



**General practices for managing external interference on
underground pipelines**

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1. SUMMARY

Knowing that the risk related to gas transmission is very low, it is also known that "Third Party Interference" (TPI) is still the major threat to underground pipelines. MARCOGAZ aims for further reduction of that threat and strongly stimulates further improvement of all kinds of barriers against third party interference, including legislation regulating soil penetration activities. This document aims to present an overview of general guidelines and practices that reduce the risk of pipelines to be damaged by external phenomena. Most of the documents that are referred to, can be summarized in the table below:

External threats	Documents contributing to enhancement of Barrier performance
(Third) party interference	"General practices for managing external interference on underground pipelines" [WG_TP-121, this document]
	"Third Party Interference – Best Practice Self-Assessment" [WG_TP-104]
	"Guidelines for a "plan request" system to avoid third party damage" [WG_TP-156]
	"Guidelines for safe working in the vicinity of high-pressure gas pipelines" [WG_TP-144]
	"Guidelines for stakeholders management regarding third party interference" [WG_TP-161].
	"Root Cause Analysis for External Interference Incidents" [WG_TP-71]
Third party infrastructure	"General practices for managing risk increasing structures in the vicinity of high-pressure gas pipelines" [WG_TP-162]
Natural hazards	"How to deal with the risk of natural hazards to pipelines and other gas infrastructure facilities" [GI_TP-17-06]
External corrosion	"General practices for managing external corrosion on underground pipelines" [WG_TP-72] [under construction]
	"Evaluation Strategies for managing external corrosion on hard-to-pig pipelines" [WG_TP-140] [under construction]
	"General practices for managing external corrosion on gas installations" [under construction]

In spite of all preventive measures and a pro-active approach, an incident cannot be excluded. MARCOGAZ document "*Informative note on Gas Emergencies*" [GI-TP-13-01] provides more information regarding the possible consequences of an incident.

To support transparency and common understanding, often used terms and definitions are summarized in the MARCOGAZ document "*Terms and definitions related to external interference on underground pipelines*" [WG_TP-139].

Increasing awareness and associated methods will contribute to an enhancement of the already high safety level of the gas transmission by pipelines.

2. INTRODUCTION

MARCOGAZ document GI-TP-08-17 on "Gas Transmission Pipeline Safety", explains that pipeline safety reaches a high level since safety is taken into account all along the life-cycle of the asset. This document identifies a number of dominant threats.

The present paper gives a high-level overview of managing the pipelines integrity with regard to the threat of external interference. It focuses on the measures taken by Transmission System Operators (TSO's) to prevent external interference.

According to the EGIG¹ (European Gas Pipeline Incident Data Group) database external interference or third-party interference (TPI) is the primary threat to the integrity of pipeline infrastructure. The EGIG database is a reliable source of information that is used to establish pipeline failure frequencies and to analyse causes of failures in the gas transmission pipeline systems.

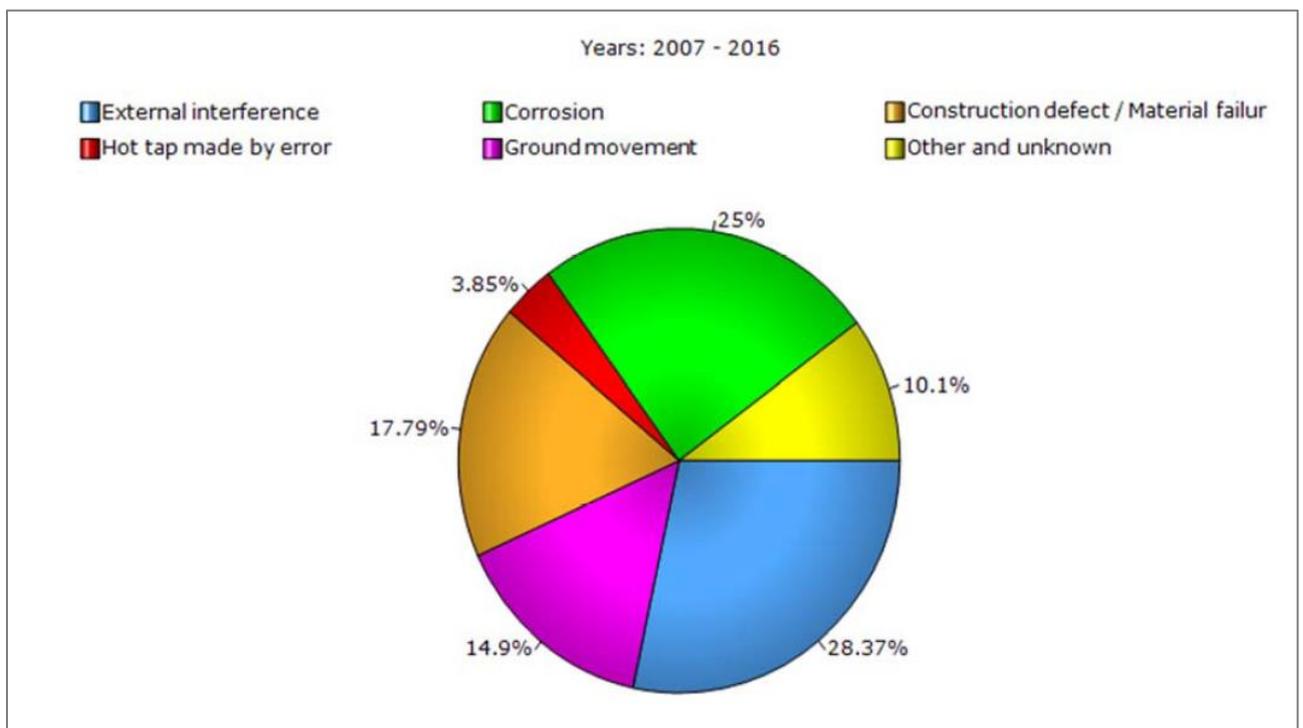


Figure 1 - Distribution of incidents (EGIG gas pipeline incident 10th report, 2007-2016)

The terms "External Interference", "Third Party Interference" and "Third Party Damage" are often used for all incidents involving own operator's personnel (oftentimes referred to as "first party" excavation damage), or the operator's contractor (oftentimes referred to as "second party" excavation damage), or people or contractors not associated with the operator (oftentimes referred to as "third party" excavation damage). However, it is of utmost

¹ www.egig.eu

importance to register and report these categories separate from each other because measures to improve performance might differ significantly.

Incidents caused by external interference are characterised by potentially severe consequences and are the greatest risk to public safety. Such incidents could lead to negative publicity, criticism of stakeholders and local authorities on safety for future activities, public protest campaigns delaying operation start of new pipelines and high technical demands and costs on pipeline construction.

Figure 2 displays the *failure frequency* in function of the initial cause of the incident and the *leak size*. Leak sizes are categorized as follows:

- **Pinhole/crack:** the effective diameter of the hole is smaller than or equal to 2 cm ($\varnothing_{\text{hole}} \leq 2\text{cm}$);
- **Hole:** the effective diameter of the hole is larger than 2 cm and smaller than or equal to the diameter of the pipe ($2\text{cm} < \varnothing_{\text{hole}} \leq \varnothing_{\text{pipeline}}$);
- **Rupture:** the effective diameter of the hole is larger than the pipeline diameter ($\varnothing_{\text{pipeline}} < \varnothing_{\text{hole}}$).

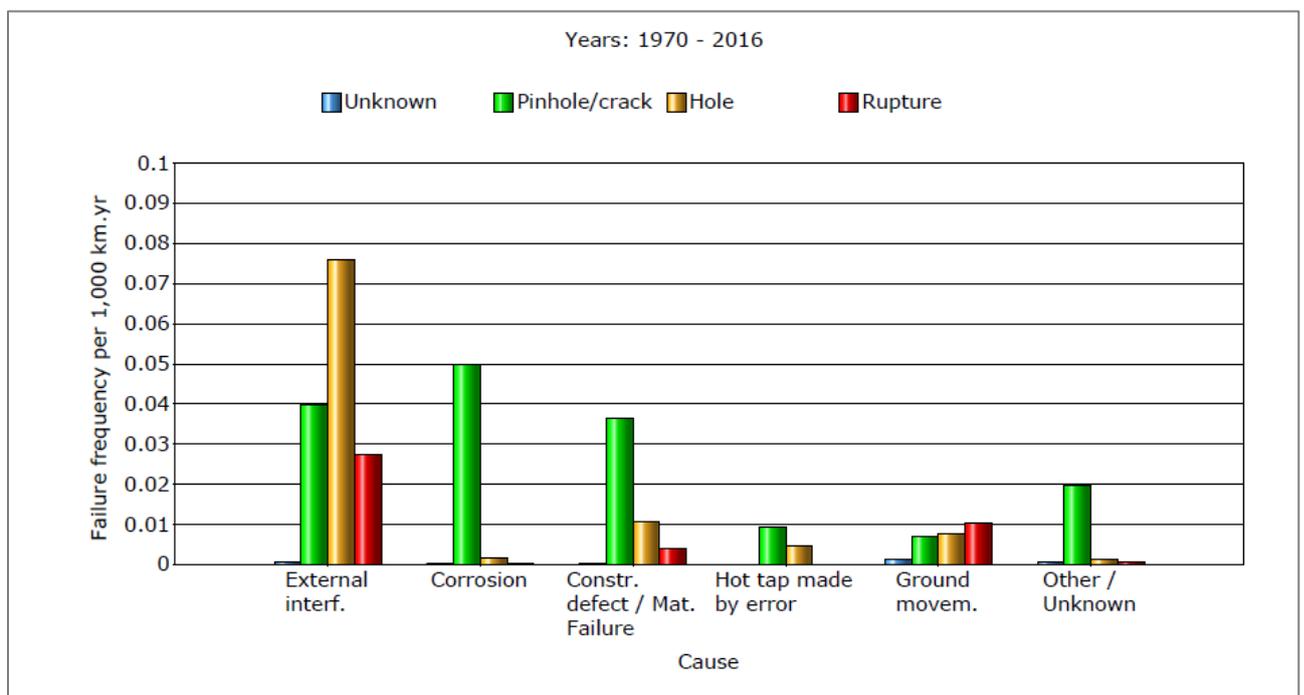


Figure 2 - Relation primary failure frequency, cause and size of leak (EGIG gas pipeline incident 10th report, 2007-2016)

From figure 2, we can conclude that external interference causes mainly holes and ruptures in pipelines. And by far, 'external interference' is the main cause of holes and ruptures of pipelines.

It should be considered also that the not as "external interference" classified origin of incidents reported by EGIG, like "hot tap made by error" and some causes for "ground movement", could be a result of 'external interference'. This increases the relevance of "external interference" even more.

The design parameters, like pipeline diameter, depth of cover and wall thickness have also an influence. From the EGIG 10th report we can see that:

- The depth of cover is one of the leading indicators for the failure frequencies of pipelines. Pipelines with a larger depth of cover have a lower primary failure frequency for external interference.
- Pipelines with a greater wall thickness have a lower failure frequency for external interference. Greater wall thickness leads to greater structural strength and hence these pipelines resist better to a shock.
- Large diameter pipelines are less vulnerable to external interferences than smaller diameter pipelines. There might be several explanations for this: small diameter pipelines have on average less depth of cover and can be more easily hooked up during ground works than bigger pipelines, their resistance towards external threats is often lower due to thinner wall thickness and might be found more frequently in urban areas where third party activity is generally higher.

3. THIRD PARTY INTERFERENCE - PREVENTION

Transmission pipelines shall be designed according to recognized standards. The EN1594², national standards and, in some countries, national legislation currently require pipeline operators to take a number of measures to reduce the likelihood of third-party interference. The national legislation may differ among European countries and may be influenced by cultural, historical and geographical factors. But the goal that the different legislations have in common is to prevent that construction and operation of gas transmission assets results in unacceptable risks to health, safety and the environment.

Typical prevention measures include:

- Routing pipelines away from populated areas,
- Marking of pipelines with marker posts,

² EN1594 - Gas infrastructure. Pipelines for maximum operating pressure over 16 bar. Functional requirements

- Underground warning tape,
- Using pipes with greater wall thickness in built up areas,
- Providing additional mechanical protection (e.g. concrete slabs) in vulnerable areas,
- Marking out of the pipeline and supervision of work,
- Liaison with land owners and other key stakeholder groups,
- Third party enquiry processes (including one call systems in some countries),
- Pipeline surveillance

4. THIRD PARTY INTERFERENCE - SELF ASSESSMENT

European gas operators have multiple safety measures or “barriers” in place to minimise the likelihood of external interference. This has resulted in a decreasing number of accidents caused by TPI during the last 40 years (see EGIG³). Nevertheless, damages to the infrastructure by TPI remain a key safety issue. The gas pipeline operators continue to monitor the existing good practices and, where possible, to improve the systems they have in place.

In order to assist pipeline companies in reviewing their systems and manage the risks associated with external interference (TPI), the document [WG_TP-104] “*Third Party Interference – Best Practices Self-Assessment*” has been prepared by MARCOGAZ. This document comprises an inventory of practices which are barriers against TPI. It is intended as a self-assessment tool or an internal audit for the prudent gas pipeline operator.

It should be noted that not all the barriers may be appropriate for every company. There may be national requirements that may replace or negate the need for some of the requirements within this document. There may also be local, cultural or geographical reasons why some of the barriers are not appropriate for individual operators. Therefore, the importance or relevance of having specific barriers to prevent Third Party Interference may vary per pipeline operator company.

5. MARCOGAZ RECOMMENDATIONS TO PIPELINE OPERATORS

On 25th and 26th October 2016, a MARCOGAZ workshop on TPI was held. The aim of this workshop was to propose recommendations allowing to decrease the number of Third-Party

³ www.egig.eu

Works (TPW) incidents. Thirteen recommendations were listed by the group of experts. After prioritizing, the "top five" was selected for further working-out.

The five recommendations are listed below:

1. Pipeline operators should **share information and best practices**, including new technologies, between TSO's within MARCOGAZ. For that purpose, the MARCOGAZ document [WG_TP-104] "*Third Party Interference – Best Practice Self-Assessment*" has been prepared.
2. Transmission pipeline operators should have **a written procedure "How to dig / How to work near pipelines"** in order to act appropriately in case of dangerous excavation activities that may damage their pipelines. More details about this subject are specified in MARCOGAZ document [WG_TP-144] "*Guidelines for safe working in the vicinity of high-pressure gas pipelines*".
3. Pipeline operators should thoroughly **investigate all incidents related to external interference** in order to learn from these events and improve safety. Incidents, and even near misses, caused by excavation, piling, groundworks and ploughing but also other activities or construction works near the pipeline should be assessed according to the MARCOGAZ document [WG_TP-71] "*Root Cause Analysis for External Interference Incidents*".
4. Pipeline operators should continuously work on **improving communication with all stakeholders**. The safety of a transmission pipeline, a company's reputation, and the success of a project depends on a good working relationship with all key stakeholders. A clear and dedicated message to different stakeholders should be sent, especially for people working near pipelines: "Pipelines are safe, works can make it dangerous!". More specifics about communication with relevant stakeholders will be specified in MARCOGAZ document [WG_TP-161] "*Guidelines for stakeholders management regarding third party interferences*".
5. Pipeline operators should **have a "one call / one click system"**. This system should be used by third-party contractors to notify pipeline operators about future excavation activities. In some European countries such a system is required by the national authorities. Functional requirements are specified in MARCOGAZ document [WG_TP-156] "*Guidelines for a "plan request" system to avoid third party damage*".

6. GENERAL PRACTICES FOR MANAGING RISK INCREASING STRUCTURES IN THE VICINITY OF HIGH-PRESSURE GAS PIPELINES

Besides works executed by third parties, also third-party installations in the vicinity of gas infrastructure can result in reduction of its safety level. MARCOGAZ recognizes the necessity of neighbouring facilities and infrastructures relatively close to gas infrastructure. Provided that proper precautions are respected (e.g. minimum separation distances), risks for the gas infrastructure can remain acceptably low. The MARCOGAZ document [WG_TP-162] (to be published soon) "*General practices for managing risk increasing structures in the vicinity of high-pressure gas pipelines*" provides high level general requirements to prevent mechanical and electromagnetic harm to the gas transmission system from neighbouring installations or infrastructure.

7. NATURAL HAZARDS AND EXTERNAL CORROSION

Special categories of external threats are natural hazards and external corrosion. Being not (directly) human inflicted, these kinds of threats are outside the scope of the present document. However, to give a comprehensive overview, the MARCOGAZ document [GI-TP-17-06] "*How to deal with the risk of natural hazards to pipelines and other gas infrastructure facilities*" gives relevant considerations about dealing with natural hazards. General practices managing external corrosion are covered in MARCOGAZ document [GI_TP-72] (under construction).

8. INFORMATIVE NOTE ON GAS EMERGENCIES

Although not exclusively, Third Party Interference incidents contribute dominantly to gas emergencies. Some relevant considerations and explanations are summarized in MARCOGAZ document "*Informative note on Gas Emergencies*" [GI-TP-13-01].

9. OVERVIEW OF TERMS AND EXPRESSIONS

External interference, or Third-Party Interference (TPI), is a topic within which a number of terms and expressions are used. In order to achieve a common understanding, MARCOGAZ document [WG_TP-139] "*Terms and definitions related to external interference on underground pipelines*" gives a list of definitions, terms and expressions.

10. CONCLUSION

Although legislation, technical rules and standards differ among European countries and are influenced by cultural, historical and geographical factors, there is a strong common understanding of relevant factors contributing to the danger of external interference and the way to deal with those.

This paper provides an overview of practices initiated by MARCOGAZ members, aiming for continuous improvement of protection against external interference threats to gas pipelines.

This will contribute to an enhancement of the already high safety level of the gas transmission by pipelines.

Although gas pipeline operators do contribute extensively in tackling the problem of third-party interference, a large part of the activities occurring in the vicinity of pipelines are outside of their control. The focus of any new legislation should therefore be on improving awareness of buried utility infrastructure and controlling the competence of the individuals carrying out excavation work in the vicinity of high-pressure pipelines.

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