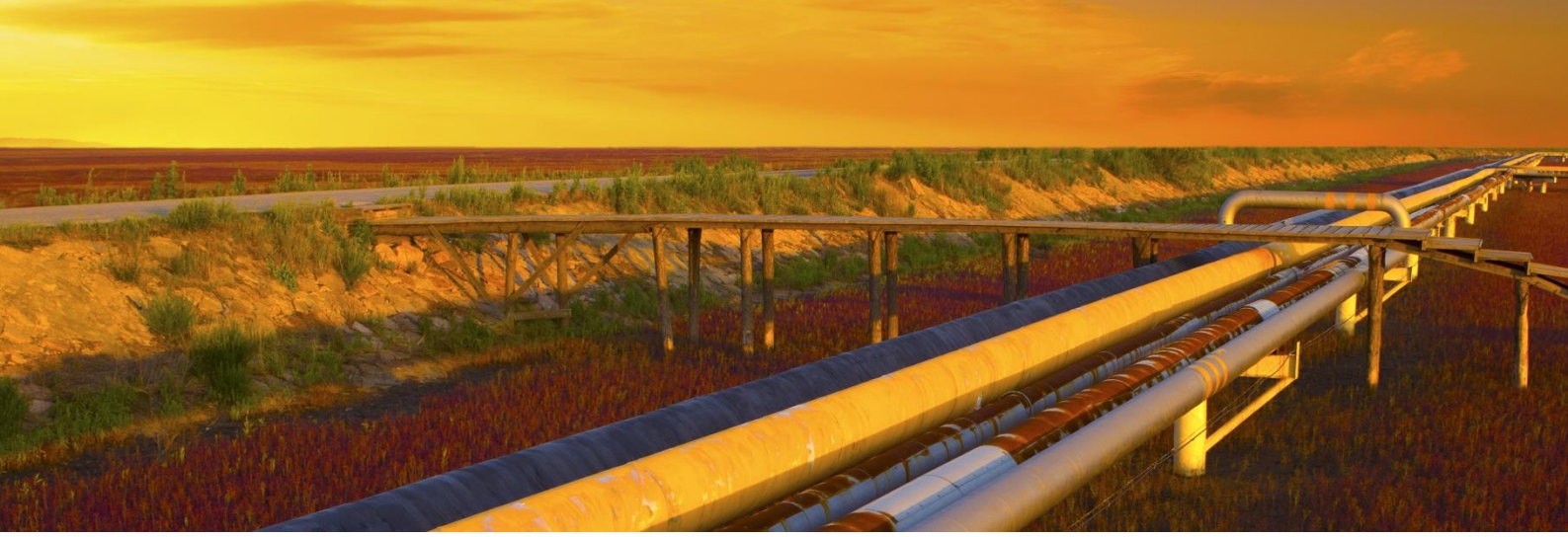

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Readiness of Gas Infrastructure Operators to Safely Cope With Renewable Gases Including Hydrogen

Position paper

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ABOUT MARCOGAZ

Founded in 1968, MARCOGAZ represents 28 member organisations from 20 countries. Its mission encompasses monitoring and policy advisory activities related to European technical regulation, standardisation and certification with respect to safety and integrity of gas systems and equipment, rational use of energy as well as environment, health and safety issues. It is registered in Brussels under number BE0877 785 464.

DISCLAIMER

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1. Introduction

Energy transition will deeply impact the natural gas industry. Renewable gases, including hydrogen, are expected to prevail in the mid-long term. Accordingly, infrastructure operators are facilitating an integrated energy market in which electricity, gas (methane, renewables, hydrogen…) and heat systems play their specific roles.

Gas infrastructure facilities will remain to play an essential role in gas conveying from supplier to (end) user and are designed, constructed, maintained, and operated for an undefined lifetime.

Among several related technical aspects to be examined beforehand, the present position paper focuses on a fundamental one: **give the proof that safety management is a high competence for natural gas infrastructure operators and that it can be applied to all gases, including hydrogen**.

2. Gas infrastructure operators' priorities: security of supply and safety

The primary objective of gas infrastructure operators is to make capacity available to gas shippers in order that gas can be conditioned, stored, transported and distributed to end consumers whilst also ensuring that potential hazards affecting public, properties and environment are avoided. **Therefore, the integrity of pipelines and industrial facilities is a major responsibility of the gas infrastructure operators.** This responsibility is taken all along the settled main activities related to gas infrastructure value chain:

Fig.1: Gas infrastructure value chain.

Related competences /skills are the consequence of more than 60 years of experience, not only in the field of safe design/operating/maintenance, but also of continuous innovating safety devices and processes to prevent incidents/accidents. Activities all along the whole infrastructure chain are carried out using mainly functional European standards drafted through CEN (CEN/TC234 Gas Infrastructure) and European Directives (specially the Directive 2012/18/EU). It is worth to underline that the aforementioned technical specifications were mainly driven by gas infrastructure operators. They cover all the aspects of the infrastructure lifecycle and include requirements for a dedicated safety management. They are kept up to date and periodically revised, notably to incorporate the changing gas compositions due to the increased use of new gases. Gas infrastructure operators remain the main contributors.

Undoubtedly, supply of renewable gases including hydrogen requires a similar infrastructure chain where local adaptations may be needed. By means of existing skills, those local adaptations would be handled by gas infrastructure operators. When adaptations are scheduled, impact on safety is the main concern and, in this field, pole position is beside those infrastructure operators.

LNG is unquestionably a recognized activity too for gas operators especially in the field of safety, nevertheless its assets should be considered apart. We shall therefore focus, in this position paper, on the gas supplying chain limited to its gaseous form.

3. Gas infrastructure safety all along its lifecycle

Here are the main steps covering the whole lifecycle of any gas infrastructure equipment. They are planned to last for many decades. Of course, safety is considered as of upmost importance all along.

a) Design
b) Construction
c) Testing and Commissioning
d) Operation and Maintenance
e) Decommissioning

As described in the previous paragraph, we further below underline the large spectrum of skills deployed by natural gas operators which gives them the capacity, with a high level of confidence, to operate any gas infrastructure, regardless the gas composition.

The involved assets along the gas chain are managed at a high quality standard although divers of characteristics:

- steel and plastic pipelines,
- compressor stations,
- gas blending installations whenever required,
- Underground Gas Storage (UGS) facilities including reservoir or caverns, wells and surface facilities,
- other above ground installations (regulating stations, delivery stations, valve stations, odorization facilities and metering, control and instrumentation equipment).

The European inventory of these assets is very large (hundreds of thousands of pipeline kms, thousands of above ground installations, hundreds of compression stations, dozens of UGS). They have been constructed during decades, a long period during which the technical experience of gas operators was continuously improved especially in the field of safety, accident prediction scenarios, construction, materials, mitigating measures… Although gas operators are dealing with a sensitive product, the relative public acceptance during the wide installation of those assets emphases the fact that there is no doubt about their level of safety. This is briefly shown below from the early stage of the asset design phase until the asset decommissioning phase.

4. Design

This phase takes into account safety aspects by means of adapted design factors, passive and active protections (for instance coating and cathodic protection), appropriate safety distances. **Generic design tools, procedures and safety fundamentals are applicable for various gas compositions** (as there are for natural gas and hydrogen). The design process can be initiated by a new initiative (green field) or as a result of a management of change process.

For instance, the basic concept for the integrity of Underground Gas Storage facilities, especially for subsurface, is mainly developed in the EN1918 standards. The well integrity policy adopted by most of

the European Underground Gas Storage Operators, is based on the “two barriers” design for operating wells. Both independent barriers would unlikely have to fail simultaneously for a leak to occur. Moreover, salt cavern underground gas storages are currently operated with pure hydrogen in the USA (Moss Bluff, Clemens dome, Splindletop) and in UK (Teesside) with similar technologies than natural gas underground storage facilities.

5. Construction

Construction procedures of the natural gas industry are strictly framed by European and national standards developed thanks to a strong involvement of the gas infrastructure operators. As for instance steel or plastic welding, Non-Destructive Testing (NDT), in-field coating, installation building, drilling wells... **No major difference is expected for renewable gases including hydrogen**.

6. Testing and Commissioning

Mainly concerned: hydraulic and tightness testing. Here also, no impact whether natural gas or renewables including hydrogen are considered; however specific sensors will be probably required for detection, depending on the type of gas.

7. Operation and Maintenance

Compared to the above phases, maintenance warranties the fitness for purpose during the whole lifetime of the infrastructure system allowing to operate safely the assets. Therefore, an Integrity Management Systems (IMS) or a Safety Management System (SMS) is set up for each category of assets. IMS or SMS gets started once the asset is commissioned. Its first objective is to preserve assets integrity through the management of the relevant safety aspects. It also handles failure situations by deploying emergency procedures as well as a crisis management aiming at minimizing hazards. By this, IMS contributes to the safety and reliability of the overall gas network. The following diagram (Fig.2) gives an illustration summarizing the content of an IMS, where different types of competences are required, for instance: safety data mining, corrosion expertise, inspection, cathodic protection, odorization, compression equipment, pressure reduction devices, leak detection, third party interferences (notification procedures / one-call system), etc.

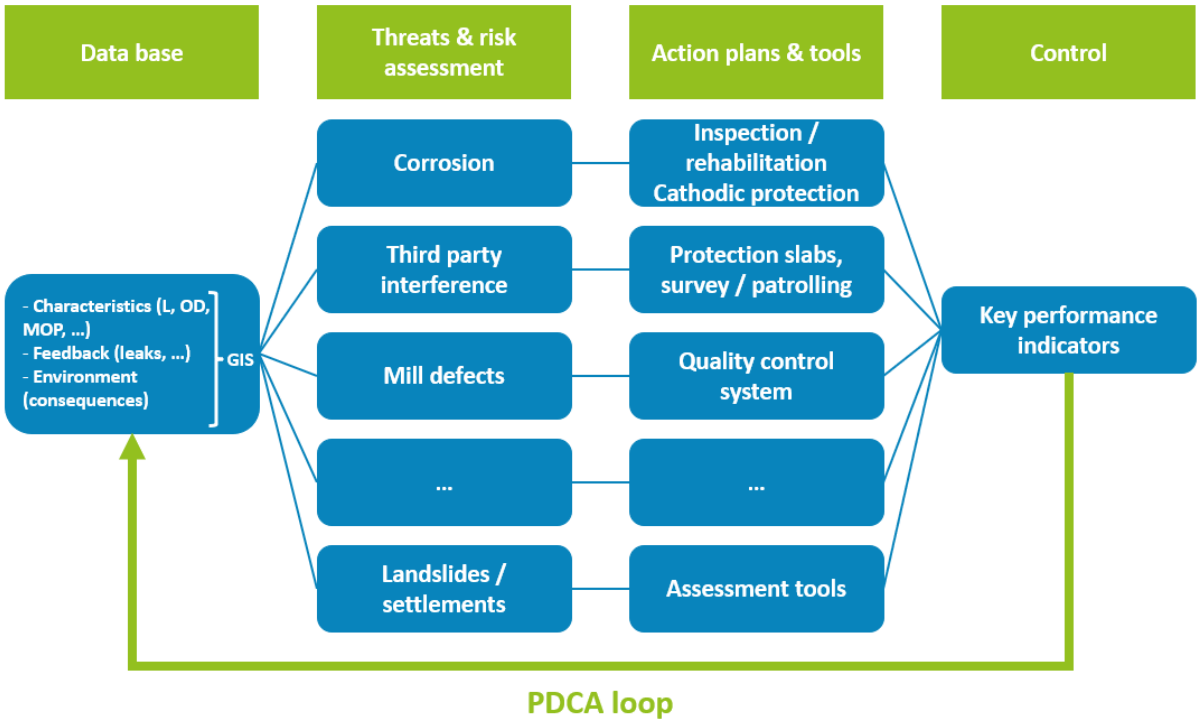

Fig.2: Integrity Management System diagram.

Safety fundamentals during operation and maintenance remain quite similar whether we are dealing with natural gas or renewables including hydrogen. **Operational teams, already acquainted with a strong safety culture, can be easily trained to get familiar with additional or complementary procedures induced specifically by other gases like hydrogen,** for instance safety distances, leak detection…

Furthermore, gas infrastructure operators have developed dedicated competences aiming at mitigating the potential effect of gas emissions to protect environment and ensure safety. These competences may be extended to renewable gases including hydrogen.

8. Decommissioning

Even when decommissioning, gas operators are still concerned by safety. A whole procedure is set up in order to avoid any misunderstanding or misinterpretation of third parties, for instance as for abandoned buried pipelines.

Some UGS have been decommissioned in Europe and the best practices of this type of activities are shared among operators and will allow standards update.

9. Stakeholder management

Although legal approaches may differ among European Member States due to cultural, historical and geographical factors, the common aim amongst all gas infrastructure operators is to construct, operate and maintain safe infrastructure in **professional relationship with the neighborhood inhabitants, suppliers, contractors and (supervising) authorities.**

Exchanges between all stakeholder groups, including individuals and contractors, with involved authorities, is necessary to identify best practices for continuous improvement of safety. Gas operators have developed internal competences to actively take part to those exchanges.

Moreover, national legislation, encouraged by gas operators' requirements, play a key part in ensuring that any third party work in the vicinity of any gas infrastructure is notified to the operator and is managed and controlled in line with its specifications.

10. Conclusions

Gas infrastructure operators, regarding their recognized skills and competences, have proven their full capacity of handling natural gas on the whole supply chain with a high level of safety, confirmed by incident/accident data bases (for instance EGIG[1], EGAS-B[2]). **Consequently, their experience may be put at the disposal of any other gas, like hydrogen**. One must remind that hydrogen was the main component of town gas (i.e., manufactured gas) and that some storage facilities were operated with town gas. Some of them have been afterward converted into natural gas underground storage. Moreover, in some countries, pipelines transporting coke oven gas, which contains up to 50-60% of hydrogen, are still operated.

Indeed, gas infrastructure operators are committed to look for relevant differences between physicochemical characteristics of natural gas and other gases like hydrogen in order to improve/adapt their know-how where required. As mentioned above, management tools/procedures and design are part of gas infrastructure operators' core skills; they will be able, in due time, to adapt existing natural gas infrastructure to renewables including hydrogen or design, build and operate any infrastructure system to convey those gases.

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[1] EGIG : European Gas pipeline Incident data Group – www.egig.eu

[2] Report on European Gas Safety : Gas Distribution (EGAS-B) - www.marcogaz.org