast iron is no longer used. All low and medium pressure mains are now made from polyethylene or steel.

Medium pressure ductile iron (MPDI) gas pipes may have been used in networks throughout the UK that were not operated by the major gas distribution networks. Their use has varied but it is more likely to be found where there is higher gas consumption or where there is a more extensive downstream gas network e.g. hospital boiler houses, industrial gas fired processes or where there are a number of gas supplies to separate premises. The risks arise from buried pipe where corrosion can take place un-noticed.

Until July 1995, Transco operated the majority of the public gas network. However, they sold 4 of their eight distribution networks and there are now five major gas distribution networks nationally. A number of models have been developed since the late 1970s to prioritise replacement of iron gas pipes. However, in 2002 HSE and the gas industry recognised that medium pressure ductile iron (MPDI) gas mains within 30 metres of buildings presented a high risk. Therefore, HSE served an Improvement Notice on Transco that accelerated the programme of replacement of MPDI. All known MPDI gas distribution mains in the networks operated by the major gas distribution networks in the UK were decommissioned by mid 2003.

However, at certain premises, gas may be conveyed around the site in buried MPDI pipes that did not belong to Transco and is not now owned by the new operators. In 2002, Transco identified specific sites where they suspected MPDI was present and also generic types of site that may contain such pipes. However, they recognised their records may not be comprehensive.

The types of site identified ranged from large industrial complexes with significant gas use, to hospitals, universities, MOD premises and prisons. Some local authorities may own networks supplying their own housing stock.

FOD/HID demarcation issues are not straightforward so in 2002 a joint project was set up to address this concern. HSE sent letters to sites identified by Transco; many of these sites reported that they did not have MPDI. A press release in the trade and technical press highlighted the issue and central contacts were made to local authorities, health and government sectors. This work identified a further 16 sites with MPDI and some sites with MPCI. All sites with MPDI were followed up to ensure suitable action was taken.

However, Inspectors may still become aware of other sites that potentially contain MPDI or may receive enquiries about this matter. The attached information document sets out key facts and guidance for further action. These sites will generally take their gas supply from the public network in a meter house at the site boundary and then distribute it via underground pipework to buildings on the site where it is used. Site occupiers/owners should establish the operating pressure and materials of construction of gas pipes and assess the risks, particularly where iron pipework is suspected. They may need to obtain competent advice. Where MPDI pipes within 30m of buildings are identified, a short-term replacement programme should be agreed. Risks from other ductile or cast iron pipes (particularly MPCI) should also be considered.

Enforcement Policy

Actual Risk

The actual risk from MPDI pipework to occupants of buildings within 30 metres is of possible multiple serious personal injuries (unless the building is lightly occupied) resulting from ignition of a gas leak in the building.

Benchmark

The benchmark standard is that MPDI pipework is taken out of use. If it is replaced with pipework from more suitable material e.g. polyethylene or steel then the outcome of a gas leak would be the same but the likelihood is now remote. The standard is well understood and agreed in industry and with HSE and has been supported by research; it is therefore established.

Risk gap

The risk gap is substantial for multiple casualties. Circumstances where there is a risk of only a single casualty are unlikely.

Initial enforcement expectation (IEE)

The initial enforcement expectation is an Improvement Notice where multiple casualties may be expected; if, in rare circumstances, potentially there would only be one casualty the IEE is a letter.

Dutyholder factors

Dutyholders may be aware of previous advice through the press release or the central contacts referred to above.

Strategic factors

Vulnerable groups may be at risk in buildings such as hospitals.

There is an expectation of consistency with enforcement action having been taken against Transco and others to ensure timely action. Therefore an Improvement Notice would be expected. Lack of formal enforcement would have a negative effect on these dutyholders.

Technical Support

Technical advice e.g. to support enforcement action, may be sought from HID Gas & Pipelines Unit.

Health and Safety Executive

Information Document

Medium Pressure Ductile Iron Gas Pipes

Introduction

This document contains guidance on managing the risks from medium pressure ductile iron (MPDI) gas pipes (pressure = 75 mbar – 2 bar). The guidance is considered good practice but is not compulsory. You may find it useful in deciding what to do to comply with the law. However, the guidance may not be applicable in all circumstances and any queries should be directed to the appropriate enforcing authority.

Gas is supplied to houses, factories and other sites via the public gas network, in most cases owned and operated by one of five major gas distribution companies or smaller independent gas transportation companies. This network supplies gas up to a primary meter. [A primary meter is the first gas meter within a premises]. After the primary meter, within some larger sites, there may be a network of gas pipes that supply gas to various buildings or processes. In some cases, this pipework can be very short, for example straight to a boiler, or may be extensive supplying a number of premises and appliances.

This network is not owned or operated by one of the gas companies and is the responsibility of the site owner.

Legal requirements

The Management of Health and Safety at Work Regulations 1999 require employers to carry out a suitable and sufficient risk assessment of their activities. They have a duty to assess the risks of their gas network to employees and members of the public.

The Health and Safety at Work etc Act 1974 requires employers and those in control of premises to control risks to their employees and others so far as is reasonably practicable.

Certain premises (e.g. domestic premises, commercial premises, hospitals, universities etc) are subject to the Gas Safety (Installation and Use) Regulations 1998 (GSIUR) which apply to pipework downstream of the first emergency control valve (first one accessible to gas users) on the site. One of the requirements of these Regulations is that employers maintain gas installation pipework in a safe condition.

The Pipeline Safety Regulations 1996 apply to pipework upstream of the emergency control valve and also impose duties to maintain gas pipework. These were amended by the Pipeline Safety (Amendment) Regulations 2003 (which came into force in November 2003) to specifically address iron gas pipes. They allow duty holders to prepare a programme for decommissioning iron pipes, which, if suitable and sufficient, has to be approved by HSE. HSE may also prepare and approve such a programme where the operator has not prepared one.

In addition, there may be a duty under the Gas Safety (Management) Regulations 1996 [GSMR] for duty holders to prepare a safety case, which has to be accepted by HSE. This depends on whether the pipework is a 'network' as defined by GSMR. For example, pipes downstream of an emergency control valve are not part of such a network. HSE can give advice on the application of GSMR. The arrangements for maintaining the gas pipes would form part of the safety case.

Hazards

Iron gas mains have a known history of failure and gas releases associated with these failures can affect premises within 30 metres. These can lead to serious fires and explosions. There have been a number of agreements over the years between HSE and with the major gas distribution networks to prioritise removal and replacement of these mains. This was formalised and in 2002 when HSE published its enforcement policy for the replacement of iron gas mains within 30 m of premises which required at risk mains to be decommissioned within 30 years. [The Health and Safety Executive's Enforcement Policy for the replacement of iron gas mains]. This policy was reviewed in 2005, revised where necessary and republished to cover the period 2006 – 2013. [The Health and Safety Executive's Enforcement Policy for the replacement of iron gas mains 2006 – 2013].

Ductile iron pipe was introduced in the early 1970's to replace cast iron. It was supplied in diameters of 4" diameter (100mm) and upward; the joints are of a bolted gland design. The surface of the material has a slightly dimpled appearance and is usually coated in a light black tar enamel finish. Due to the material strength of ductile iron compared to cast iron it was produced in a thinner wall thickness than cast iron. However, this material can corrode underground through the complete wall thickness within 12 years of installation. As underground conditions are not homogenous it can therefore be hard to predict the condition of such mains at any particular location. When ductile iron corrodes it forms a plug of corroded material that can be dislodged by natural ground movement and internal pressure. Such failures have been found to release significant amounts of gas in systems operating at pressures above 75 mbar. When such failures occur the gas can travel underground and into premises up to 30 metres away.

Because of this specific risk from MPDI mains, HSE required the major gas distribution networks to decommission all MPDI gas mains in the UK by mid 2003.

Networks containing MPDI pipes may be found where separate buildings (which would include a separate meter/regulator housing) on the same site have a gas supply. They should not be found within buildings. Most of these networks were installed in the late 1960s and 1970s and none after 1989.

Cast iron pipes have been used for transporting gas since the early 1900's. It has a rough surface and was supplied in diameters from 2" upwards. This material has a very low strength in tension and can fracture due to disturbed ground conditions or due to ground movement. It can be subject to graphitic and fissure corrosion, which can weaken the pipe and cause failures. When such failures occur the gas can travel underground and into premises up to 30 metres away.

Action

The Health and Safety Executive (HSE) announced an initiative in 2002 to identify and reduce the risks posed by gas networks not operated by the major gas distribution companies and in particular, the risks associated with networks containing MPDI. Owners of gas pipework should check the operating pressure and materials of construction of their pipes and assess the risks. In particular, it is important to identify whether there are cast iron or ductile iron mains within 30 metres of buildings.

Where found, the risk should be reduced or controlled. This may mean replacing all or parts of the network or other measures that reduce or control the risk, based on the findings from the assessment.

MPDI pipes have a higher risk and normally should be replaced as soon as practicable. This timescale will depend on a number of factors but may include issues such as the extent and complexity of the network, logistical difficulties associated with planning and organising the work, availability of contract labour, availability of pipes and so forth.

Further Guidance

Site owners may not have complete records for their gas installation and expert help may be required to establish the materials in the network and the risks posed. Organisations such as the Institution of Gas Engineers and Managers, the Pipeline Industries Guild and CORGI all maintain registers of consultants and companies that are competent to carry out gas work.

The amount of work needed to establish what materials are present in the buried part of the network needs to be proportionate to the risks posed. Risks are greatest for networks operating at pressures above 75 mbars within 30m of property. Therefore initial investigations should focus on this part of the network. Where records do not exist or are insufficient then an appraisal of the materials needs to take place.

The appraisal can use any existing local information such as date of construction of buildings, date of installation of boilers and sizes of pipework. For example if the date that the network was laid is known then this can give some indication as to the likelihood of certain materials being present:

- a) Cast iron was commonly laid in networks 2" in diameter and above up to around the 1970's.
- b) Ductile iron was laid between the late 1960's and the late 1980's in diameters of 4" (100mm) and above.

Examining the material at the meter connection may also give clues to the type of material present.

When networks operating at above 75 mbars have been examined a check on lower pressure networks can take place.

The surface appearance, the type of coating and the type of joints can all help to establish the type of material used. For example, where a pipe is uncovered in more than one location and the material and size is established as the same in each location, then it is reasonable to assume that this would be the material between the uncovered locations. Therefore, every inch of material does not need to be examined but more work will be required where the uncertainty is higher.

Other materials such as steel, PE and copper have been used in gas networks. The failure modes of these other materials do not present the same risks as cast and ductile iron. A generic assessment of such networks may therefore be possible. Records of material failures should be kept and the dutyholder's safety management system should identify problem areas that subsequently arise.