1 INTRODUCTION

Construction and development activities in the vicinity of underground gas pipelines can introduce additional risks to Gas Networks Ireland's gas transmission system.

Installations such as wind turbines, solar installations, battery farms, railway electrification, high-voltage transmission cables and other electrical infrastructure may have impact on the integrity of a gas pipeline or even cause its failure. Gas Networks Ireland recognises the necessity to accommodate neighbouring electrical installations and infrastructure once proper precautions are respected and the risks for the gas infrastructure remain acceptably low. These guidelines provide general requirements to prevent mechanical and electromagnetic harm to the gas transmission system from neighbouring electrical installations or infrastructure.

1.1 Communication

It is advisable to establish a communication framework with Gas Networks Ireland in order to keep both parties informed about operational changes or emergencies that may affect the safety of either the electrical installation, infrastructure or the gas pipeline. Prior to any plans regarding the placing electrical installations or infrastructure, Gas Networks Ireland must be contacted in order to confirm the exact location of the pipeline in relation to the planned electrical development.

Please be aware that Gas Networks Ireland need a considerable amount of notice in relation to developing electrical installations or infrastructure in proximity to our transmission assets. To avoid any unnecessary delays, please contact Gas Networks Ireland at the earliest opportunity.

1.2 Rights of Access

Gas Networks Ireland have wayleaves in place on its transmission pipeline network, placing a legal burden on the title of the property within which it exists and is noted as such on the relevant land registry folio. This wayleave can extend up to 9 m either side of the pipeline. The wayleave must be kept free from construction and obstruction to make sure that Gas Networks Ireland can always gain access when required to carry out surveillance, maintenance or in the event of a pipeline emergency. Please consult the conditions which are outlined in Gas Networks Ireland's '*Code of Practice for Working in the Vicinity of the Transmission Network (AO/PR/127)*' relating to the width of access routes and other restriction details that apply when working near to gas pipelines before designing the layout of your electrical installations.

1.3 Contact Details

For more information, and to send us information during design or before you start work, please contact the Gas Networks Ireland Dial before You Dig team on:

- 1800 42 77 47
- DIG@gasnetworks.ie

- DBYD, Gas Networks Ireland, Gasworks Road, Cork, T12 RX96

2 BEFORE WORK STARTS

2.1 Safe Distances

Generally, it is preferred that neighbouring electrical installations or infrastructure do not cause any electrical interference to the high-pressure gas pipeline. The best way of preventing the pipeline being affected by external factors is to ensure that there is a safe distance between the electrical installation/ infrastructure and the buried pipeline. Note that the safe distance will vary from site to site and is dependent on the possible magnitude of the electrical interference under normal and fault operating conditions. It is also dependent on the existing levels of electrical interference on the pipeline that may exist and the soil resistivity.

The location of the electrical installation or infrastructure must not lead to a significant increase in the risk posed to Gas Networks Ireland's buried pipelines. If the safe distance cannot be met, then the location of the electrical installation or infrastructure will only be acceptable after an evaluation of all potential risks and written approval from Gas Networks Ireland.

2.2 Development Planning

In the early stages of planning; and before any work starts near Gas Networks Ireland assets, contact must be made with Gas Networks Ireland Dial Before you Dig Service and the relevant processes followed as outlined in Gas Networks Ireland's '*Code of Practice for Working in the Vicinity of the Transmission Network (AO/PR/127)*'.

3 ELECTRICAL INSTALLATIONS AND PIPELINE CATHODIC PROTECTION

Gas Networks Ireland apply cathodic protection[1] to its steel transmission pipeline systems to protect against corrosion. Gas Networks Ireland's policy for managing and maintaining its cathodic protection system is in line with the requirements of *EN 12954*. Stray currents from electrical installations can have an adverse effect on the cathodic protection system and its ability to protect the buried steel pipelines from corrosion. The main concern for Gas Networks Ireland is the impact of the electrical installation or infrastructure, on the cathodic protection system and its ability to protect the steel gas pipeline from corrosion and voltage hazards.

To ensure that electrical designs in the vicinity of Gas Networks Ireland's buried pipelines do not reduce the effectiveness of existing cathodic protection system on the buried steel pipelines, please consider the following when designing the layout of the electrical infrastructure:

1 Cathodic protection is an electrical system applied to the pipeline to control corrosion by reducing the pipeline's electrical potential. This is achieved through a variety of system designs and will differ depending on the natural and built environmental conditions.

- Alternating Current (AC) Interference
    - Under normal conditions, the interference between high voltage cables and the pipeline can contribute to an acceleration of corrosion damage to the pipeline due to the induced voltage.
    - Under fault conditions, elevated potentials of the surrounding soil causing an increased potential difference can lead to coating damage, pipeline damage, unacceptable step and touch potentials with the associated risk of electric shock.
    - Pipelines can be adversely affected by the temperature of the surrounding soil. The soil temperature can be affected by heat transfer from current carrying buried cables. Coating degradation, increased corrosion rate or thermal stresses are possible consequences. This generally applies to high voltage cables.
- Direct Current (DC) Interference
    - DC interference may affect the integrity of pipeline systems with areas of particular concern relating to power sources that can provide significant DC fault currents (e.g. high voltage DC systems, rail traction systems, battery energy storage sites and solar farms).
    - It is important to establish the DC fault current magnitude including the frequency and duration of faults at locations in close proximity to buried pipelines as this will determine the accelerated corrosion risk.
    - Bipolar high voltage DC (HVDC) systems should be given preference to avoid stray current interference although it should be noted that some bipolar systems can operate in monopolar fault conditions for extended periods and that the stray current corrosion risk to the pipeline can be significantly increased.
    - The earthing of HVDC systems should be designed in such a way as to avoid current flowing through the earth during normal operation and to minimize earth current during fault conditions or unbalanced load conditions.
- For the installation of grounding systems, the developer should consider the effects of earth leakage and fault conditions on the steel gas pipeline.
- A risk assessment showing the impacts of the effects of a rise of earth potential (touch/ step) and possibility of voltage exceeding the dielectric strength of pipeline coatings which may have consequential damage to the pipeline or its coating shall be carried out.

3.1 Impact Upon Pipeline Cathodic Protection

In order to assess the impacts of electrical installations and infrastructure on the pipeline's cathodic protection system, Gas Networks Ireland may wish to undertake pre-construction and post-construction monitoring. The potential for AC or DC interference could increase under fault conditions or after a period of time if some degradation of the electrical installation components or cabling insulation occurs (this is particularly relevant for solar power systems).

Depending upon the perceived risks of the above and/ or the result of any initial monitoring undertaken, Gas Networks Ireland may wish to install long term monitoring systems in order to detect any impact which may compromise the cathodic protection system. The costs of any monitoring systems and any remediation works that are deemed necessary would be expected to be recharged to the developer of the electrical installation.

Please note that formal planning permission from the relevant local authority does not take account of the hazards that the electrical installation or infrastructure may pose for the buried pipeline. Obtaining planning permission should not therefore be seen as confirmation that legal duties under the Safety, Health and Welfare at Work legislation have been met.

3.2 High Voltage Systems

3.2.1 Overhead AC Cables

Under fault conditions, elevated potentials of surrounding soil causing an increased potential difference (towards the pipeline) can lead to coating damage. During fault conditions, damage to the pipeline or its coating can occur if the voltage between the pipeline and surrounding soil becomes excessive. The threshold value for acceptable interference is dependent upon the pipeline coating type.

3.2.2 Buried AC cables

In general, the level of interference from buried AC cables is lower and is dependent on the type of construction, sheathing, conduit and formation (flat, trefoil etc.). Trefoil configuration may offer some level of electromagnetic field cancellation.

3.2.3 Cable Crossings

Where a cable is to cross over the gas pipeline the clearance distances shall be maintained as outlined in Gas Networks Ireland's '*Code of Practice for Working in the Vicinity of the Transmission Network (AO/PR/127)*'. Wherever possible cables should cross the pipeline at 90 degrees.

The voltage, formation and ducting arrangements of the cable crossing should be communicated to Gas Networks Ireland. It is preferable for the cable ducts/ conduits to be non-metallic, dry and sealed. By keeping the appropriate distances, unacceptable risks regarding high voltage interferences are generally avoided. If the safe distances cannot be met, a risk assessment showing the impacts of the effects of the installation/ infrastructure on the pipeline should be submitted to the Gas Networks Ireland for consideration at the completion of the design phase and prior to the commencement of any construction works.

3.3 Solar Installations

In general, a distance equal to 200 m is considered sufficient to assure proper cathodic protection in the case of undiagnosed malfunction of the solar installation[2]. If this distance cannot be met, then the placement of the installation should only be acceptable after evaluation

2 As outlined in Macrogaz publication 'General practices for managing risk increasing structures in the vicinity of high-pressure gas pipelines' (WG-TP-162).

of all potential risks and with the approval of Gas Networks Ireland. Therefore, it is important that the Gas Networks Ireland is contacted at the earliest possible stage in the project in order to ensure that all of the requirements of this document are fully understood.

The siting of the solar installation should also take account of hazards to the pipeline that might occur during the construction of the solar installation including access for construction vehicles; lifting operations and the construction of the foundations for the solar panels. Further details regarding the precautions that are required during the construction activities are detailed in Gas Networks Ireland's '*Code of Practice for Working in the Vicinity of the Transmission Network (AO/PR/127)*'.

3.4 Wind Turbines

Similar to the solar installations, wind turbines can result in electrical interference with the pipeline's cathodic protection system. It is important that the Gas Networks Ireland is contacted at the earliest possible stage in the project in order to ensure that all of the requirements of this document are fully understood.

Additional risks from wind turbines include damage to the pipeline caused by a failure associated with the operation of the wind turbine, (e.g. a turbine blade failure) and direct/ indirect vibration on the gas pipeline, both of which could result in damage to, and/ or failure of, the pipeline. One of the principal ways of preventing damage to the pipeline is by ensuring that there is adequate physical separation between the wind turbine and the buried gas pipeline. *IS 328: Gas transmission — Pipelines and pipeline installation*s identifies an appropriate exclusion zone for wind turbines around transmission pipelines to be two (2) times the turbine mast height.

3.5 Battery Energy Storage Sites (BESS)

In recent years some developers have planned to install battery storage so that energy can be stored during low power demand periods and to provide extra power to stabilise the electrical supply voltage on the national grid or to provide short term power capacity. These sites can consist of a large number of batteries with some newer sites planned to have the ability to provide in the region of 300 MW of power. In the event of a DC current fault to ground significant current levels can flow and there would be the potential to cause damage to buried metallic utilities nearby as a result of a short-term interference event.

3.6 Railways (DC & AC)

3.6.1 DC Railways

In a DC electrified traction system, the rails are one of the main sources of electromagnetic disturbance to a buried steel pipeline's cathodic protection system. The main electrical role of the rails is to form the current return circuit. However, due to the imperfect insulation of the return circuit versus earth, the currents flowing in the running rails can 'leak' to the ground and affect the cathodic protection system of the pipeline, which offers a low electrical resistance path for the current. Due to this, the cathodic protection system of the pipeline may need to be adapted with specific measures to mitigate the risk of corrosion. The preferred solution is to avoid using direct bonds (*EN ISO 21857*).

3.6.2 AC Railways

The induced voltage by AC railway overhead lines is similar to the influence caused by AC high voltage lines. In addition to this influence, the return circuit for the current is intended to flow in earthing systems along the tracks and any metallic infrastructure in the vicinity of such railway might experience influences that could lead to corrosion risks.

3.7 Other Electrical Infrastructure

Other such electrical infrastructure (e.g. new power generation/ peaking stations, electrical substations or DC-AC converter stations) can also result in AC or DC interference and have an impact on a steel pipeline's cathodic protection system. As previously outlined, it is important that the Gas Networks Ireland is contacted at the earliest possible stage in the project in order to ensure that all of the requirements of this document are fully understood.

4 SUMMARY

Planning	• Contact Gas Networks Ireland at the earliest oppurtunity
Design	• Ensure the siting requirements in this document are observed and that the impacts upon the gas pipeline are minimised
Pre-Construction	• Ensure that Gas Networks Ireland has agreed all working methods and gas pipeline protection measures • Inform Gas Networks Ireland when the contruction is scheduled to start
Construction	• Observe all of Gas Networks Irelands requirements for working in the vicinity of gas pipelines • Ensure that Gas Networks Ireland is present for any activities it has requested to observe • Report any accidental damage to the pipeline no matter how minor
Post-Construction	• Notify Gas Networks Ireland when construction has been completed
Emergency	• Contact Gas Networks Ireland on 1800 20 50 50 • Evacuate people in the immediate vicinity of the incident

5 REFERENCED DOCUMENTS

Document Title	Document Number
Code of practice for working in the vicinity of the transmission network	AO/PR/127